TECHNICAL SPECIFICATIONS

FOR FURNISHING ALL LABOR AND MATERIALS
NECESSARY AND REQUIRED FOR:

The renovation of the 25th floor at 1 Centre Street for the City of New York future office pilot project - an amenities-driven hub that includes open work stations, conference space, a common pantry, and a variety of other spaces and configurations to facilitate collaboration and flexibility.

PROJECT ID.: 856 PW19325A

PROJECT TITLE: OFFICE SURGE SITE ONE CENTRE STREET – 25TH FLOOR

EPIN: 85624B0012

PROJECT LOCATION: 1 CENTRE STREET

BOROUGH: MANHATTAN

AGENCY: NYC Department of Citywide Administrative Services

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SECTION 01 22 00 UNIT PRICES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SUMMARY

A. General: The requirements of this Section are procedural, administrative or explanatory in nature.

B. Definition: A unit price is an amount proposed by Bidders and stated on the Bid Form as a price per unit of measurements for materials or services that may be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased, note that one price shall apply to increase or decrease in work.

1. Unit prices shall be considered all-inclusive and include all necessary material, labor, supervision, equipment, transportation, handling, insurance, bonds, rentals, overhead, profit, applicable taxes, and incidentals.

2. Methods of measurement and payment for unit prices are specified in this Section.

C. Measurement: The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this Work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

1.1 UNIT PRICE SCHEDULE
[***COORDINATE WITH CM FOR COMPLETE LIST OF UNIT PRICES***]

ITEM	UNIT OF MEASURE
1. [***INSERT***]	[***INSERT***]

END OF SECTION

SUBSTITUTION REQUEST
(After the Bidding/Negotiating Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

☐ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

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SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase — Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: ☐

A/E's REVIEW AND RECOMMENDATION

☐ Approve Substitution - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
☐ Approve Substitution as noted - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
☐ Reject Substitution - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

OWNER'S REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.
☐ Substitution rejected - Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E

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SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 01 12 00 "Multiple Contract Summary" for coordination of responsibilities for waste management.
2. Section 02 41 16 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
3. Section 02 41 19 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
4. Section 04 20 00 "Unit Masonry" for disposal requirements for masonry waste.
5. Section 04 43 13.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
6. Section 04 43 13.16 "Adhered Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
7. Section 31 10 00 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:

a. Concrete.
b. Concrete reinforcing steel.
c. Brick.
d. Concrete masonry units.
e. Wood studs.
f. Wood joists.
g. Plywood and oriented strand board.
h. Wood paneling.
i. Wood trim.
j. Structural and miscellaneous steel.
k. Rough hardware.
l. Roofing.
m. Insulation.
n. Doors and frames.
o. Door hardware.
p. Windows.
q. Glazing.
r. Metal studs.

s. Gypsum board.
t. Acoustical tile and panels.
u. Carpet.
v. Carpet pad.
w. Demountable partitions.
x. Equipment.
y. Cabinets.
z. Plumbing fixtures.
aa. Piping.
bb. Supports and hangers.
cc. Valves.
dd. Sprinklers.
ee. Mechanical equipment.
ff. Refrigerants.
gg. Electrical conduit.
hh. Copper wiring.
ii. Lighting fixtures.
jj. Lamps.
kk. Ballasts.
ll. Electrical devices.
mm. Switchgear and panelboards.
nn. Transformers.

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.

5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
8. Method used to quantify salvaged and recycled materials

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator and refrigerant recovery technician.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan. Recycled material that includes multiple material types (e.g. concrete, sheetrock, and metal) cannot be individually quantified through visual inspection. Provide a plan for separating and measuring the weight or volume of each waste stream.

B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include in the plan estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

2. Provide separate container for every recycled material stream or confirm that the waste hauler will quantify every recycled materials through means other than visual inspection.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

E. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches or more.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site or off-site designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.

1. Crush asphaltic concrete paving and screen to comply with requirements in Section 31 20 00 "Earth Moving" for use as general fill.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.
2. Crush concrete and screen to comply with requirements in Section 31 20 00 "Earth Moving" for use as satisfactory soil for fill or subbase.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 3/4-inch size.

2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

N. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

    a. Comply with requirements in Section 32 93 00 "Plants" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

    a. Comply with requirements in Section 32 93 00 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.7 ATTACHMENTS

A. Form CWM-1 for construction waste identification.

B. Form CWM-2 for demolition waste identification.

C. Form CWM-3 for construction waste reduction work plan.

D. Form CWM-4 for demolition waste reduction work plan.

E. Form CWM-5 cost/revenue analysis of construction waste reduction work plan.

F. Form CWM-6 cost/revenue analysis of demolition waste reduction work plan.

G. Form CWM-7 for construction waste

H. Form CWM-8 for demolition waste.

END OF SECTION 01 74 19

SECTION 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for Project to obtain "LEED Version 4 for Interior Design and Construction" (LEED v4 ID+C) Gold certification based on USGBC's LEED v4 ID+C. Specific sections include:

1. Reference Standards
2. Definitions
3. Preconstruction Meetings
4. Administrative Requirements
5. Action Submittals
6. Information Submittals
7. Quality Assurance
8. Materials and Product Requirements
9. Execution Requirements
10. Sustainability Reporting Forms

B. Related Sections:
1. Section 01 74 19 Construction Waste Management
2. Section 01 81 13 Sustainable Design Requirements
3. Section 01 19 13 General Commissioning Requirements
4. Section 22 08 00 Commissioning of Plumbing Systems
5. Section 23 08 00 Commissioning of HVAC Systems
6. Section 26 08 00 Commissioning of Electrical Systems
7. Specific requirements for LEED are also included in other Sections.

C. About LEED:

1. LEED stands for Leadership in Energy & Environmental Design. A program developed and maintained by the US Green Building Council which provides a framework for

certification achieved through third-party verification of green buildings. LEED is a system where projects earn points (credits) based on sustainable building goals being met.

2. LEED has Prerequisites which are mandatory for the project to achieve its certification.

3. Some LEED Prerequisites and Credits depend on compliant material selections and may not be specifically identified as LEED requirements in this document. Compliance with requirements needed to obtain LEED prerequisites and credits will be used as one criterion to evaluate substitution and comparable product requests.

4. Some LEED Prerequisites and Credits depend on the Architect's design and other aspects of the Project that are not part of the Contractors work.

5. A copy of the LEED CI v4 Rating System is available for free download at the USGBC, website: www.usgbc.org. LEED Reference Guides must be purchased.

1.3 REFERENCE STANDARDS

A. Chemical Abstract Service Registration Number (CASRN): unique numerical identifier assigned by Chemical Abstracts Service (CAS) to every chemical substance described in the open scientific literature, including organic and inorganic compounds, minerals, isotopes, alloys, and non-structural materials.

B. Cradle to Cradle Certification Product Standard is a multi-attribute, continuous improvement methodology that provides a path to manufacturing healthy and sustainable products for our world. Products that comply with Cradle to Cradle product certification Material Health Score can contribute credit to both LEED and WELL.

C. Declare is an online product library and transparency platform to help project teams select materials that comply with the Red List, as well as VOC and emissions requirements. The Declare label enables project teams to that products are free of worst-in-class toxins and support a materials industry that safeguards the health of the environmental and workers throughout the supply chain.

D. Environmental Product Declaration (EPD) is a standardized way of quantifying the environmental impact of a product or system. A third-party-verified International Organization for Standardization (ISO) Series 14025 Type III declaration that quantifies environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function.

E. GreenScreen is a platform for screening and tracking chemical inventories in products.

F. Health Product Declarations (HPD) Collaborative is a customer-led organization that provides independent third-party accreditation to ensure accurate reporting of product contents and each ingredient’s relationship to the bigger picture of human and ecological health.

G. Integral Label: an information conveyance system that cannot be easily removed, such as radio frequency identification, engraving, embossing, or other permanent markings containing information on material origin, properties, and date of manufacturer.

H. Leadership in Energy and Environmental Design (LEED) is a green building certification program based on a set of prerequisites and credits where projects earn points to achieve different levels of certification.

I. Chemical Abstract Service Registration Number (CASRN) is a unique numerical identifier assigned by Chemical Abstracts Service (CAS) to every chemical substance described in the open scientific literature, including organic and inorganic compounds, minerals, isotopes, alloys, and non-structural materials.

J. Sheet Metal and Air Conditioning Contractors (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition, 2007, ANSI/SMACNA 008-2008 Chapter 3.

K. South Coast Air Quality Management District (SCAQMD) Rule 1113 – Architectural Coatings.

L. South Coast Air Quality Management District (SCAQMD) Rule 1168 – Adhesive and Sealant Applications.

M. American National Standards Institute (ANSI) and the Business and Institutional Furniture Manufacturers Association (BIFMA) - ANSI/BIFMA e3-2011 Furniture Sustainability Standard sections 7.6.1 and 7.6.2, tested in accordance with ANSI/BIFMA Standard Method M7.1-2011.

N. California Department of Public Health (CDPH) Standard Method v1.1-2010: The California Department of Public Health's (CDPH) Standard Method v1.1-2010 is an emissions testing and evaluation standard intended to be applied to any product with the potential to emit VOCs generally used within the envelope of an enclosed indoor environment that can be tested whole or by representative sample in environmental chambers. This method specifies target chemicals and their maximum allowable concentrations.

O. CDPH Standard Method v1.2-2017.

P. Environmentally Preferable Purchasing (EPP) is New York City's minimum standards for construction and goods.

1.4 DEFINITIONS

A. LEED: USGBC's "LEED Version 4 for Interior Design and Construction."

1. Definitions that are a part of "LEED Version 4 for Interior Design and Construction" (LEED v4 ID+C) apply to this Section.

B. Cradle-to-Gate Assessment: Analysis of a product's partial life-cycle from extraction (cradle) to gate (factory completion prior to distribution).

C. Life-Cycle Assessment: Evaluation of environmental impacts of a product from cradle to gate, defined by ISO 14040 and ISO 14044.

D. Life-Cycle Inventory: Database that defines environmental input and output for each step in a material or assembly's life cycle.

E. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

F. Manufacturer Location: The final point of fabrication or manufacture of an assembly or building material.

G. Materials Construction Budget: All the material costs delivered to the site, excluding labor, soft costs and land.

1.5 PRECONSTRUCTION MEETINGS

A. Preconstruction Kick-Off: Conduct conference at 1 Centre Street, New York, NY. Review LEED requirements and action plans for meeting requirements.

1.6 LOW EMISSION VEHICLES AND EQUIPMENT

A. The Contractor must endeavor to minimize the greenhouse gas emissions from the Contractor's equipment. To achieve this goal, the following is required:

1. Electric powered equipment is to be used where practical instead of internal combustion engine (ICE) powered equipment. The Contractor may refer to the NYC Department of Citywide Administrative Services (NYC DCAS) bi-annual publication, the Clean Fleet Transition Plan (https://www1.nyc.gov/site/dcas/agencies/fleet-sustainability.page), in order to determine what equipment is available.

2. Where ICE powered equipment is necessary, efforts should be taken to ensure the most efficient ICE engines are used. This may include:

a. The use of larger efficient ICE generators to power multiple pieces of electric equipment,

b. Reductions in the use of less than 50HP engines,

c. Use of lower emission or renewable fuels, such as biodiesel or CNG,

d. Use of hybrid electric equipment, and

e. Other innovative methods proposed by the Contractor.

3. The Contractor is required to coordinate between all subcontractors and trades in order to reduce the number of ICE equipment and generators in use.

1.7 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the Project's LEED certification application. Document responses as informational submittals.

B. Submit documentation to USGBC and respond to questions and requests from USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the Project's LEED certification application.

1. Document correspondence with USGBC as informational submittals.

1.8 ACTION SUBMITTALS

A. General: Submit additional sustainable design submittals required by other Specification Sections.

B. Sustainable design submittals are in addition to other submittals.

1. For each sustainable product submittal, fill out and include the “LEED v4-v41_Product-Submittal-Worksheet”.
2. To track the sustainable product thresholds associated with LEED submission, fill out and include the “LEED v4-v41_Product-Tracking-Form” using materials gathered in the “LEED v4-v41_Product-Submittal-Worksheet”.
3. If submitted item is identical to that submitted to comply with other requirements, include an additional copy with other submittal as a record copy of compliance with indicated LEED requirements instead of separate sustainable design submittal. Mark additional copy "Sustainable design submittal."

C. Sustainable Design Documentation Submittals:

1. Environmental product declarations (EPDs) complying with LEED requirements.

a. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.

b. EPDs: The Contractor must submit to the Commissioner copies of all EPD’s submitted to the Building Transparency database per Subsection 1.5.C.

c. EPDs are required for the following materials, if used:
- Steel materials:
  - 05 12 00 Structural steel framing
  - 05 12 13 Architecturally exposed structural steel framing

- 05 21 00 Steel joist framing
- 05 31 00 Steel decking
- 05 40 00 Cold-formed metal framing
- 05 44 00 Cold formed metal trusses

- Concrete materials:
  - 03 30 00 Cast-in-place concrete

d. If EPDs are available for materials not listed above, they must be submitted.
e. EPDs must be submitted to the Building Transparency database, using the OpenEPD format, at https://buildingtransparency.org/ec3

2. Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.

   a. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.

3. Documentation complying with Section 01 74 19 "Construction Waste Management and Disposal."
4. Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials.
5. Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials.
6. Laboratory test reports for flooring, indicating compliance with requirements for low-emitting materials.
7. Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials.
8. Laboratory test reports for ceilings, walls, and thermal insulation, indicating compliance with requirements for low-emitting materials.
9. Laboratory test reports for furniture, indicating compliance with requirements for low-emitting materials.
10. Construction Indoor-Air-Quality (IAQ) Management:

    a. Construction indoor-air-quality (IAQ) management plan.
    b. Product data for temporary filtration media.
    c. Product data for filtration media used during occupancy.

d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

11. IAQ Assessment:

a. Signed statement describing the building air flush-out procedures, including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
b. Product data for filtration media used during flush-out and during occupancy.

1.9 INFORMATIONAL SUBMITTALS

A. Qualification Data: For LEED coordinator.

B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:

1. Plumbing.
2. Mechanical.
3. Electrical.
4. Specialty items, such as elevators and equipment.

C. Sustainable Design Action Plans: Provide preliminary submittals within 7 days of date established for **the Notice to Proceed**, using the "LEED v4-v41_Product-Submittal-Worksheet". Use the "LEED v4-v41_Product-Tracking-Form" to indicate where the following requirements are met:

1. List of proposed products with Environmental Product Declarations.
2. List of proposed products complying with requirements for material ingredient reporting.

Include the following plans as part of the Sustainable Design Action Plan:

1. Waste management plan complying with Section 01 74 19 "Construction Waste Management and Disposal."
2. Construction IAQ management plan.

D. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable design action plans.

1.10 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-accredited professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to these LEED credits, the Contractor shall provide additional materials and procedures necessary to obtain LEED credits indicated.

B. At least 10 different products from at least three different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.

C. At least 10 different products from at least three different manufacturers shall comply with LEED requirements for material ingredient reporting.

D. All materials shall meet the guidelines set by New York City's EPP while also adhering to contract specifications.

2.2 LOW-EMITTING MATERIALS

A. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Clear Wood Finishes, Varnishes: 275 g/L.
9. Clear Wood Finishes, Lacquers: 275 g/L.
10. Floor Coatings: 50 g/L.
11. Shellacs, Clear: 730 g/L.
12. Shellacs, Pigmented: 550 g/L.
13. Stains: 100 g/L.

B. Paints and Coatings: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Adhesives and Sealants: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Wood Glues: 30 g/L.
2. Metal-to-Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (Except Wood): 50 g/L.
4. Subfloor Adhesives: 50 g/L.
5. Plastic Foam Adhesives: 50 g/L.
6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.
14. Fiberglass Adhesives: 80 g/L.
15. Contact Adhesive: 80 g/L.
16. Structural Glazing Adhesives: 100 g/L.
17. Wood Flooring Adhesive: 100 g/L.
18. Structural Wood Member Adhesive: 140 g/L.
19. Single-Ply Roof Membrane Adhesive: 250 g/L.
20. Special-Purpose Contact Adhesive (Used to Bond Melamine-Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
21. Top and Trim Adhesive: 250 g/L.
22. Plastic Cement Welding Compounds: 250 g/L.
23. ABS Welding Compounds: 325 g/L.
24. CPVC Welding Compounds: 490 g/L.
25. PVC Welding Compounds: 510 g/L.
26. Adhesive Primer for Plastic: 550 g/L.
27. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
28. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
29. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
30. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
31. Other Adhesives: 250 g/L.
32. Architectural Sealants: 250 g/L.
33. Nonmembrane Roof Sealants: 300 g/L.
34. Single-Ply Roof Membrane Sealants: 450 g/L.

35. Other Sealants: 420 g/L.
36. Sealant Primers for Nonporous Substrates: 250 g/L.
37. Sealant Primers for Porous Substrates: 775 g/L.
38. Modified Bituminous Sealant Primers: 500 g/L.
39. Other Sealant Primers: 750 g/L.

D. Adhesives and Sealants: For field applications that are inside the weatherproofing system, 90 percent of adhesives and sealants shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Composite Wood: Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall me made with no added formaldehyde.

G. Ceilings and Walls: Ceilings, walls, and thermal insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

A. Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Comply with Section 017419 "Construction Waste Management and Disposal."

3.3 CONSTRUCTION IAQ MANAGEMENT

A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."

1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 01 50 00 "Temporary Facilities and Controls," install MERV 8 filter media at each return-air inlet for the air-handling system used during construction.
2. Replace air filters immediately prior to occupancy.

3.4 IAQ ASSESSMENT

A. Flush-Out:

1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14,000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity of no higher than 60 percent.

a. Consult HVAC or Flush-Out consultant for operating requirements.

2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. Ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside-air rate, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cu. ft./sq. ft. of outside air has been delivered to the space.

a. Consult HVAC or Flush-Out consultant for operating requirements.

3.5 ATTACHMENTS

A. Reporting Form-Sustainable Materials for sustainable materials identification.

B. Reporting Form-Low Emitting Materials for low emitting materials identification.

C. LEED Product Submittal Template

END OF SECTION 018113.17

019113 – GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Owner's Project Requirements and Basis-of-Design documentation, if included, are for reference information only.

1.02 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning.

2. Commissioning meetings.

3. Commissioning reports.

4. Use of test equipment, instrumentation, and tools for commissioning.

5. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.

6. Commissioning tests and commissioning test demonstration.

7. Adjusting, verifying, and documenting identified systems and assemblies.

B. Related Requirements:

1. Section 220800 "Commissioning of Plumbing Systems" for technical commissioning requirements for Plumbing and Fire Protection.

2. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.

3. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.

1.03 ALLOWANCES

A. Labor and management costs for the performance of commissioning. See additional responsibilities of General Contractor in General Conditions Article 45 – Commissioning.

B. The following are excluded from the commissioning allowance:

1. Equipment and systems installation, startup, and field quality-control testing indicated in the Contract Documents.

2. Test equipment, instrumentation, and tools (including, but not limited to, proprietary test equipment, instrumentation, and tools) required to perform tests.

3. Work to correct commissioning issues.

4. Work to repeat tests when equipment and systems fail acceptance criteria.

1.04 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests and commissioning test demonstrations.

B. Basis-of-Design Document: A document prepared by Owner, Architect, or Commissioning Authority that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.

C. Commissioning Authority: An entity engaged by Owner.

D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation requirements of commissioning.

E. Commissioning: A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of commissioning is defined in Section 220800, 230800, and Section 260800.

F. Construction Phase Commissioning Completion: The stage of completion and acceptance of commissioning when resolution of deficient conditions and issues discovered during commissioning and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date Construction Phase Commissioning Completion is achieved.

1. Commissioning is complete when the work specified in this Section and related Sections has been completed and accepted, including, but not limited to, the following:

a. Completion of tests and acceptance of test results.
b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
c. Comply with requirements in "Demonstration and Training."
d. Completion and acceptance of submittals and reports.

G. Owner's Project Requirements: A document written by Owner, Architect, or Commissioning Authority that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

H. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.

I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

J. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

K. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4.

1.05 COMPENSATION

A. Should Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.

1. Failure to provide timely notice of commissioning activities schedule changes.

2. Failure to meet acceptance criteria for test demonstrations.

1.06 COMMISSIONING TEAM

A. Members Appointed by Contractor(s):

1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning.

2. Project superintendent and other employees that Contractor may deem appropriate for a particular portion of the commissioning.

3. Subcontractors, installers, suppliers, and specialists that Contractor may deem appropriate for a particular portion of the commissioning.

4. Appointed team members shall have the authority to act on behalf of the entity they represent.

B. Members Appointed by Owner:

1. Commissioning authority, plus consultants that Commissioning Authority may deem appropriate for a particular portion of the commissioning.

2. Owner representative(s), facility operations and maintenance personnel, plus other employees, separate contractors, and consultants that Owner may deem appropriate for a particular portion of the commissioning.

3. Architect, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning.

1.07 INFORMATIONAL SUBMITTALS

A. Comply with requirements "Submittal Procedures" for submittal procedures general requirements for commissioning.

B. Commissioning Plan Information:

1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors to the performance of the various commissioning requirements.

2. Schedule of commissioning activities, integrated with the construction schedule. Comply with requirements in "Construction Progress Documentation" for

construction schedule general requirements for commissioning.

3. Contractor personnel and subcontractors to participate in each test.

4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.

C. Commissioning schedule.

D. Two-week look-ahead schedules.

E. Commissioning Coordinator Letter of Authority:

1. Within (10) days after approval of Commissioning Coordinator qualifications, submit a letter of authority for Commissioning Coordinator, signed by a principal of Contractor's firm. Letter shall authorize Commissioning Coordinator to do the following:

   a. Make inspections required for commissioning.

2. Coordinate, schedule, and manage commissioning of Contractor, subcontractors, and suppliers.

   a. Obtain documentation required for commissioning from Contractor, subcontractors, and suppliers.
   b. Report issues, delayed resolution of issues, schedule conflicts, and lack of cooperation or expertise on the part of members of the commissioning team.

3. Commissioning Coordinator Qualification Data: For entity coordinating Contractor's commissioning activities to demonstrate their capabilities and experience.

4. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of three previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

5. List test instrumentation, equipment, and monitoring devices. Include the following information:

6. Make, model, serial number, and application for each instrument, equipment, and monitoring device.

7. Brief description of intended use.

8. Calibration record showing the following:

   a. Calibration agency, including name and contact information.
   b. Last date of calibration.
   c. Range of values for which calibration is valid.

d. Certification of accuracy.
e. N.I.S.T. traceability certification for calibration equipment.
f. Due date of the next calibration.

F. Test Reports:

1. Pre-Startup Report: Prior to startup of equipment or a system, submit signed, completed construction checklists.

2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.

3. Commissioning Issues Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.

4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.

5. Data Trend Logs: Submit data trend logs at the end of the trend log period.

6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit print-out of log of alarms that occurred since the last log was printed.

G. Construction Checklists:

1. Material checks.

2. Installation checks.

3. Startup procedures, where required.

1.08 CLOSEOUT SUBMITTALS

A. Commissioning Report:

1. At Construction Phase Commissioning Completion, include the following:

a. Pre-startup reports.
b. Approved test procedures
c. Test data forms, completed and signed.
d. Progress reports.
e. MEP static test reports
f. Commissioning issues report log.
g. Commissioning issues reports showing resolution of issues.
h. Correspondence or other documents related to resolution of issues.
i. As Built drawings
j. Other reports required by commissioning.
k. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction Phase Commissioning Completion.

l. Report shall include commissioning work of Contractor.

B. Request for Certificate of Construction Phase Commissioning Completion.

C. Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

1.09 QUALITY ASSURANCE

A. Commissioning Coordinator Qualifications:

1. Documented experience commissioning systems of similar complexity to those contained in these documents on at least three projects of similar scope and complexity.

B. Calibration Agency Qualifications: Certified by The American Association of Laboratory Accreditation that the calibration agency complies with minimum requirements of ISO/IEC 17025.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Test equipment and instrumentation required to perform the commissioning shall remain the property of Contractor unless otherwise indicated.

B. Test equipment and instrumentation required to perform commissioning shall comply with the following criteria:

1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.

2. Calibrated and certified.

a. Calibration performed and documented by a qualified calibration agency according to national standards applicable to the tools and instrumentation being calibrated. Calibration shall be current according to national standards or within test equipment and instrumentation manufacturer's recommended intervals, whichever is more frequent, but not less than within six months of initial use on Project. Calibration tags permanently affixed.
b. Repair and recalibrate test equipment and instrumentation if dismantled, dropped, or damaged since last calibrated.

3. Maintain test equipment and instrumentation.

4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

2.02 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate or perform work on its equipment.

1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.

2. Proprietary test equipment, instrumentation, and tools shall become the property of Owner at Substantial Completion.

PART 3 - EXECUTION

3.01 PREPARATION

A. Review preliminary construction checklists and preliminary test procedures and data forms.

3.02 CONSTRUCTION CHECKLISTS

A. Construction checklists cannot modify or conflict with the Contract Documents.

B. Create construction checklists based on actual systems and equipment to be included in Project.

C. Material Checks: Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment, if applicable.

1. Services connection requirements, including configuration, size, location, and other pertinent characteristics.

2. Included optional features.

3. Delivery Receipt Check: Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness and lack of damage.

4. Installation Checks:

a. Location according to Drawings and approved Shop Drawings.
b. Configuration.
c. Compliance with manufacturers' written installation instructions.
d. Attachment to structure.
e. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall-protection regulations and safe work practices.
f. Utility connections are of the correct characteristics, as applicable.
g. Correct labeling and identification.

h. Startup Checks: Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.

D. Startup: Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, minimum.

E. Performance Tests:

1. Static Tests: As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation-resistance tests, and water-penetration tests.

2. Component Performance Tests: Tests evaluate the performance of an input or output of components under a full range of operating conditions.

3. Equipment and Assembly Performance Tests: Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.

4. System Performance Tests: Test and evaluate performance of systems under a full range of operating conditions and loads.

5. Intersystem Performance Tests: Test and evaluate the interface of different systems under a full range of operating conditions and loads.

3.03 GENERAL EXECUTION REQUIREMENTS

A. Schedule and coordinate commissioning with the construction schedule.

B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.

C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies.

1. Included in the Commissioning Plan is a detailed list of the test demonstrations.

D. Report test data and commissioning issue resolutions.

E. Schedule personnel to participate in and perform Commissioning-Process Work.

F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:

1. Operating the equipment and systems they install during tests.

2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

3.04 COMMISSIONING COORDINATOR RESPONSIBILITIES

A. Management and Coordination: Manage, schedule, and coordinate commissioning,

including, but not limited to, the following:

1. Coordinate with subcontractors on their commissioning responsibilities and activities.

2. Obtain, assemble, and submit any commissioning documentation.

3. Attend periodic on-site commissioning meetings. Comply with requirements in "Project Management and Coordination."

4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the construction schedule. Update schedule at specified intervals.

5. Report inconsistencies and issues in system operations.

6. Coordinate witnessing of test demonstrations by Owner's witness.

7. Coordinate and manage training. Be present during training sessions to direct video recording, present training and direct the training presentations of others. Comply with requirements in "Demonstration and Training."

8. Track commissioning issues until resolution and retesting is successfully completed.

9. Retain original records of Commissioning-Process Work, organized as required for the commissioning report. Provide Owner's representative access to these records on request.

3.05 COMMISSIONING TESTING

A. Quality Control: Construction checklists, including tests, are quality-control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality-control process.

B. Owner's witness will be present to witness commissioning work requiring the signature of an owner's witness, including, but not limited to, test demonstrations. Owner's project manager will coordinate attendance by Owner's witness with Contractor's published commissioning schedule. Owner's witness will provide no labor or materials in the commissioning work. The only function of Owner's witness will be to observe and comment on the progress and results of commissioning.

C. Construction Checklists:

1. Complete construction checklists as Work is completed.

2. Distribute construction checklists to installing contractors before they start work.

3. Installers:

a. Verify installation using approved construction checklists as Work proceeds.

b. Complete and sign construction checklists weekly for work performed during the preceding week.

4. Provide Owner's Commissioning Authority access to construction checklists.

D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with construction checklists. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.

E. Pre-Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria.

F. Test Procedures and Test Data Forms:

1. Test procedures written by Owner's Commissioning Agent shall define the step-by-step procedures to be used to execute tests and test demonstrations.

2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.

3. Completed test data forms are the official records of the results of tests.

4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and commissioning tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.

5. Review preliminary test procedures and test data forms and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:

a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.

6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."

7. Use only approved test procedures and test data forms to perform and document tests and test demonstrations.

G. Performance of Tests:

1. Perform and complete each step of the approved test procedures in the order

listed.

2. Owner's Commissioning Agent will record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.

3. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.

4. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.

H. Performance of Test Demonstration:

1. Notify Owner's witness at least three (3) days in advance of each test demonstration.

2. Perform and complete each step of the approved test procedures in the order listed.

3. Owner's Commissioning Agent will record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.

4. Provide full access to Owner's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of Owner's witness at the time of the test to authenticate the reported results.

5. Test demonstration data forms not signed by Contractor and Owner's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.

a. Exception for Failure of Owner's Witness to Attend: Failure of Owner's witness to be present for agreed-on schedule of test demonstration shall not delay Contractor. If Owner's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled test. On completion, Contractor shall sign the data form for Contractor and for Owner's witness, and shall note the absence of Owner's witness at the scheduled time and place.

6. False load test requirements are specified in related sections.

   a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be capable of steady-state operation and modulation at

the level of load specified. Equipment and systems permanently installed in this work shall not be used to create the false load without Engineer's written approval.

I. Deferred Tests:

1. Deferred Tests List: Identify, in the request for Certificate of Construction Phase Commissioning Completion, proposed deferred tests or other tests approved for deferral until specified seasonal or other conditions are available. When approved, deferred tests may be completed after the date of Construction Phase Commissioning Completion. Identify proposed deferred tests in the request for Certificate of Construction Phase Commissioning Completion as follows:

   a. Identify deferred tests by number and title.
   b. Provide a target schedule for completion of deferred tests.

2. Schedule and coordinate deferred tests. Schedule deferred tests when specified conditions are available. Notify Owner and Commissioning Authority at least five days (minimum) in advance of tests.

3. Where deferred tests are specified, coordinate participation of necessary personnel and of Architect/Engineer, Commissioning Authority, and Owner's witness. Schedule deferred tests to minimize occupant and facility impact. Obtain Owner's approval of the proposed schedule.

J. Commissioning Compliance Issues:

1. Test results that are not within the range of acceptable results are commissioning compliance issues.

2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.

3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.

4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:

   a. Determine the cause of the failure.
   b. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.

5. Diagnose and correct failed test demonstrations as follows:

   a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
   b. Record the results of each step of the diagnostic procedure.
   c. Record the conclusion of the diagnostic procedure on the fundamental

cause of the issue.

d. Determine and record corrective measures.

e. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.

6. Retest:

a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.

b. For each repeated test demonstration, submit a new test data form, marked "Retest."

7. Do not correct commissioning compliance issues during test demonstrations.

a. Exceptions will be allowed if the cause of the issue is obvious, and resolution can be completed in less than fifteen minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

3.06 COMMISSIONING MEETINGS

A. Commissioning Authority will schedule and conduct commissioning meetings. Comply with requirements in "Project Management and Coordination."

3.07 SEQUENCING

A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:

1. Construction Checklists:

a. Material checks.

b. Installation checks.

c. Start up, as appropriate. Some startups may depend on component performance. Such startup may follow component performance tests on which the startup depends.

d. Performance Tests:

1) Static tests, as appropriate.

2) Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.

3) Equipment and assembly performance tests.

4) System performance tests.
5) Intersystem performance tests.

2. Commissioning tests.

B. Before performing commissioning tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to construction checklists.

C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify Architect/Owwner if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.

D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

3.08 SCHEDULING

A. Commence commissioning as early in the construction period as possible.

B. Commissioning Schedule: Integrate commissioning into Contractor's construction schedule. See "Construction Progress Documentation" specification.

1. Include detailed commissioning activities in monthly updated Contractor's construction schedule and short interval schedule submittals.

2. Schedule the start date and duration for the following commissioning activities:

a. Submittals.
b. Preliminary operation and maintenance manual submittals.
c. Installation checks.
d. Startup, where required.
e. Performance tests.
f. Performance test demonstrations.
g. Commissioning tests.
h. Commissioning test demonstrations.

3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.

4. Determine milestones and prerequisites for commissioning. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short interval schedule submittals.

C. Two-Week Look-Ahead Commissioning Schedule:

1. Two weeks prior to the beginning of tests, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning.

2. Two-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.

3. Use two-week look-ahead schedules to notify and coordinate participation of Owner's witnesses.

D. Owner's Witness Coordination:

1. Notify Architect and/or Owner of commissioning schedule changes at least three workdays in advance for activities requiring the participation of Owner's witness.

3.09 COMMISSIONING REPORTS

A. Test Reports:

1. Pre-startup reports include observations of the conditions of installation, organized into the following sections:

a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.
c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.

2. Test data reports include the following:

a. "As-tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
c. Signatures of individuals performing and witnessing tests.

3. Commissioning Compliance Issues Reports: Report any commissioning

compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Use sequentially numbered facsimiles of commissioning compliance issue report form included in this Section, or other form approved by Owner. Distribute commissioning compliance issue reports to parties responsible for taking corrective action. Identify the following:

a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
b. Action distribution list.
c. Report date.
d. Test number and description.
e. Equipment identification and location.
f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
g. Diagnostic procedure or plan to determine the cause (include in initial submittal)
h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.
j. When issues have been resolved, update and resubmit the commissioning issue report forms by completing Part 2. Identify resolution taken and the dates and initials of the persons making the entries.
k. Schedule for retesting.

4. Progress reports include information for tests conducted since the preceding report and the following:

a. Completed data forms.
b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
c. Activities scheduled but not conducted per schedule.
d. Commissioning compliance issue report log.
e. Schedule changes for remaining Commissioning-Process Work, if any.

5. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."

a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.

3.10 CERTIFICATE OF CONSTRUCTION PHASE COMMISSIONING COMPLETION

A. When Contractor considers that construction phase commissioning, or a portion thereof which Owner agrees to accept separately, is complete, Contractor shall prepare and

submit to Owner and Commissioning Authority through Architect a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to compete commissioning.

B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction phase commissioning or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction Phase Commissioning Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction Phase Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction phase commissioning completion.

C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for Architect's and Commissioning Authority's services and expenses made necessary thereby, shall be at Contractor's expense.

D. When construction phase commissioning or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction Phase Commissioning that shall establish the date of completion of construction phase commissioning. Certificate of Construction Phase Commissioning Completion shall be submitted prior to requesting inspection for determining date of Substantial Completion.

+ + END OF SECTION + +

SECTION 02 41 19 SELECTIVE DEMOLITION AND ALTERATION WORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the selective demolition and alteration work as shown on the drawings and/or specified herein, including but not limited to the following:

1. Alterations, selective demolition and removals as noted on drawings and as required to accommodate new construction.

2. Removal of debris.

3. Protection of existing building and spaces to remain, and shoring of the structure as required for structural integrity and personal safety.

4. Alterations, selective demolition and removals of exterior facade where noted.

5. Patching and refinishing of existing surfaces damaged as a result of this work.

6. Protection.

1.4 QUALITY ASSURANCE

A. The Contractor shall comply with the requirements of all applicable Federal, State and local safety and health regulations regarding the demolition of structures including ANSI/NFPD 241- Building Construction and Demolition Operations.

B. The Contractor shall be responsible for any damage to any adjacent structures or buildings to remain.

C. Qualifications: Qualifications of Contractor for work of this Section shall not be less than ten (10) years of field experience in work of this nature.

D. Professional Engineer Qualifications: A professional engineer who is licensed to practice in the State of New York and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system,

assembly, or products that are similar to those indicated for this Project in material, design, and extent.

1.5 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Alteration and removal requirements for mechanical and electrical work - Mechanical and Electrical Sections.

1.6 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

1.7 SUBMITTALS

A. Schedule of Demolition Operations: Submit demolition procedures and operational sequence for Commissioner's review prior to start of work. Submit a written request to Commissioner well in advance of executing any cutting or alteration which affects:

1. The work of tying in or connecting to operational systems of the building, including electrical, mechanical and security systems.

2. The work of The City of New York or any separate Contractor.

3. The structural value or integrity of any element of the project or of adjacent structures.

4. The integrity or effectiveness of weather-exposed and moisture-resistant elements or systems.

5. The efficiency, operational life, maintenance, or safety of operational elements or systems.

B. Notice of Differing Conditions: Submit a written notification to the Commissioner if, during the work of demolition and cutting, conditions are discovered which significantly vary from those shown on the drawings. Do not commence work until Commissioner has reviewed and approved the notice and work affected.

C. Shop Drawings: Submit the following prior to starting work:

1. Submit for Commissioner's information shop drawings indicating location and typical construction details of temporary dustproof and weatherproof partitions.

2. Submit drawings of temporary structural shoring, bracing, framing or support, for the information of the Commissioner. Such drawings will be reviewed by the Structural Engineer for the effects of such temporary members on the structural elements to remain. These drawings shall include the reason for such temporary members, the location, the direction and magnitude of design reaction forces on existing structure, and details showing how these reaction forces will be applied to the existing structure.

a. Shop drawings shall be submitted with the Seal of the P.E. engaged by Contractor; P.E. must be licensed in the State of New York.

b. The Commissioner will receive acknowledgment for concepts shown. Such acknowledgments shall be of the concept only and not of actual capacities or structural design and shall not in any way diminish or limit the Contractor's responsibility for the quality and performance of the work and for protecting existing structures and facilities.

D. Engineering Services Submittal: For shoring and bracing work required by this section, submit design calculations sealed and signed by the qualified Contractor's Professional Engineer, licensed in the State of New York, responsible for their preparation.

1. Engineering services documentation shall be submitted to Commissioner for review and approval prior to any incorporation into the work.

1.8 SPECIAL PRECAUTION

A. Hazardous materials may be encountered during demolition operations including asbestos; comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution. For any and all hazardous materials, comply with the removal and abatement sections of this specification.

1.9 JOB CONDITIONS

A. Condition of Structure

1. The Contractor for the work of this Section shall be held to have visited the site, examined the premises, determined for himself the existing conditions, character of equipment and facilities needed for the performance of the work, and all matters which may in any way affect the work before submitting a bid.

a. Information regarding existing construction or conditions is based on available record drawings which may or may not truly reflect existing conditions. Such information is included on the assumption that it may be of interest to the Contractor, but the Commissioner, The City of New York and their consultants do not assume responsibility for its accuracy or completeness.
b. Notify the Commissioner in writing if, during the course of demolition, conditions are discovered which significantly vary from those shown on the drawings. Do not proceed until authorized by Commissioner.

2. The Contractor shall accept the condition of the site and structures as found. The Commissioner and The City of New York assume no responsibility for condition of site or structures nor the continuation of the condition existing at time of bidding or thereafter.

B. Areas of building to be demolished or altered will be vacated and discontinued in use prior to the start of the work.

1. Surrounding areas of the building shall remain operational by The City of New York.

C. Partial Removal

1. Items of savable value to the Contractor may be removed from the structure as the work progresses. Salvaged items must be transported from the site as they are removed.

2. Storage or sale of removed items on the site will not be permitted.

D. Explosives: The use of explosives will not be permitted.

E. Traffic

1. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities.

2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

F. Utilities

1. Refer to Division 22 and 26 of the specifications for special requirements concerning utilities and services.

2. Maintain any existing utilities required to remain; keep in service and protect against damage during demolition operations.

3. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to the governing authorities.

4. Disconnect and seal any abandoned utilities before starting demolition operations. Coordinate all work with local utility companies having jurisdiction.

1.10 SCHEDULING

A. At least seven (7) days in advance of commencing any alteration or demolition work, submit for review by the Commissioner, and approval of The City of New York, a schedule showing the commencement, the order, and the completion dates for the various parts of this work.

B. Before starting any work relating to existing utilities (electrical, sewer, water, heat, gas, fire lines, etc.) that will temporarily discontinue or disrupt service to the structures to remain, notify the Commissioner and The City of New York 7 days in advance and obtain The City of New York's approval in writing before proceeding with this phase of the work.

PART 2 PRODUCTS

Refer to Part 3 - Execution, for Product Requirements

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 PROTECTION

A. Take full precautions to protect workmen, passersby or any other persons from falling debris and other hazards of demolition operations.

B. Execute demolition work to ensure protection of existing portions of building to remain against damages which might occur from falling debris or other cause. Do not interfere with use of adjacent occupied buildings and areas. Maintain free, safe passage to and from occupied adjacent buildings.

C. Materials Placement: Do not load structure with weight that will endanger, overload or cause excessive deflection of the existing structure, or that will damage finished surfaces adjacent to and/or supported by the existing structure, except portions being removed.

D. Construction Operations: Do not employ any construction operation, equipment or vehicles that will endanger, overload or cause excessive deflection of the existing structure, or that will damage finished surfaces adjacent to and/or supported by the existing structure, except portions being removed.

E. Take precautions to guard against movement, settlement, damage, or collapse of any part of building, sidewalks, adjacent property or street passages; be liable for any such movement, settlement or collapse. If such damage does accidentally occur, Contractor shall repair promptly at no cost to The City of New York.

F. Provide the necessary safeguards to prevent accidents, to avoid all necessary hazards and protect the public, the work and property at all times, including Saturdays, Sundays, and holidays.

G. Be responsible for any and all damages which may arise or occur to any party whatsoever by reason of the neglect in providing proper lights, guards, barriers, or any other safeguards to prevent damage to property, life and limb.

H. Make such explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal. Give particular attention to shoring and bracing requirements so as to prevent any damage to existing construction.

1. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished and adjacent facilities to remain. The Contractor's Professional Engineer shall advise on bracing, shoring, or other structural requirements. The Contractor shall bear all responsibility for prevention of movement or other structural fault.

2. The Contractor shall restore, by repair or otherwise, the portions of structure or their contents altered by the Contractor in furtherance of their support operations. Restoration shall be completed to the conditions which existed prior to the start of the work. Any damage caused by inadequate support shall also be restored by the Contractor at no cost to The City of New York.

I. Provide, erect and maintain catch platforms, lights, barriers, weather protection, warning signs, and other items as required for proper protection of the workmen engaged in demolition and alteration operations, occupants of the building, public and adjacent property. Any damage

caused by the Contractor's operations shall be promptly repaired by the Contractor at no cost to The City of New York.

J. Provide and maintain temporary protection of the existing structure designated to remain where demolition, removal, and new work are being done, connections made, materials handled, or equipment moved.

K. Take necessary precautions to prevent dust and dirt from rising or entering any existing or new building systems. Protect unaltered portions of the existing building and building systems affected by the operations under this Section by dustproof partitions and other adequate means.

L. Provide adequate fire protection in accordance with local Fire Department requirements.

M. Do not close or obstruct walkways, passageways, or stairways. Do not store or place materials in passageways, stairs, or other means of egress. Conduct operations with minimum traffic interference.

N. Be responsible for any damage to the existing structure or contents by reason of the insufficiency of protection provided.

O. Promptly repair damages caused to adjacent facilities by demolition operations at no cost to The City of New York.

P. Provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.

3.3 INSPECTION

A. Verify that areas of demolition work are protected and temporary dustproof partitions have been installed.

B. Verify that construction to be removed is not load bearing or has been properly braced, framed or supported.

C. Inspect existing conditions of the project, including elements subject to damage or to movement during demolition and cutting.

D. After uncovering work, inspect the conditions affecting the installation or performance of the work.

1. Report differing or questionable conditions to the Commissioner in writing; do not proceed with the work until the Commissioner has provided further instructions.

3.4 PREPARATION

A. Provide adequate temporary support as necessary to assure the structural value or integrity of the affected portion of the work

B. Provide devices and methods to protect other portions of the project from damage.

C. Pollution Controls

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.

    a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

2. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition operations. Return adjacent areas to condition existing prior to the start of the work.

3. Provide drainage for temporary water use.

3.5 DEMOLITION AND CUTTING

A. Selectively demolish existing construction in conformance with the drawings and these specifications.

1. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surface to receive installation of work by others and patching of finish surfaces.

2. Do all cutting or removal so as to leave neat, true, plumb and square edges, at edges to remain. Use carborundum or diamond saw equipment for cutting masonry, concrete and stone work, where edges or surfaces are to remain.

3. Do not cut or remove construction which might weaken or impair the structural integrity or strength of the structural framing or support systems which are to remain.

4. Demolish and remove materials as shown on the drawings without damage to the remaining parts of the structure or mechanical/electrical/utility systems.

5. Remove materials so as to not impose excessive loads in supporting walls, floors or framing and so as not to damage remaining undemolished portions of the structure.

6. Where portions of structures are to be removed, remaining portions shall be protected from damage and prepared to fit new construction. Damage to portions of structures to remain shall be repaired.

7. Reinforcing steel in existing structures shall be left in place, cleaned and aligned to provide tie with new work.

8. Existing waterproofing systems and flashings shall be carefully exposed and protected to maintain workable conditions of fitting new work with existing construction.

9. Proceed with demolition in a systematic manner.

10. Demolish concrete and masonry in small sections.

11. Remove structural framing members and lower to ground by means of hoists, derricks, or other suitable methods.

B. Shoring

1. Design, provide, erect and maintain necessary temporary shoring, bracing, framing, or support where load bearing structural or supporting members are removed or weakened by cuts or openings or are subject to damage from demolition operations, and otherwise as required for safety or to protect finish surfaces from damage.

2. Construction and adequacy of the shoring shall be the entire responsibility of the Contractor. Any damage caused by the inadequacy of the shoring or other support shall be the responsibility of the Contractor to remedy at no additional expense to The City of New York.

3. Shoring and bracing shall remain until new structural framing and/or supports are installed. Coordinate operations fully with other trades.

4. Be ready at any time to promptly provide, add to, or strengthen temporary shoring, bracing, or support for existing work, in case existing construction begins to show signs of structural stress.

3.6 WORKMANSHIP STANDARDS FOR ALTERATION AND REMOVAL WORK

A. Cut, remove, alter, temporarily remove and replace, or relocate existing work as required for performance of the work. Perform such work required with due care, including shoring and bracing.

B. Coordinate patching involving the various trades whether or not specifically mentioned in the respective specification Sections.

C. Materials or items demolished and not designated to become the property of The City of New York or to be reinstalled shall become the property of the Contractor and shall be removed from The City of New York's property.

D. Execute the work in a careful and orderly manner, with the least possible disturbance to the public and to the occupants of the adjacent buildings.

E. In general, demolish masonry in small sections. Where necessary to prevent collapse of any construction, install temporary shores, struts, or bracing.

F. Materials to be removed by existing elevators shall be put in enclosed containers.

G. Where existing equipment and/or fixtures are indicated to be reused, repair such equipment and/or fixtures and refinish to put in perfect working order. Refinish as directed.

H. Cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.

I. Confine cutting of existing roof areas designated to remain to the limits required for the proper installation of the new work. Cut and fold back existing roofing. Cut and remove insulation and related items. Provide temporary weathertight protection as required until new roofing and flashings are installed. Consult The City of New York to ascertain if existing guarantee bonds are in force and execute the work so as not to invalidate such bonds.

J. Where utilities are removed, relocated or abandoned, cap, valve, plug, or by-pass to make complete and working installation.

K. Restore existing pipe and duct coverings damaged by work under this Contract to original undamaged condition.

L. Immediately restore to service and repair any damage caused by Contractor's workmen to existing pipe and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems which are not scheduled for discontinuance or abandonment.

M. Upon completion of contract, deliver work complete. Damage that may be caused by Contractor or Contractor's workmen to existing structures designated to remain, grounds, and utilities shall be repaired by Contractor and left in as good condition as existed prior to damaging.

N. Restore finish work of floors, walls, and ceilings remaining in place but damaged or defaced because of demolition or alteration work to condition equal that which existed at beginning of work under this Contract.

O. Where alteration or removals expose damaged or unfinished surfaces or materials, refinish such surfaces or materials, or remove them and provide new or salvaged materials to make continuous surfaces uniform.

P. Perform new work and restore and refinish existing work in conformance with applicable requirements of the specifications, except as follows:

1. Materials for use in repair of existing surfaces, but not otherwise specified, shall conform to the highest standards of the trade involved, and be in accordance with approved industry standards, and shall be as required to match existing surfaces.

2. Workmanship for repair of existing materials shall, unless otherwise specified, shall conform to the highest standards of the trade involved, and be in accordance with approved industry standards.

3. Installation of salvaged items where no similar items exist shall be done in accordance with the highest standards of the trade involved and in accordance with approved shop drawings.

Q. Materials or items designated to become the property of The City of New York shall be as shown on the drawings. Remove such items with care and store them in a location at the site to be designated by The City of New York.

R. Materials or items designated to be reinstalled shall be as shown on the drawings. Remove such items with care under the supervision of the trade responsible for reinstallation; protect and store until required. Replace materials or items damaged in their removal with similar new material.

S. The existing building shall not be used as a work shop. Neither shall the furnishings or equipment in any room be used as work benches. Should any damage occur during the progress of the work to any furniture, fixtures, equipment, or appurtenances therein, such

damage shall be repaired, replaced or made good by the Contractor without extra cost to The City of New York.

T. Where removing existing floor finish and base, remove all adhesive and leave floors and walls smooth and flush, ready to receive new finish.

U. Finish new and adjacent existing surfaces as specified for new work. Clean existing surfaces of dirt, grease and loose paint before refinishing.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General

1. Remove from the site debris, rubbish and other materials resulting from work of this Section.

2. Burning of removed materials from demolished structures will not be permitted on the site.

B. Removal: Transport materials removed from demolished structures and legally dispose of off-site. Pay any and all fees associated with disposal work. Leave the site in an orderly condition to the approval of the Commissioner.

3.8 CLEANING UP

A. Remove debris as the work progresses. Maintain existing premises in a neat and clean condition.

END OF SECTION

SECTION 02 82 00 ASBESTOS REMOVAL

PART 1 -– GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contact drawings, (2) the Specifications, (3) the DCAS General Conditions, (4) the Addendum and (5) the Contract [City of New York Construction Contract].

1.2 SCOPE OF WORK

A. Asbestos abatement work to be executed to facilitate the work of Project will consist of the removal and disposal of asbestos-containing, asbestos-contaminated, and assumed asbestos-containing materials.

B. The abatement work shall include, but may not be limited to, the removal of materials as delineated on the corresponding H Series contract drawings associated with the Project.

C. All Work shall be performed in strict accordance with the Project Documents and all governing codes, rules, and regulations. Where conflicts occur between the Project Documents and applicable codes, rules, and regulations, the more stringent shall apply.

D. Working hours shall be as required and approved by The City of New York. Asbestos abatement activities including, but not limited to, work area preparation, gross removal activities, cleaning activities, waste removal, etc. may need to be performed during ‘off-hours’ (including nights and weekends). In addition, multiple mobilizations may be required to perform the work identified in this project. The Contractor shall coordinate and schedule all Work with the facility and The City of New York.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. The following Sections/Divisions contain requirements that relate to the Work of this Section:

1. Section 02 83 04 – Incidental Disturbance of Lead Containing Materials
2. Section 02 86 00 – Identification and Disposal of Hazardous Waste
3. Section 02 87 00 – Removal and Disposal of Universal Waste and Fluorescent Lamps

1.4 REQUIREMENTS AND RESTRICTIONS

A. The Contractor shall furnish proof that employees are New York City Department of Environmental Protection (NYCDEP) Certified Asbestos Handlers and have had instruction on the dangers of asbestos exposure, on respirator use, decontamination and OSHA. regulation.

B. All removal procedures shall be conducted by workers specifically trained in such procedures.

C. Work clothes shall consist of full-body coveralls, disposable head covers, boots or sneakers and repertory protective equipment as required. Regulation eye protection and hard hats shall be available as appropriate.

D. Coveralls shall be of paper disposable type.

E. Respiratory protection for workers shall be provided by the Contractor as required by current OSHA and NYCDEP Regulations.

F. The Contractor shall furnish documentation of successful performance in asbestos removal. This shall include name and address of purchaser of service and location of work performed.

G. The Contractor shall have in their possession at all times, one copy at their office and one copy shall be posted at the job site regarding OSHA Regulation 1926.58, Asbestos and Environmental Protection Agency 40 CFR Part 61, sub part A&M National Emission Standard for Asbestos, Stripping Work Practices and Disposal of Asbestos Waste.

H. The Contractor shall be required to carry asbestos insurance when removing asbestos and throughout the entire process and assume full responsibility for failure to comply with NYCDEP and OSHA regulations.

I. The Contractor shall notify NYCDEP as required by that agency but in no case less than 10 days prior to start of work.

1.5 NOTES

A. During abatement air monitoring is not part of the work of this Contract. It shall be performed by an independent firm to be selected and paid for by The City of New York. The Contractor shall coordinate his work with the air monitoring firm, with The City of New York's cooperation.

B. Asbestos when removed and carted away from the Facility shall not be transferred from one vehicle to another except at a transfer-station certified by the New York State Department of Environmental Conservation.

C. Once work has begun at a particular area, it shall proceed at a steady rate until all asbestos removal at that location is completed.

D. An asbestos removal plan shall be filed with NYCDEP, with a copy given to The City of New York.

E. Keep a daily log to be inspected by the Commissioner. The log shall comply with the NYCDEP Rules and Regulation, Title 15, Chapter 1, eff. 2019 (15 RCNY Chapter 1). Sign the Contractor's Log Book in the Superintendent's office daily, immediately upon arrival at the work site.

1.6 CODES

A. All work shall be in accordance with 15 RCNY 1 and the New York State Department of Labor (NYSDOL) Industrial Code Rule Part 56 (12 NYCRR Part 56).

B. All asbestos removal and disposal to be performed under this Contract shall be in accordance with all applicable Federal, State and City regulations. Applicable regulations, guidelines and standards are to include, but are not limited to:

1. Occupational Safety and Health Administration (OSHA) U.S. Dept. of Labor-Asbestos Regulations 29 CFR 1926 and 1910.

2. City of New York, NYCDEP Rules and Regulation, Title 15, Chapter 1, eff. 2019.

3. The U.S. Environmental Protection Agency (EPA) Regulation for Asbestos 40 CFR 61 Subparts A & M.

4. The New York State Department of Labor Industrial Code - Rule 56.

5. N.Y. State Environment Conservation Law Article 27, Title 3 and 15.

1.7 STANDARDS

A. Violations to asbestos regulations governing this abatement will not be tolerated. At The City of New York's discretion, the Asbestos Handler Supervisor of this project will be required to be replaced.

B. The Contractor shall post at the job site the following regulations at the job site:

1. NY State Industrial Code Rule 56,

2. NY City DEP Title 15 Chapter 1, eff. 2019,

3. US EPA Regulations for Asbestos, 40 CFR 61 Subparts A and M,

4. OSHA 29 CFR 1926.1101.

C. Furnish and post approved signage indicating that asbestos work is to be conducted within the building. Signs shall be posted in the lobby of the buildings addressing the dates in which each floor will be abated. This notification is to be approved by The City of New York.

D. Asbestos abatement activities are to be monitored by an Inspector and/or a representative on behalf of The City of New York acting as an Asbestos Project Monitor. The Asbestos Handler Supervisor shall adhere to the direction of the Inspector and Project Monitor.

1.8 SPECIAL CONDITIONS

A. Prepare a schedule of work in consultation with The City of New York. The schedule is to be followed as closely as possible. Notify The City of New York a minimum of 72 hours in advance of work scheduled in common/egress areas. Notices shall be in both English and Spanish.

B. Prior to the workplace preparation, the Contractor shall coordinate with the general contractor (GC), The City of New York, and Facility Personnel any and all security and egress issues that may apply to the overall protection and safety of the building and occupants.

C. Coordinate the asbestos abatement activities with the overall project schedule and demolition activities.

D. For the purposes of this specification it is understood that the portions of the building scheduled to be impacted as part of this project will be un-occupied for the duration of work.

E. The Contractor shall coordinate and furnish all necessary equipment to facilitate the asbestos abatement work of this contract; this includes (but is not limited to) scaffolding (for roof and elevated utilities abatement, etc.) and ladder/aerial lift access. Required equipment/materials are to be considered and incorporated into the Contractor's base bid.

F. The Contractor shall secure the facility at the end of each work shift including any/all openings utilized for negative air pressure unit(s) exhaust and make up air inlets. The methods used to secure the facility shall not impede or hinder negative air unit efficiencies or make up air necessary to meet the requirements of 15 RCNY Chapter 1, § 1-91 *Engineering Controls*.

1.9 FILINGS AND CERTIFICATION

A. The Contractor shall be responsible for maintaining current project filings with regulatory agencies (EPA, NYSDOL, NYCDEP, as applicable) for the duration of the project.

B. The Contractor shall pay the filing fees for notification of asbestos work as required by the City of New York, NYSDOL, Division of Safety and Health. This shall be incorporated into the Contractor's bid.

C. The Contractor shall utilize the provisions and removal methods depicted in the H Series contract drawings for this project to facilitate the removal of asbestos-containing/assumed asbestos-containing and asbestos-contaminated materials. If the Contractor elects to utilize alternate methods, approval from The City of New York and/or Commissioner must be sought in writing.

D. Work shall not begin until there is an approved schedule and The City of New York has received a copy of the Asbestos Abatement Permit and the NYCDEP V-2 Form (as applicable).

E. The Contractor shall notify NYCDEP and NYSDOL ten (10) days prior to start of work. He shall also notify the nearest EPA office before removal work begins and obtain all necessary permits.

F. The Contractor shall coordinate the filing of this job with NYCDEP. The City of New York will sign the forms as Owner, however actual filing shall be done by the Contractor.

G. The City of New York's signature for the notification forms (ACP-7) may be obtained from DCAS.

H. ACP-7(s) submitted to The City of New York for signature must include the following:

1. Floor plans of the areas impacted by this Project showing location of the decontamination

enclosure system (H Series Contract Drawings),

2. The dimensions of the decontamination enclosure system in relation to the corridor,

3. Site specific information as to where the electrical power and water sources are located for this project,

4. Copies of the variance for any and all relief from RCNY 15 Chapter 1 in order to properly perform the asbestos abatement (as applicable).

1.10 ASBESTOS WORK PLAN

A. All asbestos abatement contractors shall always produce and submit Detail Asbestos Work Plan to The City of New York. It will include the following:

1. LOCATION – Name of Building and Address as per filing (ACP-7, NYSDOL & EPA notification)

2. GENERAL INFORMATION – The City of New York, CM Firm Name, Prime Contractor Company Name, Asbestos Contractor company name, and Air-monitoring Contractor Company Name.

3. SCHEDULE – Tentative Start and tentative completion date.

4. DEVELOPMENT LOGBOOK – Location of sign in/out logbook for contractors (construction trailer, development superintendent office or manager, etc.) and who will sign-in and out.

5. WORK DESCRIPTION AND PROCEDURE – Provide work area location & quantities. List abatement procedure being used.

6. POSTING – List and identify locations of all necessary and required postings by law.

7. DECONTAMINATION UNITS – How many, location type, (pop-up, wood structure, trailer etc.) and when they will be broken down and demobilized etc.

8. WASTE – Description of waste route after it is bagged, container on site (waste condition daily log document), pickup information and waste receipt acknowledge or manifest.

9. UTILITIES – Brief description from where electric power and water will be collected and GFCI location. Name of electrical contractor and license number.

10. CERTIFICATES – List licenses and certificates hold by workers, such as NYCDEP, NYSDOL, Federal EPA, NYCDOB (Scaffold), OSHA, etc. needed to perform work.

11. PERMITS AND AUTHORIZATIONS – List all permits, notifications, and authorizations needed to properly execute asbestos abatement work including NYCDEP, NYSDOL, Federal EPA, NYCDOB (CD5), OSHA, etc.

12. SAFETY – List and describe PPE for workers and visitors. Brief description of scaffold and safety line procedures including Safety Engineering stamp and daily report authorization where applicable as per NYCDOB codes and regulations.

13. RESPIRATORY PROTECTION PROGRAM – List name of company respiratory protection program administrator.

14. OTHERS – List or briefly explain any additional relevant information, document or procedure necessary to maintain asbestos abatement work within the asbestos regulations and contract specification compliance (NYCDEP conditions, 2 phase abatement work, etc.).

B. DOCUMENTS:

1. Asbestos building occupant notification to be posted

2. ACP-7(s)

3. NYSDOL Notification

4. EPA Notification

5. Permits, licenses and insurance for asbestos company, waste hauler and disposal site.

6. Written respiratory protection program (include title page and List Program Administrator Only)

7. Detailed emergency fire exit plan with diagram showing evacuation route for workers

8. Sample of original waste hauler manifest with all general applicable information typed.

C. If at any time The City of New York's representative or any agency having jurisdiction decides that work practices are violating pertinent regulations, or endangering workers, he will immediately notify the Contractor's Asbestos Handler Supervisor that operations will cease until all corrective action is taken.

1.11 INSURANCE

A. In addition to the general insurance requirements (see DCAS General Conditions), the Contractor shall carry asbestos insurance when removing asbestos. In addition, the contractor shall assume full responsibility for any failure to comply with NYCDEP and OSHA regulations. The Contractor shall carry the following Minimum asbestos related insurance coverage (for all investigators, Handlers and Supervisions):

1.12 MISCELLANEOUS

A. If at any time the Commissioner or any agency having jurisdiction decides that work practices are violating pertinent regulations, or endangering workers, he will immediately notify the Contractor's

Asbestos Handler Supervisor that operations will cease until all corrective action is taken.

1.13 PROTECTION OF PROPERTY

A. Where work is performed, the Contractor shall be held fully responsible for all damage to property belonging to The City of New York. Any equipment furnished under this Contract and any property of The City of New York damaged by the Contractor or his employees shall be restored to its original condition or replaced.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials, including chemical solutions, shall be delivered to the job site in their original containers sealed by the manufacturer. Materials in opened containers shall not be used on this project. Containers shall be clearly labeled with manufacturer's name, product identification and lot numbers, and shall be stored out of the weather in a protected location in their original, sealed containers. Where applicable, materials shall be mixed according to manufacturer's directions and specifications.

B. The following list indicates approved materials for use with each type of abatement work. Request(s) to use an equivalent product(s) shall be made prior to the filing of this project. All required approvals shall be obtained prior to the use of the product(s).

1. Spray Glue

a. Bull–Tack Adhesive Spray by Bullseye Environmental Corporation, (215) 486-9001

b. Lynx Tack Adhesive Spray by ARAMSCO, (800) 767-6933

c. Approved equal

2. Foam

a. Bull Foam by Twin-Chemicals, Inc., (800) 442-4958

b. Pronto Extra-Foam by Twin-Chemicals, Inc., (800) 442-4958

c. IDC Hydro Foam by IDC Corporation, (800) 327-8432

d. Antec Biofoam by Antec International ltd, distributed by Vetoquinol Canada Inc., (450) 586-2252

e. Chemsafe 600 Fibre Suppression by ARAMSCO, (800) 767-6933

f. Approved equal

3. Wetting Agent/Surfactants

   a. Foster Asbestos Removal Surfactant 32-90 by Specialty Construction Brands, Inc. (847) 358-9500

   b. Control Wetting Agent by Grayling Industries Inc, (800) 635-5053

   c. Serpi-Factant Concentrate by W.R. Grace, (866) 333-3726

   d. Chem-Safe Gold by ARAMSCO, (800) 767-9633

   e. Approved equal

4. Lockdown Encapsulant

   a. ChemSafe 500 (White only) by ARAMSCO, (800) 767-9633

   b. Foster Asbestos Removal Encapsulant 32-60 by Specialty Construction Brands, Inc. (847) 358-9500.

   c. Serpiflex White by W.R. Grace, (866) 333-3726

   d. Serpiflex Shield Formula # 5 by W.R. Grace, (866) 333-3726

   e. Control Lockdown Encapsulant by Graying Industries, Inc, (800) 635- 1551

   f. Approved equal

5. Mastic Remover

   a. “Bean-e-doo”, Franmar Chemical, Inc., (309) 452-7526

   b. 200-Plus VLO, AS895, Abatement Technologies, Inc., (800) 634-9091

   c. AMW-98, American Coatings Corp., (954) 790-7620

   d. M3205, Twin-Chem, Inc., (800) 442-4958

   e. Chemsafe Clear, ARAMSCO, (800) 767-6933

   f. No Bull 200 Flash No Odor, Bullseye Environmental Inc., (800) 692-8557

   g. Approved Equal

6. Self-Leveling Underlayment Concrete

a. Ardex K-15 (with E-25 Resilient Emulsion), Ardex Engineering Cements, (724) 203-5000

b. Approved Equal

7. General

a. Polyethylene Sheeting (6-mil thick)

PART 3 - EXECUTION

3.1 GENERAL PROVISIONS

A. The Contractor shall schedule his work with The City of New York prior to start of work.

B. During the work of this Contract, the Contractor shall take all necessary precautions to protect the property of The City of New York.

C. Water service to the site, or any other utility, shall not be interrupted without prior approval of The City of New York.

D. The Contractor shall provide and pay for all electric power required to perform the work of this Contract, within the limitations of the existing service. The Contractor shall provide all wiring, extension outlets, lights, etc. and make all electrical connections as are required, and as approved by The City of New York. All electrical work shall be done by or under the supervision of a NYC Licensed Electrician.

E. The Contractor shall furnish proof that his employees are NYCDEP Certified Asbestos Handlers and have had instruction on the dangers of asbestos exposure, respirator use, decontamination, and OSHA regulation.

F. The Contractor shall furnish documentation of successful performance in asbestos removal. This shall include name and address of purchaser of service and location of work performed.

G. The Contractor shall include all requirements specified by OSHA, The City of New York, and the Manufacturers. Materials shall be applied according to Manufacturer's directions and specifications, subject to approval and modification by The City of New York.

3.2 WORK REQUIREMENTS AND RESTRICTIONS

A. Once asbestos removal work has begun at a particular floor/location, it shall proceed at a steady rate until all work at that location has been completed.

B. Glove bag procedures shall be conducted by workers specifically trained in such procedures.

C. Work clothes provided by the Contractor shall consist of paper disposable type full body coveralls, rubber gloves and disposable head covers, boots or sneakers and respiratory protective equipment, as required by OSHA and/or any NYCDEP regulations. Eye protection and hard hats

shall be available and used as appropriate. In addition, full body "TYVEK" disposable coveralls or approved equal, cotton gloves and towels shall be provided by the Contractor on as needed basis for use by the Commissioner inspecting the work area. This added requirement shall be included and made part of the Contractor's bid price.

D. Asbestos, when removed and carted away from the site, shall not be transferred from one vehicle to another except at a transfer station certified by NYCDEP.

3.3 ASBESTOS REMOVAL PROCESS

A. Removal Method

1. At all such locations, the Contractor need not provide full enclosure unless it is specifically required by NYCDEP, EPA or other applicable regulations.

B. Pre-Removal Preparations

1. Furnish, install and maintain for the duration of the contract work all required showers, barriers, barricades, caution signs and other temporary construction necessary for the proper completion of the work in compliance with all applicable regulations.

a. In compliance with OSHA regulations, the Contractor shall furnish and post approved signs indicating that asbestos work is being done in the area. Signs shall be posted on door leading to the work area.

b. Three layers of plastic sheeting shall be used in conjunction with stud framing where a critical barrier is required over areas larger than 32 square feet.

c. In a pre-designated area, the Contractor shall set up a decontamination facility which will house a changing room, shower room and equipment room, separated by air locks.

d. All movable objects shall be removed from the work area by the Contractor prior to removal of asbestos.

e. Access to each active abatement area must be limited by the installation of a temporary plywood barrier with a lockable door installed at the stairwell and elevator entrance to the floor.

f. A fully functional remote/attached decontamination enclosure system (DECON) shall be constructed prior to any work area preparation. The water and electrical sources for the DECON shall be those sources closest to the DECON. Waste water disposal in a kitchen sink is prohibited. Where the first floor is separated by hard barriers into more than one work area, a separate DECON is required for each work area.

g. The Commissioner and/or the Project Monitor is required to approve the DECON following the inspection by the Asbestos Handler Supervisor and prior to work area preparation.

h. The airlock is to be constructed with two curtained doorways separated by a distance of three (3) feet. Each curtained doorway is to consist of three overlapping sheets of poly.

i. Where HEPA filtered vacuums are used to establish negative pressurization of the tent enclosure, a separate vacuum is to be used for the cleaning of work area surfaces and pipe chase. The vacuum hose used for the establishment of negative pressure is to be affixed to the wall at the furthest point from the air lock. The dedicated vacuum is to remain operating and in place until acceptable clearance air monitoring results have been achieved. Negative pressure equipment units are to be "piggy-backed" when exhaust is within 40 feet of windows or doors.

j. The Commissioner and/or the Project Monitor is required to approve the pre-abatement work area preparation following the inspection by the Asbestos Handler Supervisor and prior to asbestos removal.

3.4 ASBESTOS REMOVAL

A. Asbestos-containing materials shall be removed in accordance with the Contract Documents and the approved Asbestos Work Plan. Only one type of ACM shall be abated at a time within a Work Area. Where there are multiple types of ACM requiring abatement, Code Rule 56 procedures for sequential abatement shall be followed.

B. Sufficiently wet asbestos materials with a low pressure, airless fine spray of surfactant to ensure full penetration prior to material removal. Re-wet material that does not display evidence of saturation.

C. One Worker shall continuously apply amended water while ACM is being removed.

D. Perform cutting, drilling, abrading, or any penetration or disturbance of asbestos containing material in a manner to minimize the dispersal of asbestos fibers into the air. Use equipment and methods specifically designed to limit generation of airborne asbestos particles. All power operated tools used shall be provided with HEPA equipped filtered local exhaust ventilation.

E. Upon removal of ACM from the substrate, the newly exposed surfaces shall be HEPA vacuumed and/or wet cleaned. Surfaces must be thoroughly cleaned using necessary methods and any required solvents to completely remove any adhesive, mastic, etc.

F. All removed material shall be placed into 6 mil plastic disposal bags or other suitable container upon detachment from the substrate. Cleanup of accumulations of loose debris or waste shall be performed whenever there is enough accumulation to fill a single bag or container and minimally at the end of each work shift.

G. Large components shall be wrapped in two layers of 6 mil polyethylene sheeting. Sharp components likely to tear disposal bags shall be placed in fiber drums or boxes and then wrapped with sheeting.

H. Power or pressure washers are not permitted for asbestos removal or clean-up procedures unless approved in a Site-Specific Variance.

I. All construction and demolition debris determined by the Commissioner to be contaminated with asbestos shall be handled and disposed of as asbestos waste.

J. The use of metal shovels, metal dust pans, etc. are not permitted inside the work area.

K. All equipment shall be cleaned of asbestos material prior to leaving the work area.

L. All asbestos waste shall be removed from the Project each day. No storage of asbestos waste shall be permitted on The City of New York premises.

M. Air monitoring equipment must be in place and operating prior to starting abatement work.

3.5 CLEAN-UP AND GUARANTEE

A. If clearance air samples are reported greater than 0.009 f/cc or overloaded, a re-cleaning of the containment and air lock is required prior to re-testing (as applicable). This cleaning shall be repeated until successful clearance has been achieved.

B. If outside the work area air samples (during abatement monitoring) are reported greater than 0.009 f/cc, a re-cleaning of the area outside of the containment is required prior to re-testing. This cleaning shall be repeated until successful clearance has been achieved.

C. After the final cleaning operation, conduct a visual inspection to ensure dust-free conditions. Air sampling and analysis are to be performed by others.

3.6 DISPOSAL OF ASBESTOS MATERIAL AND RELATED DEBRIS

A. All asbestos debris and other debris shall be removed from the premises prior to the end of the work shift. At no time will asbestos debris be allowed to be stored on site once the Contractor has left site.

B. Building specific generator labels shall include the building location address, city and state, the date of abatement, the abatement contractor’s name, and the facility name.

C. Generator labels are to be affixed to the waste bags prior to the bags leaving the buildings. Labels are not to be affixed to the bags at the waste hauling truck.

D. All asbestos waste is to be transported directly to a transfer station or the landfill. No asbestos waste is to be stored or transferred to another location prior to transport to a transfer station or the landfill.

E. No asbestos waste is to be removed from site without a properly documented waste manifest.

F. All asbestos waste shall also be required to comply with EPA, Title 40, Part 61, Sub-part A & B (40 CFR A & B) and OSHA Regulations (29 CFR 1910) for Collecting, Packaging, Transporting and Disposing of Asbestos.

G. The transfer station, if the asbestos Contractor utilizes any, shall be DEC approved.

H. Only NYCDEP approved dump sites shall be used.

I. Workers unloading the sealed bags and machinery operators shall wear respirators when handling materials at the disposal site.

J. Dump the bags at the burial site, in accordance to all applicable NYCDEP Rules and Regulations.

K. Furnish copies of the Waste Manifest transmittal to the Contract Inspector.

3.7 ASBESTOS WASTE MANIFESTS

A. All asbestos waste shall be properly manifested prior to removal from The City of New York's property.

B. Waste transporting shall follow all provisions of the Environmental Conservation Law, Title 3, of Article 27.

C. Copies of the manifest, after all asbestos has been removed from specifying the location, and indicated where the waste will be transported, shall be given to The City of New York' and/or the Project Monitor.

D. A final copy signed by the landfill is to be submitted to The City of New York.

3.8 INDEPENDENT AIR MONITORING AND AIR CLEARANCE

A. An independent Contractor selected and paid for by The City of New York shall conduct air monitoring during and at the completion of the asbestos removal.

B. Air clearance results will be reported to The City of New York and posted daily.

C. No work area containment/critical barriers can be removed until approval is given to the Contractor by the Commissioner or the Project Monitor.

D. Air sample results to be used as clearance cannot be reported by the laboratory directly to the Contractor.

3.9 MISCELLANEOUS

A. If at any time the Commissioner decides that work practices are violating pertinent regulations or endangering workers, he will immediately notify in writing the on-site Contractor's representative that operations will cease until all corrective action is taken.

B. The Contractor will be required to keep a daily log to be inspected by The City of New York. This log will comply with City of New York LL 76/85. Only EPA approved dump sites will be utilized for final dumping.

3.10 CLEANING AND DISPOSAL

A. During the performance of work, the Contractor shall take every precaution to keep the work areas free from dirt and rubbish. Motors, gauges, electrical components, etc., shall be protected from dirt produced by this work.

B. Debris shall be removed from the premises as the work progresses and the work areas shall be left free of dirt and debris before final acceptance of this installation.

C. Except as specified elsewhere herein, all equipment removed by this Contractor shall become his property which he shall remove from the premises and legally dispose of.

3.11 PROTECTION OF APPARATUS

A. Upon final acceptance the Contractor shall be held fully responsible for all damage to apparatus and property regardless of whether furnished by him or belonging to The City of New York. Any equipment furnished under this Contract and any property of The City of New York damaged by this Contractor or his employees shall be restored to its original condition or replaced.

END OF SECTION 02 82 00

SECTION 02 83 04 INCIDENTAL DISTRUBANCE OF LEAD CONTAINING MATERIALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contact drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Construction Contract].

1.2 SUMMARY

A. This Section specifies the requirements for the management of lead-containing paint and/or lead-contaminated components associated with the project, protection of workers, pre-disposal testing and appropriate disposal of removed material.

1.3 REFERENCES

A. New York State Department of Environmental Conservation (DEC) 6NYCRR:

1. Part 360 Solid Waste Management Facilities.

2. Part 364 Waste Transporter Permits.

3. Part 370 Hazardous Waste Management System-General.

4. Part 371 Identification and Listing of Hazardous Wastes.

5. Part 372 Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities.

6 Part 373 Hazardous Waste Management Facilities.

B. New York State Department of Transportation (DOT): Follow all regulations of 49CFR Part 100 through 199.

C. Occupational Safety and Health Administration (OSHA): Lead Exposure in Construction: Interim Final Rule 29 CFR 1926.62.

D. U.S. Department of Housing and Urban Development (HUD): Guidelines for evaluation and control of Lead based paint hazards: Title Ten of Housing and Community Act of 1992.

E. U.S. Environmental Protection Agency (EPA): Resource Conservation and Recovery Act (RCRA) Section 3004 Hazardous and Solid Waste Amendments.

F. U.S. Environmental Protection Agency (EPA): Toxicity Characteristics Leaching Procedure EPA Method 1311.

1.4 DEFINITIONS

A. Authorized Personnel: The City of New York or Commissioner, and all other personnel who are authorized officials of any regulating agency, be it State, Local, Federal or Private entity who possess legal authority for enforcement or inspection of the work.

B. Containment: The enclosure within the building which establishes a contaminated area and surrounds the location where lead remediation is taking place and establishes a Lead Control Work Area.

C. Floor Surface Clearance Criteria: Shall be determined and established by an independent testing lab hired by The City of New York or Commissioner. At a minimum no single post work lead wipe sample test values shall have reading levels greater than the levels established by pre-work wipe sampling test values, or greater than 10 mg/ft^2. Record levels in mg/ft^2.

D. Fixed Object: Mechanical equipment, electrical equipment, fire detection systems, alarms, and all other fixed equipment, furniture, fixtures or other items which cannot be removed from the work area.

E. HEPA: High Efficiency Particulate Absolute filtration efficiency of 99.97 percent down to 0.3 microns. Filtration provided on specialized vacuums and air filtration devices to trap particles.

F. Lead Based Paint (LBP): Paints or other surface coatings that contain lead equal to or greater than 0.6 milligrams per square centimeter or 0.25 percent of lead by weight.

G. Lead Containing Paint (LCP): Any surface coating containing a detectable concentration lead utilizing proper analytical and/or testing methods.

H. Lead Dust Control Work Area: A cordoned off area with drop clothes or an enclosed area or structure with containment to prevent the spread of lead dust, paint chips, or debris from lead-containing paint disturbance operations.

I. PPE: Personal Protective Equipment.

1.5 ABBREVIATIONS

A. ASTM: American Society for Testing and Materials

1916 Race Street

Philadelphia, PA 19103

B. CFR: Code of Federal Regulations

Government Printing Office

Washington, DC 20402

C. DOT: Department of Transportation

Main Office, 50 Wolf Road

Albany, NY 12232

D. NIOSH: National Institute for Occupational Safety and Health

Building J, N.E. Room 3007

Atlanta, Georgia 30333

E. OSHA: Occupational Safety and Health Administration

200 Constitution Avenue

Washington, DC 20210

F. USEPA: United States Environmental Protection Agency

401 M Street SW

Washington, DC 20460

1.6 SUBMITTALS

A. Quality Control Submittals: Submit the entire Lead Abatement submittal package at the same time.

1. Worker' Qualifications: The persons removing lead containing/ coated material and their Supervisors shall be personally experienced in this type of work and shall have been employed by a company with a minimum of one-year experience in this type of work. Submit a copy of documentation of completion of the EPA lead renovators instructing program.

a. Name of lead supervisor on site during the work.

2. Detailed Work Plan: Submit one copy of the work plan required under Quality Assurance Article.

3. Waste Transporter Permit: One copy of transporter's current NYS DEC waste transporter permit.

B. Operation and Maintenance Data: Submit air filtration unit operation and maintenance data and manufacturer's catalog sheets for the HEPA filter.

1. Provide an affidavit stating that the HEPA filters to be used for this project are new and unused.

C. Contract Closeout Submittals:

1. Assessment Report compiled by a testing lab certifying that the work area has lead concentrations below the levels specified under the cleaning criteria.

2. Disposal Site Receipts: Copy of waste shipment record and disposal site receipt showing that the lead-containing materials have been properly disposed.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the referenced standards.

B. Pre-Work Conference: Before the Work of this Section is scheduled to commence, a conference will be held by The Commissioner at the Site with the Contractor and the lead handling subcontractor (if any) for the purpose of reviewing the Contract Documents, discussing requirements for the Work, and reviewing the Work procedures.

C. Detailed Lead-Containing Material Removal Work Plan: Before the physical Work begins, prepare a detailed lead-containing material removal work plan.

1. The work plan shall include, but not be limited to, the location, size, and details of lead dust control work areas, containment, sequencing of lead containing material handling, work procedures, types of equipment, crew size, and emergency procedures for fire and medical emergencies.

1.8 PROJECT CONDITIONS

A. Shutdown of Air Handling System: Complete the Work of this Section within the time limitation allowed for shutdown of the air handling system serving the work area.

B. Cover and seal all fin-tube radiator covers, diffusers, duplex outlets, speakers, smoke and heat detectors, etc. Use temporary plasticized partitions as required.

1. Prevent lead containing dust from entering hard to clean areas within the dust containment area.

2. Items judged to be too difficult to protect may be disconnected, removed and replaced at contractor’s option.

C. Remove or encase all movable equipment in the work area with two layers of 6-mil fire retardant polyethylene sheeting.

D. Cut and altar existing materials as required to perform the work. Limit cutting to the smallest amount necessary. Core drill round holes and saw cut other openings where possible for removal work. Flame cutting, high speed grinding or welding is prohibited on lead painted surfaces.

1.9 HEALTH AND SAFETY

A. Where in the performance of the work, workers, supervisory personnel or sub-contractors may encounter, disturb, or otherwise function in the immediate vicinity of contaminated items and materials, all personnel shall take appropriate continuous measures as necessary to protect all ancillary building occupants from the potential lead exposure.

1.10 FIRE PROTECTION, EMERGENCY EGRESS AND SECURITY

A. Establish emergency and fire exits from the lead dust control work area containment. Provide first aid kits and two full sets of protective clothing and respirators for use by qualified emergency personnel outside of the work area.

B. Provide a logbook throughout the entire term of the project. All persons who enter the regulated lead dust control work area or containment shall sign the logbook. Document any intrusion or incident in the log book.

1.11 PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

A. Workers must wear protective suits, protective gloves, eye protection and a minimum of half-face respirator with new HEPA filter cartridge for all projects. Respiratory protection shall be in accordance with OSHA regulation 1910.134 and ANSI Z88.2.

B. Workers must be trained per EPA, have medical clearance and must have recently received pulmonary function test (PFT) and respirator fit tested by a trained professional.

1. A personal air sampling program shall be in place as required by OSHA.

2. The use of respirators must also follow a complete respiratory protection program as specified by OSHA.

PART 2 PRODUCTS

2.1 RESPIRATORS

A. Type: Approved by the Mine Safety and Health Administration (MSHA), Department of Labor, or the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

2.2 VACUUM CLEANERS

A. Type: Vacuums equipped with new HEPA filters.

2.3 PLASTIC SHEETS

A. Type: Minimum 6-mil., clear, fire retardant polyethylene sheets.

B. Floor Protective Layer: Minimum 10-mil., reinforced polyethylene sheets.

2.4 DISPOSAL BAGS

A. Type: Minimum 6-mil thick, clear polyethylene bags with preprinted Caution Label. Properly containerize/drum prior to disposal.

2.5 EQUIPMENT

A. Temporary lighting, heating, hot water heating units, ground fault interrupters, and all other equipment on site shall be UL listed and shall be safe, proper, and sufficient for the purpose intended.

B. All electrical equipment shall be in compliance with the National Electric Code, Article 305 - Temporary Wiring.

PART 3 EXECUTION

3.1 PRE-WORK WIPE TESTING

A. No wipe testing is anticipated to be performed for this Project.

3.2 EMPLOYEE PROTECTION

A. Comply with all applicable Occupational Safety and Health Administration (OSHA) Requirements.

3..3 LEAD-CONTAINING/COATED MATERIAL HANDLING AND DISPOSAL

A. Handle and dispose of lead-containing materials in accordance with OSHA 1926.62 and the approved lead-containing material work plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when material containing or coated with lead containing paint is handled and disposed of in accordance with referenced standards.

3.4 POST-WORK WIPE TESTING

A. No post-work wipe testing is anticipated to be performed for this Project.

3.5 CLEANING CRITERIA

A. In accordance with 29 CFR 1926.62 (h), clean accumulations of dust or debris containing lead daily and conduct all cleaning with HEPA-filtered vacuums. Containerize the debris for proper disposal. Apply hazardous waste labels to drums containing dust and debris. If testing dictates that these materials are non-RCRA hazardous, re-label drums as non- hazardous and furnish testing records supporting this determination to the Commissioner.

3.6 PRE-DISPOSAL TESTING

A. Prior to disposal, the Commissioner will employ the services of an independent testing lab to perform clearance testing of the removed materials for toxicity in accordance with EPA

Method 1311, Toxicity Characteristic Leaching Procedure (TCLP).

1. Test results indicating a value greater than 5 ppm lead or 5mg/L classifies the removed material as Hazardous Waste.

3.7 DISPOSAL OF LEAD-CONTAINING/COATED MATERIAL AND RELATED DEBRIS

A. Transport and dispose of lead-containing material classified as Hazardous Waste in accordance with the standards referenced in Part 1 of this Section.

B. Transport and dispose of lead-containing material classified as Non- Hazardous Waste in accordance with the standards referenced in Part 1 of this Section.

3.8 RESTORATION

A. Remove temporary decontamination facilities and restore area designated for these facilities to its original condition or better.

END OF SECTION

SECTION 02 86 00 IDENTIFICATION AND DISPOSAL OF HAZARDOUS WASTE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contact drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Construction Contract].

1.2 DESCRIPTION OF WORK

A. This specification Covers the identification, handling, and disposal requirements for hazardous waste and related hazardous materials identified within the scope of work (SOW) limits of the Project. Removal, segregation and/or disposal of materials/components shall be as required to facilitate the demolition/construction work of this contract.

B. The Contractor shall provide proper removal/handling and disposal of hazardous wastes as depicted on the H Series Contract Drawings associated with this Project.

1.3 DEFINITION

A. Hazardous waste shall be any materials to be disposed that possess at least one of four characteristics, ignitability, corrosivity, reactivity or toxicity, as defined and regulated by the Resource Conservation and Recovery Act (RCRA) and applicable state and federal regulations, or a material specifically identified as hazardous waste by applicable Federal or State lists, in 40 CFR 261 or 6 NYCRR 371.

B. A Conditionally Exempt Small Quantity Generator (CESQG) of hazardous waste shall be a waste handler who generates no more than 100 kilograms per month of listed and/or characteristic hazardous waste, generates no more than 1 kilogram of acute hazardous waste in any calendar month, and stores no more than 1000 kilograms of listed and/or characteristic hazardous waste or more than 1 kilogram of acutely hazardous waste.

C. A Small Quantity Generator (SQG) of hazardous waste shall be a waste handler who generates no more than 1000 kilograms per month of listed and/or characteristic hazardous waste, generates no more than 1 kilogram of acute hazardous waste per month, and stores no more than 6000 kilograms of listed and/or characteristic hazardous waste or more than 1 kilogram of acutely hazardous waste.

D. Large Quantity Generator (LQG) of hazardous waste shall be a waste handler who generates more than 1000 kilograms per month of listed and/or characteristic hazardous waste, generates more than 1 kilogram of acute hazardous waste per month, or stores more than 6000 kilograms of hazardous waste or 1 kilogram of acutely hazardous waste.

E. The City of New York's Consultant: The City of New York shall provide a third-party consultant to provide pre-work assessments, project monitoring assessments for the construction procedures for

the work area and surrounding areas and final clearance assessments. The Contractor shall be responsible for the worker protection requirements.

1.4 SUBMITTALS

A. Before start of work: At the pre-construction meeting, the Contractor shall submit the following to The City of New York for review:

1. Copy of State or local license for hazardous waste hauler.

2. Certificate of at least one on-site supervisor which has satisfactorily completed the OSHA 40-hour Health and Safety course for handling hazardous waste and spills.

3. Certificates of workers, which have successfully completed the OSHA 40-Hour Health and Safety Course for Hazardous Waste and spills. *

4. List of the employees scheduled to perform this work.

5. Schedule of start and finish times and dates for this work.

6. The name, address and EPA ID No. of the disposal facility where these waste materials are to be received. Include contact person, a copy of the facility permit and telephone number.

7. The facility permit must identify the waste material(s) to be received and must be accompanied by a statement that the facility has the capacity and authority to accept the waste. Land Disposal Restriction (LDR) forms must also be provided.

8. Safety Data Sheet (SDS) for all materials to be removed.

9. If the Contractor introduces any chemical into the work environment, a SDS for that chemical must be presented to The City of New York prior to use.

10. Transporter must have notified the EPA and/or other appropriate local government agency in advance of its intentions to transport hazardous materials and, if applicable, receive an identification number. The transporter shall submit a copy of the NYS DEC Part 364 Permit, for review.

11. Health and Safety/Contingency Plan for material handling and emergency procedures.

12. Certification for medical examinations.

13. Respiratory protection program.

14. Project Plan: Provide a description of the methods, procedures and materials to be used in performing the work and handling all hazardous wastes. Also provide a schedule identifying specific work areas and duration. The schedules will be utilized to schedule facility and third-party consultant requirements.

15. Waste Sampling Plan: Provide a sampling plan that describes all samples to be taken and the parameters to be analyzed, as well as the laboratory providing the services; or provide another basis for identification of the waste, such as an SDS.

B. Do not start work until submittals are returned with the Commissioner's stamp indicating that the submittal is returned for unrestricted use.

1.5 REGULATORY REQUIREMENTS

A. All activities related to the work shall be conducted in compliance with all applicable laws, regulations, and requirements which may include, but not be limited to, the United States Environmental Protection Agency (US EPA), United States Department of Transportation (US DOT), Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA), Occupational Safety and Health Administration (OSHA), New York State Department of Environmental Conservation (NYS DEC), New York City Department of Environmental Protection (NYC DEP), and New York City Fire Department.

B. The Contractor is required to secure and maintain all required regulatory permits necessary to perform all aspects of the work.

C. The Contractor shall containerize and store waste in accordance with all applicable regulations. All containers are to be appropriately marked/labeled.

PART 2 PRODUCTS

2.1 MATERIALS

A. Drums: Recovery or salvage drums acceptable for disposal of hazardous waste. Prior approval of drums is required. Drums or containers must meet the required OSHA, EPA (40 CFR Parts 260-264 and 300), and DOT Regulations (49 CFR Parts 171-178). Use of damaged containers shall not be allowed.

B. Labels: As required by the EPA and OSHA for handling, transportation, and disposal of hazardous waste.

C. Absorbent Material: Clay, soil or any commercially available absorbent used for the purpose of absorbing hazardous or potentially hazardous materials.

PART 3 EXECUTION

3.1 GENERAL PROVISIONS

A. All waste shall be stored, handled, transported and disposed of in accordance with all federal, state and local guidelines and regulations. The Contractor is to obtain all permits, licenses, etc.,

which are necessary for the storing, transporting and disposing of hazardous waste. The Contractor shall develop all applicable manifests, Profile Sheets, Land Ban Forms and any other documentation and co-ordinate with The City of New York regarding proper signatures. The Contractor may be required to notify the EPA of the hazardous waste activities and obtain an EPA identification number specifically for the project, if one is not available.

B. The Contractor shall identify and classify the hazardous waste generated through the performance of the work as per the governing regulations, and in accordance with the Waste Sampling Plan submittal from Section 1.1 above. The Contractor shall conduct the required sampling and chemical analysis for handling, storing, transporting and disposing of the hazardous waste.

C. The Contractor is responsible for securing appropriate treatment or disposal for the waste streams at a permitted TSDF, in compliance with all requirements, and for obtaining a copy of the waste manifest as executed by the TSDF. If the manifest is not returned within the required time, the contractor shall notify The City of New York, and initiate an investigation as required.

D. Transporters shall maintain waste manifest and shipment record forms. All transporters are required to obtain and maintain NYS DEC Part 364 Waste Transporter permit and, if applicable, a NYC Fire Department permit for transporting flammables. The Part 364 Permit shall have the license plate number of the vehicle, the expiration date of the permit, the type of waste the hauler can take and the treatment, storage and disposal (TSD) facility to which the hauler can take the waste. The transporter must also have all applicable, current waste transportation permits for states where proposed disposal facility is located.

E. The Contractor shall supply all required placard and labeling and shall have an appropriately trained individual to prepare and sign the hazardous waste manifest, as the DOT shipper.

F. The Contractor shall furnish all certified copies of manifests (interim storage and final disposal) within regulatory requirements. Within 30 days from the acceptance of the waste by the disposal facility, the Contractor shall provide The City of New York with Certificate of Disposal documents, as a requirement for final payment.

G. Unless directed otherwise, the Contractor shall file the annual report and fee report if applicable for the hazardous waste shipped and provide closure notification to EPA and DEC immediately upon completion of the work.

END OF SECTION 02 86 00

SECTION 02 87 00 REMOVAL AND DISPOSAL OF UNIVERSAL WASTE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contact drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Construction Contract].

1.2 DESCRIPTION OF WORK

A. This specification covers the removal and disposal of Universal Waste, including (but not limited to) fluorescent lamps, high-intensity discharge (HID) lamps, mercury thermostats, and switches, and batteries (as depicted on H Series Contract Drawings). Demolition and removal of materials shall be as required to support the work of this contract.

1.3 SUBMITTALS

A. Before start of work: submit the following to the Commissioner for review. Do not start work until these submittals are returned with the Commissioner's approval.

1. Copy of State or local license for hazardous waste hauler;

2. Certification of at least one on-site supervisor which has satisfactorily completed the OSHA 40 Hour Health and Safety Course for Handling Hazardous Materials;

3. Certificates of workers which have successfully completed at least the OSHA 40-Hour Health and Safety Course for Hazardous Materials;

4. Certificates of workers which have successfully completed the required employee training for universal waste or appropriate type of training to the type of wastes being managed;

5. Schedule of start and finish times and dates for this work;

6 Name and address of the universal waste handler or a destination facility where the waste materials is to be treated, deposited or recycled in accordance with all regulatory requirements (include contact person and telephone numbers), if the universal waste meets the definition of hazardous waste, the name and address of the hazardous waste treatment, storage and disposal (TSD) facility, the name and address of the mercury thermostat recycling collection site;

7 Safety Data Sheets (SDS) for all materials requiring removal;

8 If Contractor introduces any chemical into the work environmental, a SDS for that chemical is required before use;

9 Contingency Plan for handling emergency spills or leaks;

10 Provide a copy of the NYS DEC Part 364 Waste Transporter permit for Universal Waste Transporters that transport more than 500 pounds of universal waste in a single shipment since they must be a permitted waste transporter;

11 Large Quantity Handlers of universal waste must provide documentation of notification to the EPA and/or the appropriate local government agency in advance of its intentions to transport the waste and receive from the facility or provide an EPA identification number prior to exceeding 5,000 kilograms of waste on-site;

12 Provide a record of all universal waste shipments received and sent offsite from the project.

1.4 DEFINITIONS

A. Large Quantity Handler (LQH) of Universal Waste shall be a waste handler who accumulates 5,000 kilograms or more of universal waste (batteries, pesticides, thermostats, or lamps, calculated collectively) at any time. This designation as a large quantity handler of universal waste is retained through the end of the calendar year in which 5,000 kilograms (11,000 pounds) or more total of universal waste is accumulated. The LQH shall notify the EPA, acquire or co-ordinate with a facility regarding an EPA identification number, and provide records for each shipment. The LQH shall ensure all employees are thoroughly familiar with proper waste handling and emergency procedures, relative to their responsibilities during normal facility operations and emergencies.

B. Small Quantity Handler of Universal Waste (SQH) shall be a waste handler who does not accumulate 5,000 kilograms (11,000 pounds) or more of total universal waste (batteries, pesticides, thermostats, or lamps, calculated collectively) at any time.

C. Destination Facility shall be a facility that legitimately and can legally accept universal waste from offsite so that the universal waste can be treated, disposed, or recycled in accordance with the regulatory requirements.

D. Universal Waste Transporter shall be anyone who transports universal waste. In New York, universal waste transporters that transport greater than 500 pounds of universal waste in a single shipment must be a permitted hazardous waste transporter pursuant to Federal and State regulations. Proper notification with the receiving handler agreeing to receive the shipment is required by the Universal Waste Transporter.

E. Universal Waste consists of the following discarded materials, as identified in 6 NYCRR 374-3: Fluorescent light bulbs high-intensity discharge (HID) lamps, mercury thermostats and switches, batteries, and pesticides. Removed or replaced mercury thermostats must be delivered to a designated mercury thermostat collection site as per current NYC DEC regulations. Disposal of mercury thermostats in a solid waste management facility is prohibited. PCB ballasts/capacitors from light fixtures shall not be treated as universal waste, they shall be handled and disposed of as hazardous waste. See the Hazardous Waste Disposal Specification for these wastes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyethylene Sheet: A single polyethylene film in the largest sheet size possible to minimize seams, 6-mil thick, clear, frosted, or black.

B. Duct Tape: Provide duct tape in 3" widths, witty an adhesive which is formulated to stick aggressively to sheet polyethylene.

C. Spray Cement: Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.

D. Labels: As required by the EPA and OSHA for handling, transportation, and disposal of hazardous waste.

E. Drums: Recovery or salvage drums acceptable for disposal of hazardous waste. Prior approval of drums is required. Drums or containers must meet the required OSHA EPA (40 CFR Parts 264265 and 300), and DOT regulations (49 CFR Parts 171-178). Use of damaged drums will not be allowed.

PART 3 – EXECUTION

3.1 UNIVERSAL WASTE

A. Employee training shall ensure that all employees are thoroughly familiar with proper waste handling and emergency procedures, relative to their responsibilities during normal operations and emergencies and to the type of waste they are handling.

B. Mercury thermostats shall be segregated from other Universal Wastes to allow for required recycling.

C. Once the properly labeled containers holding the universal waste have been filled and sealed, they shall be stored in designated accumulation areas as agreed upon by The City of New York and Contractor. They shall not be allowed to store in transportation vehicles, or onsite for more than one year from when the waste has been generated.

D. Documentation when a universal waste in storage was first accumulated shall be provided. This is to be done by dating and labeling the waste with the date of the earliest accumulation that can document the length of time the universal waste has been accumulated.

E. Maintenance of an inventory system on-site that identifies the earliest date that any universal waste in a group of universal waste items or a group of containers of universal waste became a waste was received.

F. Any waste developed from the work that exhibits one or more characteristics of hazardous waste, that are not specifically identified by EPA and DEC as Universal Waste, must be handled accordingly and not as a universal waste. See the Hazardous Waste Disposal

Specification for those wastes.

3.2 OFF-SITE SHIPMENT OF UNIVERSAL WASTE

A. Off-Site shipments shall meet the requirements for offsite shipments and is prohibited from sending or taking universal waste to a place other than a designated universal waste handler or a universal waste destination facility.

B. LQH's of universal waste must notify EPA in writing and develop an EPA identification number or co-ordinate with the facility regarding use of their EPA identification number, prior to exceeding 5,000 kilograms of universal waste onsite.

C. SQH's do not need to notify EPA, receive an EPA identification number or keep records of shipments of universal waste.

D. LQH's must keep a record of all universal waste shipments received or sent offsite and must retain those records for at least three years from the date of receipt or shipment. Records may include invoices, manifests, logs, bills of lading, or other shipping documents.

E. The Contractor shall provide certified copies of all receipts obtained from designated mercury thermostat recycling collection sites within 30 days of thermostat acceptance by collection site.

F. The Contractor shall furnish all certified copies of manifests (interim storage and final disposal) within regulatory requirements. Within 30 days from acceptance of the waste by the disposal facility, the Contractor shall provide The City of New York with Certificate of Disposal documents, as a requirement for final payment.

END OF SECTION 02 87 00

SECTION 03 30 00 CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Structural slabs on metal deck.
2. Topping slabs
3. Stair pan fills.
4. Furnishing and installing all required anchors and inserts.
5. Placing in the forms all inserts, anchors, anchor bolts, bearing plates and the like furnished by other trades for casting into the concrete and cleaning of same after stripping of forms.
6. Protection of all inserts, anchors, hangers, sleeves and supports furnished and set by others for the attachment of other work to the concrete, or required to permit the passage of other work through the concrete.
7. Supply, fabricate and place all required reinforcing bars, mesh and other reinforcement for concrete where shown, called for, and/or required complete with proper supporting devices.
8. Erection and removal of all formwork required to properly complete the work.
9. Finishing of all concrete work as hereinafter specified.
10. Curing and protection of all concrete work.
11. Site concrete consisting of curbs, walls, pads, boxes and the like as shown on the drawings.
12. Floor sealers and dust-proofing of all areas exposed and/or covered with carpet.
13. Cutting, patching, grouting, repairing and pointing up as required.
14. Vapor barrier system below slabs on grade.
15. Waterproofing.
16. Grouting of all beam bearing plates and column base plates.
17. Equipment pads as required.
18. All other work and materials as may be reasonably inferred and needed to make the work of this section complete.
19. Waste Management

B. Related Sections:

1. Division 05 Section “Structural Steel”
2. Division 05 Section “Metal Deck”

3. Division 05 Section “Metal Fabrications”
4. Division 06 Section “Rough Carpentry”
5. Division 07 Section “Waterproofing”
6. Division 07 Section “Joint Sealants”
7. Division 07 Section “Expansion Joint Cover Assemblies”

1.3 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.
   1. Sustainable Design Submittals:
      a. Environmental Product Declaration (EPD) for all batch plant ready-mixed concrete.
      b. Laboratory Test Reports: For indicating compliance with requirements for low-emitting materials.

B. Product Data: Submit data for all of the following:

   1. Reinforcement
   2. Supports for reinforcement
   3. Forming accessories
   4. Portland Cement
   5. Fly Ash
   6. Slag Cement
   7. Blended hydraulic Cement including blended limestone cement
   8. Silica fume
   9. Natural or other pozzolanic materialds
   10. Aggregates
   11. Admixtures
      a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
   12. Patching compounds
   13. Waterstops
   14. Joint systems
   15. Curing compounds
   16. Dry-shake finish materials
   17. Others items as requested by Commissioner.

C. Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures. The shop drawings shall be prepared only by competent detailers, checked by the contractor prior to submission.

   1. The shop drawings shall show construction, contraction and isolation joint locations and the added reinforcement required at same.
   2. Obtain and coordinate information for sleeves and openings in concrete, which are required for the work of other trades. Make coordinated drawings showing size and location of openings and sleeves and incorporate this information on the reinforcing drawings.
   3. Only those splices indicated on the approved shop drawings will be permitted.
   4. Provide elevations of all foundation walls and other structural elements to a minimum 1/4" scale.

D. Shop Drawings Formwork: Submit shop drawings for fabrication and erection of specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement, and other items which affect exposed concrete visually. Commissioner's review is for general applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility, prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Commissioner.

F. Contraction Joint Layout: Indicate proposed contraction joints required per applicable codes and drawings.

1. Location of contraction joints is subject to approval of the Commissioner.

G. The use of the Commissioner's electronic drawing files as a base for the reinforcement, formwork, and joint layout shop drawings will be permitted at the request of the detailer/designer upon completion and return of the waiver form. The use of the Commissioner's or Engineer of Record's electronic drawing files as a base for shop drawing details will not be permitted. The detailer/designer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design team makes no representation regarding the accuracy or completeness of the electronic files given to detailer/designer and their use will be at the detailer/designer's sole risk and without liability to the design team. The detailer/designer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing sections and details. The detailer/designer shall also remove all reference to work not included in the concrete contract.

H. Scaling of the Commissioner's drawings is not permitted. This applies to hard paper, electronic, and all other versions.

I. Samples: Submit samples of materials as requested by Commissioner, including names, sources and descriptions.

J. Laboratory Test Reports: Submit laboratory test reports for concrete materials, mix design test and microwave test, including the following:
1. Portland cement
2. Fly ash
3. Slag cement
4. Ground Glass Pozzolan
5. Blended hydraulic cement, including blended limestone cement
6. Silica fume
7. Aggregates
8. Admixtures:
    a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

K. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Commissioner. Manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements shall sign material certificates. Provide

certification from admixture manufacturers that chloride content complies with specification requirements.

L. Cold Weather and Hot Weather Concreting Procedures: Submit written descriptions of contractor's proposed cold weather and hot weather concreting procedures, when applicable.

M. Certification that pozzolanic materials conforms to ASTM C 618-01 (noting class C or class F), ASTM C 989 or ASTM C1240.

N. Certified recycled steel content. Provide cut sheets clearly indicating whether the rebar used meets the minimums for post-consumer OR post-industrial recycled contents. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and if the recycled content is post-consumer or post-industrial.

O. Recycled Aggregate: Provide laboratory reports indicating that aggregate conforms to ASTM C33 for structural concrete or ASTM D1241-00 for sub-base material. Provide cut sheets clearly indicating the source, total weight and volume of the recycled aggregate. If aggregate provided is a mix of virgin and recycled aggregates obtain a written affidavit from the manufacturer stating the recycled content percentage

P. VOC content for curing compounds, sealants and release agents: Provide a cut sheet and a Material Safety Data Sheet (MSDS) for each curing compound, sealant, hardener and release agent used highlighting VOC contents. VOC content must be less than or equal to limits stated under "PRODUCTS".

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

D. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. New York City Building Code, Latest Edition
2. ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials and Commentary."
3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and mass concrete."
4. ACI 211.2, "Standard Practice for Selecting Proportions for Structural Lightweight Concrete."
5. ACI 214R, "Evaluation of Strength Test Results of Concrete."
6. ACI 232.2R, "Use of Fly Ash in Concrete."
7. ACI 233R, "Guide to Use of Slag Cement in Concrete and Mortar."
8. ACI 234, "Guide for the Use of Silica Fume in Concrete."
9. ACI 301 "Specifications for Structural Concrete."

10. ACI 302.1R “Guide for Concrete Floor and Slab Construction.”
11. ACI 304R, “Guide for Measuring, Mixing, Transporting and Placing Concrete.”
12. ACI 305R “Hot Weather Concreting.”
13. ACI 306R-10 “Guide to Cold Weather Concreting.”
14. ACI 308.1 “Standard Specification for Curing Concrete.”
15. ACI 309R, “Guide for Consolidation of Concrete.”
16. ACI 311.4R, “Guide for Concrete Inspections.”
17. ACI 315, “Details and Detailing of Concrete Reinforcement.”
18. ACI 318 “Building Code Requirements for Structural Concrete and Commentary.”
19. ACI 347 “Guide to Formwork of Concrete.”
20. Concrete Reinforcing Steel Institute, (CRSI) “Manual of Standard Practice.”
21. CRSI-WCRSI, “Placing Reinforcing Bars.”
22. AWS D1.4, “Structural Welding Code Reinforcing Steel.”

23. The ACI Field Reference Manual, SP-15 shall be kept at the job site, and the practices set forth therein shall be strictly adhered to.
24. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
25. AASHTO T 318, “Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.”

E. Concrete Testing Service: Owner will engage a testing laboratory acceptable to Commissioner and Engineer of Record to perform material evaluation tests and to design concrete mixes.

F. Materials and installed work may require testing and retesting at anytime during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.

G. Preconstruction Meeting:

1. At least 35 days prior to the start of the concrete construction schedule, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The Contractor shall send a pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference.
2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

    a. Contractor's superintendent
    b. Laboratory responsible for the concrete design mix
    c. Laboratory responsible for field quality control
    d. Concrete subcontractor
    e. Ready-mix concrete producer
    f. Admixture manufacturer(s)
    g. Concrete pumping equipment manufacturer.

3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by the contractor to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner or owner's representative, Commissioner, and Engineer of Record.
4. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design and placing can produce the concrete quality required by these specifications.
5. A minimum of a 4 cubic yard trial mixture containing all required admixtures shall be placed at the job site using the accepted methods of placing, finishing and curing. All applicable tests including slump, strength, water content, air content, permeability, and air content will be performed. This shall occur at least four weeks before actual concreting operations with the proposed mix design begins. The admixture manufacturer(s) and inspectors shall be present. The same testing should be done in the laboratory at the same time for comparison. A test sample should be done for each condition that is to be placed.
6. The Engineer of Record will be present at the conference. The Contractor shall notify the Engineer of Record at least 10 days prior to the scheduled date of the conference.

1.5 PROJECT CONDITIONS

A. The Contractor, before commencing work, shall examine all adjoining work on which this work is in any way dependent for proper installation and workmanship according to the intent of this specification, and shall report to the Commissioner or Engineer of Record any condition which prevents this contractor from performing first class work.

B. Protect adjacent finish materials against spatter during concrete placement.

C. Provide all barricades and safeguards at all pits, holes, shaft and stairway openings, etc., to prevent injury to workmen and others within and about the premises. Also provide all safeguards as required by the Building Code, OSHA, or any other departments having jurisdiction. Take full responsibility for all safety precautions and methods.

D. Procedure of Work: The contractor shall keep themself constantly informed as to the progress of the work in the field, materials and workers ready to start work immediately when conditions of preceding work are available or ready, wholly or in part, so as not to delay the progress of building work or to interfere with the progress of work of other contractors, and in any event the contractor shall, within 24 hours after notice from the Owner, proceed with such work as directed to maintain the uninterrupted progress of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

1. Deliver reinforcing to project site in bundles marked with metal gauges indicating contents of bundle keyed to shop drawings.
2. Store at site on skids, off-grade, in manner to prevent soiling, contamination or other damage.
3. Handle as required to prevent bending, kinking or other damage.
4. Prevent bending, coating with earth, oil or other material, or otherwise damaging the reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615 M, Grade 60.

B. Weldable Reinforcing Bars: ASTM A 706/A 706M, Grade 60.

C. Galvanized Reinforcing Bars: ASTM A 767, Class II (2.0 oz. zinc psf) Class I (3.0 oz. zinc psf) hot-dip galvanized, after fabrication and bending.

D. Epoxy-Coated Reinforcing Bars: ASTM A 775 (as noted on plan and/or in section).

E. Steel Wire and Welded Wire Reinforcement: ASTM A 1064. Galvanized at exterior locations, conditions permanently exposed to weather and/or water, and where noted on drawings (plan and/or sections).

F. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 , plain-steel bars, cut true to length with ends square and free of burrs.

G. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 , plain-steel bars, ASTM A 775/A 775M epoxy coated.

H. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

I. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

J. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place, sized and shaped for strength and adequate support during concrete placement. Use wire bar type supports complying with CRSI specifications. Provide chairs with plastic-coated feet on deck formwork. Provide heights as required by structural drawings.

1. For epoxy coated reinforcement provide plastic protected chairs and plastic ties. All imperfections in the epoxy coating are to be repaired prior to placement of concrete.

    a. Use recycled plastic rebar supports (give preference to local supplier if available). Subject to compliance with requirements, provide one of the following:

        1) International Plastics Group
        2) Eclipse Plastic

2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2), at a spacing not to exceed 4'-0" on center in either direction.
3. Other supports: No Brick or Concrete block chairs will be allowed.

K. Fabrication

1. Fabricate concrete reinforcing in accordance with ACI 318, providing concrete cover specified in this Section.
2. Locate reinforcing splices not indicated on drawings at point of minimum stress. Indicate location of splices on shop drawings.
3. No hand sticking of reinforcement after commencement of concrete pour.
4. Do not place concrete if reinforcing bar temperature is below 35 degrees F.
5. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117.
6. Bend all reinforcement cold unless heating is permitted.

2.2 CONCRETE MATERIALS

A. Portland cement: ASTM C 150, Types I, II, or I/II. Total percentage of Portland Cement is NOT to exceed 75% of the cementitious content of each mix. Use one brand of cement throughout

project, unless otherwise acceptable to Commissioner. Provide either fly ash or GGBF in mix per sections below.

a. Fly Ash: Cast-in-place concrete shall incorporate fly ash as a replacement for at least 25% (by weight) of the Portland cement. All design mixes must be reviewed and approved by the Engineer of Record. Fly Ash shall not be used in conjunction with Ground Granulated Blast Furnace Slag.
b. Ground Granulated Blast Furnace Slag (GGBF): Cast-in-place concrete shall incorporate GGBF as a replacement for at least 40% (by weight) of the Portland cement. All design mixes must be reviewed and approved by the Engineer of Record. GGBF shall not be used in conjunction with Fly Ash.
c. Pozzolans and Slags: These must be completely accounted for in the design mix. Mix design must meet minimum design requirements set in the contract documents. Additional admixtures may be required to meet early strength requirements and alternative cementitious material goals. If a "blended cement" is used which already contains a certain percentage of Pozzolans or Slags this content may offset or entirely satisfy the minimum percentage required.

    1) Coal Fly Ash: ASTM C 618 (Class C or Class F): ASTM C 618 (Note: Class F fly Ash will require higher amounts or air entraining ad-mixtures than class C).
    2) Blast Furnace Slag: ASTM C989
    3) Silica Fume: ASTM C 1240
    4) Rice Hull (or “husk”) Ash: ASTM C 618 Blended hydraulic cement, as defined by ASTM C 595 or ASTM C 1157

B. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

1. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Commissioner.
2. Normal weight Fine Aggregate: washed, inert, natural or manufactured or combination thereof, sand conforming ASTM C33 gradation.
3. Normal weight Coarse Aggregate: well graded crushed stone or washed gravel conforming to ASTM C33, sizes 57 for foundations and 67 for slabs and structure.

    a. Recycled crushed concrete aggregate in concrete mixes is only to be used with approval of Engineer of Record. Recycled aggregate shall be used only as a substitute for coarse aggregate and must also be washed and well-graded, conforming to ASTM C33.
    b. For sub-base, slabs on grade and non-structural applications and Recycled Aggregate Materials are NOT required to meet the ASTM C 33 standard. In addition to concrete rubble, glass, porcelain, and tire chips can be used as filler material. Any inert material conforming to ASTM D1241 is acceptable for the applications described in this paragraph.

C. Lightweight Aggregates: Well-graded crushed expanded shale produced by rotary kiln method. Solite or equal, conforming to ASTM C330.

D. Water: Free from oils, acids, alkali, organic matter and other deleterious material to conform to ASTM C94. ASTM C94 for gray water use in the production of ready mixed concrete per approval by the Engineer of Record.

E. Air Entraining Admixture: ASTM C 260.

1. Liquid air entrainment: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	“Air Mix”	Euclid Chemical
b.	“AEA-92”	Euclid Chemical
c.	“Darex AEA”	W. R. Grace
d.	“MasterAir VR 10”	Master Builders

F. Water-Reducing Admixture: ASTM C 494.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	“MasterPolyheed 997”	Master Builders
b.	“Euclid MR”	Euclid Chemical
c.	“WRDA 64”	W. R. Grace.

G. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G and containing not more than 0.05 percent chloride ions.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	"Eucon 37, 1037 or Plastol 5000"	Euclid Chemical Co.
b.	"Rheobuild 1000"	Master Builders
c.	"MasterGlenium 7500"	Master Builders
d.	"Daracem-100"	W. R. Grace

H. Water Reducing, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C 494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long-term non- corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures. Accelerating admixtures are not to be used as antifreeze agents. Accelerating admixtures are permitted only upon review by Engineer of Record.

1. Products: Subject to compliance with requirements, provide the following or equal approved by Engineer of Record:

a.	"Accelguard 80"	Euclid Chemical Co.
b.	"Daraset”	W. R. Grace
c.	“Pozzutec 20”	Master Builders.

I. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and contain not more than 0.05 percent chloride ions.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	"Eucon Retarder 75"	Euclid Chemical Co.
b.	"Pozzolith 100XR"	Master Builders.
c.	"Plastiment"	Sika Chemical Co.
d.	"Daratard"	W.R. Grace.

J. Microsilica Admixture shall be dry densified or slurry formed. Microsilica shall come from the same source throughout the project. If a single source cannot be maintained, laboratory testing of each new source shall be required before acceptance by the Engineer of Record at no cost to the owner.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	"Emsac F 100"	Elkem Chemical, Inc.
b.	"Eucon MSA"	Euclid Chemical Co.
c.	"Force 10,000"	W. R. Grace

K. Prohibited Admixtures: Calcium chloride, thyocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.

L. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of admixtures will be required from the admixture manufacturer prior to mix design review by the Engineer of Record.

M. Macro-Fibers: Engineered macro-synthetic fibers.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	“Tuf-Strand SF”	Euclid Chemical Co.
b.	“Fibermesh 650”	Propex Concrete Systems
c.	“Strux 90/40”	W.R. Grace
d.	“Forta-Ferro”	Forta

N. Micro-Fibers: Engineered micro-synthetic fibers.

1. Products: Subject to compliance with requirements, provide the following or equal approved by Engineer of Record:

a.	"Fiberstrand N":	Euclid Chemical Co.
b.	"Fibermesh 150":	Propex Concrete Systems
c.	“Ultra-Net”	Forta

O. Natural Fiber Reinforced Concrete: Natural fiber reinforced concrete is permitted only upon review by Engineer of Record. Refer to ACI 544.1R, chapter 5

P. Corrosion Inhibitor: 30% calcium nitrite (where called for in the specifications or on the drawings). Subject to compliance with requirements, provide the following at 3 gal/cy:

1.	“Eucon CIA	Euclid Chemical
2.	“DCI”	W. R. Grace
3.	“Rheocrete CNI”	Master Builders.

Q. Contractor will be required to provide information demonstrating successful use in prior placement involving all admixtures.

2.3 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, [with factory-installed metal eyelets,] for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal approved by Engineer of Record:

   a. Greenstreak
   b. Williams Products, Inc.

2. Profile: Per Commissionerural drawings
3. Dimensions: per Commissioner drawings nontapered.

B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	“MiraSTOP”	Carlisle Coatings & Waterproofing, Inc.
b.	“Waterstop-RX”	CETCO
c.	“Conseal CS-231”	Concrete Sealants Inc.
d.	“Swellstop”	Greenstreak
e.	“Hydro-Flex”	Henry Company, Sealants Division
f.	“Earth Shield Type 20”	JP Specialties, Inc.

2.4 GROUT

A. Non-Shrink, Non-Metallic Grout: The non-shrink grout shall be a factory pre-mixed grout and shall conform to ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	"Euco-NS"	Euclid Chemical Co.
b.	"Five Star Grout"	U.S. Grout Corp.

c. "Masterflow 713 Plus" BASF

B. High Flow Grout: Where high fluidity and/or increased placing time is required, use high flow grout. The factory pre-mixed grout shall conform to ASTM C1107, "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 18" x 36" base plate.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. "Euco Hi-Flow Grout" Euclid Chemical Co.
b. "Masterflow 928" BASF
c. “Five Star Fluid Grout 100” Five Star

2.5 RELATED MATERIALS

A. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 1241, Size 10, with 100 percent passing a 3/8 inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

B. Non-slip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture, and cleaning materials.

C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

D. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Waterproof paper
b. Polyethylene film
c. Polyethylene-coated burlap

E. Curing Compounds: The compound shall be non-dissipating, liquid, membrane-forming, clear, non-yellowing acrylic and conform to ASTM C 309. Limit VOC content to 130 g/L. Use water-based curing compound. For surfaces receiving both a curing compound and additional flooring, verify that the curing compound and additional flooring are compatible.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. “SealTight 1100” W.R. Meadows
b. “Kurez W VOX” Euclid Chemical Co.
c. “Everclear VOX” Euclid Chemical Co.

d. ‘VOCOMP-25” W.R. Meadows

F. Curing & Sealing Compounds: Only specify for slabs that will remain exposed, i.e. will not receive additional flooring. The compound shall conform to ASTM C1315. Limit VOC content to 130 g/L. Use water-based curing compound.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. “Everclear VOX” Euclid Chemical Co.
b. “VOCOMP-25” W.R. Meadows

G. Sealers/Hardeners: For use on concrete surfaces that will remain exposed. Slabs that will receive additional flooring do not require sealing or hardening. Sealers and hardeners must not yellow under ultra violet light after 500 hours of test in accordance with and have a maximum moisture loss of 0.039 grams per sq. cm. when applied at a coverage rate of 250 sq. ft. per gallon. Limit VOC content to 130 g/L. Use water- or vegetable-based product.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. “Kure-N-Harden” BASF

H. For concrete floors subjected to heavy vehicular traffic use a Liquid Sealer/Densifier: The product must be a high performance, deeply penetrating concrete densifier conforming to ASTMC836; odorless, colorless, VOC - compliant, non-yellowing siliconate based solution designed to harden, dustproof and protect and to resist black rubber tire marks on concrete surfaces. The compound must contain a minimum of 20% solids content of which 50% is siliconate

I. Evaporation Retardant:

1. Products Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. "Eucobar" Euclid Chemical Co.
b. "MasterKure ER 50" BASF

J. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F 710, coordination with flooring manufacturer is required to insure concrete coatings will not obstruct the bond between the concrete and the adhesive. Insure coatings and adhesives are “benignly compatible” -- in other words, do not combine substances whose constituents are reactive. Reactivity releases VOCs and /or other toxic fumes.

K. Crack Sealer: Elastomeric liquid crack sealer resistant to water, gasoline, oil and salts.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. "Eucolastic 1NS" Euclid Chemical Co.

Maximum allowable depth of this product is ½".

L. Underlayment Compound: Free flowing, self-leveling, pumpable cementitious base compound.

1. Products: Subject to compliance with requirements, provide the following or equal approved by Engineer of Record:

a.	"Flo-Top 90 or Super Flo-Top"	Euclid Chemical Co.
b.	"Ardex"	Ardex Co.
c.	"Underlayment 110"	Master Builders

M. Bonding Admixture: The compound shall be a latex, non-rewettable type.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	"Flex-Con"	Euclid Chemical Co.
b.	"SBR Latex"	Euclid Chemical Co.

N. High Strength Polymer Repair Mortar: For form and pouring or large horizontal repairs, provide the flowable on-part, high strength repair mortar.

1. Products: subject to compliance with requirements, provide the following or equal approved by Engineer of Record:

a.	"Eucocrete"	The Euclid Chemical Co.
b.	"Euco Speed MP" (Cold Weather)	The Euclid Chemical Co.
c.	"Emaco R"	Master Builders.

O. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

a.	"Daraweld C"	W.R. Grace

P. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Type IV for bonding hardened concrete to hardened concrete, and Type V for bonding freshly mixed concrete to hardened concrete.

Q. Reglets: Fabricate reglets of not less than 0.022 inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

R. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

S. Vapor Barrier: Provide vapor barrier which conforms to ASTM E 1745, Class A or B. The membrane shall have a water-vapor permeance rate no greater than 0.012 perms when tested in accordance with ASTM E 154, Section 7. The vapor barrier shall be placed over prepared base

material where indicated below slabs on grade. Vapor barrier shall be no less than 10 mil thick in accordance with ACI 302.1R. Preferred vapor barriers will be manufactured from post- consumer recycled polymers.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	"Stego Wrap (15 mil) Vapor Barrier"	Stego Industries LLC
b.	"Griffolyn Vaporguard"	Reef Industries
c.	"Premoulded Membrane with Plastmatic Core"	W.R. Meadows.

T. Expansion Joint Filler: ASTM D 1751.

1. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a.	"Homex 300"	Homasote Company
b.	"Standard Cork Expansion Joint Filler"	APS Cork
c.	"Fibre Expansion Joint"	W.R. Meadows

U. Water: Potable.

2.6 PROPORTIONING AND DESIGN OF MIXES

A. Preparation of Design Mixes

1. All mix designs shall be proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318 and prepared by a licensed testing laboratory approved by the owner, but paid for by the contractor. Submit mix designs on each class of concrete for review.
2. If previously used mixes are submitted, all materials shall be from the same sources and with the same brand names as the previously utilized mix.
3. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1200 psi higher than the specified strength. This over-design shall be increased to 1.10f'c+700 psi when concrete strengths greater than 5000 psi are used.
4. The proposed mix designs shall be accompanied by complete standard deviation analysis or trial mixture test data.

B. Submit each proposed mix to the Commissioner and Structural Engineer for review at least 5 days prior to the pre-concrete conference. Do not begin concrete production until Commissioner and Engineer of Record has reviewed and approved mixes.

1. Submit Test reports for any pozzolans or slags indicating compliance with ASTM C 618 or ASTM C 989, respectively.
2. Provide cut sheets clearly indicating the percentages of pozzolans or slags used in the mix design as replacement for Portland cement. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the percentage.
3. Test reports for recycled aggregate indicating compliance with ASTM C 33. Provide cut sheets clearly indicating the percentage of aggregates used that are recycled. Or, if cut

sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.

4. Provide cut sheets clearly indicating the percentage of sub-base and filler aggregate materials that are recycled. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and source or sources of the material.

C. Design mixes to provide concrete with strength as indicated on drawings and schedules.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Commissioner and Engineer of Record. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Commissioner and Engineer of Record before using in work.

E. Admixtures:

1. Use admixtures according to manufacturer's written instructions. Chemical admixtures must be approved by testing agency and Architect prior to use.
2. Use water-reducing admixture or high range water-reducing admixture (superplasticizer) in all concrete as required for placement and workability.
3. Use non-corrosive, non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50°F (10°C).
4. Use high-range water-reducing admixture in pumped concrete, concrete, parking structure slabs, fiber concrete, concrete required to be watertight, concrete with ultimate strength of 5,000 psi or more, and concrete with water/cement ratios below 0.50.
5. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Exposure category for exterior concrete is F1. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1-1/2 percent within following limits:

    a. Concrete structures and slabs exposed to freezing and thawing or deicer chemicals.
        1) 1-1/2” maximum aggregate: 4.5 percent (exposure class F1, moderate exposure); 5.5 percent (exposure class F2 and F3, severe exposure)
        2) 1” maximum aggregate: 4.5 percent (exposure class F1, moderate exposure); 6 percent (exposure class F2 and F3, severe exposure)
        3) ¾” maximum aggregate: 5 percent (exposure class F1, moderate exposure); 6 percent (exposure class F2 and F3, severe exposure)
        4) ½” maximum aggregate: 5.5 percent (exposure class F1, moderate exposure); 7 percent (exposure class F2 and F3, severe exposure)
        5) 3/8” maximum aggregate: 6 percent (exposure class F1, moderate exposure); 7.5 percent (exposure class F2 and F3, severe exposure)

    b. Other Concrete: (not exposed to freezing, thawing, or hydraulic pressure): 2 percent to 4 percent air.
    c. Interior concrete to receive hard troweling shall not be air entrained unless specifically approved by the Engineer.

6. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.

F. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:

1. Concrete for precast slabs, precast beams, structural topping slab, caisson caps, caissons, poured in place slabs and grade beams, columns and walls, over water, on ground or exposed to weather: W/C 0.40.
2. Concrete on metal deck:

    a. With specified minimum compressive strength not greater than 5,000 psi: 0.40.
    b. With specified minimum compressive strength not greater than 7,000 psi: 0.35.

3. “Quick Dry” Concrete: 0.40.
4. Subjected to freezing and thawing; W/C 0.45.
5. Subjected to deicers/watertight: W/C 0.45.
6. Reinforced concrete subjected to brackish water, salt spray or deicers; W/C 0.40.

G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramp slabs and sloping surfaces: Not more than 3".
2. Reinforced foundation systems, including mud slabs below hydrostatic slabs: Not less than 1" and not more than 3".
3. Concrete containing HRWR admixture (superplasticizer): Not more than 9" unless otherwise approved by the Commissioner. The concrete shall arrive at the job site at a slump of 2" to 3" (3" to 4" for concrete receiving a "shake-on" hardener or lightweight concrete), be verified, then the high-range water-reducing admixture added to increase the slump to the approved level.
4. Other Concrete: 5”, plus or minus 1” at point of placement.

H. Chloride Ion Level: Chloride ion content of aggregate shall be tested by the laboratory making the trial mixes. Calcium chloride shall not be used.

2.7 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced. Each load of concrete may be incorporated into the work after on-site testing is complete, the concrete is deemed acceptable, and the batch ticket is approved by the Architect.

C. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required. When air temperature is between 85°F (30°C) and 90°F (32°C), reduce maximum mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce maximum mixing and delivery time to 60 minutes.

D. No water shall be added after mixing to concrete containing HRWR (Superplasticizer). If loss of slump occurs, the concrete treated with HRWR may be redosed as long as a "flash set" has not

occurred. Redosage procedures must be discussed and approved by the Engineer of Record and the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

B. Construction Layout

1. Layout all concrete structural work in accordance with the Contract Documents.
2. Verify prior to placement, all dimensions, alignments, anchor bolts, embeds, utilities and other building components prior to pour.

C. Preparation of Form Surfaces

1. Coat contact surfaces of forms with a non staining form coating compound before reinforcement is placed.
2. Thin form-coating compounds only with thinning agent of type, in amount and under conditions as directed by form-coating compound manufacturer. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliances with manufacturer's instruction.
3. Prior to placing, forms shall be cleaned free of foreign material and shall be washed down with water. Excess debris and standing water shall be removed from forms.
4. Placing shall be a continuous operation between planned construction joints with fresh cement mixed only with plastic concrete already in place. Avoid cold joints.

3.2 INSPECTION

A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

3.3 CONCRETE

A. Concrete shall develop the minimum compressive strengths shown on drawings at 28 days when sampled and tested in accordance with ASTM C 31 and C 39 with the maximum slump in accordance with the approved mix design.

B. Concrete shall be in accordance with the requirements and specifications of "Building Code Requirements for Structural Concrete" as modified by the building code noted above.

C. Fly Ash Concrete & Slag Concrete: Concrete mixes containing high volumes of fly ash or Slag have slower set times and may take up to 56 days to reach full strength. The Engineer of Record,

agency responsible for concrete mix design, the Commissioner and the concrete subcontractor must coordinate to ensure that the form stripping schedule is consistent with the ability of the structure to support itself and all imposed construction loads.

3.4 VAPOR BARRIER INSTALLATION

A. Examine the condition of porous fill and remedy any unsatisfactory portions prior to installing vapor barriers.

B. Sub-base material to be per above sections.

C. Following leveling and tamping of sub-base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of pour.

D. Lap joints 6" and seal with appropriate tape.

E. After placement of moisture barrier, cover with granular material and compact to depth as shown on drawings.

F. Avoid cutting or puncturing vapor barrier during reinforcement placement and concreting operations.

3.5 PLACING REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least minimum coverage's for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

1. Minimum required concrete cover for reinforcement shall be provided as follows (excepting extremely corrosive atmosphere, other severe exposures, or situations requiring fire protection, which shall meet any applicable requirements beyond these):

    a. Slabs and Joists in dry locations - top and bottom bars #11 bars and smaller - 3/4 inch.
    b. Formed concrete surfaces exposed to earth, water, or weather
        1) #5 bars and smaller: 1-1/2 inch.
        2) #6 bars and larger: 2 inches.

c. Formed beams and columns
   1) Stirrups, spirals, and ties - 1-1/2 inch.
   2) Principal reinforcing - 2 inches.

d. Formed beams and columns - exposed to earth, water, or weather
   1) Stirrups, spirals, and ties - 2 inches.
   2) Principal reinforcing - 2-1/2 inches.

e. Walls - dry condition
   1) #11 bars and smaller - 3/4 inches.
   2) 2) #14 and #18 - 1-1/2 inch.

f. Footings, grade beams, and base slabs at unformed surfaces and bottoms – 3 inches.

g. Tolerances or minimum concrete cover shall meet the requirements of ACI 117.

E. Install welded wire reinforcement in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

F. Micro-Fibers: All concrete where indicated on the drawings shall contain the specified micro- fibers. Length shall be per the manufacturer's specification. The dosage rate shall be 1.0 – 1.6 lbs per cubic yard per the manufacturer's specification. Submit proposed dosage rate to Engineer of Record for review prior to concrete placement.

G. Macro-Fibers: All concrete where indicated on the drawings shall contain the specified macro-fibers. Length shall be per the manufacturer's specification. The dosage rate shall be 3.0 – 5.0 lbs per cubic yard per the manufacturer's specification. Submit proposed dosage rate to Engineer of Record for review prior to concrete placement.

H. Epoxy-coated reinforcing bars supported from formwork shall rest on coated wire bar supports. Reinforcing bars used as support bars shall be epoxy-coated. In walls having epoxy-coated reinforcing bars, spreader bars where specified by the Commissioner or Engineer of Record, shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcing bars shall be made of corrosion-resistant material.

I. Epoxy-coated reinforcing bars shall be fastened with nylon- , epoxy- , or plastic-coated tie wire, or other acceptable materials.

J. Repair of damaged epoxy-coating: When required, damaged epoxy-coating shall be repaired with patching material conforming to ASTM A775. Repair shall be done in accordance with the patching material manufacturer's recommendations.

K. Unless permitted by the Engineer of Record, epoxy-coated reinforcing bars shall not be cut in the field. When epoxy-coated reinforcing bars are cut in the field, the ends of the bars shall be coated with the same material used for repair of coating damage.

L. Clean excavations, forms, etc. of loose earth, water, debris, trash, etc. prior to placing reinforcement.

M. Check forms for levelness and plumb. Verify proper alignment and bracing.

N. Verify that all other trades have their materials in place.

O. Provide corner bars at corners and intersections same diameter and quantity as primary reinforcing bars. Use soft, black annealed tie wire to secure steel at laps, splices and intersections. See additional information in Drawings.

P. Do not free stick any reinforcing. All reinforcing bars must be tied in place prior to a pour.

Q. Make splices as indicated on the Drawings unless otherwise permitted. Mechanical connections for reinforcement not shown on the Drawings may be used when accepted.

R. Reinforcement Relocation: When necessary to move reinforcement beyond the specified placing tolerances to avoid interference with other reinforcement, conduits, or embedded items, submit the resulting arrangement of reinforcement for acceptance.

S. Place wire mesh at mid-depth of slab thickness. Provide 12 inch minimum lap at splices. Use soft, black annealed tie wire to secure mesh at laps.

T. Reinforcement for 1 day's pour shall be completely placed and an approval made by the Architect prior to starting the concrete pour. Notify the Architect 24 hours in advance of a pour.

U. Do not use cutting torch to cut or bend reinforcing bars.

V. Do not cut any reinforcing bar without written approval from the Architect. Notify the Architect of any conflict with bar spacing, sleeve or other obstruction.

3.6 JOINTS

A. Construction Joints: Locate and install construction joints as indicated, or if not indicated, locate as directed by the Architect or Engineer and so as not to impair strength and appearance of the structure, as acceptable to Commissioner.

B. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.

D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions, using manufacturer's specified welding irons.

E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals and elsewhere as indicated.

1. Joint filler and sealant materials are specified in the section for “Related Materials”

F. Allow concrete to set for 24 hours before adjoining pour is started. Slabs across the joint shall be level and the surface shall not be feathered

G. Before proceeding to the next pour at a joint, thoroughly clean the joint, remove all loose laitance, and brush-in a thick cement slurry.

H. Contraction (Control) Joints in Slabs-on-Ground: Maximum joint spacing shall be 36 times the slab thickness unless otherwise noted on the drawings. The dry cut saw shall be used immediately after final finishing and to a depth of 1-1/4". A conventional saw shall be used as soon as possible without dislodging aggregate and to a depth of 1/4 slab thickness.

1. Joint sealant material is specified in the section for “Related Materials”.

3.7 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.8 CONCRETE PLACEMENT

A. Ready-mix concrete shall comply with the requirements of ASTM C 94 and ACI 304. All plant and transporting equipment shall comply with the concrete plant standards and truck mixer and agitator standards of the National Ready Mix Concrete Association.

B. Cold weather mixing procedures shall be submitted to the Commissioner for approval.

C. Notify Commissioner and Owner’s Inspector at least 36 hours (1 1/2 regular working days) before each pour so that forms and reinforcing may be examined. Do not place concrete until inspection has been made or waived.

D. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

1. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

E. General: Comply with ACI 304 “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete,” and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of

weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

F. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints. Use internal vibrators penetrating both the top and preceding layers.

G. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

H. Use and type of vibrators shall conform to ACI 309 “Recommended Practice for Consolidation of Concrete.” Do not use vibrators to transport concrete inside forms. The vibrator shall be inserted at intervals not exceeding 80% of the vibrator's diameter of influence. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix. Vibration hall be thorough, using vibrators small enough to work within reinforcing. Avoid under-vibration and over-vibration of concrete. Vibrate to remove all air from concrete but not so much to produce segregation.

I. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

J. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

K. Slabs: Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedge, bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. See also "MONOLITHIC SLAB FINISHES" below.

L. Maintain reinforcing in proper position during concrete placement operations.

M. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

1. When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Use only a non-corrosive, non-chloride accelerator. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
4. Care must be taken to store water-based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.

N. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F (32°C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
3. Fog spray forms, reinforcing steel and subgrade just before concrete is placed.
4. Do not place if concrete is over 98 deg F.

3.9 FLOOR FLATNESS/LEVELNESS TOLERANCES

A. FF defines the maximum floor curvature allowed over 24 in. Computed on the basis of successive 12 in. (300 mm) elevation differentials, FF is commonly referred to as the "Flatness F-Number".

B. FL defines the relative conformity of the floor surface to a horizontal plane as measured over a 10 ft. (3.05 m) distance commonly referred to as the "Levelness F-Number".

C. All floors shall be measured within 72 hours of being poured and in accordance with ASTM E 1155 "Standard Test Method for Determining Floor Flatness and Levelness Using the "F Number" System (Inch-Pound Units).

D. All slabs shall achieve the specified overall tolerance. The minimum local tolerance (1/2 bay or as designated by the Commissioner) shall be 2/3 of the specified tolerances.

E. All elevated slabs shall achieve the specified FL tolerance before the removal of the forms.

F. All slabs on metal deck shall achieve the specified FF.

G. Maximum Variation of Surface Flatness:

1. Finish concrete to flatness and levelness tolerances ("very flat"), which correspond to FF 50/FL 30 minimum overall for composite for all measured values and FF 30/FL 20 minimum for any individual floor section

H. Correct the slab surface if tolerances are less than specified.

I. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.10 CONCRETE FINISHING

A. Trowel finish floor surfaces scheduled for floor surfaces scheduled to receive floor covering.

B. Non-slip Broom Finish: Apply non-slip broom finish to exterior finish concrete platforms, steps, and ramps, and elsewhere as indicated. Immediately after trowel finishing, slightly roughen

concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

C. Trowel to a smooth finish after the slab is screeded and floated. Start trowelling when all water has disappeared from the surface to first level the surface, then start final trowelling when concrete has set where it no longer shows indentation from finger pressure. Trowel to a hard, smooth surface free of marks. Dusting with cement and sand will not be permitted. Application of water to the concrete surface will not be permitted prior to the initial set.

D. Grind smooth any surface defects, which would telegraph through the applied floor covering.

E. Fill any surface with defects or local flatness/levelness that does not meet the flatness specified tolerances.

F. Keep all Floors that will be polished free of all oil stains and construction damage.

3.11 FINISH FOR FORMED SURFACES

A. Non Exposed Form Finish (for non exposed grade beams and piers, unless otherwise indicated): This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas filled repaired and patched and with fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Exposed Architectural Concrete Form Finish (for exposed grade beams and piers, unless otherwise indicated): This is the concrete surface having minimal texture imparted by form facing material used, with regular patterned tie holes and defective areas filled, repaired and patched; and with fins and other projections exceeding 1/4 inch in height rubbed down or chipped off. Exposed architectural concrete shall be sanded and cleaned per the requirements stated herein.

3.12 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
3. In order to avoid plastic or drying shrinkage cracks during warm, dry or windy weather, ACI 302 and ACI 308 shall be followed using wind breaks and sun shades when recommended. Evaporation retardant shall be as specified in Section 2.04.
4. Care must be taken to store water based curing and sealing compounds where they will not freeze. In most cases, they cannot be reconstituted after thawing.

B. Curing Methods: Perform curing of concrete by moisture curing, moisture-retaining cover curing, curing and sealing compound, and by combinations thereof, as herein specified.

1. Provide moisture curing by following methods.

    a. Keep concrete surface continuously wet by covering with water.
    b. Continuous water-fog spray.
    c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Provide moisture-retaining cover curing as follows:

    a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Provide curing and sealing compound to exposed interior slabs not receiving additional flooring. A clear curing and sealing compound shall be used on exterior slabs, sidewalks and curbs not receiving a penetrating sealer.
4. Use the specified curing compound on surfaces to be covered with finish or coating material applied directly to concrete, such as liquid densifier/sealer, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials. Apply compound in accordance with manufacturer's direction.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of the specified curing compound or a continuous moist curing method approved by the Commissioner.

E. Certify that all curing compounds, sealers and hardeners are compatible with all adhesive products intended for attaching co-lateral floor material. In conformance with ASTM F710, coordination with flooring manufacturer is required to insure concrete coatings will not obstruct the bond between the concrete and the adhesive. In addition, insure coatings and adhesives are "benignly compatible" -- in other words, do not combine substances whose constituents are reactive.

F. Sealer and Dustproofer: Apply a second coat of the specified curing and sealing compound to exposed interior slabs not subjected to vehicular traffic, noted on the drawings. These slabs must have received an initial coat of the curing and sealing compound.

3.13 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in- place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Grout base plates and foundations as indicated using specified free-flowing non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

E. Where high fluidity and/or increased placing time is required use the specified high flow grout. This grout shall be used for all base plates larger than 10 square feet.

F. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screeds, tamp, and finish concrete surfaces as scheduled.

G. Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.14 CONCRETE SURFACE REPAIRS

A. Prior to all repairs, an as-built condition sketch and method of repair must be submitted to the Commissioner and Engineer of Record for review and approval.

B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Commissioner.

C. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with a bonding grout containing the specified bonding admixture. Place patching mortar after while bonding grout is still tacky.

D. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

E. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Commissioner. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discoloration's that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or pre-cast cement cone plugs secured in place with bonding agent. If defects cannot be repaired, remove and replace concrete.

F. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

G. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for tureens of slope, in addition to smoothness, using a template having required slope. If defects cannot be repaired, remove and replace concrete.

H. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions. If defects cannot be repaired, remove and replace concrete.

I. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days, except at hydrostatic slabs.

J. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. The specified underlayment compound or repair toping may be used when acceptable to Commissioner.

K. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

L. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cutout holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

M. Structural Repair: All structural repairs shall be made with prior approval of the Engineer of Record as to method and procedure, using the specified polymer repair mortar and/or specified epoxy adhesive. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by the manufacturers previously specified shall be used. In addition, all cracks shall be filled with the specified crack sealer or other method as approved by the Engineer of Record. All garage slabs shall be repaired prior to the slab being treated with the specified penetrating anti- spalling sealer.

N. Underlayment Application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material. Underlayment application shall achieve the tolerances specified in "MONOLITHIC SLAB FINISHES" above.

O. Specified Polymer Horizontal Repair Mortar: All exposed floors shall be leveled, where required, with the specified self-leveling repair topping.

P. Repair Methods not specified above may be used, subject to acceptance of Commissioner.

3.15 WORK IN CONNECTION WITH OTHER TRADES AND CONTRACTS

A. Sleeves, pockets, openings, etc., shall be set in the concrete walls and arches as required for the mechanical trades as shown on approved shop drawings; these shall be encased or built into the concrete work and shall be properly placed and secured in position in the forms before concrete is placed.

B. Provide all chases, pipe slots, etc., required for the mechanical trades (see mechanical drawings), constructed as shown on the approved shop drawings.

C. Leave temporary access panels where required to install mechanical equipment as required by trade affected. Panels shall be formed with construction joints as specified. Details for such panels shall be submitted to Commissioner for approval.

D. Coordinate all penetrations, cutting, and patching with waterproofing contractor.

3.16 CUTTING AND PATCHING

A. Contractor for concrete work shall be responsible for all cutting, removing and patching work where concrete surfaces are not installed within the limits shown on the drawings or specified herein. All such work shall meet with the approval of the Commissioner or Engineer of Record.

B. Where cutting and patching is required to accommodate the work of other subcontractors, such cutting shall be done at the expense of said subcontractors but shall be performed by the contractor for concrete work.

C. The location and extent of cutting in completed concrete work and the patching thereof shall meet with the approval of the Commissioner or Engineer of Record.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Contractor will employ a testing laboratory to perform tests and to submit test reports.

B. Provide special inspections per the applicable Building Code and the requirements of all applicable ACI standards.

C. At locations previously indicated in this specification and on the contract drawings, verify the use of non-magnetic materials. No magnetic materials are permitted in locations where prohibited by this specification or the contract drawings.

D. Contractor shall coordinate and schedule in a timely manner with the testing laboratory to perform the following tests and inspections. Tests shall be performed in accordance with ACI 301. See Section 01 45 23 - Testing Laboratory Services.
   1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
   2. Slump: ASTM C 143; one test at point of discharge for each truck; additional tests when

concrete consistency seems to have changed.

3. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each truck of air-entrained concrete.
4. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above; and each time a set of compression test specimens made.
5. Compression Test Specimen: ASTM C 31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
6. Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 25 cu. yds. plus additional sets for each 50 cu. yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimens tested at 7 days, three specimens tested at 28 days, and one specimens retained in reserve for later testing if required.

    a. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
    b. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
    c. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

7. Water Cementitious Ratio Test: Check water content of concrete in accordance with AASHTO T 318 “Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying”. Frequency of this test shall be the same as that of compressive strength tests, noted above.
8. Floor Preparation to Receive Resilient Flooring: For any concrete that receives resilient flooring, test concrete in accordance with ASTM F 710 prior to acceptance by owner.
9. Test results will be reported in writing to Commissioner, Engineer of Record, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

    a. Non Compliance: All test reports indicating non-compliance shall be faxed immediately to all parties on the test report distribution list and the hard copies submitted on different colored paper.
    b. Nondestructive Testing: Windsor probes, sonoscope, or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

10. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been

    attained in the structure, as directed by Commissioner. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

3.18 WASTE MANAGEMENT

A. Separate and recycle waste materials in accordance with the Section 017419 Construction Waste Management and Disposal and to the maximum extent feasible.

B. Collect cut off steel and discarded reinforcement steel and place in area for recycling.

C. Place materials defined as hazardous or toxic waste in designated containers.

D. Use trigger operated spray nozzles for water hoses and closed loop system to reduce water consumption.

E. Reusable forms should be cleaned immediately after removal and non-reusable forms recycled to the maximum extent economically feasible.

F. Incorporate crushed concrete or masonry materials in sub-base to the maximum extent feasible in accordance with sub-base specifications.

G. Before concrete pours, designate location or uses for excess concrete. Options include:

1. Additional paving
2. Post footing anchorage
3. Landscaping -- site concrete features
4. Flowable fill

H. To avoid contamination of the local landscape, before concrete pours, designate a location for cleaning out concrete trucks where run-off can be contained, reused or incorporated. Options include:

1. Company owned site for that purpose
2. On-site area to be paved later in project

END OF SECTION

SECTION 03 35 43 POLISHED CONCRETE FLOOR SPECIFICATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 DESCRIPTION

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the cement leveling compound as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Special requirements for polished Concrete Process
2. Special requirements for integrally colored, polished and architectural cast-in-place concrete, as installed by Get Real Surfaces

1.4 RELATED SECTIONS

A. Section 018113 - Sustainable Design Requirements.

B. Section 033000 - Cast-in-place Concrete.

C. Section 034001 - Precast Concrete Stairs Cladding.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

3. Environmental Product Declarations (EPDs).
4. New York City's Environmentally Preferable Purchasing (EPP)

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.
   1. Sustainable Design Submittals:
      a. Environmental Product Declaration (EPD) for all batch plant ready-mixed concrete.
      b. Laboratory Test Reports: For indicating compliance with requirements for low-emitting materials.

B. Product Data: Submit data for all of the following:

   1. Reinforcement
   2. Supports for reinforcement
   3. Forming accessories
   4. Portland Cement
   5. Fly Ash
   6. Slag Cement
   7. Blended hydraulic Cement including blended limestone cement
   8. Silica fume
   9. Natural or other pozzolanic materials
   10. Aggregates
   11. Admixtures
      a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
   12. Patching compounds
   13. Waterstops
   14. Joint systems
   15. Curing compounds
   16. Dry-shake finish materials
   17. Others items as requested by Commissioner.

C. Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures. The shop drawings shall be prepared only by competent detailers, checked by the contractor prior to submission.

   1. The shop drawings shall show construction, contraction and isolation joint locations and the added reinforcement required at same.
   2. Obtain and coordinate information for sleeves and openings in concrete, which are required for the work of other trades. Make coordinated drawings showing size and location of openings and sleeves and incorporate this information on the reinforcing drawings.
   3. Only those splices indicated on the approved shop drawings will be permitted.
   4. Provide elevations of all foundation walls and other structural elements to a minimum 1/4" scale.

D. Shop Drawings Formwork: Submit shop drawings for fabrication and erection of specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement, and other items which affect exposed concrete visually. Commissioner's review is for general applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility, prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Commissioner.

F. Contraction Joint Layout: Indicate proposed contraction joints required per applicable codes and drawings.

1. Location of contraction joints is subject to approval of the Commissioner.

G. The use of the Commissioner's electronic drawing files as a base for the reinforcement, formwork, and joint layout shop drawings will be permitted at the request of the detailer/designer upon completion and return of the waiver form. The use of the Commissioner's or Engineer of Record's electronic drawing files as a base for shop drawing details will not be permitted. The detailer/designer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design team makes no representation regarding the accuracy or completeness of the electronic files given to detailer/designer and their use will be at the detailer/designer's sole risk and without liability to the design team. The detailer/designer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing sections and details. The detailer/designer shall also remove all reference to work not included in the concrete contract.

H. Scaling of the Commissioner's drawings is not permitted. This applies to hard paper, electronic, and all other versions.

I. Samples: Submit samples of materials as requested by Commissioner, including names, sources and descriptions.

J. Laboratory Test Reports: Submit laboratory test reports for concrete materials, mix design test and microwave test, including the following:
1. Portland cement
2. Fly ash
3. Slag cement
4. Ground Glass Pozzolan
5. Blended hydraulic cement, including blended limestone cement
6. Silica fume
7. Aggregates
8. Admixtures:
    a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

K. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Commissioner. Manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements shall sign material certificates. Provide

certification from admixture manufacturers that chloride content complies with specification requirements.

L. Cold Weather and Hot Weather Concreting Procedures: Submit written descriptions of contractor's proposed cold weather and hot weather concreting procedures, when applicable.

M. Certification that pozzolanic materials conforms to ASTM C 618-01 (noting class C or class F), ASTM C 989 or ASTM C1240.

N. Certified recycled steel content. Provide cut sheets clearly indicating whether the rebar used meets the minimums for post-consumer OR post-industrial recycled contents. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and if the recycled content is post-consumer or post-industrial.

O. Recycled Aggregate: Provide laboratory reports indicating that aggregate conforms to ASTM C33 for structural concrete or ASTM D1241-00 for sub-base material. Provide cut sheets clearly indicating the source, total weight and volume of the recycled aggregate. If aggregate provided is a mix of virgin and recycled aggregates obtain a written affidavit from the manufacturer stating the recycled content percentage

P. VOC content for curing compounds, sealants and release agents: Provide a cut sheet and a Material Safety Data Sheet (MSDS) for each curing compound, sealant, hardener and release agent used highlighting VOC contents. VOC content must be less than or equal to limits stated under "PRODUCTS".

1.9 FIELD SAMPLES

A. Prepare field samples under provisions of Section 01300 and coordinate with Section 03300. Locate where directed.

B. 36" x 36" x 4" thickness Size panel to indicate special treatment and finish required.

C. Use specified integrally colored concrete in utilizing minimum concrete order size of 3 yards. This will help with color quality control.

D. Obtain acceptance of surface finish.

E. Maintain sample panel exposed to view for duration of concrete work. Remove when directed

1.10 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.11 REGULATORY REQUIREMENTS

A. Conform to New York City Building Code for combustibility or flame spread requirements.

1.12 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301, 303, 304, 305, 306, and 309.

B. Obtain materials from same source throughout job.

C. Batch plant shall be able to show a minimum of five (5) years' experience in batching concrete. If required, plant shall furnish a list of similar sized jobs or special condition jobs performed during the last two (2) years.

1.13 TESTS

A. Concrete Testing Service: Owner will engage a testing laboratory acceptable to Commissioner and Engineer of Record to perform material evaluation tests and to design concrete mixes.

1.14 COORDINATION

A. Notify appropriate trades of concrete pour and polishing schedules to allow adequate time for installation of complementary trade work.

B. From material supplier, obtain anchor bolts / other steel items to be cast into concrete.

C. With appropriate trades, coordinate size and location of mechanical equipment concrete pads.

1.15 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials in accordance with the requirements of General Conditions - Article 2.

B. Mix and deliver concrete to project ready-mixed in accordance with ASTM C94.

C. Schedule delivery so that continuity of any pour will not be interrupted for over 30 minutes.

D. Place concrete on site within 90 minutes after proportioning materials at batch plant.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Get Real Surfaces, 121 Washington Street, Poughkeepsie, NY 12601. 845-452-3988).

B. OR APPROVED EQUAL

2.2 CONCRETE MATERIALS

A. Cement:

1. ASTM Cl50, Type I or III (as determined by project conditions), grey color.

2. Use only one brand, type and source of cement for entire Project. ANSI Z 137.1 .56 Wet

B. Aggregate:

1. General:
   - Provide fine and coarse aggregate for each type finish from one source for entire Project.
   - Provide fine and coarse aggregate of color range and gradation to match approved samples.
2. Fine aggregate: ASTM C33.
   - a. Manufactured sands from coarse aggregate or dust-free, silt-free, salt-free natural sand.
   - b. Restrict deleterious reactive materials with alkalis in cement per ASTM C33.
3. Coarse aggregate:
   - Normal weight aggregate: ASTM C33.
   - Lightweight aggregate: ASTM C330.
   - [Provide special mix, gradation, and color[s] as follows:]

C. Water: clean, fresh and potable.

D. Admixtures:

- 1. Only use admixtures, which have been tested and accepted in, mix designs.
- 2. Air Entrainment: ASTM C260.

E. Integral Coloring Admixtures:
- 1. Integral Color by Davis Pigments, synthetic oxide pigment, meeting ASTM C979, [C494], ISO 9002, one (1) bag per yard in [specify color]. [Color to match Architect's sample. Color to be selected by architect/owner from manufacturer's available standard and custom colors].
- 2. Calcium chloride and admixtures containing chloride ions or other salts are not permitted.

2.3 CONCRETE POLISHING MATERIALS

A. Polishing / Hardening / Densifier agent: proprietary concrete densifier per installer.

B. Finish / Stain Resist agent: proprietary concrete micro-impregnating agent per installer.

C. Diamond Pads: #30, #60, #120, #220, #400, #800, #1500, as conditions dictate, or equal

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 CONCRETE PLACEMENT

A. Concrete should be batched and placed in accordance with ACI standards.

B. Concrete should be hard-steel-troweled finished but not “burned.”.

C. Maintain consistent water to cement ratio.

D. Ensure slump remains consistent and does not exceed five (5) inches.

E. Use a wood float as magnesium floats can entrap bleed water.

F. Attempt a flat floor finish of FF40 or better. FF = Floor Flatness.

G. Care should be taken not to overwork or trowel-burn edges.

H. Do not topically apply water during finishing, as it will weaken the surface and can cause a washed-out appearance.

I. Do not over-apply curing compound, as a milky appearance will result.

J. Do not use waxed, acrylic, silicone or petroleum-based curing compounds for concrete to be polished.

K. Use of dissipating curing compounds or non-staining waterproof cure paper should be considered

3.3 CONCRETE FINISHING GUIDELINES

A. Care must be taken during concrete finishing to obtain an FF 40 or better, and to avoid over-working, surface watering, chatter marks, and application of non-approved curing compounds that will blemish and / or weaken the surface. (For approved curing agents and methods, refer to Get Real Surfaces ready-mix specification).

B. It is paramount to maintain consistent placement and finishing techniques throughout the pour, without

adding water to the surface as cloudiness, inconsistent strength and non-uniform appearance may result.

C. Contractors shall be advised that the concrete slab is the finished floor. No known chemical process or cleaning system will completely remove petroleum stains from concrete surfaces. Prevention of spills is essential.

D. DO NOT allow trades to park vehicles on the slab without applying protection, such as plastic or non-absorbent drop clothes, under the vehicles

E. DIAPER any hydraulic equipment used on the floor during the construction process.

F. NO pipefitting / cutting will take place on the floor slab.

G. DO NOT place steel on the slab without protection beneath.

REMEMBER – THIS SLAB WILL BECOME THE FINISHED FLOOR.

3.4 CONCRETE POLISHING GUIDELINES

A. All concrete floor surface designated to be polished in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 03 40 01 PRECAST CONCRETE STAIRS AND CLADDING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 DESCRIPTION

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the cement leveling compound as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Self-leveling cement compound applied over existing concrete substrates; thickness shall be 1/4" minimum.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Concrete work - Section 033000.

1.5 QUALITY ASSURANCE

A. Applicator: Company specializing in performing the work of this Section with a minimum of 3 years' experience and approved by the manufacturer of the product used.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Composite Wood.

5. Environmental Product Declarations (EPDs).
6. New York City's Environmentally Preferable Purchasing (EPP)

3. Health Product Declarations (HPDs).

4. Low-Emitting Materials.

5. Regional Content.

2.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

2.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Submit samples for approval to illustrate quality, color, and texture of surface finish; slight variation in color from approved sample shall be deemed acceptable.

C. Shop Drawings shall be submitted for approval as required. Shop Drawings shall be at a sufficient scale to indicate unique and unusual conditions and to indicate adjacent construction or finishes affected by the Work. Shop Drawings shall indicate the location of all required seams.

D. Templates taken shall supersede all Shop Drawing dimensions unless noted otherwise.

E. Templates must be approved by the architect or other specified representative of the client.

2.9 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

2.10 REGULATORY REQUIREMENTS

A. Conform to New York City Building Code for combustibility or flame spread requirements.

2.11 MOCK-UP

A. Construct a mock-up of underlayment material, 8 feet long by 8 feet wide.

B. Locate where directed by the Commissioner.

C. Approved mock-up may remain as part of the Work.

2.12 JOB REQUIREMENTS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F. 24 hours before, during, and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture and until underlayment is dry, allow a minimum of seven (7) days.

PART 2 PRODUCTS

2.4 MANUFACTURER

A. Units shall be manufactured by Get Real Surfaces, Inc., Poughkeepsie, NY 12601 (845-452-3988).

B. OR APPROVED EQUAL

2.5 MATERIALS

A. Concrete Material

1. Units shall be composed of a proprietary mix of Portland Cement (ASTM C150), Aggregate (ASTM C33), and Pigment achieving a design weighing no less than 145 lbs./cf. and a compressive strength of 6000 psi minimum at 28 days.

2. Absorption 6.50%

3. ANSI Z 137.1 .56 Wet

4. ASTM C666 Freeze Thaw - Pass (no change)

B. Reinforcing Materials

1. Primary Reinforcing: GFRP (Glass Fiber Reinforced Polymer Rebar)

2. Secondary Reinforcing (where applicable): glass and/or PVA fiber

2.6 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Mix to achieve following characteristics:

1. Density: 115 lb./cu. ft. minimum dry density.

2. Compressive Strength: 4,000 psi minimum in accordance with ASTM C 109.

3. Fire Hazard Classification: Flame/Smoke rating of 0/0 in accordance with ASTM E 286.

C. Mix to self-leveling consistency.

PART 3 EXECUTION

3.5 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.6 FABRICATION

A. All units shall be a minimum slab thickness of 1 1/2” unless specified otherwise by design or engineering. 18 lbs. / sq.ft. @ 1.5" thickness.

B. All units shall be factory sealed. Sealer is to be determined by Manufacturer based on application of product.

C. Units shall be cast in largest pieces practicable for the application.

D. Fiberglass Reinforcing rod shall be placed at the entire perimeter of product.

E. Fabricate units straight, smooth, and true to size and shape, with exposed edges and corners precise and

square unless otherwise indicated.

F. Fabricate units with smooth surface finish free of pockets, sand streaks, and honeycomb, with uniform color and texture to match approved control sample.

G. Entrapped air voids or similar casting variations will be filled with a Portland cement based colored filler (unless otherwise specified) and is considered common practice.

D. Dimensional Tolerances of Finished Units:

1. Overall height, width or length: ±1/8".

2. Angular deviation of plane of side: 1/16"

3. Warp (out of plane): 1/8” per 5'

4. Thickness + zero, minus 1/16"

3.7 INSTALLATION

A. TOLERANCES

1. Installed units shall have planned seams, 3/16” in width unless specified otherwise and shall be filled with corresponding colored caulk or grout appropriate for the particular installation as specified by architect or designer.

B. GENERAL PRECAST NON-STRUCTURAL STAIR COMPONENTS.

1. Allowances for variations in field conditions shall be considered when planning thickness of and material selected as setting bed. Typically, 1/4" minimum thickness for rapid setting thin set or epoxy bonding mortar is required.

2. Prior to installing the product, layout all critical points. Dry fit units (to assure a proper fit), prior to the addition of bonding material.

END OF SECTION

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SECTION 03 54 16 CEMENT LEVELING COMPOUND

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 DESCRIPTION

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the cement leveling compound as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Self-leveling cement compound applied over existing concrete substrates; thickness shall be 1/4" minimum.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Concrete work - Section 033000.

1.5 QUALITY ASSURANCE

A. Applicator: Company specializing in performing the work of this Section with a minimum of 3 years' experience and approved by the manufacturer of the product used.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements. The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Composite Wood.

2. Environmental Product Declarations (EPDs).

3. Health Product Declarations (HPDs).

6. Low-Emitting Materials.

7. Regional Content.

2.13 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

2.14 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Submit catalog information and product data for material to be used.

C. Submit approval letter as required by Article 3.2, para. B. herein.

2.15 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

2.16 REGULATORY REQUIREMENTS

A. Conform to New York City Building Code for combustibility or flame spread requirements.

2.17 MOCK-UP

A. Construct a mock-up of underlayment material, 8 feet long by 8 feet wide.

B. Locate where directed by the Commissioner.

C. Approved mock-up may remain as part of the Work.

2.18 JOB REQUIREMENTS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F. 24 hours before, during, and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture and until underlayment is dry, allow a minimum of seven (7) days.

PART 2 PRODUCTS

2.7 MANUFACTURER

A. Subject to the requirements specified herein, provide one of the following products:

1. “Supercap SC500” by Laticrete.
2. “Sikalevel 325” by Sika.
3. "Level Set 200" by ProSpec.
4. "K-15" made by Ardex.
5. "Ultraplan 1 Plus" by the Mapei Corp. (rapid setting).
6. "Novoplan 2 Plus" by the Mapei Corp. (standard setting).
7. "Level Quick R/S" or "E/S" by Custom Building Products.
8. Or approved equal.

2.8 MATERIALS

A. Underlayment: One of the above listed products.

B. Water: Potable and not detrimental to underlayment mix materials.

C. Primer: Manufacturer's recommended type.

D. Joint and Crack Filler: Latex based.

2.9 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Mix to achieve following characteristics:

1. Density: 115 lb./cu. ft. minimum dry density.
2. Compressive Strength: 4,000 psi minimum in accordance with ASTM C 109.
3. Fire Hazard Classification: Flame/Smoke rating of 0/0 in accordance with ASTM E 286.

C. Mix to self-leveling consistency.

PART 3 EXECUTION

3.8 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

B. Contractor shall ensure that cement leveling work meets manufacturer's requirements for finish floor materials to be installed in each area being leveled.

C. Contractor shall verify that cement leveling products and final installation are compatible with finish flooring to be installed by testing or as required by flooring manufacturer. Obtain instructions if test results are not within limits recommended by flooring manufacturer.

D. Prior to commencing installation, verify that required floor-mounted utilities are in correct location.

3.2 INSPECTION

A. Examine the areas and conditions where cement leveling compounds are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

B. Manufacturer's representative must inspect surfaces to receive cement leveling compound and approve those surfaces in writing to the Commissioner prior to start of application.

3.3 PREPARATION

A. Vacuum clean surfaces; remove any material (curing compounds, film, dirt) that would be detrimental to bond of cement leveling compound.

B. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

C. Close floor openings.

3.4 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Place to minimum 1/4" thickness.

C. Transition to existing floor; use stiff mix to slope to align with existing adjacent floor.

3.5 CURING

A. Air cure in accordance with manufacturer's instructions.

3.6 APPLICATION TOLERANCE

A. Top Surface: Level to 1/8 inch in 10 ft.

3.7 PROTECTION OF FINISHED WORK

A. Do not permit traffic over unprotected floor underlayment surfaces and until underlayment is completely dry.

END OF SECTION

SECTION 04 01 40 MAINTENANCE OF STONE ASSEMBLIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the maintenance of stone assemblies as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Cleaning existing exterior limestone surfaces.

2. Repointing existing limestone walls.

3. Repair of existing damaged stone.

4. Replacement of stone as required.

1.3 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Interior Stone Restoration – Section 090610.

1.4 QUALITY ASSURANCE

A. Stone Repair and Repointing Specialist Qualifications: Engage an experienced stone repair and repointing firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in- service performance. Experience in only installing standard unit masonry or new stone masonry is insufficient experience for stone repointing work.

1. Installer certification: All repairs should be performed by a trained installer holding a Training Workshop Certificate from Cathedral Stone Products, Inc. or approved equivalent. Contractor shall maintain proof of this credential for each installer at the site at all times (for M70 & M160).

B. Field Supervision: Stone repair/repointing specialist firms shall maintain experienced full-time supervisors on Project site during times that stone repointing work is in progress.

C. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging stonework. Include provisions for supervising performance and preventing damage.

by EMED Co.

D. Field-Constructed Mock-Ups: Prior to start of general stone restoration, prepare the following sample panels on the building where directed by Architect. Obtain Architect's acceptance of visual qualities before proceeding with the work. Retain acceptable panels in undisturbed condition, suitably marked, during construction as a standard for judging completed work.

1. Cleaning: Demonstrate materials and methods to be used for cleaning each type of exposed surface and condition on sample panels of approximately 25 sq. ft. in area.

a. Test adjacent non-masonry materials for possible reaction with cleaning materials.
b. Allow waiting period not less than seven (7) calendar days after completion of sample cleaning to permit study of sample panels for negative reactions.

2. Repointing: Prepare two (2) separate sample areas of approximately 3'-0" high by 6'-0" wide for each type of repointing required, one for demonstrating methods and quality of workmanship expected in removal of mortar from joints and the other for demonstrating quality of materials and workmanship expected in pointing mortar joints.

3. Patching: Prepare sample area approximately 3'-0" high by 6'-0" wide for demonstrating techniques and quality of stone repair work.

E. Mortar Analysis: Engage a laboratory to analyze existing historic mortars using either the wet chemical method or instrumental method of analysis (as directed by the Architect), to determine their composition. Provide resulting information regarding original composition of mortar to the Architect.

1. New mortar must match the historic mortar in color, texture, and tooling.

a. If possible, through laboratory analysis, match the binder components and their proportions with the historic mortar, if those materials are available.

2. The sand must match the sand in the historic mortar.

3. New mortar must have greater vapor permeability and be softer (measured in compressive strength) than the masonry units.

4. The new mortar must be as vapor permeable and as soft or softer (measured in compressive strength) than the historic mortar.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. **Adhesives and Sealants**
7. **Ceilings**
8. **Composite Wood & Agrifiber Products**
9. **Flooring Systems**
10. **Furniture & Seating**
11. **Insultation**
12. **Paints & Coatings**
13. **Wall Panels**

*red : Contractor to select four of these additional tests

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Product Data: Submit manufacturers' technical data for each product indicated including recommendations for their application and use and VOC compliance. Include test reports and certifications substantiating that products comply with requirements.

B. Certificates should be submitted stating that all Installers of the repair mortar have successfully completed the training workshop for installation of the mortar. (Three day workshops for Installers of Jahn Restoration Mortars are offered by Cathedral Stone ® Products, Inc. and held at 7266 Park Circle Drive, Hanover, MD 21076; tel. (410) 782-9150; fax. (410) 782-9155.)

C. Samples: For the following:

1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6" long by 1/2" wide, set in aluminum or plastic channels, for each type, color, and texture of pointing mortar.

    a. Have each set contain a close color range of at least three Samples of different mixes of colored sands and cements that produce a mortar matching the existing, cleaned mortar when cured and dry.
    b. Submit with precise measurements on ingredients, proportions, gradations, and source of colored sands from which each Sample was made.

c. Include with each Sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.

2. Sand Type Used for Pointing Mortar: Minimum 8 oz. of each in plastic screw-top jars.

3. Sealant materials.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

B. Protect cleaning and restoration materials during storage and construction from wetting by rain, snow, or ground water, and from staining or intermixture with earth or other types of materials.

C. Protect grout, mortar, and other materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

1.9 PROJECT CONDITIONS

A. Clean stone surfaces only when air temperatures are 40 deg. F. and above and will remain so until stone has dried out, but for not less than seven (7) days after completion of cleaning.

B. Do not repoint mortar joints or repair stone unless air temperatures are between 40 deg. F. and 80 deg. F. and will remain so for at least forty-eight (48) hours after completion of work.

C. *Hot Weather Requirements:* **Protect repair mortar from direct sunlight and wind.** Do not use or prepare mortar when ambient air temperature is above 90° F.

D. Prevent grout or mortar used in repointing and repair work from staining face of surrounding stone and other surfaces. Immediately remove grout and mortar in contact with exposed stone and other surfaces.

E. Protect sills, ledges, and projections from mortar droppings.

1.10 SEQUENCING/SCHEDULING

A. Perform stone restoration work in the following sequence:

1. Repair existing stone.

2. Clean existing stone surfaces.

3. Rake out all existing mortar from joints.

4. Repoint all existing mortar joints of stone indicated to be restored.

PART 2 PRODUCTS

2.1 MATERIALS

A. Where replacing stone, provide stone to match existing for type, color, texture, size, thickness, etc., to match existing as approved by the Architect.

B. For mortar materials, conform to the following requirements:

1. Jahn Restoration Mortars are distributed by Cathedral Stone® Products, Inc., 7266 Park Circle Drive, Hanover, MD 21076; tel. (410) 782-9150; fax. (410) 782-9155; website: www.cathedralstone.com email: info@cathedralstone.com. Jahn Mortars are premixed cementitious repair materials formulated to match the color and texture of the existing masonry, and do not contain any acrylic, latex, or other synthetic polymer additives. Mix the mortar with clean, potable water.

2. Substitutions: If proposed equal is submitted, lab test to establish equivalent performance levels. Use an independent testing laboratory, as determined by the Specifier, and paid for by the submitting party.

C. Water for Cleaning: Clean, potable, free of oils, acids, alkalis, salts, and organic matter.

D. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effect of acidic and alkaline masonry cleaners.

1. Products: Subject to compliance with requirements provide one of the following or Approved Equal:

a. "Diedrich Acid Guard," Diedrich Chemicals.
b. "Sure Klean Acid Stop," ProSoCo, Inc.

E. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, at rates required by the manufacturer, measured at spray tip, and for volume.

1. For spray application of chemical cleaners provide low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray-tip.

2. For spray application of water provide fan-shaped spray-tip which disperses water at angle of not less than 15 degrees.

F. Chemical Cleaner: "Sure Klean 942" Limestone and Marble Cleaner, or approved equal; ready-to-use non-acidic alkaline cleaning gel designed for removing moderate-to-severe atmospheric staining on exterior or interior stone masonry surfaces.

G. Consolidation Treatment and Protection: Submit to conformance with requirements, use "1100 Consolidation Treatment" as manufactured by ProSoCo, Inc. or Approved Equal.

2.2 STONE PATCHING MATERIALS

A. Stone Patching Mortar: Single-component, cementitious, mineral based mortar equal to M70 Jahn Restoration Mortars made by Cathedral Stone Products Inc., or approved equal.

2.3 MORTAR MIXES

A. Measuring and Mixing: Measure cementitious and aggregate material in a dry condition by volume or equivalent weight. Do not measure by shovel, use known measure. Mix materials in a clean mechanical batch mixer.

1. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix which will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 1-to-2 hours. Add remaining water in small portions until mortar of desired consistency is reached. Use mortar within thirty (30) minutes of final mixing; do not retemper or use partially hardened material.

B. Colored Mortar: Produce mortar of color required by use of selected coloring agent.

C. Do not use admixtures of any kind in mortar, other than colorant.

D. Mortar Proportions: Comply with ASTM C 270, Proportion Specification, Type N, with cementitious material content limited to Portland cement-lime and coloring agent.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where stone restoration and cleaning are to be performed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect.

3.2 PROTECTION

A. General: Comply with recommendations of manufacturers of chemical cleaners for protecting building surfaces against damage from exposure to their products.

B. Protect persons, motor vehicles, surrounding surfaces of building whose stone surfaces are being restored, building site, and surrounding buildings from injury resulting from stone restoration work.

1. Prevent chemical cleaning solutions from coming into contact with pedestrians, motor vehicles, landscaping, buildings and other surfaces which could be injured by such contact.

2. Do not clean stone during winds of sufficient force to spread cleaning solutions to unprotected surfaces.

3. Dispose of run-off from cleaning operations by legal means and in manner which prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

4. Erect temporary protection covers over pedestrian walkways and at points of entrance and exit for persons and vehicles which must remain in operation during course of stone restoration work.

C. Protect glass, unpainted metal trim and polished stone from contact with acidic chemical cleaners by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape. Apply masking agent to comply with manufacturer's recommendations. Do not apply liquid masking agent to painted or porous surfaces.

3.3 CLEANING EXISTING STONE, GENERAL

A. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other.

B. Use only those cleaning methods indicated for each stone material and location.

C. Perform each cleaning method indicated in a manner which results in uniform coverage of all surfaces, including corners, moldings, interstices, and which produces an even effect without streaking or damage to stone surfaces.

D. Prewet all stone surfaces to be cleaned with chemicals.

E. pH readings shall be taken and recorded prior to all cleaning operations and after cleaning to ensure that chemicals are completely rinsed from stone surfaces.

F. All chemically treated surfaces shall be thoroughly rinsed clean with a pressure wash not to exceed 500 psi, until the surface achieves a neutral pH reading, or returns to the pH reading of the stone prior to cleaning.

G. Rinse off chemical residue and soil by working upwards from bottom to top of each treated area at each stage or scaffold setting.

H. Water Application Methods: Prior to chemical cleaning, apply water application to mock-ups by spray at various pressures to determine if stone surfaces can be cleaned adequately and to the Architect's satisfaction in this manner. If water applications prove ineffective, proceed with chemical cleaners.

I. Chemical Cleaner Application Methods: Apply chemical cleaners to stone surfaces to comply with chemical manufacturer's recommendations. Do not allow chemicals to remain on surface for periods longer than that indicated or recommended by manufacturer.

1. For hard to remove dirt or grime, apply pre-wash cleaner prior to application of chemical cleaner; follow manufacturer's instructions.

3.4 REPOINTING EXISTING STONE

A. Joint Raking

1. Rake out mortar from joints to depths equal to 2-1/2 times their widths but not less than 1/2" nor less than that required to expose sound, unweathered mortar.

2. Remove mortar from stone surfaces within raked-out joints to provide reveals with square backs and to expose stone for contact with pointing mortar. Brush, vacuum or flush joints to remove dirt and loose debris.

3. Do not spall edges of stone units or widen joints. Replace any stone which become damaged.

    a. Cut out old mortar by hand with chisel and mallet.
    b. Power operated rotary hand saws and grinders will be permitted but only on specific written approval of Architect based on submission by Contractor of a satisfactory quality control program and demonstrated ability of operators to use tools without damage to stone. Quality control program shall include provisions for supervising performance and preventing damage due to worker fatigue.

B. Joint Pointing

1. Rinse joint surfaces with water to remove any dust and mortar particles. Time application of rinsing so that, at time of pointing, excess water has evaporated or run off, and joint surfaces are damp but free of standing water.

2. Apply first layer of pointing mortar to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8" until a uniform depth is formed. Compact each layer thoroughly and allow to become thumbprint-hard before applying next layer.

3. After joints have been filled to a uniform depth, place remaining pointing mortar in three (3) layers with each of first and second layers filling approximately 2/5 of joint depth and third layer the remaining 1/5. Fully compact each layer and allow to become thumbprint hard before applying next layer. Take care not to spread mortar over edges onto exposed stone surfaces, or to featheredge mortar.

4. When mortar is thumbprint hard, tool joints to match original appearance of joints, unless otherwise indicated. Remove excess mortar from edge of joint by brushing.

5. Cure mortar by maintaining in a damp condition for not less than seventy-two (72) hours.

6. Where repointing work precedes cleaning of existing stone, allow mortar to harden not less than thirty (30) days before beginning cleaning work.

END OF SECTION

SECTION 04 20 00 UNIT MASONRY

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the unit masonry work as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Concrete block walls and partitions.
2. Concrete block backup walls to new limestone and granite exterior cladding.
3. Metal joint reinforcing, anchors, ties, closures and related accessories for masonry.
4. Control and expansion joints in masonry, filled with joint fillers.
5. Chases, recesses, pockets and openings in masonry as required for installation of work by others.
6. Building in of items furnished by others into masonry, including access doors, door frames, anchors, sleeves and inserts, and other similar items to be embedded in masonry.
7. Grouting in of metal items built into masonry work.
8. Protection, pointing and cleaning of masonry.

1.3 RELATED SECTIONS

A. Concrete - Section 033000.

B. Thermal insulation - Section 072100.

C. Firestops and smokeseals - Section 078413.

D. Sealant - Section 079200.

1.4 SUBMIT SHOP DRAWINGS FOR THE FOLLOWING:

1. Anchoring details.

2. Control and expansion joint locations and details.

B. Submit Samples for the following:

1. Joint reinforcing, each type, width and proposed location (labeled).

2. Anchors, wedges and ties, each type, width and proposed location (labeled).

3. Joint filler, each type.

4. Mortar color, 12" long cured sample.

C. Submit technical and installation information for the following:

1. Mortar materials, each material and mortar type.

2. Certification of mortar mix.

3. Flashing material, descriptive literature.

4. Concrete block, joint reinforcing, anchors, ties and joint filler; submit manufacturer's technical and descriptive literature.

5. Block manufacturer shall submit certifications of compliance with ASTM C 90, C 331 and UL 618 prior to any job site delivery. Field sampling of concrete block may be tested by an Independent Testing Laboratory retained by the Owner according to the requirements of ASTM C 140.

D. Construction Procedures (Submit the following)

1. Procedures and materials for cleaning masonry work; including certification that cleaner will not adversely affect stone, gaskets, sealants, etc.

1.5 QUALITY ASSURANCE

A. Conform to the following non-cumulative tolerances (any masonry work not meeting these standards shall be re-built as directed by the Architect).

1. Variation from the plumb:

   a. In lines and surfaces of columns, walls and arrises:
      1). In 10 feet 1/8"
      2). In any story of 25 feet maximum 1/4"
      3). In 40 feet or more 1/4"
   b. For external corners, expansion joints and other conspicuous lines:
      1). In any story of 25 feet maximum 1/4"
      2). In 40 feet or more 3/8"

2. Variation from the level or the grades indicated on the drawings; for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:

   a. In any bay or 20 feet maximum 1/4"
   b. In 40 feet or more 1/4"

3. Variation of the linear building lines from established position in plan related portion of columns and partitions:

   a. In any bay or 20 feet maximum 1/4"
   b. In 40 feet or more 1/2"

4. Variation in cross-sectional dimensions of columns and in thickness of walls:

   a. Minus 1/8"
   b. Plus 1/8"

5. Variation in dimensions of masonry openings:

   a. Horizontal dimension -0" + 1/16"
   b. Vertical dimension +0" - 1/16"

B. Work of this Section shall conform to the requirements of the following (unless otherwise superseded by prevailing Building Code):

1. ACI 530/ASCE 5/TMS 402 Building Code Requirements for Masonry Structures.

2. ACI 530-1/ASCE 6/TMS 602 Specifications for Masonry Structures.

C. Pre-Construction Conference: Prior to installation of masonry and associated work, Contractor shall arrange a meeting with Masonry Subcontractor, installers of related work, and other entities concerned with masonry wall performance, including the Architect and Owner. Contractor shall record discussions and agreements and furnish copy to each participant. Provide at least seventy-two (72) hours' advance notice to participants prior to convening conference. Review methods and procedures related to masonry work, including, but not limited to, the following:

1. Review masonry requirements (drawings, specifications and other Contract Documents).

2. Review required submittals, both completed and yet to be completed.

3. Review and finalize construction schedule related to masonry work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

4. Review required inspection, testing, certifying and material usage accounting procedures.

5. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

6. Coordinate work with air/vapor barrier membrane and related flashing, review details to avoid conflicts.

1.6 TESTING

A. General: The Project Manager shall perform inspection of the concrete block work to certify that all materials and installation are in compliance with the Contract Documents.

1. Verify placement of masonry reinforcement and accessories before mortar is placed.

B. Reference Standards:

1. ASTM C270 - Mortar for Unit Masonry.

2. Grout Mix Designs: Review and approve mix designs submitted by Contractor for compliance with ASTM C270.

3. Mortar Testing: Secure the quantity of mortar samples from Contractor as required for adequate testing.

   a. Perform mortar testing in accordance with UBC Standard 21-16.
   b. Test the mortar strength for all work requiring mortar.

4. CMU Inspection:

   a. Inspect reinforcement placement prior to grouting.
   b. Inspect grout spaces immediately prior to the closing of the cleanouts.
   c. Verify CMU units are laid properly.

1.7 PRODUCT HANDLING

A. General: Deliver, store, handle and protect all materials from damage, moisture, dirt and intrusion of foreign matter. Store all masonry units and mortar materials on raised platforms and under ventilated and waterproof cover. Store packaged materials in manufacturer's unopened containers, marked with manufacturer's name and product brand name. Immediately reseal containers after partial use. Remove and replace damaged materials.

B. Masonry Units: Pack, deliver and store to prevent breakage, cracking, chipping, spalling or other damage. Store, protect and ventilate units at project site.

C. Aggregate: Store with provisions for good drainage.

D. Reinforcement and Anchors: Store and protect so that when placed, joint reinforcement and anchors will be free of soil, dirt, ice, loose rust, scale, or other coatings which would destroy or reduce bond with mortar, and will not be disfigured or bent out of shape.

1.8 CODE REQUIREMENTS

A. Work of this Section shall conform to all applicable requirements of the City of New York Building Code.

1.9 JOB CONDITIONS

A. In cold weather, when the outside temperature is below forty (40) degrees F., conform to the requirements of "Cold Weather Masonry Construction and Protection Recommendations" publication by Brick Industry Association (BIA). No anti-freeze admixtures are permitted.

1. In addition, conform to the following:

a. Masonry materials must be warmed as required.
b. Brickwork must be protected a minimum of 24 hours after installation so as to maintain enough heat for hydration of the cement in the mortar.

B. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg. F. and above. In addition, conform to the following:

1. Masonry materials must be cool.

2. Mortar must be used within 2 hours of initial mixing.

C. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24" down both sides and hold cover securely in place.

2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24" down face next to unconstructed wythe and hold cover in place.

D. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.

PART 2 PRODUCTS

2.1 MATERIALS

A. Standard Concrete Block

1. Portland cement, ASTM C 150, Type 1, low alkali (less than 65) one source.

2. Aggregates, ASTM C 331, lightweight expanded shale, clay or slate aggregates, manufactured by the rotary kiln process equal to "Solite," "Norlite," "Haydite, or Approved Equal.

a. Block scheduled to receive painted finish shall contain normal weight aggregate meeting ASTM C-33 in addition to light weight aggregate in order to receive a smooth, uniform finish.

3. Concrete Masonry Units: Load bearing lightweight aggregate concrete masonry units conforming to the requirements of ASTM C 90.

a. Block behind exterior façade stone and block for rated walls shall be 75% solid units.
b. All other block may be hollow units.

4. The producer of the concrete masonry units shall furnish certification from an independent testing laboratory confirming that all 8" or larger masonry units meet all of the UL 618 requirements for two (2) hours or better (as required), referencing full scale fire test reports (ASTM E 119). All 4" and 6" units shall conform to "National Bureau of Standards" and "National Research Council" full scale fire tests.

5. Sizes and Shapes: Nominal face size 8" x 16" by thickness as indicated on drawings, with stretcher units, jamb units, header units, square corner units (at ends and corners of exposed or painted work), sash units (at control joints within masonry wall), lintel units and other special shapes and sizes required to complete the work.

6. Finish: For exposed or painted block surfaces, in addition to ASTM requirements, block shall have uniformly dense, flat, fine grain texture, with no cracks, chips, spalls, or other defects which would impair appearance. For concealed CMU, surfaces shall be free from deleterious materials that would stain plaster or corrode metal.

7. Curing: All concrete block shall be steam cured, and air dried for not less than thirty (30) days before delivery.

8. Density of concrete block shall not exceed one hundred and five (105) lbs. per cubic foot.

9. Shrinkage: Shrinkage of concrete blocks shall not exceed 0.065% when tested in accordance with ASTM C 426-99.

10. Water Content

    a. At the time of delivery to the job site, concrete masonry units shall have a value, in weight of contained water, of not more than thirty (30) percent of the fully saturated content for the unit tested.
    b. Ship all units from the factory, and store at the job site, with all necessary protection to prevent increase of water content from rain and other sources.

B. Joint Reinforcing for Masonry Walls

1. For block walls forming part of exterior wall construction, provide super heavy duty reinforcing fabricated of 3/16" dia. side and cross

rods, truss or ladder design, ties, spaced every other block course (16" o.c.). Provide prefabricated pieces at corners and intersections of walls or partitions.

a. Reinforcing assembly shall be hot dip galvanized steel finish conforming to ASTM A 153 with zinc coating of 1.5 oz. of zinc per sq. ft., after fabrication.

2. For interior block walls and partitions, provide standard reinforcing fabricated of 9 ga. side and cross rods, truss or ladder design, no ties, spaced every other block course. Provide prefabricated pieces at corners and intersections of walls or partitions. Reinforcing shall be mill galvanized conforming to ASTM A 641, Class B-1, applied after fabrication.

3. Wire used in assemblies noted above shall be cold drawn steel wire conforming to ASTM A 82.

4. Approved Joint Reinforcing Manufacturers

a. Hohmann & Barnard
b. Wire-Bond
c. Heckmann Building Products
d. National Wire Products Industries, Inc.

C. Anchors and Ties

1. Wire Mesh: Hot-dip galvanized sixteen (16) gage steel wire, square mesh, width 3" by length to suit condition; No. 268 by Heckmann Building Products, or approved equal by manufacturer noted above in Para. C.6.

2. For anchoring CMU wall, at the exterior masonry cavity wall, to the underside of the concrete beam, provide and the following:

a. Galvanized steel wall anchor No. 420 as manufactured by Heckmann Building Products or approved by manufacturer noted above in Para. C.6. Galvanized to conform to ASTM A 153, Class B-2.
b. No. PTA-422 galvanized steel dowel anchor and NS Neoprene Sponge placed between the concrete block and the PTA 422 as

manufactured by Hohmann & Barnard or approved equal by manufacturer noted above in Para. C.6. Galvanizing to conform to ASTM A 153, Class B-2.

3. For anchoring masonry to structural steel, provide hot-dip galvanized steel, as listed, or approved equal by manufacturer noted above in Para. C.6:

   a. Made by Heckmann Building Products. Galvanizing shall conform to ASTM A 153, with zinc coating of 1.5 oz. of zinc per sq. ft.
      1). No. 195 Column Anchors
      2). No. 197 Column Anchors
      3). No. 315 Weld-On Anchor Rods with No. 316 Triangle Ties
      4). No. 315-B Weld-On Anchor Straps with No. 316 Triangle Ties
   b. Made by Hohmann & Barnard or approved equal. Galvanizing shall conform to ASTM A 153, with zinc coating of 1.5 oz. of zinc per sq. ft.
      1). No. 355 Column Anchors
      2). No. 356 Column Anchors
      3). No. 357 Beam Anchors
      4). No. 359 F anchor straps with VWT tie.

4. For anchoring CMU interior partitions to underside of steel beams, provide hot dip galvanized steel tube anchors equal to No. 419 and No. 421 made by Heckmann Building Products, No. PTA-420 made by Hohmann & Barnard, or approved equal by manufacturer noted above in Para. C.6.

5. For anchoring CMU interior partitions to underside of structural deck, provide 4" x 4" x 1/4" galvanized steel angles (ASTM A 36), 3'-0" long spaced 3'-0" o.c. alternately on each side of partition. Anchor partition securely to structural deck.

D. Reinforcing Bars and Rods: ASTM A 615, Grade 60. See Drawings for size.

E. Control and Expansion Joint Fillers

1. Vertical Installation Within Concrete Masonry Wall: Extruded high grade neoprene rubber, cross shape, for use with concrete masonry sash units, which shall provide a force fit in the grooves of the sash block, and shall have 1/2" diameter tubular ends (compressed 25% when installed in 3/8" wide joint).

   a. Provide the following sizes:
      1). 2-5/8" wide control joint fillers for 4" block walls.
      2). 4-5/8" wide for 6" block walls.
      3). 6-5/8" wide for 8", 10" and 12" block walls.
   b. Provide backer rod and sealant joint over joint filler as per drawings and Section 079200 of these specifications.

2. Isolation Joint Filler at Abutting Construction and at Intersecting CMU Walls: Compressible and resilient closed cell neoprene gasket with pressure sensitive adhesive backing, thickness 30% greater than thickness of joint. Acceptable joint filler shall be "Everlastic, Type NN-1" by Williams Products, Inc., or approved equal. Recess joint filler and install backer rod and sealant as per drawings and Section 079200 of these specifications.

2.2 MORTAR MATERIALS

A. Maximum amount possible of post-consumer and pre-consumer recycled content.

B. Portland Cement: ASTM C 150, Type 1, standard color, one source.

C. Hydrated Lime: ASTM C 207, Type S, as manufactured by Corsons, or approved equal.

D. Aggregate: Clean, washed, buff colored sand, graded per ASTM C 144.

E. Aggregate for Grout: ASTM C 404.

F. Water: Clean, fresh and suitable for drinking.

2.3 MORTAR MIX

A. Exterior Block Back-Up Construction: Provide Portland cement/lime mortar as noted above conforming to ASTM C 270, Type N.

B. Interior Masonry Construction: Provide Portland cement/lime mortar conforming to ASTM C 270, Type N, for load bearing conditions, mortar shall conform to ASTM C 270, Type M.

C. Reinforced Concrete Block: Provide Portland cement/lime mortar conforming to ASTM C 270, Type S.

D. Mortar for Cement Cants: One (1) part Portland cement and four (4) parts sand, by volume.

E. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of unit masonry. Use grout of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout. Grout shall have a minimum compressive strength of 3000 psi when tested in accordance with ASTM C 1019.

F. Mixing

1. General: Add cement just before mixing and mix dry. Use sufficient amount of water as necessary to produce workable mix. Mix in small batches to make plastic mass.

2. Mixing: Machine mix all mortars in approved type mixer with device to accurately and uniformly control water. Add hydrated lime dry. Mix dry materials not less than two (2) minutes. Add water, then mix not less than three (3) minutes, not to exceed five (5) minutes. Mix only amount of mortar that can be used before initial set. Do not use mortar which has reached its initial set or two (2) hours after initial mixing, whichever comes earlier. Mortar may not be re-tempered. Clean mixer for each batch, whenever mortar type is changed, and at end of each day's work.

3. Acceleration or other admixtures not permitted.

4. Mortar shall have a flow after suction of not less than seventy-five (75) percent of that immediately after mixing as determined by ASTM C 91.

G. Admixtures

1. No air-entraining admixtures or cementitious materials containing air-entraining admixtures shall be used in the mortar.

2. No antifreeze compounds or other substances shall be used in the mortar to lower the freezing point.

3. Calcium chloride or admixtures containing calcium chloride shall not be used in mortar.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that masonry may be completed in accordance with all pertinent codes and regulations, the referenced standards, and the original design.

3. Do not start any work until mock-ups are approved by the Architect.

B. Discrepancies

1. In the event of discrepancy, immediately notify the Architect in writing.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3. Starting of work by the Contractor means acceptance by the Contractor of the substrate.

3.2 COORDINATION

A. Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work of this Section.

3.3 PREPARATION

A. Concrete Block: Do not wet concrete block units.

3.4 INSTALLATION

A. General

1. Build walls to the full thickness shown. Build single wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown.

2. Build chases and recesses as shown or required for the work of other trades.

3. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

4. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement type joints, returns and off-sets. Avoid the use of less than half size units at corners, jambs and wherever possible.

5. Lay up walls plumb and true with courses level, accurately spaced and coordinated with other work.

6. Provide templates made of steel studs for plumbing of two story masonry openings.

7. Pattern Bond: Lay exposed masonry patterns as noted on drawings. If not shown, provide running bond. Lay concealed concrete block with all units in a wythe bonded by lapping not less than two (2) inches. Bond and interlock each course of each wythe at corners. Do not use units of less than four (4) inches horizontal face dimensions at corners or jambs.

8. Where possible, masonry walls and partitions shall be built after all overhead ducts, pipes and conduits are in place and tested. Masonry shall be neatly built around the items above. Walls and partitions shall be plumb, true to line and free from defects such as open cells, voids, dry joints and other similar defects. In rooms and

spaces scheduled to have concrete block finish, all such surfaces including upper wall surfaces up to termination of structural ceiling in spaces without suspended ceilings, shall be made suitable for paint application. Cutting of openings in walls and partitions in place shall be done only with the approval of the Architect.

9. Do not use any brick that do not meet chippage and tolerances of the applicable ASTM standard noted herein for the grade, type or class of brick.

10. Mortar, ties and reinforcement must not extend into or bridge any expansion joints.

B. Mortar Bedding and Jointing

1. Lay concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on exterior walls and in all courses of piers, columns and pilasters, where solid CMU is used and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.

2. Lay masonry walls with 3/8" joints unless otherwise shown on drawings.

3. Tool exposed joints slightly concave after the mortar joint is “thumbprint” hard. Concealed joints shall be struck flush, including at any CMU schedule to receive a waterproofing or air barrier membrane.

4. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

C. Built-In Work

1. As the work progresses, build in items specified under this and other Sections of these specifications. Fill in solidly with masonry around built-in items.

2. Mortar in door frames, access doors, louvers and other metal items embedded or built into masonry work solidly with mortar as the masonry units are laid up.

3. Grout under lintels, bearing plates, and steel bearing on masonry with solid bed grout.

4. Sleeves, pipes, ducts and all other items which pass through masonry walls shall be caulked with interior grade sealant meeting requirements of Section 079200, so as to be air tight and prevent air leakage. Refer to Section 078413 for packing of voids in rated masonry walls.

5. Fill vertical cells of masonry units solid with grout which have anchoring, reinforcing rods, supporting or hanging devices embedded in the cell including stone anchors and window or curtain wall anchors.

6. Fill vertical cells of masonry units solid with mortar on each side of door frames to sixteen (16) inches beyond.

7. Unless otherwise noted, fill vertical cells of masonry units solid with grout which are below steel bearing plates, steel beams, and ends of lintels, to eight (8) inches beyond bearing and from floor to bearing.

8. Place wire mesh in horizontal joint below masonry unit cells to be filled with mortar, to prevent mortar from dropping into unfilled cells below.

9. Masonry indicated as being reinforced shall have all voids filled solid with grout. Grout shall be consolidated in place by vibration or other methods which insure complete filling of cells. When the least clear dimension of the grouted cell is less than two (2) inches, the maximum height of grout pour shall not exceed twelve (12) inches. When the least clear dimension is two (2) inches or more, maximum height of grout pour shall not exceed forty-eight (48) inches. When grouting is stopped for one (1) hour or longer, the grout pour shall be stopped 1-1/2" below the top of a masonry unit. Vertical bar reinforcing shall be accurately placed and held in position while being grouted, and shall be in place before grouting starts. All such reinforcing shall have a minimum clear cover of 5/8". Lap all bars a

minimum of forty (40) bar diameters and provide steel spacer ties (not to exceed 192 bar diameter) to secure and position all vertical steel and prevent displacement during grouting. Provide continuous horizontal reinforcement embedded in mortar joints every second course.

D. Cutting and Patching

1. All exposed masonry which requires cutting or fitting shall be cut accurately to size with motorized carborundum or diamond saw, producing cut edges.

2. Do not saw cut any masonry openings in face brick construction without Architect's approval and after a procedure has been reviewed and approved.

3. Holes made in exposed masonry units for attachment of handrail brackets and similar items shall be neatly drilled to proper size.

4. All masonry which requires patching in exposed work, if approved by Architect, shall be patched neatly with mortar to match appearance of masonry as closely as possible and to the Architect's satisfaction. Rake back joints and use pointing mortar to match as required.

E. Solid Wall Construction

1. Fill the vertical longitudinal joint between wythes solidly with mortar by parging the in-place wythe and shoving units into the parging.

2. Tie wythes with continuous horizontal reinforcement embedded in mortar joints sixteen (16) inches o.c. vertically.

F. Interior Block Partitions

1. Build to full height unless otherwise shown on drawings. At non- rated partitions fill void between CMU and structural deck with continuous neoprene filler conforming to the requirements of Section 079100. At fire rated partitions, fill void with fire stop material meeting the requirements of Section 078413. Fasten to structure at top of partition using steel angles as specified herein.

2. Provide continuous horizontal joint reinforcing every other block course, except as otherwise noted. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8". Lap reinforcement a minimum of six (6) inches at ends of units.

3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

4. Corners

    a. Provide interlocking masonry unit bond in each course at corners.
    b. Provide continuity at corners with prefabricated "L" reinforcement units, in addition to masonry bonding.

5. Intersecting and Abutting Walls

    a. Unless vertical control joints are shown as part of structural frame, provide interlocking masonry bond. Provide starters and special shapes as shown on the drawings to bond these walls.
    b. In addition to masonry bonding, provide horizontal reinforcement using prefabricated "T" units at interior partitions.

G. Ties and Anchors for Masonry Construction

1. Provide ties and anchors as shown or specified, but not less than one metal tie, spaced not to exceed sixteen (16) inches o.c. horizontally and/or vertically. Provide additional ties within 1'-0" of all openings and adjacent to expansion joints and spaced not more than 16" apart around perimeter of openings.

2. Anchor masonry to structure complying with the following:

    a. Provide an open space not less than 1/2" in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.

H. Control and Expansion Joints

1. Provide expansion, control and isolation joints in masonry as shown. Build in related items as the masonry work progresses.

2. CMU Control Joint Spacing: If location of control joints is not shown, place vertical joints spaced not to exceed 40'-0" o.c. In addition, locate joints at points of natural weakness in the masonry work, including the following:

   a. At structural column or joint between bay.
   b. Above control joints in the supporting structure.
   c. Above major openings at end of lintels upward and below at ends of sills downward. Place at one side of jamb for openings less than 6'-0" wide and at both sides for openings over 6'-0" wide.
   d. At reduction of wall thickness.
   e. Where masonry abuts supporting structure.
   f. If additional joints are required, indicate same on approved shop drawings.

I. Lintels

1. For concrete block walls, use specially formed U-shaped concrete block lintel units with reinforcing bars in accordance with the following table, filled with grout.

Number and Size of Reinforcing Bars Required at Concrete Block Lintels		
Maximum Clearance Span	Wall Width	Rebar No. - Size
2'-0" to 6'-0" 6'-0" to 8'-0"	6"	2 - #3 2 - #4
2'-0" to 6'-0" 6'-0" to 8'-0"	8"	2 - #3 2 - #4
2'-0" to 6'-0" 6'-0" to 8'-0"	12"	3 - #3 3- #4

2. U-shaped concrete block lintels shall extend a minimum of 8” at each side of opening.

3.5 CANTS

A. Provide specified mortar for cement cants at beams and other projections in elevator shafts, where adjoining wall is of masonry construction. Cants shall slope twenty (20) degrees from the horizontal.

3.6 CLEANING, PROTECTION, ADJUSTMENT

A. Protection

1. The Contractor shall take adequate precautions for the protection of all surfaces against mortar spatter, and shall immediately remove any such spatter should it inadvertently occur, leaving no stain or discoloration.

2. Excess mortar shall be wiped off the masonry surfaces as the work progresses.

3. Wood coverings shall be placed over all such masonry surfaces as are likely to be damaged during the progress of the entire project.

4. Protective measures shall be performed in a manner satisfactory to the Architect.

5. Damaged masonry units shall be replaced to satisfaction of the Architect.

6. Exterior masonry walls shall be draped with waterproof covering until copings are in place, to prevent water penetration in cavity.

B. Clean-Up

1. Upon completion, all exposed masonry shall be thoroughly cleaned following recommendations of the NCAM Technical Note No. 20. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 4' x 4' in a location approved by the Architect. No further cleaning work may proceed until the sample area has been approved by the Architect, after which time the same cleaning materials and method shall be used on

the remaining wall area. If stiff brushes and water do not suffice, the surface shall be thoroughly saturated with clear water and then scrubbed with a solution of an approved detergent masonry cleaner, equal to "Vana Trol" made by ProSoCo Inc. or equal made by Diedrich or approved equal, mixed and applied as per manufacturer's directions, followed immediately by a thorough rinsing with clear water. All adjacent non-masonry surfaces shall be thoroughly protected during cleaning.

a. Unless otherwise required by cleaning agent manufacturer use only low pressure device (30 to 50 psi) for application of cleaning agent and water rinsing.

C. Pointing: Point any defective joint with mortar identical with that specified for that joint.

END OF SECTION

SECTION 05 01 70 DECORATIVE METAL RESTORATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the metal restoration as shown on the drawings and specified herein, including, but not limited to, restoring the following:

1. Existing elevator doors/frames, transoms - refinished to match control sample.

2. Restoration, modification, and repair of ornamental metal items including Mail Chutes.

3. Stripping paint from metal elements indicated to be restored. Protecting adjacent surfaces during stripping.

4. Painting restored metal elements.

1.3 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Painting and Finishing - Section 099100.

C. Elevator entrances – existing.

1.4 QUALITY ASSURANCE

A. Restoration Specialist: The Contractor or subcontractor who will perform the work specified in this section must, within the last five (5) consecutive years, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work. The firm must employ personnel skilled in the restoration processes indicated herein.

B. Source of Materials: Obtain materials for restoration from a single source for each type of material required to ensure a match in quality, color, and texture.

C. Field Supervised Construction: Contractor shall notify Architect before beginning work. Obtain the Architect's approval of the installation of restored work, before proceeding with the work.

D. Bidders must visit the site beforehand and make themselves thoroughly familiar with specific conditions relating to this Section.

E. The Contractor shall comply with relevant ASTM Standards for all materials.

F. Cleaning Standards: Mock-up areas approved by the Architect shall constitute standards for approving subsequent cleaning and restoration work. The Contractor shall protect approved test and mock-up panels for the duration of the work.

G. The Contractor shall maintain a steady work crew consisting of skilled craftsmen who are experienced with the materials and methods specified and familiar with the design requirements, and a full-time foreman who shall be present on site daily. The Contractor shall confirm that all workmen under his direction fully understand the requirements of the job. Work shall be executed by skilled artisans, thoroughly trained and familiar with the methods required.

H. The Manufacturer's representative shall be present on-site during testing of interior Metal cleaning.

I. All results of refurbishing must meet with the Architect's approval.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. **Adhesives and Sealants**
7. **Ceilings**
8. **Composite Wood & Agrifiber Products**
9. **Flooring Systems**
10. **Furniture & Seating**
11. **Insultation**
12. **Paints & Coatings**
13. **Wall Panels**

*red : Contractor to select four of these additional tests

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Submit the following:

1. Materials list of items and methods for metal restoration proposed to be provided under this Section;

2. Fabricators' descriptions and other data needed to prove compliance with the specified requirements;

3. Shop Drawings showing details of refurbishment, details of construction, installation, and anchorage.

4. Mock-ups, representing full extent of required refurbishment including finished paint, hardware etc.

B. Product Literature: The Contractor shall submit copies of manufacturer's latest published literature and instructions for materials specified herein for approval and obtain approval before materials are delivered to the site. Product data shall be submitted on all materials

C. Work Description: Prior to commencing the cleaning operations, the Contractor shall submit to the Architect a written description of the entire methods and procedures proposed for cleaning the stair including, but not limited to; method of application, dilution of application, temperature of application, length of time of surface contact, method of rinsing surface (temperature, pressure, and duration), repetition of procedure, etc.

D. Methods of Protection: Prior to commencing the cleaning operations, the Contractor shall submit to the Architect a written description of proposed materials and methods of protection for preventing damage to any adjacent material or finish during the cleaning and restoration, or to any material not being cleaned, and any adjacent material to remain, for approval.

E. Samples

1. For each finish color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate, provide stepped samples defining each separate coat, including primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color and texture are achieved.

2. Provide samples of new cast iron, as required. Castings shall match the original element in all dimensions, profiles, and appearance.

1.8 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.9 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and for approval by DCAS, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups for the following types of decorative metal: Existing metals.

2. Mockups to be on site on element requiring refinishing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 PLANS AND SPECIFICATIONS

A. The requirements shown or described establish basic performance standards. Within the limitations established by drawings and specification, the Contractor is responsible for the visual acceptance of the systems.

B. The descriptions and details do not cover all conditions or modifications, which may be required. It is, however, intended those conditions not so described shall be developed through the Contractor's shop drawings to the same level of aesthetics as indicated for detailed areas and stipulated in these specifications. The Contractor, by accepting a contract for the work, acknowledges this and agrees that the Architect shall have the final say as to all matters whether described or detailed or not in the Contract Documents.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Provide materials selected for their smoothness and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, trademarks, or roughness.

1. Ferrous Metals

a. Steel Plates, Shapes, and Bars: ASTM A 36.

b. Gray Iron Castings: ASTM A 48, Class 30.

c. Malleable Iron Castings: ASTM A 47, Grade 32510.

B. Paint stripper for Metals (Peel-Away Type): Manufacturer’s standard paste or thixotropic (gel), alkaline formula paint stripping system. Paint stripper shall not contain methylene chloride or any flammable or volatile solvents. Paint stripping system shall include a special fibrous laminated cloth which bonds to the softened paint for easy removal.

1. Manufacturer: A company regularly engaged in the production of paint stripping compounds for at least 10 years, which retains factory-trained representatives who are available for consultation and job site inspection and assistance at no additional cost.

2. Source: PEEL-AWAY 7 by Dumond Chemicals, Inc., 1501 Broadway, New York, NY 10036, 212/869-6350, or approved equal.

3. Similar products by other manufacturers will only be considered for use after comparison testing for safety and effectiveness at GCT.

a. Neutralizer: Manufacturer’s standard neutralizer as recommended by manufacturer of paint stripper.

C. Water: Potable, non-staining and free of materials detrimental to all surfaces to be cleaned. All water shall be delivered to cleaning location in PVC pipe using non-ferrous fittings and connectors. Install a 5-micron filter in line with supply, and change filter daily or more frequently as required.

D. All chemical materials shall be safe in use and shall not violate city, state, or federal environmental or safety regulations.

E. Paint: Per Section 099000.

F. Paint Removal Tools: Metal stripping can use metal scrapers or steel wool, but stone coating removal should use only wood or plastic scrapers.

G. Cast-Iron Restoration Products

1. One-part, polyurethane-based paintable sealant: Sikaflex-15LM, manufactured by Sika Corporation or Approved Equal.

2. Silicon/steel alloy paste: Belzona 1111, manufactured by Belzona or Approved Equal.

2.2 ANCHORS

A. Anchors and Fastenings: Anchors and fastenings shall be stainless steel Type 302 or 304. Expansion bolts, cinch bolts and plugs shall not be acceptable.

2.3 FABRICATION AND FITTING CRITERIA

A. Cutting: Cut metal by sawing, shearing or blanking. Flame cutting will be permitted only if cut edges are ground back to clean, smooth edges. Make cuts accurate, clean, sharp, square and free of burrs, without deforming adjacent surfaces or metals.

B. Holes: Drill or cleanly punch holes (do not burn), so that holes will be accurate, clean, neat and sharp without deforming adjacent surfaces or metals.

C. Connections

1. Make connections with tight joints, capable of developing full strength of member, flush unless indicated otherwise, formed to exclude water where exposed to water. Locate joints where indicated on drawings. Provide connections to allow for thermal movement of metal at locations and by methods approved by Architect. For work exposed to view, use concealed fasteners (unless welded or other connections indicated) with joints accurately fitted, flush and rigidly secured with hairline contacts.

2. Welding: Welding shall be in accordance with recommendations of the American Welding Society and shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth with and to match finish of adjoining surfaces so that joint will not be visible; undercut metal edges where welds are required to be ground flush and dressed smooth. All welds on or behind surfaces which will be exposed to view shall be done so that finished surface will be free of imperfections such as pits, runs, splatter, cracks, warping, dimpling, depressions or other forms of distortion or discoloration. Remove weld splatter and welding oxides from all welded surfaces.

D. Supplementary Parts: Provide as necessary to complete each item of work, even though such supplementary parts are not shown or specified.

E. Accurately cut, fit, drill and tap work of this Section to accommodate and fit existing conditions. Furnish or obtain templates for proper coordination of this work.

F. Exposed Work: In addition to requirements specified herein or shown on drawings, all surfaces exposed to view shall be clean, and free from dirt, stains, grease, scratches, distortions, waves, dents, buckles, tool marks, burrs and other defects which mar appearance of finished work. Work exposed to view shall be straight and true to line or curve, smooth arrises and angles as sharp as practicable, miters formed in true alignment, profiles accurately intersecting, and with joints carefully matched to produce continuity of line and design. Exposed fastenings, where permitted, shall be of the same material, color and finish as the metal to which applied, unless otherwise indicated, and shall be of the smallest practicable size.

G. Materials used shall be of such strength, thickness and alloy that they are capable of meeting all standards and descriptions specified herein, shall match existing and as detailed on drawings.

H. All painting and re-painting shall conform to the requirements of Section 099000 and as specified herein. Contractor to propose paint systems for all metals to be repainted.

I. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

J. Concrete Inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where decorative metal restoration is to be accomplished and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect.

3.2 PREPARATION

A. General: Perform restoration and replacement in accordance with the materials and methods demonstrated by the accepted mock-ups.

B. Inspection:

1. Together with the restoration specialist, examine the conditions under which the work is to be performed and notify the Engineer in writing of any conditions detrimental to the proper and timely completion of the work.

2. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the specialist and the Engineer.

3. Examine existing exterior ornamental metal items and order accepted replacements as soon as possible to allow adequate lead time.

C. Protection:

1. Provide and maintain effective, non-staining protection for adjacent surfaces and areas below the work during performance of the work. Protect surfaces from damage and from contact with paint stripper, neutralizer, waste resulting from paint stripping operations, paint, and other finishing materials. Use proven methods appropriate to the surface being protected, and as acceptable to the Engineer before the methods are initiated.

2. Control and collect waste from restoration operations.

3. Maintain protection in place until completion of work.

3.3 PAINT STRIPPING

A. General

1. Perform paint stripping prior to replacement and repair work.

2. Follow manufacturer's instructions regarding the proper preparation and use of paint stripping and neutralizing materials.

3. Perform stripping and neutralizing using methods and materials used for accepted mock- up.

B. Chemical Stripping of Metals

1. Unless otherwise instructed by manufacturer of products, strip paint starting from top of each unit of work, continuing progressively down the unit.

2. Apply stripper by brush and trowel.

3. Cover paint stripper with special fibrous laminated cloth as recommended by manufacturer or stripper.

4. Allow stripper to remain on surface for dwell time established by accepted mock-up.

5. Remove softened paint and stripper with scrapers and brushes and deposit debris in plastic bags for disposal.

6. Rinse surfaces with a wet vacuum having a brush at the end of the nozzle in combination with a two-gallon hand pumped pressure sprayer.

7. Neutralize metal surfaces as recommended by manufacturer of stripper just prior to prime painting.

8. Rinse and dry surfaces after applying neutralizer.

9. Comply with lead abatement regulations where applicable.

3.4 EXISTING SURFACE PREPARATION

A. The preparation and cleaning procedures for each specific substrate condition should follow the instructions of the paint or material's manufacturer.

B. When existing finishes are indicated to be stripped, their removal shall be complete, including undercoats and other materials that would affect the new paint or show through new materials.

The cleaned substrates shall be completely free from films, coatings, dust, dirt, and other contaminants.

C. Where paint or other existing organic coatings have been completely removed, the substrate shall be prepared as it would be if new.

D. Hardware, accessories, machined surfaces, plates, fixtures, and similar items not to be painted or coated should be removed before the surface preparation for painting. After the painting or other coating has been completed in each area, the removed items can be modified and reinstalled.

E. Surfaces should be cleaned before the first paint is applied, and if necessary, between coats to remove oil, grease, dirt, dust, and other contaminants. Activities should be scheduled so that contaminants will not fall onto wet newly painted or coated surfaces. Paint or other organic coatings shall not be applied over dirt, rust, scale, oil, grease, moisture, scuffed surfaces, or under other conditions detrimental to the formation of a durable paint or other coating film.

F. Existing surfaces to be repainted or recoated that are glossy and do not require complete removal of an existing coating shall be roughened by sanding or another appropriate method that will produce enough surface tooth to accept the new paint.

G. Shoulders at the edges of sound existing paint or other organic coatings shall be ground smooth and sanded as necessary to remove the shoulders so that flaws will not telegraph through the new paint or other organic coating.

H. Existing paint to be repainted should be scrubbed using mild detergent and water, rinsed thoroughly with clean water, and allowed to dry before painting.

I. Before the application of paint is started in an area, that space should be swept clean with brooms and excessive dust removed. After a painting operation has been started, however, that area should not be swept with brooms. Necessary cleaning should then be done using commercial vacuum-cleaning equipment.

J. Surfaces to be painted or coated shall be kept clean, dry, smooth and free from dust and foreign matter that would adversely affect adhesion or appearance.

K. Existing ferrous-metal surfaces that are not galvanized, shop coated, or previously painted and are to be painted should be cleaned of oil, grease, dirt, loose mill scale and other foreign substances, using solvent or mechanical cleaning methods as recommended by the paint manufacturer. The recommendations of the Steel Structures Painting Council should be followed unless they conflict with the paint manufacturer's recommendations. Bare and sandblasted or pickled ferrous metal should be given a metal treatment wash before a primer is applied.

L. It is necessary to remove dirt, oil, grease, and defective paint from shop coated or previously painted ferrous, galvanized, and nonferrous metal surfaces using a combination of scraping, sanding, wire brushing, sandblasting, and by applying a cleaning agent recommended by the paint manufacturer. Surfaces shall be wiped clean before they are painted. Shoulders should be sanded if necessary to prevent telegraphing. Where necessary to produce a smooth finish, existing paint should be stripped to the bare metal.

M. Removing rust and other corrosion before painting or repainting is essential. The methods used will depend on the amount of rust or other corrosion present and severity of the problem.

Follow recommendations of the Steel Structures Painting Council for cleaning ferrous metals and those of the manufacturer for nonferrous metals. Rust removal methodology shall meet all local, state and federal regulations for interior air quality. Visible pits and or rough areas shall be filled and sanded smooth prior to finishing.

N. Just as welds, abrasions, factory-applied or shop-applied prime coats, and shop-painted surfaces in new materials are touched up after erection and before application of the first field coat of paint, previously painted surfaces shall also be touched up. On new surfaces, the touch-up material shall be the same as the primer. On previously painted surfaces the touch-up paint shall be the same material as the first field coat. Surfaces that are to be covered shall be touched up before they are concealed. Exposed touch-ups should be sanded smooth.

O. Patching and Filling

1. Fill all open holes indicated with suitable steel alloy paste.

2. Clean all surfaces over which paste is applied to ensure proper bonding.

3. Sand paste, when hardened, to match the profile of adjacent cast-iron surfaces.

4. Limit use of unreinforced steel alloy paste to non-structural applications where the diameter of holes and depth of patches is no more than ¾-inch at the widest point.

5. Where dimensions of areas to be patched are greater, apply paste over stainless steel rods and/or mesh, in consultation with the Architect.

P. Sealing of Open Joints

1. Seal all joints between cast-iron sections where indicated and at all new sections.

2. Clean out joints immediately before installing joint sealant to comply with joint sealant manufacturer's written instructions.

3. Provide closed-cell backer rod and bond-breaker tape to prevent three-sided adhesion.

Q. Fabrication of New Metalwork

1. Use materials of size and thickness at least equal to the existing or as indicated on drawings and as required to produce strength and durability in finished product. Work to dimensions shown on shop drawings, using proven details of fabrication and support.

2. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Diassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

3. Form exposed connection with hairline joints flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown, or if not shown, Phillips flat- head (countersunk) screws or bolts.

4. Provide anchorage of type required to coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

5. Do not use metals which are corrosive or incompatible with materials joined.

6. All new castings should be factory primed with rust inhibitive primer. Do not prime edges to be field welded or soldered, unless otherwise specified.

7. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-7 “Brush-off Blast Cleaning.”

8. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning."

9. Immediately after surface preparation, brush or spray on primer in accordance with the manufacturer’s instructions at a rate to provide uniform dry film thickness of 2.0 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges, exposed and non-exposed surfaces.

10. Apply one (1) shop coat to fabricated metal items, except apply two (2) coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

R. Installation of New and Restored Castings and Historic Metalwork

1. Provide anchorage devices and fasteners where necessary for securing new and restored cast-iron elements to in-place construction.

2. Perform cutting, drilling and fitting required for installation of cast iron. Set work accurately in location, alignment and elevation, plumb and level measured from established lines and levels.

3. Fit exposed connections accurately together to form tight hairline joints. Grind exposed joints smooth and touch-up paint coat. Install concealed gaskets, joint fillers, sealants, insulation and flashing as the work progresses, so as to make work weathertight.

4. Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

5. Repair and/or replace broken, defective or stained metals as directed by the Architect at no additional cost or time to the Owner.

3.5 PROTECTION

A. Protect restored areas with Homasote or Masonite or Approved Equal during the construction process to prevent damage and wear. Before final inspection, remove protection coverings.

END OF SECTION

SECTION 05 12 00 STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Furnish and deliver for installation by others, anchor bolts, bearing plates and loose lintels with complete instructions and templates to facilitate installation.
2. Furnish and erect all struts, columns, bearing plates, beams, steel trusses, girders, bracing, hangers and all related connections (bolted and welded).
3. Openings (unreinforced and reinforced) in structural steel to accommodate mechanical and electrical work.
4. Shop painting and field touch-up painting.
5. Erection bracing and supports, including steel wedges, shims or nuts required for leveling base plates.
6. Lintels and angles attached to structural steel as shown on drawings.
7. Unless specifically excluded, furnish and install all other items for structural steel work indicated on the drawings, specified, or obviously needed to make the work of this Section complete.
8. Waste Management

B. Related Sections:

1. Division 03 Section “Cast in Place Concrete”
2. Division 04 Section “Unit Masonry”
3. Division 05 Section “Metal Deck.”
4. Division 05 Section “Metal Fabrications.”
5. Division 06 Section “Rough Carpentry.”
6. Division 07 Section “Waterproofing.”
7. Division 07 Section “Joint Sealants.”
8. Division 07 Section “Expansion Joint Cover Assemblies.”

C. Related Work Specified Elsewhere

1. Installation of anchor bolts furnished under this section.

2. Grout under base and bearing plates.
3. Installation of loose lintels furnished under this section.
4. Miscellaneous metal work
5. Stair framing and hangers.
6. Field painting of structural steel, except as specified herein.
7. Fireproofing systems.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches .
2. Welded built-up members with plates thicker than 2 inches .
3. Column base plates thicker than 2 inches .

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of all connections required by the drawings to be completed by structural steel fabricator (including comprehensive engineering analysis by a qualified professional engineer) to withstand loads indicated and comply with other information and restrictions indicated, unless noted otherwise.

1. Select and complete connections using schematic details indicated and AISC 360.
2. Use design method indicated on structural drawings.
3. Moment Connections: Fully restrained unless otherwise noted on drawings.

1.5 SUBMITTALS

A. Submittal Procedure: Refer to General Conditions Article 4.

B. Product Data: Submit data for each type of product indicated in the contract documents.

C. Shop Drawings: Submit shop drawings in accordance with the specifications as follows:

1. Show clearly all work, including relationship of structural steel to the adjacent work of other trades and to significant lines of finishes of other trades.
2. Do not fabricate or deliver work to the site before drawings reviewed by the Commissioner and Engineer of Record have been returned.
3. Before preparing steel shop drawings, submit proposed submittal schedule for review by Commissioner and Engineer of Record.
4. Before preparing steel shop drawings, submit for review a set of job standards showing all necessary joint details with full particulars of connection pieces, shop and field welds, and holes for erection bolts and permanent bolts. These shall include any moment and shear connections. Appropriate marks for designating all types and sizes of joint details shall be included. After approval of these job standards, the erection plans are to be submitted and shall be marked to indicate unmistakably the type and size of joint to be used for every beam connection. Do not order steel in advance of approval of the job standards and the erection plans with joint marks, except at own risk
5. Engineering Services Submittal: Submit calculations for design of connections on job standards, sealed and signed by the qualified Contractor's Professional Engineer, licensed in the State of New York, responsible for their preparation.

    a. Engineering services documentation shall be submitted to Commissioner for review and approval prior to any incorporation into the work.

6. Submit calculations for design of connections on job standards and all other connections such as moment and brace frames. Calculations shall be signed and sealed by a Professional Engineer licensed in the state in which the project is located.
7. Prepare remainder of steel shop drawings after approval of job standards and erection plans. Drawings submitted prior to approval of job standards will be returned without review.
8. Prepare shop drawings in conformance with the applicable procedures shown in "*Detailing for Steel Construction*," latest edition, published by AISC. Prepare shop drawings under the supervision of competent engineering personnel, licensed by the state in which the construction is to take place. During the preparation of shop drawings, and prior to submittal, coordinate and cross check all shop drawings, including those prepared by subcontractors, for compliance with the Contract Documents.
9. Indicate clearly the size and grade of steel for each component. Identify rolled shapes, tubes and plates by using the standard designations used in "Steel Construction Manual" Latest Edition, by AISC.
10. Indicate welds and nondestructive tests by using the symbols conforming to AWS A2.4 "Symbols for Welding and Nondestructive Testing." Where necessary for clarity, indicate welding procedure designations or other data in the tail of the welding symbol.
11. Show explicitly the type of connection used in each location, including the grade, size, and number of bolts; the type, number, position, designation and orientation of each washer; and the size of each hole, whether slotted or round. Ensure that adequate wrench clearance for correct bolt tightening is provided and note special bolt tightening sequences where applicable and necessary.
12. Show all camber dimensions in the shop drawings. Where specific camber is not shown in the drawings, note on each affected shop drawing that such members are to be fabricated with the natural camber up.
13. Show holes required for securing work specified in other sections to structural steelwork, as well as all holes required for passage through structural steelwork of work of other

trades. Provide field work drawings for all such holes not shown in shop or erection drawings. Addition of, or change in size or location of openings will not be permitted without prior approval.

14. Use bolted connections wherever possible; avoid field welding unless otherwise noted on drawings.
15. Make details in such a way as to avoid having steel, connections, bracing, bolts, etc., interfere with adjacent work or in any way reduce the areas of shafts, openings, clearances, etc.
16. Detail and schedule cleaning and painting data and requirements, including specific indication of "no-paint" areas.
17. The use of the Commissioner's or Engineer of Record's electronic drawing files as a base for the erection shop drawings will be permitted at the request of the structural steel detailer upon completion and return of the waiver form. The use of the Commissioner's or Engineer of Record's electronic drawing files as a base for shop drawing details will not be permitted. The structural steel detailer will be responsible for compatibility of the files with his hardware or software. The electronic files are not to be considered the contract documents, the design team makes no representation regarding the accuracy or completeness of the electronic files given to the structural steel detailer and their use will be at the structural steel detailer's sole risk and without liability to the design team. The structural steel detailer shall remove the project title box and all references to the structural drawings including drawing numbers and structural drawing sections and details. The structural steel detailer shall also remove all reference to work not included in the steel contract.
18. Scaling of the Commissioner's drawings is not permitted. This applies to hard paper, electronic, and all other versions.
19. Show clearly the size and location of each member and the erection mark assigned to each member. Show each field connection with all data and details necessary for assembling the structure. Direct special attention to the possible need for special guying, bracing, or shoring to prevent deformation of existing or new structure due to stresses caused by erection procedures and equipment, by construction loadings, and by forces of natural phenomena.
20. Prepare, keep up-to-date, and submit a complete drawing index cross-referencing each assigned piece mark with the drawing number in which the piece is detailed. Detail drawings submitted without an up-to-date index and the applicable erection drawing(s) showing the location of each piece will be deemed an incomplete submission and will not be accepted as subject to any agreed shop drawing review schedule.
21. Prepare anchor bolt and base plate erection drawings containing complete location and placing details, including details of all templates. Provide anchor bolt erection drawings to the concrete trade in advance of applicable concrete work and in coordination with concrete construction sequence.
22. Submit, in writing, any proposed deviations from the Contract Documents, prior to the submission of shop drawings showing the proposed deviation. Submit requests for deviations on the steelwork subcontractor's letterhead. Deviations not identified, or identified only in letters of transmittal or in shop drawings or both, without the required written request, may not be accepted, and shall be sufficient cause for the Commissioner to return each shop drawing containing such deviations without further action. Acceptance of shop drawings containing deviations not detected by the Commissioner during shop drawing review shall not relieve the steelwork subcontractor from responsibility to conform strictly to the Contract Documents.
23. Prior to resubmission of shop drawings with additions or corrections, circle or bubble and identify all changes. Drawings submitted without each change being clearly identified are subject to return for resubmission.

24. Prior to making shop drawings for any portion of the work involving alterations to an existing structure, make all necessary field observations, measurements and surveys of existing conditions. If probes are required to accomplish such measurements, give timely notice where probes will be required.

D. Submit certified copies of each survey conducted by a surveyor licensed by the state in which the construction is to take place and employed by the structural steel subcontractor. Survey shall show elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and Contract Documents.

E. Reports:

1. Submit certified copies of mill test reports for all steel furnished. Perform mechanical and chemical tests for all material regardless of thickness or use.
2. Submit certification of recycled steel content. Certification shall clearly indicate post-consumer AND post-industrial recycled steel content for the particular member or members used.
3. Submit anchor bolt checking certification as required.
4. Submit qualification certificates of all welders who will perform work on the project.
5. Submit survey of erected steelwork as required.

F. Submit verification of bio-degradable or low VOC, and low Hazardous Air Pollutants (HAPS) cleaning solutions. Provide a cut sheet for all cleaning solutions used in the surface preparation of steel components. Highlight VOC limits and chemical component limits.

1.6 QUALITY ASSURANCE

A. Except as modified by this specification, comply with the applicable provisions and recommendations of the following codes and standards:

1. New York City Building Code, Latest Edition
2. AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".
3. AISC "Code of Standard Practice for Steel Buildings and Bridges" latest edition.
4. AISC “Seismic Provisions for Structural Steel Buildings”, latest edition.
5. Industrial Fasteners Institute "Handbook of Bolt and Bolted Joints" latest edition.
6. RCSC "Specifications for Structural Joints Using High-Strength Bolts."
7. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.
8. AWS D1.1, "Structural Welding Code."
9. AWS A5.18 & A5.28, Structural Welding Code for GMAW
10. SSPC "Painting Manual, Volume 2, Systems and Specifications.", Latest edition.

B. Qualifications for welding work shall be as follows:

1. Qualify welding procedures and welding operators in accordance with the AWS "Standard Qualification Procedure."

a. Include amended requirements of the building code as noted above.

2. Submit certification that all welders to be employed in work are AWS qualified. If re-certification of welders is required, retesting will be responsibility of structural steel subcontractor.

a. Include licensing requirements as per the building code noted above and local jurisdiction.

C. Professional Engineer Qualifications: A professional engineer who is licensed to practice in the State of New York and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

1.7 TESTING AND INSPECTION

A. Special Inspection as required by the applicable Building Code of all structural steelwork in the shop and field will be performed by an inspection agency retained by the Owner at no expense to the Contractor. The inspection agency shall work under the direction of the Owner. Contractor shall provide the inspection agency with the following:

1. Schedule of all work in both shop and field with at least ten days' written notice before commencement of either activity.
2. A complete set of approved shop and erection drawings.
3. Cutting lists, order sheets, material bills, shipping bills and mill test reports.
4. Information as to time and place of all rollings and shipment of material to shops.
5. Representative sample pieces as requested by the testing agency.
6. Full and ample means and assistance for testing all material.
7. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.

B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person making the connection.

C. The following minimum criteria shall be adhered to in testing of welds and bolts:

1. All welds and bolts shall be examined by visual means.
2. 25% of all welds, selected randomly, shall be measured.
3. Bolted joints shall be verified per the RCSC “Specification for Structural Joints Using High-Strength Bolts,” Section 9, based on installation method.
4. All welds subject to tensile stress shall be examined by the Ultrasonic Method for 100% of their length.
5. 10% of all manual fillet welds shall be tested by the magnetic particle method.
6. 1'-0" at each end of automatic fillet welds shall be tested by the magnetic particle method.
7. 100% of groove welds shall be tested by the ultrasonic method.

D. Shop inspection will include examination of steel for straightness and alignment, fissures, mill scale, and other defects and deformities, as described in ASTM A6, examination of fabricated

pieces for conforming to approved shop drawings, testing of bolts and welds, and inspection of shop painting. All shop welds shall be visually inspected and spot tested using Ultrasonic Method ASTM E 114 and AWS, Chapter 6, Part C. All inspected welds shall be identified by the inspector.

E. Field inspection will include examination of erected steel for welding, proper fitting and tensioning of bolts, alignment, trueness and plumbness, touching-up of shop coat, level of billets and base plates.

F. Inspection of welding will be such as to assure that the work is within the quality requirements specified below and elsewhere in this section of the specifications and will include:

1. Ascertainment that the electrodes and flux used for the SAW, GMAW and FCAW welding processes conform to the requirements of this section of the specifications.
2. Ascertainment that the approved welding procedures and sequence are followed without deviation, unless specific approval for change is obtained from the Engineer of Record.
3. The testing agency shall be prepared to utilize the following approved methods of testing:

    a. Liquid penetrant inspection: ASTM E 165.
    b. Magnetic particle: ASTM E 1444.
    c. Radiographic inspection: ASTM E 94 and E 1032.
    d. Ultrasonic inspection: ASTM E 114 and AWS, Chapter 6, Section C.

G. When defects are revealed, additional inspection by whatever method is deemed necessary by the inspector, shall be performed to the extent necessary to assure that the full amount of defect has been located. No further work shall be done on the assembly or sub-assembly in question until all the necessary corrections have been made. Defects shall be repaired, using the same welding procedure that was used initially in making the weld, unless otherwise approved by the Engineer of Record. Inspection of the repaired weld shall be by the same method that was used to reveal the defect. A second repair of a defective area shall not be made without approval of the Engineer of Record.

H. Apparatus and procedures for measuring required tension in pretensioned and slip-critical high strength bolted connections shall be furnished and maintained by the steel contractor, in accordance with the RCSC “Specification for Structural Joints Using High-Strength Bolts,” and shall be approved by the inspection agency. The inspection agency shall observe the pre-installation verification testing required and shall ensure by routine observation that the bolted installations conform to the approved pretensioning method being used. The steel contractor shall provide a laborer and scaffolding as required for the testing of connections by the inspection agency, and shall, at his own expense, furnish such facilities and provide such assistance as may be required for proper inspection.

I. A distinguishing mark will be placed on all work that has been inspected and approved. Material or work that is not acceptable will be designated by words such as "REJECT" or "REPAIR" marked directly on the material or work.

J. Inspection of Shop Painting:

1. Visually evaluate surface preparation by comparison with pictorial standards in accordance with SSPC-Vis 1.
2. Measure dry film thickness of each coat with a magnetic film thickness gauge in

accordance with SSPC-PA 2.

3. Visually inspect dried film for runs, sags, dry spray, overspray and missed areas.
4. Repair defective or damaged areas in accordance with painting requirements specified. Exposed structural steel shall be free of runs and holidays. Make repairs to shop or field coat as directed.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work. Minimize the disturbances to site and soil conditions.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members in a safe, dry, off ground location, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration, discoloration or staining.

D. Do not store materials on structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structures as directed.

1.9 PROJECT CONDITIONS

A. The structural steel contractor shall coordinate the structural steel work with the work of other Contracts. Verify all dimensions and details of this Contract and those of other Contracts that affect the work before proceeding. Any discrepancies shall be immediately reported to the Commissioner.

B. Be fully responsible for the accurate installation of the work. Any discrepancy which arises from his failure to execute the work in conformity to the drawings and specifications shall be properly remedied at the contractor's own expense and in a manner acceptable to the Commissioner.

C. Locate dimensionally on setting plans all anchor bolts, inserts, bearing and base plates, etc., and prepare and deliver all required templates and fully dimensioned setting plans in time for the proper execution of the work. Anchor bolts shall be set by another subcontractor. The structural steel contractor shall check all such settings for correctness after they have been cast in place, and before proceeding with erection work.

D. Report to the Commissioner and certify compliance with the above checking requirements in writing and indicate any inaccuracies found in the location of anchor bolts or inserts, and corrections which must be made to their installation. Any inaccuracies not included in the report and found during or after steel erection shall be the responsibility of the structural steel contractor and the cost of corrective measures shall be borne by the structural steel contractor.

E. Use base lines, bench marks, or other standards for survey work that have been provided or verified by others. If permanent building bench marks have been established, these will be used for field checking.

F. Coordinate with all other trades to insure that work of this section does not cause undue conflict. Insure that location of erection devices such as cranes, derricks, booms or hoists, does not cause over-stresses to steel frame to work previously placed by other trades or to existing structures. When required, retain the services of a licensed professional engineer to ascertain that erection devices do not create unsafe conditions or cause overstresses.

G. Ensure full co-ordination with other related trades and professions.

1.10 SUBSTITUTION

A. Commissioner reserves the right to require substitute shapes of other sizes than those indicated on the drawings when it is apparent that the shapes specified cannot be furnished within the time required for the progress of construction. Make said substitutions without additional cost to the owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel shapes, including structural steel wide flange and structural tee rolled shapes, channels, angles, plates, pipe, and hollow structural sections: As noted on structural drawings.

B. High Strength Bolts: As noted on Structural Drawings.

C. Anchor Rods: As noted on structural drawings

D. Filler metal for welding electrodes. As noted on structural drawings.

E. Structural steel primer paint: rust inhibitive primer conforms to the following criteria

1. Coordinate all paint requirements with specification section 099000.
2. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A
3. Demonstrate a minimum opacity as determined by ASTM D 2805
4. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
5. “Slip Critical” compatible rating where applicable
6. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in Master Painters Institute (MPI) *Green Performance Standard*, GPS-1-08.
7. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 340 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.
8. The product shall meet all the requirements of MPI Standards: 23, 26, 76, 79, 95, 107, 135, 173, 275. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category.

    a. Exterior exposed steel, normal conditions: Use alkyd or polyamide solvent based

paints (MPI #'s 76, 79 & 101)
b. Interior exposed steel: Use water based paint (MPI # 107)
c. Special Applications, highly corrosive environments: Use zinc rich paints (MPI #'s 20 & 200)

F. Structural steel field paint for exposed members: rust inhibitive primer conforms to the following criteria

1. Coordinate all paint requirements with specification section 099000.
2. Demonstrate a minimum of adhesion as classified by 4B of ASTM D 3359 method A
3. Demonstrate a minimum opacity as determined by ASTM D 2805
4. Demonstrate corrosion resistance per standards ASTM B 117 & ASTM D 5894
5. "Slip Critical" compatible rating where applicable.
6. The product shall not contain any of the prohibited compounds as listed in Green Seal *Standard for Paintings and Coatings*, GS-11, latest edition and in the Master Painters Institute *Green Performance Standard*, GPS-1-08.
7. The product shall meet the VOC limits as set forth in the MPI Green Performance Standard, GPS-1-08, with a maximum allowable VOC of 400 g/L for rust preventative coatings. Limits are expressed in THINNED state. Preference shall be given to products with the least crystalline silica content.
8. The product shall meet all the requirements of MPI Standards: 23, 26, 76, 79, 95, 107, 135, 173, 275. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category. Products not listed with MPI are acceptable if and only if they meet the same environmental criteria for the same product category.

a. Exterior exposed steel, normal conditions: Use alkyd or polyamide solvent based paints (MPI #'s 23, 79)
b. Interior exposed steel: Use water based paint (MPI # 107)

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 FABRICATION

A. All shop connections shall be high strength bolted unless specifically shown otherwise. Fabricate work in shop in as large assemblies as practicable. Use welded connections ONLY where shown on drawings. If a bolted connection is not possible, obtain written approval from the Engineer of Record for the welded connection.

B. Camber: As indicated on drawings.

C. Mill column ends and bearing stiffeners to give full bearing over the cross section. Plane contact surfaces of bearing plates when required by the AISC Specifications. It is not necessary to plane

bottom surfaces of plates on grout beds.

D. Drill or punch holes at right angles to the surface of the metal, not more than 1/16" larger than the connector diameter. Do not make or enlarge holes by burning. Drill material having a thickness in excess of the connector diameter and material thicker than 7/8". Holes shall be clean-cut without torn or ragged edges. Remove outside burrs resulting from drilling operations.

E. Provide holes in members to permit connection of the work of other trades. Use suitable templates for proper location of these holes. Steel requiring adjustment or accurate alignment shall be provided with slotted holes or full bearing shims as shown.

F. Provide holes, slots and openings required by other trades together with necessary reinforcing required. Use suitable templates for proper location of these openings. All such openings shall be shown on the shop drawings. No change in size or location will be permitted without prior approval.

G. Manual flame cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is within 1/8" of the required line.

3.3 SHOP CONNECTIONS

A. Provide connections as shown on the drawing exactly as detailed. Where connections are not detailed, the minimum connections shall comply with appropriate tables headed, "Framed Beam Connections" shown in the AISC "Manual of Steel Construction" unless otherwise noted on the drawings. Use high strength bolts unless otherwise shown.

B. Do not use welded connections unless shown on details. Field welding is not allowed without written instruction from the Engineer of Record.

C. Proportion and detail all connections on shop drawings to resist forces shown on design drawings.

D. Bolting

1. Bolts shall be of a length that will extend not less than 1/4" beyond the nuts. Enter bolts into holes without damaging the thread.
2. Joint Type: As noted on the Structural Drawings.
3. Make high-strength bolted joints without the use of erection bolts. Bolt heads and nuts shall rest squarely against the metal. Where structural members have sloping surface, bolted connections shall be provided with beveled washers to afford square seating or framing for bolt heads or nuts.
4. All joints are to be compacted to the snug-tight condition in accordance with Section 8 of the RCSC “Specification for Structural Joints Using High-Strength Bolts.” Protect bolt heads and threads from damage during installation.
5. Pretensioned and slip-crtical joints are to be installed by one of the methods prescribed in Section 8.2 of the RCSC “Specification for Structural Joints Using High-Strength Bolts,” unless written approval is obtained from the Engineer of Record.
6. Bolts that have been completely tightened shall be marked for identification.

E. Welding

1. The following environmentally preferable welding processes shall be used as described for the related application without exception:

   a. Submerged Arc Welding (SAW): Plate girders, fillet and butt joints in pipes, cylinders, columns and beams, and welds where 'downhand' or horizontal positions are possible.
   b. Gas Metal Arc Welding (GMAW) shall be used where SAW is not applicable (such as for angled connections and anything irregular or short).
   c. Field welding shall be allowed only in special circumstances; in such cases Flux Core Arc welding (FCAW) shall be specified

2. Do not begin structural welding until joint elements are inspected for surface preparation, fit-up, and cleanliness of surface to be welded and are then bolted or tacked in intimate contact and adjusted to dimensions shown on drawings, or both, with allowance for any weld shrinkage that is expected. No members are to be spliced without prior approval by the Engineer of Record.

   a. Containment surface preparation debris must meet SSPC-Guide 6 guidelines.

3. Pre-heat and interpass temperature shall be in accordance with Table 4.2 (including footnotes) of the AWS Code for Welding in Building Construction. The temperature shall be measured from the side opposite to that which the pre-heat is applied, where possible.
4. All groove welds shall be continuous and full penetration welds unless otherwise shown on the design drawings. Welds made without the aid of a back-up bar shall have their roots chipped, ground or roughened out to sound metal from the second side, before welding is done from the second side.
5. All welds shall be sound throughout. There shall be no crack in any weld or weld pass. Weld may be considered sound if it contains only slight porosity or fusion defects which are well dispersed.
6. The heat, input, length of weld and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.

3.4 SHOP PAINTING AND CLEANING

A. Finishing, coating, plating

1. Shop painting and factory finishing shall be preferred to field painting whenever possible. Where applicable, finishes and surface preparations based on a physical process such as abrasive blasting, grinding, buffing and polishing are preferred to coatings and solvent based cleaning. Where coatings are necessary powder-coated fabrication is preferred to painting and plating. Avoid plated metals especially those using cadmium and chromium as plate material or cyanide or copper/formaldehyde based electroless copper as the plating solution.

B. Remove all rust, scale, grease and other detrimental foreign matter in accordance with SSPC-SP 3, Power Tool Cleaning, unless conditions/opportunities listed below apply.

1. Use surface preparation classification recommended by paint manufacturer, SSPC or Master Painters Institute (MPI) for paint product used.

    a. SSPC-Guide 6, Guide for Containing Debris Generated During Paint Removal Operations, must be followed for all applicable surface preparation techniques.

C. Immediately after surface preparation, apply structural steel primer paint where specified, in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 2.0 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces. Use type of primer paint as specified in "Materials" article above. Apply two coats to surfaces that will be inaccessible after erection

D. Paint all structural steel in accordance with the foregoing specification, except as follows:

1. Steel which is to receive spray-on fireproofing.
2. Within 2" of field welds or welds made after paint is applied.
3. Faying surfaces in bolted connections shall be prepared per Section 3.2 of the RCSC “Specification for Structural Joints Using High-Strength Bolts.”
4. Machined surfaces and threaded parts required for adjustment of the structure. Protect these with suitable rust inhibiting coating which may be removed after final installation of the work so that proper finished coatings may be applied.

3.5 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

3.6 SOURCE QUALITY CONTROL

A. Refer to testing and inspection requirements specified above.

3.7 EXAMINATION

A. Verify field measurements prior to start of erection. Check the alignment and elevation of all column supports and location of all anchor bolts with transit and level instruments before starting erection. Notify Commissioner of any errors. Obtain Commissioner's approval of methods proposed for correcting errors prior to proceeding with corrections and erection.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.8 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural

steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.9 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

C. Column billets and bearing plates shall be supported and aligned on steel wedges, shims, or leveling nuts. After the supported members have been plumbed and properly positioned by instrument and anchor nuts tightened, the entire bearing area under the plate shall be packed solidly with grout specified in another Section. Wedges and shims shall be set back a minimum of 3/4" from the edges of plates and shall be left in place. Leveling plates are not permitted.

D. Plumbing, Leveling and Bracing

1. Structural steel shall be erected true and level, and temporary bracing shall be introduced wherever necessary to provide for all loads to which the structure may be subjected, including equipment and the operation thereof. Such bracing shall be left in place as long as may be required for safety. No welding shall be done or bolts drawn up tight until structural steel has been properly aligned. Obtain approval for guy locations to assure lack of interference with operations of other trades.

E. Drifting

1. Light drifting necessary to draw holes together will be permitted, but drifting of unfair holes will not be permitted. Twist drills shall be used to enlarge holes as necessary to the next larger size; use next larger size bolts as required. Reaming that weakens the members, or make it impossible to fill the holes properly or to adjust accurately after reaming, will not be allowed.

3.10 FIELD CONNECTIONS

A. In addition to the requirements for shop connections comply with the following:

1. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
2. Joint Type: As noted on structural drawings.

B. Weld Connections: Comply with AWS D1.1/D1.1M [and AWS D1.8/D1.8M] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary

connections, and removal of paint on surfaces adjacent to field welds.

2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

3.11 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 3, Power Tool Cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9."

D. After erection, all damaged areas in shop coat, exposed surfaces of bolt heads, nuts and washers, and all field welds and unpainted areas adjacent to field welds and high strength bolts shall be painted with a "touch-up" application of same paint used in the shop coat and then painted with same paint used for shop coat tinted another color. Retouch in field, any scraped, abraded, and unpainted surfaces. Painting shall be as specified for shop coats.

E. Structural steel which is to support mechanical equipment and will be left exposed to the weather in the finished project shall be field painted with one coat of anti-corrosive paint as described in Part 2 for Paint Materials.

3.12 WASTE MANAGEMENT

A. Separate and recycle waste materials in accordance with the Section 017419 Construction Waste Management and Disposal and to the maximum extent feasible.

B. Separate for recycling and place in designated containers the following metal waste in accordance with the Waste Management Plans and local recycler standards: Steel, iron, galvanized steel, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass and bronze.

C. Collect all metal cut-offs and scraps and recycle as above.

D. Fold up metal banding, flatten and place in designated area.

E. Close and seal tightly all partly used paint and finish containers and store protected in a well-ventilated, fire-safe area at moderate temperature.

F. Designated un-used paint for:

1. Immediate re-use
2. Long term maintenance needs

3. Recycling by an appropriate facility.
4. Donation

G. Place empty containers of solvent-based paints in areas designated for hazardous materials.

H. Do not dispose of paints or solvents by pouring on the ground. Place amounts too small to re-use in designated containers for proper disposal

I. Place materials defined as hazardous or toxic waste in designated containers.

END OF SECTION

SECTION 05 12 10 ARCHITECTURAL STRUCTURAL STEEL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the architectural structural steel and as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Structural steel - Section 051200.

C. Finish field painting – Section 099000.

1.4 DEFINITIONS

A. AESS: Architecturally exposed structural steel.

1. Category AESS 4: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 4 and is designated as AESS 4 or Category AESS 4 in the Contract Documents.

1.5 QUALITY ASSURANCE

A. General: Work of this section shall be fabricated and installed by an experienced fabricator or manufacturer, who has been engaged in work of equivalent scope and fabrication standards for at least five years. Materials, methods of fabrication, fitting, assembly bracing, supporting, fastening, and erection shall be in accordance with drawings and specifications, approved shop drawings, and be of highest quality practices of the industry, using new and clean materials as specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected. All work shall be accurately and neatly fabricated, assembled and erected.

B. All work for this Section shall comply with AESS Classification 4 Showcase Elements in accordance with AISC Code of Standard Practice (ANSI/AISC 303) per chart at the end of this Section.

1.6 STANDARDS

A. Except where more stringent requirements are specified herein, comply with the applicable provisions and recommendations of the following (latest edition):

1. AISC “Specification for the Design, Fabrication and Erection of Structural Steel for Buildings”.

2. AISC “Architecturally Exposed Structural Steel”.

3. AISC “Specifications for Structural Joints Using ASTM A325 or A490 Bolts”.

4. AWS D1.1 “Structural Welding Code”.

5. SSPC “Steel Structures Painting Manual, Volume 2, Systems and Specifications”.

6. ANSI/AWS A533-9X, Specification for Alloy Wires, Cored Wire and Ceramic Rods for Thermal Spraying, American Welding Society.

7. ANSI/AWS C2.18.93, Guide for the Protection of Steel with Thermal Spraying Coating of Aluminum and Zinc, American Welding Society.

8. ASTM C633, Standard Test Method for Adhesion or Cohesive Strength for Flame Sprayed Coatings, American Society for Testing and Materials.

9. SSPC-CS Guide 23.00, June 1, 1991, Coating System Guide for Thermal Spray Metallic Coating Systems, Steel Structures Painting Council.

1.7 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project’s Sustainable Design Requirements as well as New York City’s Environmentally Preferable Purchasing (EPP). The “Sustainable Design Requirements” are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the “Sustainability Requirements” section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City’s Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. **Adhesives and Sealants**
7. **Ceilings**
8. **Composite Wood & Agrifiber Products**
9. **Flooring Systems**
10. **Furniture & Seating**
11. **Insultation**
12. **Paints & Coatings**
13. **Wall Panels**

*red means select 4

1.8 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.9 SUBMITTALS

A. Shop Drawings: Submit shop and erection drawings for all structural steel components showing the following:

1. Types of materials, including sizes and weights of members.

2. Location, types and details of connections.

3. Welding sequences as required by “Structural Welding Code”.

4. Cleaning and painting schedules.

5. Fabrication and erection procedure where needed to control shrinkage, fabrication tolerances or to insure proper inspection.

B. Reports

1. Submit certified copies of mill test reports for all steel furnished. Perform mechanical and chemical tests for all material regardless of thickness or use. No part of the ASTM Specifications will be waived without written consent of the Architect.

2. Submit copies of prequalified and other welding procedures in form prescribed in “Structural Welding Code”.

C. Samples: Submit samples of each:

1. Typical welded connection.

2. Typical nut and bolt connection.

3. Paint sample painted on welded steel components.

D. Submit structural calculations and details signed and sealed by a P.E. licensed in the State of New York, show fabrication, sizes of members, connections and anchorage. Where member sizes vary from those shown on drawings due to structural requirements, coordinate with the Architect before fabrication.

1.10 PRODUCT HANDLING

A. Conform to delivery, storage and handling requirements specified in Section 051200.

B. Do not handle structural steel until paint has thoroughly dried. Care shall be exercised to avoid abrasions and other damage. Provide all necessary cradles, dunnage, padding or other protection as required during storage and transportation. Wherever possible, handle primed steel with non-marring slings or by means of shackles inserted into connection holes.

C. Stack material out of mud and dirt and provide for proper drainage. Protect shop painted steel from damage or soiling by adjacent construction operations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide materials which have been selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces which exhibit pitting, seam marks, roller marks, "oil-canning" stains, discolorations or other imperfections on the finished units will not be acceptable.

B. Structural Steel

1. ASTM A572 Grade 50 for wide flange shape.

2. ASTM A500 Grade A for square, round or rectangular shape.

3. ASTM A36 for all other steel.

C. High Strength Bolts and Nuts: ASTM A325 and ASTM A490, minimum 3/4 in. diameter.

D. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of the metal to be welded, and as required for color match, strength and compatibility in the fabricated items.

E. Anchors and Inserts: Either furnish inserts to be set in concrete or masonry work, or provide other anchoring devices as required for the installation of ornamental metal items. Provide toothed steel or lead shield expansion bolt devices for drilled-in-place anchors. Provide galvanized or cadmium-coated anchors and inserts for exterior installations.

1. Provide units with exposed surfaces matching the texture and finish of the metal item anchored.

2.2 FABRICATION

A. Category AESS 4:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.

2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.

3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.

4. Make intermittent welds appear continuous, using filler or additional welding.

5. Seal weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates.

6. Limit butt and plug weld projections to 1/16 inch (1.6 mm).

7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.

8. Remove weld spatter, slivers, and similar surface discontinuities.

9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.

10. Grind tack welds smooth unless incorporated into final welds.

11. Remove backing and runoff tabs, and grind welds smooth.

12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.

13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.

14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.

15. Conceal fabrication and erection markings from view in the completed structure.

16. Make welds uniform and smooth.

17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.

18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.

19. Orient HSS seams as indicated or away from view.

20. Align and match abutting member cross sections.

21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch (3.2 mm). At closed joints, maintain uniform contact within 1/16 inch (1.6 mm).

22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.

23. Treat HSS seams to appear seamless.

24. Contour and blend welds and weld transitions between members, removing splatter exposed to view.

25. Fill surface imperfections with filler and sand smooth to achieve surface quality approved by Architect.

26. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.

2.3 TOLERANCES

A. Fabrication tolerances shall be as follows:

1. Rolled Shapes: Permissible tolerances for out-of-square or out-of-parallel depth, width and symmetry of rolled shapes shall be as specified in ASTM Specification A6. Match abutting cross-sectional configurations. The as-fabricated straightness tolerances of members shall be one-half of the standard camber and sweep tolerances in ASTM A6.

2. Built-Up Members: The tolerances on overall profile dimensions of members made up from a series of plates, bars and shapes by welding are limited to the accumulation of permissible tolerances of the component parts as provided by ASTM Specification A6. The as fabricated straightness tolerances for the member as a whole shall be one-half the standard camber and sweep tolerances for rolled shapes in ASTM A6.

3. Weld Show-Through: It is recognized that the degree of weld show-through, which is any visual indication of the presence of a weld or welds on the side away from the viewer, is a function of weld size and material thickness. The members or components will be acceptable as produced for non-visible conditions, welds exposed to view shall have no show-through.

4. Joints: All copes, miters and butt cuts in surfaces exposed to view shall be closed, no open joints permitted.

B. Erection Tolerances

1. Members and components shall be plumbed, leveled and aligned to a tolerance not to exceed one-half the amount permitted for structural steel. Provide adjustable connections between AESS and the structural steel frame or the masonry or concrete supports, in order to provide means for adjustment.

2.4 SHOP FINISHING OF STEEL

A. Finishing of Architectural Structural steel shall be as follows:

1. Surface Prep: SSPC-SP-10 Near White Metal Blasting, with 3-4 mil anchor pattern.

2. First coat Zinc/Aluminum metallizing at 4-6 mils dft.

3. Second Coat: Series V69F at 2-4 mils dft by Tnemec.

4. Third Coat: Field applied urethane topcoat, see Section 099000.

B. Zinc for aluminum metallizing material shall consist of 85% zinc, 15% aluminum wire meeting standard noted herein. System shall be provided by Atlantic Coast Metallizing & Coatings Corp. Richie Goelz 516.694.9850 or approved equal.

C. The system shall meet or exceed the following:

1. Adhesion of Zinc/Aluminum Metallizing: An average of 1,5000 psi, per ASTM D4541.

2. Adhesion of Epoxy Sealer Over Zinc/Aluminum Metallizing.

a. A rating of 5 out of 5 per ASTM D3359 after system had been exposed to 10 freeze thaw cycles (1 cycle = 4 hours 100% humidity, 16 hours in freezer, 4 hours in 140 degree oven).

3. Corrosion Resistance of Zinc/Aluminum Metallizing:

a. 0% rust at scribe after 16 months exterior exposure
1). A rating of 10 out of 10 (no rusting at scribe) after 4 years natural exposure.

4. Corrosion Resistance of Zinc/Aluminum Metallizing with 1 coat Epoxy sealer and 1 coat of urethane topcoat (see Section 099000).

a. A rating of 10 out of 10 (no rusting at scribe) after 1500 hours salt fog (Prohesion Method) ASTM D1654.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where architectural structural steel is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 ERECTION

A. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.

B. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.

C. Remove weld spatter, slivers, and similar surface discontinuities.

D. Grind off butt and plug weld projections larger than 1/16 inch (1.6 mm).

E. Continuous welds shall be of uniform size and profile.

F. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.

G. Splice members only where indicated on Drawings.

H. No torch cutting or field fabrication is permitted.

I. Weld profiles, quality, and finish shall be as approved by Architect.

J. Make joint welds, including tack welds, appear continuous by filling intermittent welds.

K. Grind welds smooth.

L. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.

M. Oversize welds where ground, contoured, or blended, and grind to provide a smooth transition, matching profile approved by Architect.

3.3 CONNECTIONS

A. Connections shall comply with requirements specified in Part 2 – Products.

B. No field splices shall be allowed.

3.4 FIELD PAINTING

A. After erection, clean exposed surfaces and repair damaged shop paint with the same primer used in the shop coat.

3.5 TOLERANCES

A. Individual pieces shall be plumbed, leveled and aligned in accordance with the requirements specified herein.

B. Dimensions shown on Drawings are based on an assumed design temperature of 70 degrees F. Fabrication and erection procedures shall take into account the ambient temperature range at the time of the respective operations.

3.6 FIELD AND SHOP QUALITY CONTROL

A. Testing and inspection of structural steel will be performed by a testing agency retained by the Owner. Provide the testing agency with the following:

1. A complete set of accepted documents required under Paragraph “Submittals”.

2. Cutting lists, order sheets, material bills, and shipping bills.

3. Information as to time and place of all rollings and shipment of material top shops.

4. Representative sample pieces as requested by the testing agency.

5. Full and ample means and assistance for testing all material.

6. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and filed.

B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the Inspector can refer back to the person making the connection. Welders must be AWS; copies of such shall be provided to the Testing Agency.

C. The Inspector will perform his duties, when possible, in such a way that fabrication and erection are not unnecessarily delayed or impeded, and as follows:

1. The Inspector shall make all tests and inspections as required by prevailing Codes and Ordinances. The Inspector shall make all the tests and inspections as may be indicated on the Structural Drawings.

2. The Inspector will make all tests and inspections as required by “Structural Welding Code”.

3. The technique for radiographic inspection will be in accordance with Section 6, Part B of the "Structural Welding Code". A double film technique will be used. One copy of each film will be sent to the Architect, the other will be retained by the Inspector.

4. Ultrasonic inspection will be performed in accordance with Section 6, Part C of the "Structural Welding Code".

5. Shop welds will be inspected in the shop before the work is painted or approved for shipment.

6. The Inspector will make all tests and inspections of high strength bolt connections as required by AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts".

7. Where inspection reveals defects, the extent of inspection will be increased as much as necessary to ensure that the full extent of the defects in a joint has been found and to ensure that the same defects are not present on similar parts or under similar circumstances.

8. Work that is not acceptable will be designated by "Repair" or "Reject", as applicable.

9. The Inspector will maintain a daily record of the work he has inspected and its disposition. One copy of each of the reports will be submitted to the Architect on a weekly basis.

    a. Welding reports of tests will be made in form prescribed in the "Structural Welding Code".

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AESS CATEGORY MATRIX

CATEGORY		AESS C	AESS 4	AESS 3	AESS 2	AESS 1	SSS
I.D.	CHARACTERISTICS	CUSTOM ELEMENTS	SHOWCASE ELEMENTS	FEATURE ELEMENTS IN CLOSE VIEW	FEATURE ELEMENTS NOT IN CLOSE VIEW	BASIC ELEMENTS	STANDARD STRUCTURAL STEEL
1.1	Surface preparation to SSPC-SP 6		×	×	×	×	
1.2	Sharp edges ground smooth		×	×	×	×	
1.3	Continuous weld appearance		×	×	×	×	
1.4	Standard structural bolts		×	×	×	×	
1.5	Weld spatters removed		×	×	×	×	
2.1	Visual Samples		×	×	optional		
2.2	One-half standard fabrication tolerances		×	×	×		
2.3	Fabrication marks not apparent		×	×	×		
2.4	Welds uniform and smooth		×	×	×		
3.1	Mill marks removed		×	×			
3.2	Butt and plug welds ground smooth and filled		×	×			
3.3	HSS weld seam oriented for reduced visibility		×	×			
3.4	Cross-sectional abutting surface aligned		×	×			
3.5	Joint gap tolerances minimized		×	×			
3.6	All welded connections		optional	optional			
4.1	HSS seam not apparent		×				
4.2	Welds contoured and blended		×				
4.3	Surfaces filled and sanded		×				
4.4	Weld show-through minimized		×				
C.1							

Table 10.1 found in the 2016 *Code of Standard Practice for Steel Buildings and Bridges* (ANSI/AISC 303-16).

END OF SECTION

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes but is not limited to the following as shown on the drawings and as specified herein:

1. Floor deck
2. Roof deck
3. Headed shear studs
4. All necessary deck supports and reinforcing other than principal framing members including diagonals at columns, angles, plates, etc.
5. Flashing, cell closures, closure plates and sheet metal work required to contain concrete.
6. Ceiling hanger tabs at new decking composite with concrete where new suspended ceilings are required.
7. Waste Management.

B. Related Requirements:

1. Concrete and reinforcement over decking
2. Structural steel
3. Shoring of metal deck where unsupported span exceeds the allowable
4. Ceiling systems
5. Mechanical and electrical where supported from deck
6. Fireproofing systems
7. Sheet metal work
8. Waste Management/Recycling Strategies

1.3 PERFORMANCE REQUIREMENTS

A. Metal deck unit sizes and gauges are indicated on the drawings. Gauges indicated on the drawings are a minimum. Thickness of deck may be required to be increased by deck manufacturer for loadings indicated on drawings.

B. Unit shall span over three or more supports except where steel layout does not permit.

C. Maximum allowable deflection under live load plus super imposed dead load shall not exceed (1/360) of the span or (1/4) inch whichever is less.

D. Deck shall be sized as unshored. Shoring of deck is not permitted unless specifically shown in areas on the drawings.

E. Use of piercing, non-piercing, and integral hanger tabs is not permitted at roof deck.

F. Units included in a fire rated assembly must be classified in appropriate UL design.

1.4 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Product data, including manufacturer's specifications, load tables, section properties and installation instructions for each type of decking and accessories.

C. Shop Drawings: Shop drawings for all installations showing gauges, deck layout, type of deck, any shoring required, where located, welding details necessary for fabrication to fit in place, and all accessories. Do not use reproductions of the Design Drawings. In addition, include the following:

1. Ceiling tab, fillers, closures and similar items.
2. Show placement of headed shear studs connectors with respect to the flutes of the metal deck. Variation from the specified deck configuration may result in a decrease of the capacity of the studs, requiring more studs.

D. Product Certificates: Certification of specification compliance for each item specified.

E. Reports

1. Submit certification of recycled steel content. Certification shall clearly indicate post-consumer AND post-industrial recycled steel content for the particular member or members used.
2. Submit verification of finishing process:

    a. Provide a cut sheet and a Material Safety Data Sheet (MSDS) for all shop and field paints used highlighting VOC limits and chemical and mineral component limits.
    b. For heavy metals in used plating processes: Provide a cut sheet and a Material Safety Data Sheet (MSDS) for each plating material and related compounds highlighting chemical component limits.
    c. Certification of recycled zinc content for galvanized products: Provide cut sheets clearly indicating whether the galvanized products used meet the minimums for post-consumer OR post-industrial recycled contents. Or, if cut sheets are not available, obtain a written affidavit from the manufacturer stating the recycled content percentage and if the recycled content is post-consumer or post-industrial.

3. Submit verification of biodegradable or low VOC, and low Hazardous Air Pollutants (HAPS)

cleaning solutions. Provide a cut sheet and a Material Safety Data Sheet (MSDS) for all cleaning solutions used in the surface preparation of steel components. Highlight VOC limits and chemical component limits.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.
2. Acoustical roof deck.

G. Evaluation Reports: For steel deck.

1.5 QUALITY ASSURANCE

A. Except as modified by governing codes and by this specification, comply with the applicable provisions and recommendations of the following codes and standards:

1. New York City Building Code, Latest Edition
2. American Iron and Steel Institute (AISI) "Specification for the Design of Cold-Formed Steel Structural Members".
3. American Welding Society (AWS), D1.1 "Structural Welding Code" and D1.3 "Structural Welding Code-Sheet Steel".
4. Steel Deck Institute (SDI) "Design Manual for Composite Decks, Form Decks, and Roof Decks".
5. American National Standards Institute (ANSI)/Steel Deck Institute (SDI) “Quality Control and Quality Assurance for Installation of Steel Deck”.
6. ASTM Standards as applicable in the building code of the local jurisdiction and as noted in this specification.

B. Fabricator Qualifications: The work under this section shall be performed by a fabricator and erector submitting conclusive evidence of having satisfactorily completed work of similar scope and of having the necessary skill, equipment, facilities and capacities to fabricate and perform the erection in accordance with the construction schedules and in full compliance with all requirements of the Contract Documents.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work. However, efforts should be made to minimize the disturbance to site and soil conditions for example, by not requiring excessive areas to be put aside for on-site storage.

B. Store materials to permit easy access for inspection and identification. Keep all materials in a safe, dry, off ground location, using pallets, platforms, or other supports. Protect all materials from corrosion and deterioration, discoloration or staining. Make efforts to minimize any wastage and ensure that as much waste as possible is recycled.

C. Do not store materials on structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structures as directed.

1.7 PROJECT CONDITIONS

A. Examine all work prepared by others to receive work of this section and report any defects affecting installation to the contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.

B. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of the steel decking units, the steel decking contractor shall bring the matter to the attention of the contractor for corrective action. The steel decking units are not to be placed until the necessary correlations are made.

C. Installation of the deck and shear studs will be inspected by the Commissioner and/or Owner's agent.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 MANUFACTURERS

A. Supply manufactured deck units in accordance with the applicable requirements of the Steel Deck Institute's "Design Manual for Floor Decks and Roof Decks".

B. Deck shall be manufactured by one of the following (or other equivalent as approved by the Commissioner and engineer of record):

1. United Steel Deck (manufactured by Canam)
2. New Millennium
3. Vulcraft

2.3 DECK MATERIALS

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, with the minimum section properties indicated on the drawings. Contractor shall provide heavier gauge if minimum gauge indicated is not adequate to support total loads as shown on the drawings.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated on the drawings. Contractor shall provide heavier gauge if the minimum gauge indicated is not sufficient to support construction loads as unshored forms and/or total load as indicated on the drawings based on the composite section. Deck shall have deformations specifically designed to produce

composite action between the deck and the concrete slab by mechanical bond.

2.4 ACCESSORIES

A. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

C. Anchor clips, vent clips, welding washers, flashing, saddle plates, sump pans, other accessories shall be those types, sizes, and configurations recommended by the decking manufacturer, and shall be of the same material and finish as the deck units. All accessories shall conform to ASTM A653/A63M.

D. Cell closure flexible strips, and fillers shall be of material in compliance with applicable building code governing class of construction.

E. Provide metal closure strips at edges of all slabs and openings that serve as pour stops for concrete. Gauge shall be sufficient to span or cantilever from steel beams.

F. Roof sump pans: Fabricate from a single piece of galvanized sheet steel of the same quality as the deck units; not less than nominal 0.0747" (14 gauge) thick before galvanizing; with bottoms level after erection and sloping sides to direct water flow to the drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess pans not less than 1-1/2" below the roof deck surface, unless otherwise shown or required by deck configuration. Weld to deck at maximum 12" on-center.

G. Headed studs for shear connectors shall be per drawings manufactured from cold drawn wire and conforming to ASTM A 108, Grades 1010 thru 1020.

1. Subject to compliance with requirements, studs shall be manufactured by one of the following:

a. Nelson
b. KSM

2.5 FABRICATION

A. Fabricate deck units in accordance with the AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and accepted shop drawings. Fabricate deck units to the sizes and configurations indicated and cut to lengths which will span not fewer than three supporting members; use only full length units at overhang where indicated in a manner that laps fit tightly. Locate openings for penetrations where indicated and provide support framing and edge reinforcement for all openings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSPECTION

A. Inspection of the metal deck and shear stud installation will be performed by an inspection agency retained by the owner at no expense to the contractor. The inspection agency shall work under the direction of the owner. Contractor shall provide the inspection agency with the following:

1. Schedule of all work in both shop and field with at least ten days written notice before commencement of either activity.
2. A complete set of approved shop and erection drawings.

3.3 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section. Erection shall closely follow the erection of structural steel.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members as per load schedule provided on contract documents.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work, per drawings and manufacturer’s specifications.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

G. Headed shear studs shall be installed by welding through metal deck onto beam below. Automatic welding machinery of approved design, amperage, duration of current, etc., shall be used. Studs shall be tested by testing laboratory in accordance with AWS Procedures for Bend Test; replace all studs which do not pass test.

H. All welding shall be performed by competent experienced welding mechanics. Welding mechanics must have AWS D1.3 certification for welding sheet metal less than 1/8 inch thick. All welds shall be given a protective coat of paint as specified in painting article of section 051200.

I. All abraded or damaged protective surfaces of steel decking work shall be touched up with a protective coat of paint by this contractor as erected.

3.4 ROOF DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members per drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports per drawings.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing per manufacturer's specification but not less than 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. All unframed openings in roof deck shall be reinforced per the drawings.

E. Roof sump pans: Fabricate from a single piece of galvanized sheet steel of the same quality as the deck units; not less than nominal 0.0747" (14 gauge) thick before galvanizing; with bottoms level after erection and sloping sides to direct water flow to the drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess pans not less than 1-1/2" below the roof deck surface, unless otherwise shown or required by deck configuration. Weld to deck at maximum 12" on-center.

F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.5 FLOOR DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members per the drawings.Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports per the drawings.

B. End Bearing: Install deck ends over supporting frame with a minimum end bearing per manufacturer's specification but not less than 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2" minimum or butted at Contractor's option.

C. All unframed deck openings in composite deck with concrete larger than 6" shall be reinforced per the drawings.

D. At composite deck with concrete, metal hanger tabs shall be installed at all panel sidelaps 24 inches on-center, longitudinally 24 inches on-center to create a grid nominally 24 inches by 24 inches. Tabs shall be 18 gauge minimum, capable of supporting the specified ceiling, tabs shall be a minimum of 18 gauge capable of supporting ceiling and all other suspended loads or 200 pounds, whichever is greater.

E. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

F. Sealing cellular deck openings, butt joints, and junctions with trench headers with tape is not included in this Section. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

G. The steel decking units shall be placed on the supporting steel framework and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting beams.

H. Deck shall, where possible, span 3 or more supports.

I. The side laps of adjacent units shall be fastened by approved method (to be shown on shop drawings) between supports at intervals as noted on the drawings.

J. All welding shall be performed by competent experienced welding mechanics. Welding mechanics must have AWS D1.3 certification for welding sheet metal less than 1/8 inch thick. All welds, shall be given a protective coat of paint as specified in painting article of Section 051200.

K. All abraded or damaged protective surfaces of steel decking work shall be touched up with a protective coat of paint by this contractor as erected.

L. Headed shear studs shall be installed by welding through metal deck onto beam below. Automatic welding machinery of approved design, amperage, duration of current, etc., shall be used. Studs shall be tested by testing laboratory in accordance with AWS Procedures for Bend Test; replace all studs which do not pass test.

M. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.6 FIELD QUALITY CONTROL

A. Special Inspection as required by the applicable Building Code of all metal decking will be performed by an inspection agency retained by the Owner at no expense to the Contractor. The inspection agency shall work under the direction of the owner. Contractor shall provide the inspection agency with the following:

1. Schedule of all work in field with at least ten days' written notice before commencement of either activity.
2. A complete set of approved shop and erection drawings.
3. Order sheets, material bills, shipping bills and mill test reports.
4. Representative sample pieces as requested by the testing agency.
5. Full and ample means and assistance for testing all material.
6. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in the mills, shop and field.

B. Each person installing connections shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person making the connection.

C. The following minimum criteria shall be adhered to in testing of welds:

1. All welds shall be examined by visual means.
2. 25% of all welds, selected randomly, shall be measured.
3. In addition, all welds subject to tensile stress shall be examined by the Ultrasonic Method for 100% of their length.
4. 10% of all manual fillet welds shall be tested by the magnetic particle method.
5. 1'-0" at each end of automatic fillet welds shall be tested by the magnetic particle method.
6. 100% of groove welds shall be tested by the ultrasonic method.

D. Field inspection will include examination of decking for welding and touching-up of shop coat.

E. Inspection of welding will be such as to assure that the work is within the quality requirements specified below and elsewhere in this section of the specifications and will include:

1. Ascertainment that the electrodes and flux used for the SAW, GMAW and FCAW welding processes conform to the requirements of this section of the specifications.
2. Ascertainment that the approved welding procedures and sequence are followed without deviation, unless specific approval for change is obtained from the Commissioner.
3. The testing agency shall be prepared to utilize the following approved methods of testing:

    a. Liquid penetrant inspection: ASTM E 165.
    b. Magnetic particle: ASTM A 709.
    c. Radiographic inspection: ASTM E 94 and E 1032.
    d. Ultrasonic inspection: ASTM E 114 and AWS, Chapter 6, Section C.

F. When defects are revealed, additional inspection by whatever method is deemed necessary by the inspector, shall be performed to the extent necessary to assure that the full amount of defect has been located. No further work shall be done on the assembly or sub-assembly in question until all the necessary corrections have been made. Defects shall be repaired, using the same welding procedure that was used initially in making the weld, unless otherwise approved by the Commissioner. Inspection of the repaired weld shall be by the same method that was used to reveal the defect. A second repair of a defective area shall not be made without approval of the Commissioner.

G. A distinguishing mark will be placed on all work that has been inspected and approved. Material or work that is not acceptable will be designated by words such as "REJECT" or "REPAIR" marked directly on the material or work.

H. Testing agency will report inspection results promptly and in writing to Contractor and Commissioner.

I. Remove and replace work that does not comply with specified requirements.

J. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.7 CLEANING UP

A. Remove all equipment, unused materials and debris from the site immediately upon the completion of this work.

3.8 WASTE MANAGEMENT

A. Separate and recycle waste materials in accordance with the Section 017419 Construction Waste Management and Disposal and to the maximum extent feasible.

B. Separate for recycling and place in designated containers the following metal waste in accordance with the Waste Management Plans and local recycler standards: Steel, iron, galvanized steel, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass and bronze.

C. Collect all metal cut-offs and scraps and recycle as above.

D. Fold up metal banding, flatten and place in designated area.

E. Close and seal tightly all partly used paint and finish containers and store protected in a well-ventilated, fire-safe area at moderate temperature.

F. Designated un-used paint for:

1. Immediate re-use
2. Long term maintenance needs
3. Recycling by an appropriate facility.
4. Donation

G. Place empty containers of solvent-based paints in areas designated for hazardous materials.

H. Do not dispose of paints or solvents by pouring on the ground. Place amounts too small to re-use in designated containers for proper disposal

I. Place materials defined as hazardous or toxic waste in designated containers.

END OF SECTION

SECTION 05 50 00 MISCELLANEOUS METALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the miscellaneous metal work as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Rough hardware.
2. Unistrut supports for ceiling baffles.
3. Loose steel lintels.
4. Light steel framing and supports not included as part of work of other trades.
5. Furnishing stair nosings for interior metal stairs.
6. Countertop supports.
7. Masonry support steel.
8. Sleeves in concrete walls and slabs.
9. Steel framing, bracing, supports, anchors, bolts, shims, fastenings, and all other supplementary parts indicated on drawings or as required to complete each item of work of this Section.
10. Prime painting, touch-up painting, galvanizing and separation of dissimilar metals for work of this Section.
11. Cutting, fitting, drilling and tapping work of this Section to accommodate work of other Sections and of concrete, masonry or other materials as required for attaching and installing work of this Section.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Structural steel - Section 051200.

C. Steel pan stairs - Section 055100.

D. Painting - Section 099000.

1.5 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

C. Reference Standards: The work is subject to requirements of applicable portions of the following standards:

1. "Manual of Steel Construction," American Institute of Steel Construction.

2. AWS D1-1 "Structural Welding Code," American Welding Society.

3. SSPC SP-3 "Surface Preparation Specification No. 3, Power Tool Cleaning," Steel Structures Painting Council.

4. SSPC PA-1 "Painting Application Specification," Steel Structures Painting Council.

5. "Handbook on Bolt, Nut and Rivet Standards," Industrial Fasteners Institute.

D. Steel Materials: For steel to be hot dip-galvanized, provide steel chemically suitable for metal coatings complying with the following requirements: carbon below 0.25 percent, silicon below 0.24 percent, phosphorous below 0.05 percent, and manganese below 1.35 percent. Notify galvanizer if steel does not comply with these requirements to determine suitability for processing.

E. Engage the services of a galvanizer who has demonstrated a minimum of five (5) years' experience in the successful performance of the processes outlined in this specification in the facility where the work is to be done and who will apply the galvanizing and coatings within the same facility as outlined herein. The Commissioner has the right to inspect and approve or reject the galvanizer/galvanizing facility.

F. The galvanizer/galvanizing facility must have an ongoing Quality Control/Quality Assurance program which has been in effect for a minimum of five years and shall provide the Commissioner with process and final inspection documentation. The galvanizer/galvanizing facility must have an on-premise testing facility capable of measuring the chemical and metallurgical composition of the galvanizing bath and pickling tanks.

G. Inspection and testing of hot-dip galvanized coating shall be done under the guidelines provided in the American Hot-Dip Galvanizers Association (AGA) publication "Inspection of Products Hot-Dip Galvanized After Fabrication."

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Manufacturer's Literature: Submit manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions for products to be used in the fabrication of miscellaneous metal work, including paint products.

C. Shop Drawings: Shop drawings for the fabrication and erection of all assemblies of miscellaneous iron work which are not completely shown by manufacturer's data sheets. Include plans and elevations at not less than 1" to 1'-0" scale, and include details of sections and connections at not less than 3" to 1'-0" scale. Show anchorage and accessory items.

D. Welding shall be indicated on shop drawings using AWS symbols and showing length, size and spacing (if not continuous). Auxiliary views shall be shown to clarify all welding. Notes such as 1/4" weld, weld and tack weld are not acceptable.

E. Certification: For items to be hot-dip galvanized, identify each item galvanized and to show compliance of application. The Certificate shall be signed by the galvanizer and shall contain a detailed description of the material processed and the ASTM standard used for the coating and, the weight of the coating. In addition, and as attachment to Certification, submit reports of testing and inspections indicating compliance with the provisions of this Section.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metals

1. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

2. Steel Plates, Shapes and Bars: ASTM A 36.

3. Steel Tubing: Cold formed, ASTM A 500; or hot rolled, ASTM A 501.

4. Structural Steel Sheet: Hot rolled, ASTM A 1011; or cold rolled, ASTM A 1008, Class 1; of grade required for design loading.

5. Galvanized Structural Steel Sheet: ASTM A 924, of grade required for design loading. Coating designation G90.

6. Steel Pipe: ASTM A 53, type and grade as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (Schedule 40), unless otherwise indicated.

7. Gray Iron Castings: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

8. Malleable Iron Castings: ASTM A 47, grade as selected by fabricator.

9. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

10. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153.

B. Grout: Non-shrink, non-metallic grout conforming to the requirements of Section 033000.

C. Fasteners

1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

2. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

3. Anchor Bolts: ASTM F 1554, Grade 36.

4. Lag Bolts: ASME B18.2.1.

5. Machine Screws: ASME B18.6.3.

6. Plain Washers: Round, carbon steel, ASME B18.22.1.

7. Masonry Anchorage Devices: Expansion shields, FS FF-S-325.

8. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.

9. Lock Washers: Helical spring type carbon steel, ASME B18.21.1.

D. Shop Paint: Shop prime all non-galvanized miscellaneous metal items using Series 88 Azeron Primer made by Tnemec, ICI Devoe "Rust Guard" quick dry alkyd shop coat No. 41403, "Interlac 393" by International Protection Coatings, or Approved Equal.

1. If steel is to receive high performance coating as noted in Section 099100, shop prime using primer noted in Section 099100.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Galvanizing Repair Coating: For touching up galvanized surfaces after erection, provide repair coating that is V.O.C. compliant, equal to "Silver Galv" made by Z.R.C. Worldwide or approved equal. Apply to a dry film thickness of 1.5 to 3.0 mils.

2.2 PRIME PAINTING

A. Scope: All ferrous metal (except galvanized steel) shall be cleaned and shop painted with one coat of specified ferrous metal primer. No shop prime paint required on galvanized steel or aluminum work.

B. Cleaning: Conform to Steel Structures Painting Council Surface Preparation Specification SP 3 (latest edition) "Power Tool Cleaning" for cleaning of ferrous metals which are to receive shop prime coat.

1. Steel to get high performance coating as noted in Section 099100 shall be cleaned as per SSPC SP.6 "Commercial Blast Cleaning."

C. Application

1. Apply shop prime coat immediately after cleaning metal. Apply paint in dry weather or under cover. Metal surfaces shall be free from frost or moisture when painted. Paint all metal surfaces including edges, joints, holes, corners, etc.

2. Paint surfaces which will be concealed after shop assembly prior to such assembly. Apply paint in accordance with approved paint manufacturer's printed instructions, and the use of any thinners, adulterants or admixtures shall be only as stated in said instructions.

3. Paint shall uniformly and completely cover the metal surfaces, 2.0 mils minimum dry film thickness. No work shall be shipped until the shop prime coat thereon has dried.

D. Touch-Up: In the shop, after assembly and in the field, after installation of work of this Section, touch-up damaged or abraded portions of shop prime paint with specified ferrous metal primer.

E. Apply one shop coat to fabricated metal items, except apply two (2) coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

2.3 GALVANIZING

A. Scope: All ferrous metal exposed to the weather, and all ferrous metals indicated on drawings or in specifications to be galvanized, shall be cleaned and then hot-dipped galvanized after fabrication as provided by Duncan Galvanizing or approved equal.

B. Avoid fabrication techniques that could cause distortion or embrittlement of steel items to be hot-dip galvanized. Fabricator shall consult with hot-dip galvanizer regarding potential warpage problems or handling problems during the galvanizing process that may require adjustment of fabrication techniques or design before finalizing shop drawings and beginning of fabrication.

C. Cleaning: Thoroughly clean metal surfaces of all mill scale, rust, dirt, grease, oil, moisture and other contaminants prior to galvanizing.

D. Application: Hot-dip galvanizing shall conform to the following:

1. ASTM A 143: Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel.

2. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A 153: Galvanized Coating on Iron and Steel Hardware - Table 1.

4. ASTM A 384: Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.

5. ASTM A 385: Practice for Providing High Quality Zinc Coatings.

6. ASTM A 924: Galvanized Coating on Steel Sheets.

7. Minimum weight of galvanized coating shall be two (2) oz. per square foot of surface.

E. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

F. All galvanized materials must be inspected for compliance with these specifications and marked with a stamp indicating the name of the galvanizer, the weight of the coating, and the appropriate ASTM number.

G. To minimize surface imperfection (e.g.: flux inclusions), material to be galvanized shall be dipped into a solution of Zinc Ammonium Chloride (pre-flux) immediately prior to galvanizing. The type of galvanizing process utilizing a flux blanket overlaying the molten zinc will not be permitted.

H. After galvanizing all materials not exposed to view must be chromated by dipping material in a 0.2% chromic acid solution.

I. Galvanized surfaces, where exposed to view, must have a smooth, level surface finish. Where this does not occur, piece shall be rejected and replaced to the acceptance of the Commissioner.

2.4 PROTECTIVE COATINGS

A. Whenever dissimilar metals will be in contact, separate contact surfaces by coating each contact surface prior to assembly or installation with one coat of specified bituminous paint, which shall be in addition to the specified shop prime paint. Mask off those surfaces not required to receive protective coating.

2.5 WORKMANSHIP

A. General

1. Miscellaneous metal work shall be fabricated by an experienced fabricator or manufacturer and installed by an experienced tradesman.

2. Materials, methods of fabrication, fitting, assembly, bracing, supporting, fastening, operating devices, and erection shall be in accordance with drawings and specifications, approved shop drawings, and best practices of the industry, using new and clean materials as specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected.

3. All work shall be accurately and neatly fabricated, assembled and erected.

B. Shop Assembly: Insofar as practicable, fitting and assembly of work shall be done in shop. Shop assemble work in largest practical sizes to minimize field work. It is the responsibility of the miscellaneous metal subcontractor to assure himself that the shop-fabricated miscellaneous metal items will properly fit the field condition. In the event that shop-fabricated miscellaneous metal items do not fit the field condition, the item shall be returned to the shop for correction.

C. Cutting: Cut metal by sawing, shearing, or blanking. Flame cutting will be permitted only if cut edges are ground back to clean, smooth edges. Make cuts accurate, clean, sharp and free of burrs, without deforming adjacent surfaces or metals.

D. Holes: Drill or cleanly punch holes; do not burn.

E. Connections: Make connections with tight joints, capable of developing full strength of member, flush unless indicated otherwise, formed to exclude water where exposed to weather. Locate joints where least conspicuous. Unless indicated otherwise, weld or bolt shop connections; bolt or screw field connections. Provide expansion and contraction joints to allow for thermal movement of metal at locations and by methods approved by Commissioner.

1. Welding

a. Shall be in accordance with AWS D1.1 Structural Welding Code of the American Welding Society and shall be done with electrodes and/or methods recommended by the manufacturer of the metals being welded.
b. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth with and to match finish of adjoining surfaces; undercut metal edges where welds are required to be flush.
c. All welds on or behind surfaces which will be exposed to view shall be done so as to prevent distortion of finished surface. Remove weld spatter and welding oxides from all welded surfaces.

2. Bolts and Screws: Make threaded connections tight with threads entirely concealed. Use lock nuts. Bolts and screw heads exposed to view shall be flat and countersunk. Cut off projecting ends of exposed bolts and screws flush with nuts or adjacent metal.

F. Operating Mechanism: Operating devices (i.e. pivots, hinges, etc.) mechanism and hardware used in connection with this work shall be fabricated, assembled, installed and adjusted after installation so that they will operate smoothly, freely, noiselessly and without excessive friction.

G. Built-In Work: Furnish anchor bolts, inserts, plates and any other anchorage devices, and all other items specified under this Section of the Specifications to be built into concrete, masonry or work of other trades, with necessary templates and instructions, and in ample time to facilitate proper placing and installation.

H. Supplementary Parts: Provide as necessary to complete each item of work, even though such supplementary parts are not shown or specified.

I. Coordination: Accurately cut, fit, drill and tap work of this Section to accommodate and fit work of other trades. Furnish or obtain, as applicable, templates and drawings to or from applicable trades for proper coordination of this work.

J. Exposed Work

1. In addition to requirements specified herein and shown on drawings, all surfaces exposed to view shall be clean and free from dirt, stains, grease, scratches, distortions, waves, dents, buckles, tool marks, burrs, and other defects which mar appearance of finished work.

2. Metal work exposed to view shall be straight and true to line or curve, smooth arrises and angles as sharp as practicable, miters formed in true alignment, profiles accurately intersecting, and with joints carefully matched to produce continuity of line and design.

3. Exposed fastenings, where permitted, shall be of the same material, color and finish as the metal to which applied, unless otherwise indicated, and shall be of the smallest practicable size.

K. Preparation for Hot-Dip Galvanizing: Fabricator shall correctly prepare assemblies for galvanizing in consultation with galvanizer and in accordance with applicable Reference Standards and applicable AGA publications for the "Design of Products to be Hot-Dip galvanized After Fabrication." Preparation shall include but not be limited to the following:

1. Remove welding flux.

2. Drill appropriate vent holes and provide for drainage in inconspicuous locations of hollow sections and semi-enclosed elements. After galvanizing, plug vent holes with shaped lead and grind smooth.

2.6 MISCELLANEOUS METALS ITEMS

A. Rough Hardware

1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting

woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.

2. Fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood connections; elsewhere, furnish steel washers.

B. Slotted-Channel Framing Supports:

1. Provide support system P1001 made by Unistrut, complying with MFMA-4 (Metal Framing Standards Publication) or comparable product from one of the following:

   a. Champion Fiberglass.
   b. Eaton.
   c. Or approved equal.

2. Ceiling Anchorage: Wherever possible, attachment to ceiling anchorage shall be by means of drilled concrete insets, through Hilti bolts, or by direct attachment to the structural framing of the building.

3. Vertical Supports: The exposed rails and the ceiling anchorage shall be connected by vertical supports and vertical drips as indicated on the shop drawings. Vertical supports shall provide for both basic and micro vertical adjustments.

4. Bracing: Equipment shall be adequately braced to meet all code requirements.

C. Loose Steel Lintels

1. Provide loose structural steel lintels for openings and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit where indicated. Provide not less than eight (8) inches bearing at each side of openings, unless otherwise indicated.

2. Loose lintels shall conform to the following Schedule:

Opening Width (Maximum)	WALL THICKNESS		
	4 inches	6 inches	8 inches*
2'-0"	3-1/2" x 3-1/2" x 1/4"	6" x 4" x 5/16"	3-1/2" x 3-1/2" x 1/4"
3'-0"	3-1/2" x 3-1/2" x 5/16"	6" x 4" x 5/16"	3-1/2" x 3-1/2" x 5/16"
4'-0"	3-1/2" x 3-1/2" x 5/16"	6" x 4" x 5/16"	3-1/2" x 3-1/2" x 5/16"
5'-0"	4" x 3-1/2" x 3/8"	6" x 4" x 3/8"	4" x 3-1/2" x 5/16"
6'-0"	5" x 3-1/2" x 3/8"	6" x 4" x 3/8"	5" x 3-1/2" x 5/16"
7'-0"	5" x 3-1/2" x 3/8"	5" x 5" x 1/2"	5" x 3-1/2" x 3/8"
8'-0"	5" x 3-1/2" x 3/8"	5" x 5" x 5/8"	5" x 3-1/2" x 3/8"

* Two angles at all openings in eight (8) inch walls.

3. At columns or vertical surfaces where lintels cannot bear on masonry, provide clip angles sized for structural capacity of lintel.

D. Miscellaneous Light Steel Framing

1. Light steel framing, bracing, supports, framing, clip angles, shelf angles, plates, etc., shall be of such shapes and sizes as indicated on the drawings and details or as required to suit the condition and shall be provided with all necessary supports and reinforcing such as hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, etc., as required to properly support and rigidly fasten and anchor same in place and to steel, concrete, masonry and all other connecting and adjoining work.

2. All light steel framing steel shall be furnished and erected in accordance with the applicable requirements of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" by the American Institute of Steel Construction and as specified herein.

E. Safety Nosings for Interior Metal Stairs

1. Provide three (3) inch wide cast iron safety nosing with hatched abrasive surface extending to end of stringers, manufactured by American Abrasive Metals Co., or equal made by Wooster Products Inc., American Mason Safety Tread Co., or approved equal.

2. Provide anchors spaced not more than four (4) inches from each end and not more than twelve (12) inches o.c. Furnish nosings to concrete trades for installation.

3. Apply asphaltic coating to surfaces in contact with concrete.

F. Countertop Supports: Steel framing as indicated or required to support countertops. Conceal framing under countertops and within wall behind countertops. Provide supports to withstand a concentrated load of not less than three hundred (300) lbs. applied at any point with a deflection not to exceed L/240 for the length of the countertop.

G. Masonry Support Steel

1. Provide galvanized steel, relieving angles, plates, accessories and other steel shapes for masonry support steel; for lintels refer to Para. E. herein.

2. Fabricate masonry support steel to allow final adjustment with the closest tolerances possible. Relieving angles which require cutting to fit masonry flashing shall be straightened without deflections.

3. Coordinate masonry support system with concrete work for locations of wedge inserts.

4. Install to meet requirements of building masonry work, face brick coursing and stone placement. Coordinate final adjustments with masonry work as work progresses.

H. Sleeves in Concrete Walls and Slabs

1. Sleeves through concrete walls shall be of Schedule 40 steel pipe with i.d. two (2) inches larger than o.d. of pipe or conduit (including insulation, if any) to be accommodated. Sleeves shall project one-half (1/2) inch on each side of finished wall. Provide rectangular

one-quarter (1/4) inch steel plate collar at center, continuously welded to the perimeter of the sleeve, and six (6) inches wider than the o.d.

2. Slots in slabs shall be 12 gauge steel sheet, galvanized, of dimensions indicated, with strap anchors welded in place not more than twelve (12) inches on centers.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where miscellaneous metal is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 ERECTION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry, or similar construction.

C. Fitting Connections: Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot dip galvanized after fabrication, and are intended for bolted or screwed field connections.

D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance, and quality of welds made, and methods used in correcting welding work.

E. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

F. Field Touch-Up of Galvanized Surfaces: Touch-up shop applied galvanized coatings damaged during handling and installation. Use galvanizing repair coating specified herein for galvanized surfaces.

END OF SECTION

SECTION 05 51 00 STEEL PAN STAIRS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the steel pan stairs as indicated on the drawings and specified herein, including but not limited to, the following:

1. Steel pan stairs, including all clips, hangers, inserts, braces and other supports.

2. Steel pipe hand rails, guard rails and intermediate rails for steel stairs, including supports, brackets, and anchors.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Structural steel - Section 051200.

C. Miscellaneous metals - Section 055000.

D. Installation of inserts in drywall furnished by this Section - Section 092900.

E. Finish painting - Section 099000.

1.5 QUALITY ASSURANCE

A. Qualification of Welders: Use only certified welders and the shielded arc process for all welding performed in connection with the work of this Section. Protect adjacent surfaces when field welding to prevent damage or stain. Welders and welding operators must be qualified by tests as provided by AWS.

B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with:

1. "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.

2. "Code for Welding in Building Construction" of the American Welding Society.

3. "Metal Stairs Manual" of the National Association of Architectural Metal Manufacturers.

C. Conflicting Requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards of these specifications, the provisions of the more stringent shall govern.

D. Field Measurements: If construction process permits, take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress. Allow for trimming and fitting wherever taking field measurements before fabrication might delay work.

E. Tolerances: Allow for construction tolerances as required.

F. Coordination: Coordinate this work with the work of all other trades interfacing with metal pan stairs, such as structural openings, sprinklers and standpipes, and other trades as required.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmentally Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Adhesives and Sealants
   7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

1.9 DRAWING SUBMISSION

A. General: It is the intent of the Working Drawings to display the layouts and general design parameters upon which the Shop Drawings shall be developed. Detail development and all

connections shall be part of Shop Drawing Development.

B. Shop Drawings

1. Before any steel stairs are fabricated, submit shop drawings to the Commissioner for approval.

2. Show all locations, markings, quantities, materials, sizes and shapes, and indicate all methods of connecting, anchoring, fastening, bracing, for the stair construction, support and attachment to the work of other trades.

C. Engineering Data

1. Before any metal pan stairs are fabricated, submit engineering data drawings to the Commissioner for review. The Contractor is responsible for the structural design and supports for the stair system and must show his proposed system on these drawings.

2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of stair members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of New York and shall be signed and sealed by this Engineer.

1.10 SAMPLES SUBMISSION

A. Submit the following listed samples and other samples as may be requested by the Commissioner, to show the quality standards:

1. Railing bracket.

2. Exposed weld.

3. Exposed bolted connection.

4. Bent pipe railing.

B. Samples shall be submitted cleaned and shop primed and shall represent standards to which all respective materials used in the Project shall meet.

1.11 PERFORMANCE STANDARDS

A. Stairs and railings shall be constructed to conform to the following performance standards, unless greater required by Code:

1. Stairs and platforms shall support a live load of one hundred (100) psf and a concentrated live load of three hundred (300) lbs. and shall have a live load deflection limited to 1/360 of the span. Loads shall not apply simultaneously.

2. Railings shall withstand a two hundred (200) lb. force applied to rail from any direction, and a uniformly distributed load of 50 lbs./lin. ft. applied downward or horizontally, loads not to act simultaneously.

1.12 PRODUCT HANDLING

A. Protection: Use all means necessary to protect steel pan stair before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Commissioner and at no additional cost to The City of New York.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural Steel: ASTM A 36.

B. Steel Sheets: ASTM A 245, Grade C, minimum ten (10) gauge for platforms, twelve (12) gauge minimum for treads and risers.

C. Steel Pipe: ASTM A 53, Type E., Grade A, and ASTM A 501. Use standard malleable iron fittings for steel pipe.

D. Malleable Iron Castings: ASTM A 47, Grade 35018.

E. Bolts and Nuts: ASTM A 307, Grade A bolts.

F. Machine Screws: ASME B 18.6.3.

G. Expansion Bolts: "Cinch" type, galvanized, of approved manufacture.

H. Threaded End Hanger Rods: Minimum 3/4" diameter, ASTM A 36.

I. Shop Paint: Shop prime all stairs and railings using Series 88 Azeron Primer made by Tnemec, ICI Devoe "Rust Guard" quick dry alkyd shop coat No. 41403, or "Interlac 393" by International Protection Coatings, or Approved Equal.

J. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D1187.

K. Concrete Fill and Reinforcing Materials

1. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 3000 psi.

2. Nonslip-Aggregate Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

3. Welded Wire Fabric: ASTM A 185, 6 by 6 inches – W1.4 by W1.4, unless otherwise indicated.

2.2 FABRICATION

A. General

1. Steel pan stair work shall be fabricated by an experienced manufacturer in accordance with approved shop drawings and best practices of the industry, using new and clean materials as specified, having structural properties sufficient to safely sustain or withstand strains and stresses to which material will be subjected.

2. Fabricate shop assemblies in largest practical sizes to minimize field work. All exposed surfaces shall be clean and free from all dirt, stains, grease marks, scratches, waves, dents, buckles, tool marks, rattles, and other objectionable defects which mar appearance or use of finished work.

3. Cutting: Cut materials by sawing, shearing, or blanking. Flame cutting will be permitted when ground back to clean edges. Cuts shall be made accurately, clean, sharp and free of burrs, without deforming adjacent metals.

4. Connections: Make connections with tight joints, capable of developing full strength of the members, flush. Locate joints where least conspicuous. Use concealed fasteners where possible. Weld or rivet shop connections; bolt, screw or weld field connections.

    a. Welding: Welds shall be continuous, except where spot welding is specifically permitted. Welding shall conform to the Standard Code of the American Welding Society. Exposed welds are required to be ground flush.
    b. Bolts and Screws: Make threaded connections tight with threads entirely concealed. Use lock nuts, or upset thread ends. Exposed bolts and screw head shall be flat and countersunk, unless otherwise indicated on drawings. Remove projecting ends of bolts and screws. Punch or drill holes; do not burn.

B. Stairs and Platforms

1. Provide stringers, risers, sub-treads and platforms matching profiles as shown. Form tread pan and riser in a continuous piece to receive the finished tread; tread shall be a minimum of twelve (12) gauge. Weld risers and treads to carrier angles which shall be welded to the structural steel stringers. Fasten countersunk bolts or stud welded clips through mesh for cement fill. Provide welded-on clips for the support of gypsum drywall soffits.

2. On intermediate platforms, provide metal bases formed of stringers. Miter and weld and grind smooth internal and external corners of metal bases. Form platform runs of minimum ten (10) gauge steel.

3. Countersink bolt heads and screws on finished surfaces or cut off flush with such surfaces.

4. Properly fit and securely fasten together all parts making exposed joints close fitting. Cut, drill, punch and tap as required for installation.

5. Make joints as strong and rigid as adjoining sections. Weld continuously along entire line of contact except where spot welding is indicated.

6. Separate dissimilar metals in or adjacent to work of this Section with a coat of bituminous paint on each surface prior to installation.

7. Closure and Filler Plates: Where indicated on drawings or as required, at least twelve (12) gauge sheet steel, securely fastened to top and bottom of stringer and adjacent wall, by welding or screws.

8. Struts, Hangers, Platform Headers and Subframing:

    a. Provide supports as detailed and required, including all struts, clip angles, angles or hangers which are required and necessary for support of stair construction.

b. Supports shall be of size suitable for the support load, as required. Struts, angles and hangers shall be supported by and directly connected to the structural framing. Struts and hangers, with their connections, shall be concealed.
c. Provide other inserts, anchors and/or other subframing as may be required to complete the stair construction and properly support it on the structural framing.

C. Handrails, Railings, Posts and Brackets

1. Provide steel pipe of size shown on drawings, Schedule 40. Use heavier weight pipes and/or reinforce pipes internally as required to meet performance standards given in paragraph 1.7 herein. Fittings shall be flush type, malleable or cast iron. Wall brackets shall be steel design as detailed.

2. Handrail, post and railing spacing shall meet Code requirements.

3. Construction: Form direction changes in rails using solid bar stock or elbows. Connections shall be shop welded, except where expansion joints are required. Field connections shall be welded for continuity. All exposed welds shall be ground smooth and flush.

a. If elbows are not available for angles shown, bends shall maintain full diameter of pipe, use mandrel, no kinks, ripples, flats are acceptable.

4. Fabricate newel or steel tubing with wall thickness of 0.120" and provide gray iron casting newel caps.

5. Anchor posts to steel with steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.

6. Secure handrails to walls with wall brackets. Provide brackets as shown on drawings. For installation in drywall, furnish Drywall Section steel plate to receive wall plate portion of bracket and anchor or bolt wall plate through drywall to supporting steel plate. Locate brackets at not more than 5'-0" o.c. unless otherwise shown.

7. Anchor rail ends into adjacent walls with steel flanges welded to rail ends and anchored into the wall construction as described above.

2.3 SHOP PAINTING

A. Scope: All ferrous metal shall be cleaned and shop painted with one coat of specified ferrous metal primer.

B. Cleaning: Conform to Steel Structures Painting Council Surface Preparation Specification SP 3 (latest edition) "Power Tool Cleaning" for cleaning of ferrous metals which are to receive shop prime coat.

C. Application

1. Apply shop prime coat immediately after cleaning metal. Apply paint in dry weather or under cover. Metal surfaces shall be free from frost or moisture when painted. Paint all metal surfaces including edges, joints, holes, corners, etc.

2. Paint surfaces which will be concealed after shop assembly prior to such assembly. Apply paint in accordance with approved paint manufacturer's printed instructions, and the use of any thinners, adulterants or admixtures shall be only as stated in said instructions.

3. Paint shall uniformly and completely cover the metal surfaces, 2.0 mils minimum dry film thickness. No work shall be shipped until the shop prime coat thereon has dried.

D. Touch-Up: In the shop, after assembly and in the field, after installation of work of this Section, touch-up damaged or abraded portions of shop prime paint with specified ferrous metal primer.

E. Apply one shop coat to fabricated metal items, except apply two (2) coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where steel pan stairs are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION

A. Work in the field shall comply with the same requirements as specified for shop work above.

B. Except where otherwise shown or specified for a particular item of work or for built-in work, fasten metal work to solid masonry with expansion bolts. Fastenings to wood plugs in masonry will not be accepted. Drill holes to the exact diameter of the bolts using a rotary drill for concrete and a percussion drill for other masonry. Thread screws full length to the head of the screw.

C. Provide connecting members needed for properly securing the work to masonry, drywall and structural framing, including bolts, machine screws, rods, hangers, inserts, sleeves, plates, anchors, expansion bolts, washers and other items as required. Furnish built-in items to drywall trades as required for proper anchorage.

D. Leave work exposed to view, including stair soffits, clean, smooth and neatly finished. All exposed welds shall be dressed smooth.

E. Include supplementary parts necessary to complete each item even though such work is not definitively shown or specified.

F. Coordinate and schedule the work of this Section with the work of other trades. Furnish anchors, sockets, fastenings and other miscellaneous items to be embedded in concrete or masonry, or required for securing metal work to other construction so as not to delay job progress.

G. Attach wall railings to the wall construction, using appropriate bolts and anchors to meet performance standards.

H. Install work plumb and true to the exact lines and levels, in the correct location and in proper relation to adjoining work.

I. Touch up marred and abraded shop paint of exposed surfaces after erection in the field.

J. Posts shall be set plumb within 1/8" vertical tolerance. Longitudinal members shall be parallel with each other and with floor surface or slope of stair to a tolerance of 1/8" in ten (10) linear feet. Center lines of members within each run of railing shall lie in the same vertical plane. Field joints of connecting sections shall be hairline.

3.4 TOUCH-UP PAINTING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop coat, and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

END OF SECTION

SECTION 05 52 10 STEEL PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the steel pipe and tube railings as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Steel pipe and tube railings.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Miscellaneous metals – Section 055000.

C. Painting and finishing – Section 099000.

1.5 PERFORMANCE REQUIREMENTS (UNLESS GREATER REQUIRED BY CODE)

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional Engineer licensed in the State of New York, using performance requirements and design criteria indicated.

1. Uniform load of 50 lbf/ft. applied in any direction.

2. Concentrated load of 200 lbf applied in any direction.

3. Uniform and concentrated loads need not be assumed to act concurrently.

B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.

b. Infill load and other loads need not be assumed to act concurrently.

3. Where prevailing Code requirements require greater loads, such loads shall apply.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible material

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.

2. Railing brackets.

3. Grout, anchoring cement, and paint products.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Samples: For each type of exposed finish required.

E. Engineering Services Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified Professional Engineer licensed in the State of New York responsible for their preparation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Pipe and Tube Railings

a. Pisor Industries, Inc.
b. Wagner, R&B, Inc.; a division of the Wagner Companies
c. Julius Blum & Co.
d. Or approved equal.

2.2 METALS

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.

2. Hot-Dip Galvanized Railings: Hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

G. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

I. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for exterior applications.

2.4 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work, true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. Nonwelded Connections: Where noted on approved shop drawings, connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

E. Form changes in direction by inserting prefabricated elbow fittings.

F. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.

G. Close exposed ends of railing members with prefabricated end fittings.

H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers to transfer loads through wall finishes.

2.5 FINISH

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.

2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.

3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. Preparing Galvanized Railings: Prepare surface as per the requirements of ASTM D 6386.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning":

D. Galvanized Ferrous Metals

First Coat: "27 Typoxy" or "N69 Epoxoline II" by Tnemec; "Intergard 345" by International Protective Coatings; "Carboguard 893 SG" or "Carboguard 888" by Carboline; "Devran 203 WB Epoxy Primer" by Akzo; Epoxy Mastic Coating V 160 Series by Cortech/Moore or "Recoatable Epoxy Primer 867-45" by Sherwin Williams or Approved Equal.

Second Coat: "V73 Endura Shield" or "1074/1075" by Tnemec; "Interthane 870UHS" or "990 UHS" by International Protective Coatings; "Carbothane 133 LH" by Carboline; "Devthane 379UH Aliphatic Vizethne" by Akzo; Acrylic Aliphatic Urethane V 500 (Gloss) or V 510 (Semi-Gloss) by Corotech/Moore or "Hi-Solids Urethane B65-300/350" by Sherwin Williams or Approved Equal.

E. Non-Galvanized Ferrous Metals

Prime Coat: "Tneme-Zinc 90/97" by Tnemec; "Interzinc 52" or "315" by International Protective Coatings; "Carbozinc 859, Class B" by Carboline; "Cathacoat 302V Reinforced Inorganic Zinc Primer" by Akzo; Organic Zinc Rich Primer V 170 by Corotech/Moore or "Zinc Clad II Plus Inorganic Zinc Rich Coating B69V212" by Sherwin Williams or Approved Equal.

Second Coat: "27 Typoxy" or "N69 Epoxoline II" by Tnemec; "Intergard 345" by International Protective Coatings; "Carboguard 893 SG" or "Carboguard 888" by Carboline; "Bar-Rust 231V Multi Purpose Epoxy Mastic" by Akzo; Epoxy Mastic Coating V 160 Series by Corotech/Moore or "Macropoxy 646 I.C. Epoxy B58-600" by Sherwin Williams or Approved Equal.

Third Coat: "V73 Endura Shield" or "1074/1075" by Tnemec; "Interthane 870UHS" or "990 UHS" by International Protective Coatings; "Carbothane 133 LH" by Carboline; "Devthane 379 UH Aliphatic Urethane" by Akzo; Acrylic Aliphatic Urethane V 500 (Gloss) or V 510 (Semi-Gloss) by Corotech/Moore or "Hi-Solids Polyurethane B65-300/350" by Sherwin Williams or Approved Equal.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

C. Anchor posts in concrete by inserting into core-drilled holes and grouting annular space.

D. Anchor railing ends at walls with round flanges anchored to wall construction.

E. Attach railings to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage.

F. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

2. For hollow masonry anchorage, use toggle bolts.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 70 00 ORNAMENTAL METALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the ornamental metals, including heavy gauge stainless steel and non-ferrous metal products which are used in building construction for functional, architectural, and decorative effects, and which are not a part of other metal systems specified in other Sections. The extent of these items is indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Metal Trim.
2. Shop Finished Metal Plate.
3. Bronze Metal Panels and Trim.
4. Stair rail infill panels at mechanical penthouse stairs.
5. Panel infill at elevator lobby screen walls.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Miscellaneous metals - Section 055000.

1.5 QUALITY ASSURANCE

A. General: Work of this section shall be fabricated and installed by an experienced fabricator or manufacturer who has been engaged in work of equivalent scope and fabrication standards for at least five (5) years. Materials, methods of fabrication, fitting, assembly, bracing, supporting, fastening, operating devices, and erection shall be in accordance with drawings, specifications, and approved shop drawings, and be of highest quality practices of the industry, using new and clean materials as specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected. All work shall be accurately and neatly fabricated, assembled, and erected.

B. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job progress; allow for adjustments and fitting where taking of field measurements before fabrication might delay the work.

C. Shop Assembly: Insofar as practicable, fitting and assembly of work shall be done in shop. Work that cannot be permanently shop assembled, shall be completely assembled, marked and disassembled in shop before shipment to insure proper assembly in field. Shop assemble work in largest practical sizes to minimize field work. It is the responsibility of the Contractor for this work to assure himself that the shop fabricated items will properly fit the field condition. In the event that shop fabricated items do not fit the field condition, the item shall be returned to the shop for correction.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmentally Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Adhesives and Sealants
   7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Shop Drawings: Submit for all items of work of this Section, as enumerated under paragraph 1.2, showing locations, layouts, materials, thicknesses, finishes, dimensions, construction, relation to adjoining construction, erection details, profiles, jointing and all other details to fully illustrate the work of this Section.

C. Samples: Submit fabricated samples (of sufficient size to fully show construction, materials and finishes) of all items of work as enumerated under paragraph 1.2 herein.

D. Product Data: Submit manufacturer's, fabricator's and finisher's specifications and installation instructions for products used in ornamental metal work, including finishing materials and methods.

E. Samples for Verification: For each type of exposed finish required, prepared on 12 inch x 12 inch samples of metal of same thickness and material indicated for the Work.

F. Contractor Licensed Engineer Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Coordination Drawings: For decorative formed metal elements that house items specified in other Sections. Show dimensions of housed items, including locations of housing penetrations and attachments and necessary clearances.

1.9 COORDINATION

A. Coordinate installation of anchorages for decorative formed metal items. Furnish setting drawings, templates and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts and items with integral anchors, that are to be embedded in concrete to masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of decorative formed metal with adjacent construction to ensure that wall assemblies, flashings, trim and joint sealants, are protected against damage from the effects of weather, age, corrosion and other causes.

1.10 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary at no additional cost to The City of New York.

1.11 PERFORMANCE STANDARDS FOR RAILINGS (UNLESS GREATER REQUIRED BY CODE)

A. Railing assemblies shall be designed and installed to resist the simultaneous application of a lateral force of 50 PLF and a vertical load of 100 PLF, both applied to the top of the railing. Railings shall resist a total lateral force and total vertical load of at least 200 lbs. each.

B. Submit calculations and drawings signed and sealed by a Professional Engineer licensed in the State of New York indicating that railing system can meet these performance criteria.

1.12 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and for approval by DCAS, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups for the following types of decorative metal:
Bronze metal plate and metal panels
Painted metal plate at portals

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide materials which have been selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Exposed to view surfaces which exhibit pitting, seam marks, roller marks, "oil-canning," stains, discolorations, or other imperfections on the finished units will not be acceptable.

B. Bronze

1. Comply with the following standards for the forms and types of bronze for the required items of work.

a. Temper: Provide bronze materials in standard commercial tempers and hardness, as required for fabrication, strength and durability.
b. Extruded Shapes: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).
c. Plates and Bars: ASTM B 36, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
d. Seamless Tube: ASTM B 135, Alloy UNS No. C23000 (red brass, 85 percent copper).
e. Seamless Pipe: ASTM B 43, Alloy UNS No. C23000 (red brass, 85 percent copper).
f. Composition Bronze Castings: ASTM B 62, Alloy UNS No. C83600 (85-5-5-5 or composition bronze).

C. Expanded Metal Mesh: Refer to the finish schedule on the drawings. Match the control sample.

D. Stainless Steel Metal Mesh: Refer to the finish schedule on the drawings.

E. Malleable Iron Castings: ASTM A 48, Class 30, and shall be uniform in quality, free from blow holes, porosity, hard spots, shrinkage defects, swells, cracks or other defects. Surfaces shall be smooth and true to pattern.

F. Exposed Steel (cold rolled)

1. Structural Shapes and Sheets: ASTM A 1008.

2. Strip: ASTM A 109.

G. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of the metal to be welded, and as required for color match, strength and compatibility in the fabricated items.

H. Fasteners: Furnish basic metal and alloy, matching finished color and texture as the metal being fastened, unless otherwise indicated. Provide Phillips flat-head screws for exposed fasteners, unless otherwise indicated.

I. Anchors and Inserts: Either furnish inserts to be set in concrete or masonry work, or provide other anchoring devices as required for the installation of ornamental metal items. Provide

toothed steel or lead shield expansion bolt devices for drilled-in-place anchors. Provide galvanized or cadmium-coated anchors and inserts for exterior installations.

1. Provide units with exposed surfaces matching the texture and finish of the metal item anchored.

J. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).

K. Cast-in-Place and Preinstalled Anchors: Anchors fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete.

L. Sealants, Interior: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834; of type and grade required to seal joints in decorative formed metal; and as recommended in writing by decorative formed metal manufacturer.

1. Sealants shall have a VOC content of not more than 250 g/l when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

M. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by produced of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items

1. Use filler metals that will match the color of metal being joined and will not cause discoloration.

2.2 FABRICATION

A. Cutting: Cut metal by sawing, shearing or blanking. Flame cutting will be permitted only if cut edges are ground back to clean, smooth edges. Make cuts accurate, clean, sharp, square and free of burrs, without deforming adjacent surfaces or metals.

B. Holes: Drill or cleanly punch holes (do not burn), so that holes will be accurate, clean, neat and sharp without deforming adjacent surfaces or metals.

C. Connections

1. Make connections with tight joints, capable of developing full strength of member, flush unless indicated otherwise, formed to exclude water where exposed to water. Locate joints where indicated on drawings. Provide connections to allow for thermal movement of metal at locations and by methods approved by Commissioner. For work exposed to view, use concealed fasteners (unless welded or other connections indicated) with joints accurately fitted, flush and rigidly secured with hairline contacts. All edges within public reach shall be eased.

2. Welding: Welding shall be in accordance with recommendations of the American Welding Society and shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth with and to match finish of adjoining surfaces so that joint will not be visible; undercut metal edges where welds are required to be ground flush and dressed smooth. All welds on or behind surfaces which will be exposed to view shall be done so that

finished surface will be free of imperfections such as pits, runs, splatter, cracks, warping, dimpling, depressions or other forms of distortion or discoloration. Remove weld splatter and welding oxides from all welded surfaces.

3. Brazing (for Brass and Bronze): Brazing shall be in accordance with recommendations of the producer of the metal, using type and alloy of filler metal and electrodes as required for color match, strength and compatibility in the fabricated items. Brazing shall be continuous. Brazed surfaces exposed to view shall be ground flush and dressed smooth with and to match finish of adjoining surfaces so that joint will not be visible; undercut metal edges where brazed surfaces are required to be ground flush and dressed smooth. All brazed surfaces on or behind surfaces which will be exposed to view shall be done so that finished surface will be free of imperfections such as pits, runs, splatter, cracks, warping, dimpling, depressions or other forms of distortion or discoloration. Remove splatter and oxides from all brazed surfaces.

4. Bolts and Screws: Make threaded connections tight with threads entirely concealed. Use lock nuts. Bolts and screw heads, where shown to be exposed to view, shall be flat and countersunk. Cut off projecting ends of exposed bolts and screws flush with nuts of adjacent metal.

D. Operating Mechanism: Operating devices, mechanism and hardware used in connection with this work shall be fabricated, assembled, installed and adjusted after installation so that they will operate smoothly, freely, noiselessly and without excessive friction.

E. Built-In Work: Furnish anchor bolts, inserts, plates and any other anchorage devices, and all other items for architectural metal work to be built into concrete, masonry, or work of other trades, with necessary templates and instructions, and in ample time to facilitate proper placing and installation.

F. Supplementary Parts: Provide as necessary to complete each item of work, even though such supplementary parts are not shown or specified.

G. Coordination: Accurately cut, fit, drill and tap work of this Section to accommodate and fit work of other trades. Furnish or obtain, as applicable, templates and drawings to or from applicable trades for proper coordination of this work.

H. Exposed Work: In addition to requirements specified herein or shown on drawings, all surfaces exposed to view shall be clean, and free from dirt, stains, grease, scratches, distortions, waves, dents, buckles, tool marks, burrs and other defects which mar appearance of finished work. Ornamental metal work exposed to view shall be straight and true to line or curve, smooth arrises and angles as sharp as practicable, miters formed in true alignment, profiles accurately intersecting, and with joints carefully matched to produce continuity of line and design. Exposed fastenings, where permitted, shall be of the same material, color and finish as the metal to which applied, unless otherwise indicated, and shall be of the smallest practicable size.

I. Materials used shall be of such strength, thickness and alloy that they are capable of meeting all standards and descriptions specified herein and as detailed on drawings.

J. Bending: Bend sheet metal to the required shape. Bent items shall be free of grain separation, oil canning or other distortion.

1. Square Bends: Back-cut sheets to attach maximum square bend possible, with maximum radius of 1/16 in.

2. Knife Edge Bends: Back-cut and back bevel sheets to attain sharpest bend possible, with maximum radius of 1/32 in.

2.3 SHOP FINISHING

A. General

1. Refer to the finish schedule on the drawings.

2. Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated.

3. Provide colors or color matches as indicated on selected samples.

4. Protect mechanical finishes on exposed surfaces from damage by application of strippable temporary protective covering prior to shipment.

5. Corrosion Protection: Coat concealed surfaces which will be in contact with concrete, masonry, wood or dissimilar metals, in exterior work and work to be built into exterior and below grade walls and decks, with a heavy coat of bituminous paint. Do not extend coating onto exposed surfaces.

B. Bronze

1. Statuary Conversion Coating, Bright Relieved and Lacquered: CDA-M12-C55-06x. Mechanical Finish: matte finish as cast; Chemical Finish: conversion coating, sulfide; Mechanical Finish: buffed as specified, with clear organic coating specified above.

2. Color: Uniform, matching color of accepted sample.

2.4 PROTECTION

A. Provide necessary protection to all exposed surfaces of architectural metal work, so as to prevent damage, staining, discoloration, abrasion, etc., to these surfaces from time of shipment from factory to acceptance of work of this project. Protection shall be provided by wrappings, strippable coatings, or other means. After installation, remove protective paper or strippable coating and clean exposed surfaces, and then provide additional temporary protection to protect architectural metal work from damage during subsequent construction activities. Surfaces which are damaged, stained, discolored, abraded etc., shall be rejected and replaced with new materials, at no cost to The City of New York.

2.5 STEEL FRAMING, BRACING, SUPPORTS AND REINFORCEMENTS

A. Steel framing, plate reinforcing, supplementary steel framing or reinforcing, bracket assemblies, and the like required for the support, framing, reinforcing, bracing, etc., of work of this Section shall be of such sizes and shapes as indicated on the drawings, or as required to suit the conditions, and shall be provided with all necessary supports and accessory items such as inserts, hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, etc., as required to

properly and rigidly fasten, anchor or attach work of this Section in place and to the concrete, masonry and other connecting and adjoining work.

2.6 METAL-CLAD DOORS AND FRAMES

A. Laminate 0.0403" thick, metal sheets to outside face of hollow-metal doors and frames (specified in Division 8 Section "Steel Doors and Frames") at locations indicated. Use adhesive recommended by metal fabricator that will fully bond metal to metal and that will prevent telegraphing and oil canning.

2.7 METAL RAILING INFILL PANELS

A. Fabricate of materials as specified in the finish schedule and as shown on drawings.

B. Metal mesh panels must read as flat and free of bow, or read-through of stiffeners. To this end, exposed metal faces when supported in the building shall be of such flatness that the maximum uniform bow in 2 ft. shall not exceed 1/32", and the maximum overall variation in plane between high and low point within a panel shall not exceed 1/16".

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where ornamental metal work is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION

A. General: Install work of this Section square, plumb, straight, true to line or radius, accurately fitted and located, with flush, tight hairline joints (except as otherwise indicated or to allow for thermal movement), with provisions for other trades, with provisions to allow for thermal movement, with provisions to exclude water where exposed to weather, and with attachment devices as required for secure and rigid installation. It is the responsibility of the Contractor to assure himself that shop fabricated architectural metal items will properly fit the field condition. In cases where the shop fabricated architectural metal items do not fit the field condition, the item shall be returned to the shop for correction.

B. Attachments

1. Unless otherwise indicated, work to be built into concrete or masonry shall be anchored with shop welded on galvanized steel strap anchors; work to be attached to concrete or masonry shall be anchored by bolts into embedded inserts or expansion shields; work attached to structural steel shall be anchored by welds or bolts; work attached to metals other than structural steel shall be anchored by bolts or screws. Power actuated fasteners not permitted unless approved by Commissioner. Provide all supplementary parts necessary to complete each item of work of this Section.

2. All attachment devices shall be of type, size and spacing to suit condition and as approved by Commissioner. Provide shims, slotted holes, or other means necessary for leveling, plumbing and other required adjustments. Attachment devices for work exposed to view shall be concealed, unless indicated otherwise. Where bolts or screws are permitted in work exposed to view, they shall be oval head and counter sunk, unless otherwise noted, with projecting end cut off flush with nuts or adjacent material, and shall match adjacent surfaces.

3. Do all necessary drilling, tapping, cutting or other preparations of surrounding construction in the field accurately, neatly and as necessary for the attachment and support of work of this Section, but obtain Commissioner's approval prior to such preparation to work of others.

C. Tolerances: All work of this Section shall be plumb, square, level, true to radius and correctly aligned within the following limitations:

1. Offset from true horizontal, vertical and design location shall not exceed 1/16" per ten (10) feet of length for any component, not cumulative.

2. Maximum offset from true alignment between abutting components shall not exceed 1/32".

D. All railings shall be installed to withstand loads as required by New York City Building Code.

E. Do not cut or abrade finishes which cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units at Contractor's option.

F. Install concealed gaskets and joint fillers as the work progresses, so as to make the work soundproof or lightproof as required.

G. Restore protective coverings which have been damaged during shipment or installation of the work. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location.

H. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.

I. Field Welding: Comply with AWS Code for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work.

3.4 CLEANING

A. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.

3.5 PROTECTION

A. Protect finishes of ornamental metal from damage during construction period with temporary protective coverings approved by ornamental metal fabricator. Remove protective covering at the time of Substantial Completion.

B. Restore finishes damaged during construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 06 20 00 CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the carpentry work as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Blocking and miscellaneous wood, including plywood subflooring and wall lining for telephone and electric closets.

2. Rough hardware.

3. Installation only of door hardware.

4. Installation only of doors and hollow metal frames.

5. Temporary controls furnished by Carpentry trades.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Architectural woodwork - Section 064023.

C. Roofing - Section 075565.

D. Steel doors and frames - Section 081113.

E. Wood doors - Section 081416.

F. Door hardware - Section 087100.

1.5 QUALITY ASSURANCE

A. Lumber Standard: Comply with PS 20.

B. Plywood Standard: Comply with PS 1 and American Plywood Assoc. (APA).

C. Shop fabricate carpentry work to the extent feasible and where shop fabrication will result in better workmanship than feasible for on-site fabrication.

D. Grade Marks: Identify lumber and plywood by official grade mark.

1. Lumber: Grade stamp to contain symbol of grading agency certified by Board of Review, American Lumber Standards Committee, mill number or name, grade of lumber, species grouping or combination designation, rules under which graded where applicable, and condition of seasoning at time of manufacture.

a. MC-15 or KD: Maximum of fifteen (15) percent moisture content.

E. Installation of doors, frames and hardware shall conform to the minimum standards of "Installation Guides for Doors and Hardware" of the Door and Hardware Institute.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings
8. Composite & agrifiber products

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Pressure Treatment: Include certification by treating plant stating chemicals and process used, net amount of salts retained and conformance with applicable standards.

C. Fire-Retardant Treatment: Include certification by treating plant that treatment material complies with governing ordinances and that treatment will not bleed through finished surfaces.

1.9 PRODUCT HANDLING

A. Deliver carpentry materials to the site ready to use with each piece of lumber clearly marked as to grade, type and mill, and place in an area protected from the elements.

B. Deliver rough hardware in sealed kegs and/or other containers which shall bear labels as to type and kind.

C. Pile lumber for rough usage, when delivered to the site in stacks to insure drainage and with a minimum clearance of six (6) inches above grade. Cover stacks with tarpaulins or other watertight coverings. Store grounds and similar small sized lumber inside the building as soon as possible after delivery.

D. Do not store seasoned lumber in wet or damp portions of the building.

E. Protect fire retardant treated materials against high humidity and moisture during storage and erection.

F. Remove delivered materials which do not conform to specified grading rules or are otherwise not suitable for installation from the job site and replace with acceptable materials.

G. All items specified in Section 087100 of this specification entitled "Finish Hardware" shall be received, accounted for, stored and applied under this Section.

H. Hardware shall be sorted and stored in space assigned by Contractor and shall be kept at all times under lock and key. The safety and preservation of all items delivered will be the responsibility of the Contractor.

1.10 JOB CONDITIONS

A. Installer must examine the substrates and supporting structure and the conditions under which the carpentry work is to be installed, and notify the Contractor in writing of conditions detrimental to the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer and the Commissioner.

B. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 PRODUCTS

2.1 WOOD MATERIAL

A. General

1. All wood shall be sound, flat, straight, well-seasoned, thoroughly dry and free from all defects. Warped or twisted wood shall not be used.

2. For miscellaneous wood blocking, grounds, furring as required, use Utility Grade Coastal Douglas Fir or Southern Pine, free from knots, shakes, rot or other defects, straight, square

edges and straight grain, air seasoned with maximum moisture content of nineteen (19) percent. Wood shall be S4S, S-Dry, complying with PS-20.

3. Plywood and rough carpentry for telephone and electric closets, provide 3/4" thick C-D EXT-APA plywood, fire retardant treated as specified herein.

B. Wood Treatment

1. All interior wood material specified herein shall be fire retardant treated to comply with the AWPA standard U1 to achieve a flame spread rating of not more than 25 (UL Class "FR- S") when tested in accordance with UL Test 723 or ASTM E 84. The fire retardant chemicals used to treat the lumber must comply with FR-1 of AWPA Standard P49 and be free of halogens, sulfates and ammonium phosphate.

   a. After treatment, kiln dry to a moisture content of fifteen (15) percent; if wood is to be painted or finished, kiln dry to a moisture content of twelve (12) percent. Treatment shall be equal to "Dricon" made by Arch Wood Protection Inc. or approved equal. Provide UL approved identification on treated materials.

2. For exterior blocking, roofing and sheet metal, pressure treat wood with copper azole, Type B (CA-B); ammoniacal copper quat (ACQ) or similar preservative product that contains no arsenic or chromium. Preservative shall comply with AWPA Standard U1, (.25 lbs./cubic foot of chemical in wood).

   a. After treatment, kiln dry to a maximum moisture content of fifteen (15) percent. Treatment shall be equal to "Wolmanized Natural Select" made by Arch Wood Protection Inc. or approved equal.

3. Treated wood which is cut or otherwise damaged shall be further treated in accordance with the AWPA Standard M-4.

2.2 HARDWARE

A. Rough Hardware for Treated Woods and Exterior Use: Hot-dipped galvanized or Type 304 stainless steel.

B. Nails: Common steel wire, untreated for interior work as per ASTM F 1667.

C. Bolts: Standard mild steel, square head machine bolts with square nuts and malleable iron or steel plate washers or carriage bolts with square nuts and cut washers conforming to the following:

1. Bolts: ASTM A 307, Grade A.

2. Nuts: ASTM A 563.

3. Lag Screws and Bolts: ASME B 18.2.1.

D. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2; use stainless steel for treated woods and exterior use.

E. Wood Screws: ASME B 18.6.1.

F. Concrete and Masonry Anchors: Standard expansion-shield self-drilling type concrete anchors where so shown or noted on the drawings, or where approved by the Commissioner.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where carpentry is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION OF DOOR HARDWARE

A. Hardware shall be carefully fitted and securely attached, in accordance with these specifications and the instructions of the various manufacturers.

B. Unless otherwise noted, mount hardware units at heights established in Section 081113.

C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair- line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.

G. All keys used shall be construction keys which are to be tagged with fiber discs as approved, clearly labeled with identifying inscriptions and then neatly arranged in a temporary cabinet. All construction keys shall be returned to The City of New York.

H. Adjusting and Cleaning

1. Adjust and check each operating item of hardware and each door, to ensure proper operation and function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.

2. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make a final check and adjustment of all hardware items in such space or area. Clean and re-lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.4 INSTALLATION OF DOORS AND FRAMES

A. Preparation

1. Remove welded-in shipping spreaders installed at factory.

2. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

3. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

B. Installation

1. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

2. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

   a. Install frames in accordance with ANSI/SDI A250.11, Recommended Erection Instructions for Steel Frames, unless more stringent requirements are specified herein.
   b. At fire-protection-rated openings, install frames according to NFPA 80.
   c. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

d. Install frames with removable glazing stops located on secure side of opening.
e. Frames set in masonry walls shall have door silencers installed in frames before grouting.
f. Remove temporary braces necessary for installation only after frames have been properly set and secured.
g. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

3. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with post-installed expansion anchors.

   a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames conforming to the requirements of Section 072100 "Thermal Insulation."

5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar; refer to Section 042000 "Unit Masonry" for installation of frames in masonry walls.

6. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. In-Place Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

9. Installation Tolerances: Adjust steel door frames for squareness, alignment, twist, and plumb to the tolerance given in HMMA 841 of ANSI/NAAMM, current edition.

10. Steel Doors: Fit hollow metal doors accurately in frames to the tolerances given in HMMA 841 of ANSI/NAAMM, current edition.

    a. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

11. Glazing: Comply with installation requirements in Section 088000 "Glass and Glazing" and with standard steel door and frame manufacturer's written instructions.

    a. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

C. Wood Doors

1. Condition doors to average prevailing humidity in installation area prior to hanging.

2. Install doors in accordance with manufacturer's instructions.

3. Fit door to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

4. Clearances: Install doors to meet clearance requirements specified in Section 081416.

5. Fire-Rated Doors: Install in corresponding fire-rated frames in accordance with the requirements of NFPA No. 80. Provide clearances complying with the limitations of the authority having jurisdiction.

D. Adjustments: Check and readjust operating door hardware items just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.

3.5 BLOCKING AND MISCELLANEOUS WOOD

A. General

1. Erect rough carpentry true to line, levels and dimensions required; squared, aligned, plumbed, and securely fastened in place.

2. Shim where required to true up furring, blocking and the like. Use wood or metal shims only.

3. Do all cutting, fitting, drilling and tapping of other work as required to secure work in place and to perform the work included herein. Do all the cutting and fitting of carpentry work, for the work of other trades as required.

B. Blocking and Miscellaneous Wood

1. Furnish and install all wood grounds, furring, blocking, curbs, bucks, nailers, etc., that may be necessary and required in connection with the carpentry and with the work described for any other trades and including required carpentry for electrical fixtures. All blocking and nailers shall be continuous wherever required, whether or not so indicated.

2. Blocking shall be as required for the proper installation of the finished work and for items in mechanical sections as required. Blocking, edgings, stops, nailing strips, etc., shall be continuous, unless distinctly noted otherwise. Provide blocking as required to install all equipment. Provide blocking and nailers where shown or required to fasten interior sheet metal work.

3. Fastening for wood grounds, furring and blocking shall be of metal and of type and spacing as best suited to conditions. Hardened steel nails, expansion screws, toggle bolts, self-clinching nails, metal plugs, inserts or similar fastenings shall be used, of suitable type and size to draw the members into place and securely hold same.

C. Rough Lumber for Roofing and Sheet Metal

1. Furnish and install all wood nailing strips and wood blocking required in connection with respective types of roofing, fans, flashings, and sheet metal work, using preservative treated wood as herein before specified.

2. Wood blocking shall be of sizes and shapes as indicated on the drawings and/or designed for the reception of curb flashings for roof ventilators and similar items.

3. All nailing strips and blocking shall be carried out in accordance with the printed installation instructions, and/or recommendations of the accepted manufacturer of the roofing materials, and in coordination and cooperation with the sheet metal work trades.

4. All blocking and nailing strips shall be firmly secured in place using counter bored bolt and nut fastenings, or secured by any other proposed flush surfaced fastenings.

5. Wood nailing strips or blocking required to be embedded in concrete work shall be furnished in time due for placing, prior to start of concrete operations. Locations and spacings of nailing strips or blocking shall be performed in coordination with the concrete trades, as required for respective installations.

3.6 TELEPHONE AND ELECTRIC EQUIPMENT MOUNTING BOARDS

A. Furnish and install 3/4" thick plywood panels to the walls of the telephone and electric equipment rooms in accordance with the requirements of the local utility company.

B. Secure to wall using proper devices for substrates encountered, spaced twelve (12) inches o.c., maximum around the edges, 1-1/2" from corners, and in three (3) rows of three (3) each in the field. Recess fastening devices flush with the plywood surface. Adjacent panels shall be butted with 1/16" space between without lapping.

3.7 ROUGH HARDWARE

A. Securely fasten rough carpentry together. Nail, spike, lag screw or bolt as required by conditions encountered in the field and the Contract Documents.

B. Provide rough or framing hardware, such as nails, screws, bolts, anchors, hangers, clips, inserts, miscellaneous fastenings, and similar items of the best quality and of the proper size and kind to adequately secure the work together and in place, in a rigid and substantial manner.

C. Secure rough carpentry to masonry with countersunk bolts in expansion sleeves or other acceptable manner, with fastenings not more than sixteen (16) inches apart. Secure woodwork to hollow masonry with toggle bolts spaced not more than sixteen (16) inches apart.

D. Countersink bolts in nailers and other rough woodwork and include washers and nuts. Cut bolts off flush with surfaces and peen as may be required to receive finished work.

E. Inserts to secure wood nailers to concrete shall be malleable iron threaded inserts with 3/8" diameter bolts of length to allow for countersinking. Locate at end of each nailer and at intervals not exceeding thirty (30) inches o.c.

F. Furnish to the mason for building into the work, or attaching the work which is to be built in, anchors, bolts, wall plates bolted to masonry, corrugated wall plugs, nailing blocks, etc., which are required for the proper fastening and installation for the work or other items as called for in this Section.

G. Detailed instructions with sketches of necessary requirements, shall be given to the masonry trade showing the location and other details of such nailing devices.

3.8 TEMPORARY PROTECTION BY CARPENTER

A. General: Provide temporary protection as follows:

1. Temporary wood doors at exterior entrances and at interior door openings, as required.

2. Temporary protection and enclosures at elevators, stairs, and other shafts, at openings in floor and roof.

3. Temporary elevator cabin and temporary hatchway doors for each floor of elevators used for temporary service.

4. Temporary sills at door thresholds and other openings.

5. Temporary stair handrails continuously from top to bottom of each stair.

B. Stair Protection: Provide wood protection for stairs: cover finished treads. Protect platforms, treads and risers with dressed planking full stair width; hold in place with continuous edge strips. Erect required handrails and railings for closing in open wells and open sides of stairs. Protect railing from damage. Protect door sills and saddles.

C. Openings in Floors and Roofs: Protect openings in floors and roof slabs with adequate wood railings, substantially framed, braced and nailed. Cover openings not required to be kept open with not less than two (2) inches thick planking, cleat together, brace; make sufficiently strong and secure. Protect openings in floors and roofs immediately after forms are removed.

D. Exterior Openings: Provide temporary enclosures for exterior openings where required, properly secured and maintained until finished work is in place. Provide a sufficient number of temporary doors to give access to the building, all provided with hardware, locks and keys.

E. Maintenance: Maintain all temporary protection in good repair during the construction period. Remove when no longer required.

F. Temporary Locks: Provide temporary locks, including keys, for temporary doors. Use of permanent building hardware in connection with temporary doors is prohibited.

3.9 CLEANING UP

A. General: Keep the premises in a neat, safe and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut-ends and debris.

B. Sweeping

1. At the end of each working day, or more often if necessary, thoroughly sweep all surfaces where refuse from this portion of the work has settled.

2. Remove the refuse to the area of the job site set aside for its storage.

3. Upon completion of this portion of the work, thoroughly broom clean all surfaces.

END OF SECTION

SECTION 06 40 23 ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the architectural woodwork as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Wood paneling.
2. Wood facia and moldings.
3. Wood casework and counters with special veneers.
4. Wood casework with plastic laminate finish.
5. Hardware for casework.
6. Wood shelving.
7. Banquette seating.
8. Wood framing and rough lumber as required for work of this Section.
9. Wood grounds, blocking, nailers, furring as required for work of this Section.
10. All rough hardware and fastenings for work of this Section.
11. Drilling concrete and masonry, drilling and/or tapping metal work, as required, for the installation of work of this Section.
12. Back painting as specified herein.
13. Shop finish of work of this Section, except items indicated herein to be shop primed only.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Carpentry - Section 062000.

C. Caulking between architectural woodwork and any wall, floor, or ceiling joints - Section 079200.

D. Wood doors - Section 081416.

E. Field finishing - Section 099000.

1.5 QUALITY STANDARDS

A. The quality standards of the Architectural Woodwork Institute, "Architectural Woodwork Standards," 2nd Edition, dated October 1, 2014, and enhancements 2019 shall apply to all workmanship including materials and installation, for architectural woodwork and by reference are made a part of this specification. All work shall conform to "Premium" grade requirements of the AWI "Architectural Woodwork Standards," unless otherwise modified herein.

B. In the event of a dispute as to the quality grade (or grades), the Contractor shall call upon the Architectural Woodwork Institute for an inspection under AWI's Quality Certification Program which shall include a QCP Inspection and Report. The Contractor agrees to abide by the decision of this Report. The cost of said inspection and report shall be borne by the Contractor.

C. Employ only tradesmen experienced in the fabrication and installation of architectural woodwork.

D. Woodworking firm must be accredited by the AWI Quality Certification Program (QCP).

E. Provide fire test reports by an accredited testing laboratory of all woodwork demonstrating compliance with fire rating classification as required by Code.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmentally Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Adhesives and Sealants
   7. Composite Wood & Agrifiber Products
   8. Furniture & Seating
   9. Paints & Coatings

9. Wall Panels

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Shop Drawings

1. Submit shop drawings of all woodwork specified and indicated on the drawings. Shop drawings shall indicate room plans and elevations at 3/4" equals 1'-0" scale and typical construction details at 3" equals 1'-0" scale. Shop drawings shall indicate all materials, thicknesses and finishes.

2. Shop drawings shall show all hardware, anchors, fastenings and accessories.

3. Shop drawings shall show all jointing, joint treatment and butt jointing in veneers and plastic laminate.

4. Shop drawings for wood paneling must show complete elevations of rooms to receive paneling as well as panel matching required by these specifications.

5. Shop drawings for cabinet work must show centerline height and horizontal location of all required internal wall blocking.

6. Where architectural woodwork deviates from AWI standards noted herein, shop drawings must identify these deviations.

C. Samples: Submit samples of each of the following items:

1. Transparent finish for each species of wood veneer laminated to particleboard, twelve (12) inches square, for each finish specified or shown.

2. Plastic laminate, twelve (12) inches square, including a section of outside corner.

3. Each finish type and perforation type of wood panel, 24” wide x 36” high.

4. Each type and finish of each type of wood trim, molding, etc., eight (8) inches long, finish as specified.

5. Cabinet hardware.

1.9 QUALIFICATIONS

A. The work of this Section shall be provided by a firm having a minimum of five (5) years’ experience on projects of similar size and quality to that specified and shown.

1.10 COORDINATION

A. Coordinate the work of this Section with other appropriate Sections of the specifications to ensure proper scheduling for fabrication and installation of the work specified herein

B. Coordinate with partition and finish trades to ensure that proper provisions are made for the installation of the work specified herein.

C. Verify all dimensions in the field prior to fabrication of all Architectural Woodwork to assure proper fit.

1.11 PRODUCT HANDLING

A. All materials and work of this Section shall be protected from damage, from time of shipment from shop to final acceptance of work. Cover, ventilate, and protect work of this Section from damage caused by weather, moisture, heat, staining, dirt, abrasions, any other causes which may adversely affect appearance or use, or which may cause deterioration of finish, warping, distortion, twisting, opening of joints and seams, delamination, loosening, etc., of work of this Section.

B. Keep all finish carpentry, millwork, and cabinet work under cover both in transit and at the premises. Do not deliver any finish carpentry, millwork or cabinet work before it is required for installation. Protect such work to avoid damage in transit, during erection and after erection until acceptance of the building; use all such methods to provide the proper protection. Remove such protection when directed by the Commissioner.

C. Deliver finish carpentry, millwork, and cabinet work in a dry stable condition; protect same against injury and dampness. Do not store or install finish carpentry, millwork or cabinet work until after the concrete, masonry and plaster work are thoroughly dry.

D. Damaged or defective items of work of this Section are subject to rejection and replacement with new by Contractor, at no cost to The City of New York.

1.12 JOB CONDITIONS

A. Humidity Controls: The ambient relative humidity at the site, including both the storage and the installation areas, shall be maintained between 25% and 55% prior to delivery and through the life of the installation.

B. Determine equilibrium moisture content and maintain required temperature and relative humidity as required for a tolerance of plus or minus one (1) percent of the specified optimum moisture content until woodwork receives specified finishes. Refer to “Guide to Wood Species Selection,” AWI, for method of determining equilibrium moisture content values.

C. Examination of Substrate and Conditions: The installer must examine the substrate and the conditions under which the work of this Section is to be performed, and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with work under this Section until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

D. Areas to receive architectural woodwork must be fully enclosed with windows and/or curtain wall installed and glazed, exterior door in place, HVAC systems operational and temporary openings closed. Any plaster, wet grinding and concrete work shall be fully dry.

E. Architectural woodwork shall be allowed to come to equilibrium on site for 7 days prior to installation.

PART 2 PRODUCTS

2.1 BASIC REQUIREMENTS

A. Wood Moisture Content: Provide kiln-dried (KD) lumber with an average moisture content range of six (6) to eleven (11) percent for interior work.

B. Measurements: Before proceeding with woodwork required to be fitted to other construction, obtain field measurements and verify all dimensions of shop drawing details as required for accurate fit.

C. Compatibility of Grain and Color: Commissioner reserves the right to select materials for best compatibility between visually related members and veneers.

D. Machine and sand woodwork to comply with requirements of Standards for specified grade.

E. Fabricate woodwork to dimensions, profiles and details shown. Rout or groove back of flat trim members, kerf backs of other wide flat members except plywood or veneered members.

F. Miter joints by joining, splining and gluing to comply with requirements for the specified grade.

G. Inspect each piece of lumber and plywood or each unit of woodwork after drying; do not use twisted, warped, bowed of otherwise damaged or defective wood.

2.2 GENERAL – MATERIALS

A. Softwood lumber shall conform to the requirements of the latest edition of American Lumber Standards Simplified Practice Recommendation R-16. Grades shall conform to the grading rules of the Association having jurisdiction, and shall bear the official grade and trademark of the Inspection Bureau of the Association and a mark of mill identification.

B. Framing and Rough Lumber: No. 1 KD grade Southern Pine or Dense Construction grade Douglas Fir, having extreme fiber in bending stress of at least 1700 psi, surfaced four sides (S4S). Provide fire retardant treatment meeting requirements of Section 062000.

C. Grounds, Blocking, Nailers, Furring: Southern Pine, Douglas Fir or Sitka Spruce, grade to suit particular purpose and to be straight, square edged, straight grained, surfaced four sides (S4S), and which will retain nails and screws without splitting. Provide fire retardant treatment.

D. Wood Veneers and Lumber: Provide AWI Premium Grade materials and workmanship. For species not listed in the AWS comply with the following:

1. Provide AWS Lumber Grade Premium and AWS Grade AA Veneer, book-matched, minimum 6 inch face veneer width. Kiln dry to 6-8 percent moisture content. Components shall be free of defects and sapwood. Match adjacent pieces for color and grain pattern.

2. Single-Source Requirement for Wood Veneers and Solids: Intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and solids

from the same distributor, and from the same flitches and solids sources to the greatest extent possible.

E. Lumber: AWI Section 3 with the following requirements:

1. Hardwood for Transparent Finish: WD1 – 40 Satin Finish. Refer to the finish schedule on the drawings.

F. Plywood: AWI Section 4; Veneer core, particleboard, or plywood core unless otherwise specified, and with the following requirements:

1. Hardwood: Premium Grade, face veneers as shown or specified

2. Particleboard: Premium Grade, fire retardant for wall paneling only equal to Duraflake FR and Duraflake for cabinets. In addition, particleboard and MDF shall be certified to the following EPP CPA 3-08 formaldehyde emission limits:

   a. Particleboard meets 0.18 ppm.
   b. MDF meets 0.21 ppm.

3. Edges: Banded with hardwood in accordance with Premium Grade Standards.

G. Veneer Matching Requirements:

1. Matching Between Adjacent Veneer Leaves: Slip match and end match.

2. Matching Within Individual Panel Faces: Balance and Center Match.

3. Method of Matching Panels: Blueprint-matched panels and components

H. Finishing (Wood)

1. Transparent Finish for Paneling, Casework and Trim

   a. AWI Factory Finish System “Conversion Varnish”, System 5, Transparent.
   b. AWI Premium Grade.
   c. Stain: refer to the finish schedule on the drawings.
   d. Degree of Sheen: refer to the finish schedule on the drawings.

2.3 PLASTIC LAMINATE

A. Face Sheets: NEMA Publication LD3, Grade GP50, Type I, 0.05" thick, as manufactured by Formica, Nevamar, Wilson-Art. Color, pattern and finish as selected by the Architect.

B. Backing Sheets: Non-decorative, high-pressure plastic laminate, NEMA LD3, Grade BK20, 0.02" thick.

C. Edges: Finish with plastic laminate to match face and applied before face sheets are applied, unless otherwise shown or specified.

2.4 MISCELLANEOUS PRODUCTS

A. Fasteners

1. Wood Screws: FS FF-S-111, type, size, material and finish as required for the condition of use.

2. Nails: FS FF-N-105, type, size, material and finish as required for the condition of use.

3. Anchors: Type, size, material and finish as required for the condition of use.

4. Staples: Upholstery type staples of sufficient strength to hold fabric taut in place without sagging.

B. Adhesives

1. For Laminating Plastic Laminate Surfaces: Urea resin, Type II, as recommended by fabricator.

2. For All Other Uses: polyvinyl acetate resin emulsion or other type as recommended by the fabricator.

2.5 CABINETS WITH PLASTIC LAMINATE FINISH

A. General

1. Fabricate all cabinetry and millwork to the "Premium Grade" standards of the AWI, Section 10.

2. Face construction of cabinets shall be "Flush Overlay."

3. Provide 3/4" thick doors, drawer fronts and fixed panels (including thickness of plastic) except where required to be thicker by Standards; and provide flush units.

4. Provide dust panels of 1/4" thick plywood or tempered hardboard above compartments and drawers, except where located directly below countertops.

5. Exposed Edges: Plastic laminate matching exposed panel surfaces. Ease exposed edge of overlap sheet.

B. Plastic Laminate

1. Plastic Laminate for Horizontal Surfaces: 0.050" thick, general purpose type (high pressure).

2. Plastic Laminate for External Vertical Surfaces: 0.028" thick, general purpose type (high pressure).

3. Plastic Laminate for Post Forming: 0.042" thick, post forming (high pressure).

4. Plastic Laminate for Cabinet Linings: 0.020" thick, cabinet liner (high pressure).

5. Plastic Laminate for Concealed Panel Backing: 0.020" thick, backer type (high pressure).

6. Plastic Laminate Colors and Patterns: As selected by the Architect from manufacturer’s standard satin finish products. Acceptable Manufacturers: Wilson-Art, Nevamar, Formica, or Approved Equal.

C. Shop Assembly: All work shall be shop assembled. Work that is too large for entrance into the use area shall be fabricated in attachable sections with provisions for reconnection in the using space.

D. Material Thicknesses: See drawings for general materials thicknesses. Minimum thickness of solid lumber for web frames, trim, bases, etc., shall be 3/4". Minimum thickness of plywood and particleboard shall be 3/4".

E. Sizes: See drawings for woodwork sizes required. The manufacturer shall check field dimensions and verify all openings and actual field conditions prior to fabrication of work.

F. Manufacturer is responsible for rigidity and structural stability.

2.6 BUILT-IN CABINETS, WOODWORK WITH WOOD VENEER FINISH

A. Construction: Details of cabinet and wood work construction shall conform to design as detailed on the drawings and shall be constructed in accordance with AWI Section 10, Premium Grade.

B. Finishing: All work shall be factory pre-finished. No field finishing will be permitted, except minor retouching that is necessary after installation to leave work in perfect condition. Field touch-up shall be accomplished using the same finishes as originally applied at the factory. All finishes shall be free from runs, sags and other visual defects. All wood shall be thoroughly hand smoothed and hand sanded to remove all traces of machine and tool marks. All steel or other metal components shall be deburred, thoroughly cleaned and degreased prior to finishing. Requirements for surface preparation shall be in accordance with AWI Standards specified. Surfaces shall be finished as follows:

1. Wood Species and Cut for Exposed Surfaces: As specified hereinabove.

    a. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
    b. Matching of Veneer Leaves: Slip match.
    c. Vertical Matching of Veneer Leaves: End match.
    d. Veneer Matching within Panel Face: Balance match.
    e. Veneer Matching within Room: Provide casework veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

2. Semiexposed Surfaces: Provide surface materials indicated below:

    a. Surfaces Other Than Drawer Bodies: Compatible species to that indicated for exposed surfaces, stained to match.
    b. Drawer Sides and Backs: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
    c. Drawer Bottoms: Hardwood plywood.

3. All wood veneer surfaces shall be given transparent finish as specified herein.

4. Backing Veneer: Provide backing veneer, of same thickness and strength as face veneer for balanced construction, where plywood surface not exposed, not semi-exposed, or not to be finished. Note that interior surface of cabinets, closets, are to be finished.

C. Edge Banding: All visible edges of case and body members fabricated from plywood shall be banded. Transparent finished wood veneer panels shall be banded with wood species to match face veneers.

2.7 CABINET HARDWARE

A. Architectural Woodwork Hardware: Provide the following items, or their approved equal, as required:

1. Hinges: Hafele concealed hinges.

2. Catches: Magnetic; top and bottom.

3. Pulls: Selected by the Commissioner.

4. Locks: Directed by the Commissioner.

5. Drawer Slides (24" maximum width): Accuride, Model 7434, full extension, 100 lb. capacity, or Approved Equal.

a. Drawer Slides (16" maximum width) Easy Close: Accuride Model 3832C, full extension, 100 lb. capacity, or Approved Equal.

6. Shelf Supports: Pin and grommet system equal to No. 282.01.701 pin and 282.50.704 grommet made by Hafele.

7. Finish: Satin Stainless Steel.

8. Closet Hardware: Oval wardrobe rails, chrome plated steel with center bracket and wall support brackets made by Hafele or approved equal.

2.8 WOOD FOR TRIM AND MOLDINGS

A. Quality Standard: For the following types of interior architectural woodwork, comply with indicated standards as applicable.

1. Standing and Running Trim: AWI Section 6.

2. Miscellaneous Millwork: AWI Section 6.

B. Wood Work for Transparent Finish: Except as otherwise indicated, comply with the following:

1. Grade: Premium.

2. Species of Solid Wood: Quarter Sawn Species as noted on drawings.

2.9 HARDWOOD VENEERED PLYWOOD PANELS

A. Type: Interior grade, hot press laminated with waterproof adhesive, pre-finished, with face veneers and core construction as specified herein, meet AWI Section 8 standards.

B. Core Construction: Shall be fire retardant treated, meeting requirements of Section 062000; type at fabricator's option.

1. Where the core is free of urea formaldehyde, provide a layer of veneer over the substrate prior to application of finish veneer to prevent telegraphing of patterns of the adhesive.

C. Thickness: 3/4" thick.

D. Face Veneers: refer to the finish schedule on the drawings.

E. Finish: Veneers shall be finely sanded and clear factory pre-finished using AWI System noted herein.

F. Panel Sizes: See drawings for panel sizes required.

G. Exposed edges of panels shall be solid sections matching face veneer.

H. Where wood doors are set in veneered wood paneling, veneer on door shall be sequenced to fit veneer pattern; doors to meet the requirements of Section 081416.

2.10 BANQUETTE SEATING

A. Frames: Constructed of selected kiln-dried hardwood of 1/4 stock surfaced two sides and ¾" thick plywood as specified herein, which are doweled, glued, nailed and screws. All joints shall be reinforced with glue-blocks and all oak wood upright members shall be placed on approximately 18" center lines. Bases recessed.

B. Seats: Seat cushion to be of thickness indicated on drawings, polyurethane foam rubber and dacron filled. Upholstery details are tuck and welted on all cushions. All upholstered seats shall be set over 3/4" plywood panel which is screw mounted to frame. Tops of cushions extend above padded frame capping.

C. Medium- and High-Density Foam: Thickness and density as indicated, 40 lb. compression foam plus dacron. All foam in seats and back shall be encapsulated with "Therma Block" wrapping made by DuPont, type as required by upholstery conditions encountered.

D. Fabric/ Upholstery at Banquette Seating: As scheduled.

2.11 FABRICATION - GENERAL

A. Provide lumber framing for architectural woodwork, complete with all bracing and fastening devices as required for a rigid installation, and as required to sustain the imposed loads.

B. Do all fabrication from field measurement with provision for scribing as required to meet built-in conditions.

C. Coordinate the work of this Section with the work of other trades.

D. Fabricate units in largest practicable sections. Assemble in the shop for trial fit, disassemble for shipment and reassemble with concealed fasteners.

E. Maintain relative humidity and temperature during fabrication, storage and finishing operations matching that of the areas of installation.

F. Details indicate the required type and quality of construction. Modifications to conform to manufacturer's standards will be considered providing they comply with the Contract Documents, maintain the profiles shown and subject to acceptance by the Commissioner.

G. Reinforcing shown is minimum. Provide additional reinforcing as required to ensure a rigid assembly. Exposed surfaces shall be free from dents, tool marks, warpage, buckle, glue and open joints, or other defects affecting serviceability or appearance. Accurately fit all joints, corners and miters. Conceal all fasteners. Make threaded connections up tight so that threads are entirely concealed.

H. Factory finish all items where possible. Defer final touch-up, cleaning and polishing until after delivery and installation.

I. Comply with AWI, Premium Grade standards for sanding, filling countersunk fasteners, back priming and similar preparations for the finishing of architectural woodwork, as applicable to each unit of work.

J. Prepare all countersunk wood screw attachments for wood plugs. Wood plugs shall match surrounding species and grain direction; putty filling is not acceptable.

2.12 FABRICATION - SPECIFIC ITEMS

A. Casework

1. Include all preparations for mechanical, electrical, telephone and plumbing work required.

2. Provide cabinet hardware for casework as shown.

3. Provide dust panels and filler panels in body webs and between drawer units.

4. Provide wood veneers for exposed surfaces as specified herein before.

5. Hollow core doors will not be permitted.

6. Provide matching veneers for edge treatments of case body members where transparent finishes are indicated or specified.

7. Provide drawers with slides as specified. Drawers shall not rest on web body frames.

8. Provide wood veneers for transparent finish, of matching and continuing grain, for drawer and door edges.

B. Paneling

1. General Paneling Requirements

a. Panel type shall be AWI, Premium Grade construction.
b. Panel joints shall be flush type unless otherwise shown.
c. Provide concealed wood blocking and framing, anchors, clips, splines, supporting and attaching devices.
d. Provide cut-outs to receive attachments, mechanical and electrical work as required.

2. Wood Veneer Paneling

a. Comply with AWI Section 8.
b. Provide veneers as specified and as shown, including all matching requirements. Run veneer in the direction shown.

C. Closet and Storage Shelving

1. Provide closet and storage shelving in accordance with AWI Section 600, Custom Grade, unless otherwise shown or specified.

2. Exposed edges shall have hardwood edge bands.

D. Standing and Running Trim: Provide standing and running trim of the sizes, profiles, species and finish as specified or shown and complying with AWI Section 6, Premium Grade.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where architectural woodwork is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 FRAMING

A. Use specified framing lumber, sizes and spacing as indicated on drawings and as required to support loads.

B. Framing shall be cut square on bearings, closely fitted, accurately set to required lines and levels, rigidly secured in place at bearings and connection with nails, lag screws and/or bolts as required by conditions.

3.4 GROUNDS, BLOCKING, NAILERS AND FURRING

A. Provide all wood grounds, blocking, nailers, furring, and the like for work of this Section, where shown and where required, dressed to size indicated or required to suit the condition. Install grounds, blocking, nailers, furring, etc., rigidly, in proper alignment, trued with a long straight edge.

3.5 ROUGH HARDWARE

A. Provide all rough hardware, such as nails, screws, bolts, anchors, hangers, clips and similar items. Hardware shall be of the proper size and kind to adequately secure the work together and in place, in a rigid and substantial manner. Use galvanized hardware at exterior walls, and at other locations where subject to moisture or where water will be present.

B. Secure wood to concrete and to solid masonry with countersunk bolts in expansion sleeves or other approved manner, to steel with countersunk bolts, to hollow masonry and to drywall with heavy duty countersunk toggle bolts. Space fastenings not more than sixteen (16) inches apart.

Hardened cut nails, power-driven fastenings, or other suitable devices may be used where approved by the Commissioner.

C. Connections and fastenings shall be made in such manner as will compensate for swelling and shrinkage and shall permit the work to remain permanently in place without any splitting or opening of joints.

3.6 INSTALLATION OF CABINET FINISH HARDWARE

A. All items of finish hardware furnished under this Section shall be carefully fitted and secured in place as part of the work of this Section. Locations and positioning of hardware shall be subject to the Commissioner's approval. Care shall be taken not to mar or damage hardware, or other work. Install doors plumb and true. Hardware shall be fitted to assure operation without forcing.

B. After preliminary fitting of hardware, the Contractor shall remove trim for painting and finishing work; after which he shall reinstall the hardware in a permanent manner.

C. Upon completion of the work, before final acceptance of the building by The City of New York, the Contractor shall, in the presence of the Commissioner, show that all hardware is in satisfactory working order; fit all keys in their respective locks and, upon acceptance of the work, shall tag and deliver all keys to the Commissioner and The City of New York.

D. When directed by The City of New York, at any time during the first year after the completion of the Contract, the Contractor shall return to the building and adjust and refit the work and hardware, and leave such items in satisfactory working order.

3.7 GENERAL INSTALLATION

A. Wall anchorage and general installation procedures for cabinetry work shall conform to AWI Section 10, Article entitled "EXECUTION", Sub-Article 6.1 with all related sub-paragraphs.

B. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including countertops), and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offset in revealed adjoining surfaces.

C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

3.8 TRIM, MOLDINGS, ETC.

A. Install with minimum number of joints possible, using full-length pieces for each run. Stagger joints in adjacent and related members. Cope at returns, miter corner.

B. Joints of all trim and/or moldings shall be set tight, miter exterior angles and cope interior angles. Joints, except end joints less than twelve (12) feet apart, will not be permitted in straight runs of trim and/or moldings and rails.

C. Secure all trim and/or moldings with glue and blind nail with finishing nails. Set exposed nail heads in finished work and putty. Sand all work to remove any tool marks and irregularities.

D. Wood shall receive finish as specified in Section 099000 - Painting.

3.9 WOOD RAILS

A. Wood shall be planed straight, square and level, then sanded smooth with flush finished surfaces. Joints shall occur over supports. Right angle joints shall be mitered.

B. All exposed fastening devices shall be countersunk and set below finished wood surfaces, and fitted with matching wood plugs; sand plugs and finish smooth and flush with exposed surfaces.

C. Handrails shall be capable of withstanding a force of two hundred (200) lbs. applied to rail at any point from any direction.

D. Provide all hardware and metal supports required for complete installation as detailed on drawings.

3.10 VENEERED WOOD PANELS

A. Provide a system of concealed panel hanger clips, shims and corresponding wall clips to support the panel system. Face nailing shall not be permitted.

B. Hang the panels in the designated locations. Panels shall be straight, level, flat and flush with adjoining panels.

C. Where reveals are indicated, keep panels spaced so that reveals are parallel and of widths shown.

3.11 CLOSET AND STORAGE SHELVING

A. Provide closet and storage shelving at the locations shown. Provide hang rods where shown. Set adjustable center hangers.

3.12 CABINET WORK AND MILLWORK

A. General

1. Materials and workmanship shall conform to the Quality Standards of the Architectural Woodwork Institute specified herein and to the drawings.

2. Cabinet work and millwork shall be performed by experienced cabinet work and millwork company, having craftsmen skilled in their trade.

3. Fabricate all cabinet work and millwork completely in the shop, in complete and/or as large units as practical, leaving only fitting, assembly, installation and a minimum of fabrication and finishing to be done at the building. Assembled work shall be rigidly secured and permanently fastened together with concealed fasteners.

4. Afford Commissioner every facility for inspection of work at shop or mill at such times as the Commissioner may select.

5. As far as practicable, use concealed fastenings for joining and assembling the work. Where this is impossible, the means of securing shall be placed in inconspicuous places and methods of joining and assembling submitted for Commissioner's approval prior to fabrication.

6. Mill all finish wood accurately to detail, with clean cut moldings, profiles and lines, machined, sanded smooth, housed, jointed, blocked, put together in the best manner, with provision for swelling and shrinkage, and to assure the work remaining in place without warping, splitting or opening of joints.

7. Cut trim to dimensions and profiles shown, from solid stock.

8. Make all trim and the like in single lengths wherever possible; joints mitered, glued and splined. Continuous members shall have tight flush joints, doweled or splined and glued.

9. Make all joints hairline tight, fitted accurately and joined with hardwood splines or dowels, glued together, or by other method approved by Commissioner. Use screws, not nails, for fastenings.

10. Gluing shall, where practicable, be by the hot plate press method and glued surfaces shall be in close contact throughout. Glue stains on finished work will not be permitted.

11. Cover surface fastenings, where permitted, with matching wood plugs or wood putty. Finish exposed edges of plywood with matching solid stock. Lock miter external corners; tongue and groove internal corners to allow for contraction and expansion.

12. Machine sand with grain, finish with hand sanding, leave exposed surfaces free from machine or tool marks that will show through the finish.

13. Work which adjoins drywall, concrete, or other finish shall be fitted and scribed in a careful manner and ample allowance shall be given for cutting and scribing.

14. Erect work true to lines, levels and dimensions, square, aligned and plumb, securely and rigidly fastened in place.

B. Cabinet Work: Provide all items of cabinet work indicated on drawings and as herein specified.

1. Tops, sides, backs, bottoms, filler panels, dividers, shelves, fronts, doors and drawer fronts shall be of plywood or flakeboard core, with the specified wood veneer or plastic laminate as indicated on drawings.

2. Drawer sides and backs shall be 1/2" thick solid clear selected white birch, suitable for clear finish. Drawer bottom shall be 3/8" thick plywood with clear selected white birch veneers, suitable for clear finish.

3. Cabinet doors and drawers shall be flush mounted.

4. Adjustable shelves in cabinets shall have grommets spaced 2" o.c.

5. Fixed shelves shall be dadoed into side supports and glued.

6. Shelves shall be 3/4" thick for spans up to 30"; for spans in excess of 30" to 48" shelves shall be 1" thick.

7. All cabinets shall have closed top, sides, bottom, and back with veneers to match face work. Cabinets to fit accurately into indicated locations; scribe moldings permitted only where indicated.

8. Countertops, counters, counter fronts, shelves, etc., indicated on drawings to have plastic laminate, shall have plastic laminate shop applied to 3/4" thick core, with plastic laminate backing sheet on underside or back of countertops, counters and shelves. Plastic laminate shall be pressure laminated to core with laminate at external corners. Provide concealed wood framing to support plastic laminate counters, securely fastened to wall and to underside of counters.

C. Countertops shall be installed to support a minimum concentrated live load of 150 lbs. acting downward at mid span at outer edge of counter without causing deformation and damage.

3.13 WOOD BASES

A. Provide plywood backing, toggle bolted to substrate, if substrate not suitable for securing wood base.

B. Machine wood bases from specified wood, to profiles indicated on drawings.

C. Set base level and plumb. Where indicated on drawings, face of wood base shall be flush with wall above. Glue wood base to substrate or to plywood backing, and screw or nail wood base to substrate or to plywood backing with countersunk wood screws or with finishing nails, recess wood screw heads, and spackle with wood putty, set and spackle nails with wood putty. Do not nail or fasten wood base to floor. Ends of wood base shall be either splined or ship lapped.

D. Where no wood backing occurs, screw apply base at each stud with screw countersunk and wood putty applied and sanded smooth and flush with base.

3.14 WOOD DOOR FRAMES

A. Where indicated on drawings, provide wood frames and bucks for wood doors. Bucks shall be braced, set straight and plumb and have anchors for building into adjoining construction; space anchors not over two (2) feet apart (one foot from corners). Machine wood frames from specified solid wood to profiles indicated on drawings. Set frames plumb, level, square; securely attached to adjoining construction. Wood frames, bucks and trim shall conform to details.

3.15 PAINTING AND FINISHING

A. General: All painting and finishing work of this Section shall be shop applied, unless otherwise noted, as specified below. All painting and finishing shall match approved samples. Field finish painting, where specified below, shall be by painting Subcontractor, as specified for in Painting Section.

B. Schedule of Painting and Finishing

1. Shop Primer On:

a. Wood bases.
b. Wood trim and moldings to be field finish painted.

c. Ferrous metal work.

2. Shop Natural Finish On:

a. Wood paneling.
b. Wood cabinets with wood veneers.

C. Back-Painting: All work of this Section in contact with concrete or masonry or other moisture areas and all concealed surfaces of cabinet and millwork, shall be back-painted with one (1) coat of oil based paint prior to installation, shop applied where practicable.

D. Field Touch-Up: Field touch-up shall be the responsibility of the installing Subcontractor, and shall include the filling and touch-up of exposed job made nail or screw holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and mars, and final cleaning up of the finished surfaces.

3.16 CLEAN UP AND PROTECTION

A. Clean Up: At regular intervals during the course of the work, all debris and excess material shall be cleaned up and removed from the site. Upon completion of installation, clean all spaces of debris caused by woodwork installation.

B. Protection: Protect all woodwork from marring, defacement of other damage until final completion and acceptance of the project by The City of New York. Repair or replace all defective units prior to final inspection as directed by the Commissioner. Any units that cannot be satisfactorily repaired in the opinion of the Commissioner shall be replaced with new units of same original design, at no additional cost to The City of New York.

END OF SECTION

SECTION 07 21 00 THERMAL INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete Thermal insulation as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Board Insulation.
2. Vapor Retarder.
3. Attachment devices.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Masonry - Section 042000.

C. Roof insulation - Section 075565.

D. Firestops and smokeseals - Section 078413.

E. Acoustical insulation - Section 092900.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
1. Environmental Product Declarations (EPDs)

2. New York City's Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Insulation
8. Paints & Coatings

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Submit product data for each type of product indicated, including re-cycled content.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

1.8 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Vertical and Lateral Fire Propagation Test Characteristics: The exterior wall assembly is required to comply with NFPA 285 "Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components." The base wall, stud cavity insulation, wall sheathing, air barrier, continuous wall rigid insulation and exterior cladding are components that are required to be to be evaluated as part of this specific assembly test. The basis of design product listed below is a component of the design test assembly selected by the Commissioner.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 PRODUCTS

2.1 MINERAL-WOOL BOARD INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Owens Corning Thermafiber.

2. Rockwool International.

3. JM Insulshield.

4. Delta Rockwool.

5. Approved equal.

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

C. Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Nominal density of 8 lb/cu. ft., Type III, thermal resistivity of 4.35 deg F x h x sq. ft./Btu x in. at 75 deg F.

2. Fiber Color: Darkened, where indicated.

2.2 VAPOR RETARDER

A. Install per manufacturer's recommendations for steel framing. Tape vapor retarder about all back-boxes, openings, and structural framing.

B. Polyamide Smart Membrane Film Vapor Retarder: Provide "MemBrain" by CertainTeed or approved equal, with maximum permeance rating of 0.1 perm (57 ng/Pa x s x sq. m) and with flame-spread and smoke-developed indexes of not more than 20 and 55, respectively, per ASTM E 84.

C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where thermal insulation is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION, GENERAL

A. Clean substrates of substances that are harmful to insulation including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

B. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

C. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

D. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF SEMI-RIGID INSULATION FOR FRAMED CONSTRUCTION

A. Install wall insulation with edges closely butted, with joints square, straight and in alignment (no staggered), and with vapor barrier facing on warm side of building, and with exposed faces flush and in the same plane without warp or twist. Cut and fit insulation to closely fit intersecting or penetrating surfaces. Seal joints between insulation, between insulation and intersecting or penetrating surfaces and between insulation and perimeter surfaces with 4" wide vaporproof aluminum tape applied on the vapor barrier side. Insulation shall be friction fit between furring channels or studs.

3.5 INSTALLATION OF VAPOR RETARDER

A. Place vapor retarder on side of construction indicated on Drawings. Extend vapor retarder to extremities of areas to protect from vapor transmission. Secure vapor retarder in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarder over framing by lapping no fewer than two studs. Comply with manufacturer’s instructions for installation to steel framing.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarder with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

D. Repair tears or punctures in vapor retarder immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 27 00 - VAPOR PERMEABLE AIR BARRIER LIQUID MEMBRANE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. The Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the vapor permeable air barrier liquid membrane as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Vapor permeable/air barrier applied to masonry.

2. Materials and installation to bridge and seal the following air leakage pathways and gaps:

a. Seismic and expansion joints.
b. Piping, conduit, duct and similar penetrations.
c. All other air leakage pathways in the building envelope.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Thermal Insulation – Section 072100.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Provide evidence to the Commissioner of licensing and certification under the Air Barrier Association of America's (ABAA's) Quality Assurance Program

C. Submit shop drawings showing locations and extent of air barrier and details of all typical conditions, intersections with other envelope systems and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated and how miscellaneous penetrations such as conduits, pipes electric boxes and the like are sealed.

D. Submit manufacturer's product data sheets for each type of membrane, including manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.

E. Submit manufacturer's data showing solids content of fluid applied membranes and coverage rates and wet film thickness upon application in order to achieve minimum dry film thickness required by this specification.

F. Submit manufacturer's installation instructions.

G. Submit certification by air barrier manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

H. Submit certification of compatibility by air barrier manufacturer, listing all materials on the project that it connects to or that come in contact with it.

I. Submit samples, 3 by 4 inch minimum size, of each air barrier material required for Project.

J. Test results of air permeability testing of primary air barrier material (ASTM E 2178-01)

K. Test results of assembly in accordance with ASTM E 2357.

L. Proof that the air barrier is part of an NFPA 285 approved wall assembly

1.8 PERFORMANCE REQUIREMENTS

A. Provide air barrier constructed to perform as a continuous air barrier, and as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration. Membrane shall accommodate movements of building materials by providing

expansion and control joints as required, with accessory air seal materials at such locations, changes in substrate and perimeter conditions.

B. Provide an air barrier assembly that has been tested in accordance with the Air Barrier Association of America's (ABAA's) approved testing protocol to provide air leakage results not to exceed:

1. 0.01 cfm/sf @ 1.57 psf as per ASTM E2357

C. NFPA 285 Compliance

1.9 QUALITY ASSURANCE

A. Installer Qualifications:

1. The air barrier contractor shall be, during the bidding period as well as for the duration of the installation, officially recognized as a Licensed Contractor by the Air Barrier Association of America (ABAA). The contractor shall carry liability insurance and bonding.

2. Each worker who is installing air barriers must be either a Certified Applicator or an installer who is registered with ABAA.

3. Each Lead Certified Applicator can supervise a maximum of five registered installers. The Certified Applicator shall be thoroughly trained and experienced in the installation of air barriers of the types being applied. Lead Certified Applicators shall perform or directly supervise all air barrier work on the project.

B. Single-Source Responsibility: Obtain air barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

D. Field-Constructed Mock-Ups: Prior to installation of air barrier, apply air barrier as follows to verify details under shop drawing submittals and to demonstrate tie-ins with adjoining construction, and other termination conditions, as well as qualities of materials and execution:

1. Construct typical exterior wall panel, 8 feet long by 8 feet wide (one of CMU and one of sheathed areas, incorporating back-up wall, cladding, window and doorframe and sill, insulation, flashing, building corner condition, and typical penetrations and gaps; illustrating materials interface and seals.

E. Test mock-up in accordance with ASTM E 783 and ASTM E1105 for air and water infiltration.

F. Manufacturer shall be on-site at least once a week to observe installation and provide written report within 3 days.

G. Manufacturer shall confirm all termination details and compatibility with materials being terminated to.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer. Protect stored materials from direct sunlight.

C. Avoid spillage. Immediately notify The City of New York, Commissioner if spillage occurs and start clean up procedures.

D. Clean spills and leave area as it was prior to spill.

1.11 WARRANTY

A. System Warranty: Provide the manufacturer's five (5) year material warranty, including the primary air barrier and installed accessory sealant and membrane materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fluid-Applied Membrane: Henry Air-Bloc 17MR Vapor Permeable Fluid-Applied Membrane or W.R. Grace Perm-A-Barrier VP or approved equal. Trade names used herein are those of the Henry Company

B. Transition Membrane: Blueskin SA or Blueskin VP 160

C. Liquid Applied Flashing: Henry Air-Bloc LF

D. Primer: Blueskin LVC Adhesive.

E. Sealant: Henry HE 925 BES Sealant.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where the above grade waterproof membrane is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected to permit proper installation of the work.

3.3 SURFACE PREPARATION

A. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants.

B. Cracks in masonry and concrete up to 1/2" wide shall be filled with a trowel application of Liquid Applied Flashing or Sealant and allowed to skin over prior to application of the fluid-applied membrane to the surface. Alternatively, the cracks may be sealed with a strip of Transition Membrane applied to the substrate.

C. Surfaces should be tied in with beams, columns, etc. using strips of Transition Membrane lapped a minimum of 3" on both substrates.

3.4 TRANSITION MEMBRANE

A. Align and position self-adhering transition membrane, remove protective film and roll firmly into place with heavy roller. Ensure minimum 2" overlap at all ends and side laps.

B. Promptly roll all laps and membrane with a counter top roller to effect seal.

C. Ensure all preparatory work is complete prior to applying Liquid Applied Membrane

3.5 FLUID-APPLIED MEMBRANE APPLICATION

A. Apply fluid-applied membrane to wall substrates in a continuous coat at manufacturer's recommended rate by spray or trowel to provide a minimum wet film thickness of 0.090" (90 mils) for rough surfaces like CMU and 0.070" (70 mils) for smooth sheathing.

1. Minimum dry film thickness shall be 0.048" (48 mils) on CMU and 0.037" (37 mils) on smooth sheathing.

B. Overlap liquid membrane on to transition membrane at connections a minimum of 1".

C. Apply fluid-applied membrane around masonry ties to ensure a complete seal.

D. Do not leave membrane exposed for any longer than 180 days.

E. Penetrations: Seal all penetrations with Liquid Applied Flashing or Sealant or other procedures in accordance with manufacturer's instructions.

3.6 PROTECTING AND CLEANING

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Protect air barrier from exposure to the elements as required by the manufacturer.

D. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work using procedures as recommended by manufacturer.

1. Schedule work to ensure that the air and vapor barrier system is covered as soon as possible after installation. Protect air and vapor barrier system from damage during subsequent operations. If the air and vapor barrier system cannot be permanently covered within 180 days after installation, apply temporary UV protection.

3.7 FIELD QUALITY CONTROL

A. Air Barrier Association of America Installer Audits: Cooperate with ABAA's testing agency. Allow access to work areas and staging. Notify ABAA in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Do not cover Work of this Section until testing and inspection is accepted. Arrange and pay for site inspections by ABAA to verify

conformance with the material Manufacturer's instructions, the site Quality Assurance Program used by ABAA, and this section of the project specification.

1. Audits and subsequent testing shall be carried out at the following rate:

    a. Up to 10,000 ft^2 of air barrier contract requires one (1) audit.
    b. 10,001 – 35,000 ft^2 of air barrier contract requires two (2) audits.
    c. 35,001 – 75,000 ft^2 of air barrier contract requires three (3) audits.
    d. 75,001 - 125,000 ft^2 of air barrier contract requires four (4) audits.
    e. 125,001 – 200,000 ft^2 of air barrier contract requires five (5) audits.
    f. 200,001 ft^2 and over of air barrier contract requires six (6) audits.

2. Forward written audit reports to the Commissioner within 10 working days of the inspection and test being performed.

3. If the inspections reveal any defects, promptly remove and replace defective work at no additional cost to The City of New York.

B. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.

2. Remove and replace deficient air-barrier components for retesting as specified above.

C. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

END OF SECTION

SECTION 07 55 65 COLD FLUID APPLIED MEMBRANE ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the cold fluid applied reinforced roofing and waterproofing membrane, for both exposed membrane conditions and pavers and pedestals and all other ancillary waterproofing work including but not limited to installation of drains, pipe flashings, penetration flashings, sealants and metal work as specified, and including but not limited to, the following:

1. Adhered cold fluid-applied reinforced waterproofing system including, membrane, penetration flashings, base flashings, and expansion joints.

    a. Conventional installation.
    b. Liquid roofing over metal penthouse roofing.

2. Substrate preparation, cleaning, leveling and patching

3. Temporary waterproofing and priming

4. Waterproofing membrane installation

5. Flashing installation and expansion joint installation

6. Alkalinity protection

7. Insulation installation

1.4 WIND UPLIFT STANDARD

A. Wind Resistance and Stability of Insulation Board: Insulation board producer/manufacturer is responsible for determining thickness of ballast adequately to counter floating action, and withstand wind uplift at the project site. Thickness and/or weight of ballast indicated on drawings or in specifications are minimum values.

B. Anchorage method and specifications (e.g. weight density and thickness) of pavers for IRMA or PMR roof systems should be determined by Contractor's professional engineer to accommodate for uplift wind pressures per ASCE-7 or Code, whichever is more stringent.

C. The required ballast shall be per Dupont/DOW' "TECH SOLUTIONS 508.3".

1.5 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

1.6 REFERENCES

A. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual.

B. ACI-308 - Recommended Practice for Curing Concrete

C. ASTM D 638 - Test Methods for Tensile Properties of Plastics

D. ASTM D 4258 - Standard Practice for Surface Cleaning Concrete for Coatings

E. ASTM D 4259 - Standard Practice for Abrading Concrete

F. ASTM D 4541 - Method for Pull-Off Strength of Coatings using Portable Adhesion Tester

G. ASTM E 96(A) - Test Methods of Moisture Transmission of Material

H. ASTM E 108, ANSI/UL 790 for Fire Resistance

I. International Concrete Repair Institute Guideline 03732 Concrete Surface Preparation

J. Steel Structures Painting Council (SSPC)

1.7 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP).
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Insulation

1.8 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.9 SUBMITTALS FOR REVIEW

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Membrane System Product Data: Provide current standard printed product literature indicating characteristics of membrane materials, flashing materials, components, and accessories product specification and installation.

C. Submit sample copies of both the Manufacturer and Applicator warranties for the periods stipulated. Each specimen must be a preprinted representative sample of the issuing company's standard warranty for the system specified.

D. Submit copies of current Material Safety Data Sheets (MSDS) for all components of the work.

E. Membrane Shop Drawings: Submit shop drawings of cold fluid-applied reinforced showing all a project plan, size, flashing details, and attachment for review and approval by the Owners Representative and Membrane Manufacturer.

F. Submit a letter signed by the manufacturer and Contractor acknowledging that the submitted roofing system complies with ASCE-7, for wind speed requirements based on height of structure and geographic location of project..

1.10 QUALITY ASSURANCE

A. Membrane Supplier: Company specializing in manufacturing the products specified in this section with ten (10) years documented experience. Membrane Manufacturer shall submit the following certifications for review:

1. Substrates and conditions are acceptable for purpose of providing specified warranty.

2. Materials supplied shall meet the specified requirements.

B. Applicator: Company specializing in performing the work of this section with (3) years documented experience and approved by system manufacturer/supplier for warranted membrane and vegetated system installation. Applicator shall submit the following certification for review:

1. Applicator shall submit documentation from the membrane manufacturer/ to verify contractor's status as an approved applicator for warranted installations.

C. Evaluate moisture content of substrate materials. Constructor shall determine substrate moisture content throughout the work and record with Daily Inspection Reports or other form of reporting acceptable to The City of New York or designated Representative, and Membrane Manufacturer.

D. Random tests to determine tensile bond strength of membrane to substrate shall be conducted by the Contractor at the job site using an Elcometer Adhesion Tester Model 106 or similar device, or by the performance of a manual pull test. Contractor shall perform tests at the

beginning of the Work, and at intervals as required to assure specified adhesion with a minimum of three (3) tests per 5000 square feet. Smaller areas shall receive a minimum of three (3) tests. Test results shall be submitted to The City of New York or his designated Representative and the Membrane Manufacturer. Contractor shall immediately notify The City of New York or his designated Representative and Membrane Manufacturer in the event bond test results are below specified values.

1. Adequate surface preparation will be indicated by tensile bond strength of membrane to substrate greater than or equal to 220 psi (1.5 N/mm^2), as determined by use of an adhesion tester.

2. Adequate surface preparation will be indicated by 135° peel bond strength of membrane to substrate such that cohesive failure of substrate occurs before adhesive failure of membrane/substrate interface.

3. In the event the bond strengths are less than the minimum specified, additional substrate preparation is required. Repeat testing to verify suitability of substrate preparation.

E. Monitor quantities of installed materials. Monitor application of resin mixture, reinforcing fleece and flashing. Perform Work in accordance with manufacturer's instructions.

F. Mock-up areas shall be used to determine required methods and tools to obtain degree of substrate preparation required by the membrane manufacturer. Conduct tests as required to verify that substrate preparation meets specified requirements. Tests shall include, but are not limited to, tensile bond strength and moisture content of substrate. In addition, mock-up areas shall be used to confirm application practices in the installation of the membrane and vegetative system assembly.

1. Prepare and clean a three (3) foot (0.9 m) by three (3) foot (0.9 m) area of each substrate material type.

2. Submit findings in writing to The City of New York or his designated Representative and Membrane Manufacturer.

3. Mock-up areas shall be maintained for quality control for the entire project.

1.11 REGULATORY REQUIREMENTS

A. Conform to applicable building and jurisdictional codes for roofing/waterproofing assembly and fire resistance requirements.

B. Comply with requirements of OSHA, NIOSH or local governing authority for work place safety.

C. Comply with authority or agency “Confined Space Policy” during and throughout all work to be performed.

1.12 PRE-INSTALLATION MEETING

A. Convene a pre-installation meeting at the job site (1) week before starting work of this section. Require attendance of parties directly affecting work of this section, including but not limited to, Commissioner and Commissioner, Roofing/Waterproofing/Landscaping Contractor, and Membrane Manufacturer/Vegetative System Representative. Review roofing/waterproofing/vegetative system (all of these to be reviewed) preparation and

installation procedures, coordination and scheduling required with related work, and condition and structural loading limitations of deck/substrate.

1.13 FIELD INSPECTION SERVICES

A. Manufacturer's technical representative shall provide the following inspections of the membrane application:

1. Jobstart inspection at the beginning of each phase of the project, to review special detailing conditions and substrate preparation.

2. Periodic in-progress inspections throughout duration of the project to evaluate membrane and flashing application.

3. Final punch-list inspection at the completion of each phase of the project prior to installation of any surfacing or overburden materials.

4. Warranty inspection to confirm completion of all punch list items, followed by EVFMto confirm watertightness of installed waterproofing membrane.

1.14 DELIVERY, STORAGE, AND PROTECTION

A. The Contractor together with The City of New York or his designated Representative shall define a storage area for all components. The area shall be cool, dry, out of direct sunlight, and in accordance with manufacturer's recommendations and relevant regulatory agencies. Materials shall not be stored in quantities that will exceed design loads, damage substrate materials, hinder installation or drainage.

B. Store solvent-bearing solutions, resins, additives, inhibitors or adhesives in accordance with the MSDS and/or local fire authority. After partial use of materials replace lids promptly and tightly to prevent contamination.

C. Rolls of fleece reinforcing materials shall be stored horizontally on platforms sufficiently elevated to prevent contact with water and other contaminants. DO NOT use rolls that are wet, dirty or have damaged ends. Fleece reinforcing materials must be clean, dry, and free of all contaminants.

D. Roofing/waterproofing materials must be kept dry at all times. If stored outside, raise materials above ground or roof level on pallets and cover with a tarpaulin or other waterproof material. Plastic wrapping installed at the factory should **not** be used as outside storage covers.

E. Follow manufacturer's directions for protection of vegetated system materials prior to and during installation. Do not use materials that have been damaged to the point that they will not perform as specified.

F. Copies of all current MSDS for all components shall be kept on site. Provide any and all crew members with appropriate safety data information and training as it relates to the specific chemical compound he or she may be expected to deal with. Each crew member shall be fully aware of first-aid measures to be undertaken in case of incidents. Comply with requirements of OSHA, NIOSH or local governing authority for work place safety.

1.15 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing/waterproofing membrane during or with the threat of inclement weather.

B. Application of cold fluid-applied reinforced roofing/waterproofing membrane may proceed while air temperature is between 40°F (5°C) and 85°F (30°C) providing the substrate is a minimum of 5°F above the dew point.

C. When ambient temperatures are at or expected to fall below 50°F (10°C), or reach 85°F (30°C) or higher, follow Membrane System Manufacturer's recommendations for weather related additives and application procedures.

D. Ensure that substrate materials are dry and free of contaminants. DO NOT commence with the application unless substrate conditions are suitable. Contractor shall demonstrate that substrate conditions are suitable for the application of the materials.

E. Odor control and elimination measures are not typically necessary, but if required by The City of New York or his designated Representative, Contractor shall implement odor control and elimination measures prior to and during the application of the roofing/waterproofing materials. Control/elimination measures shall be field tested at off-hours and typically consists of one (1) or a multiple of the following measures:

1. Sealing of air intakes with activated carbon filters. Install filters in accordance with requirements and recommendations of the filter manufacturer. Seal filters at joints and against building exterior walls to prevent leakage of unfiltered air where required due to size of intake opening. Provide track system to secure filters.

2. Erection and use of moveable enclosure(s) sized to accommodate work area(s) and stationary enclosure for resin mixing station. Enclosure shall be field constructed or pre-manufactured of fire retardant materials in compliance with local code requirements in accordance with requirements of The City of New York or his designated Representative. Equipment enclosure(s) with mechanical air intake/exhaust openings and Odor Control Air Cleaners, as required to clean enclosed air volume and to prevent odor migration outside the enclosure. Exhaust opening shall be sealed with activated carbon filter.

3. Placement of odor elimination stations inside and outside of the enclosure(s) as required by field condition, in coordination with The City of New York or his designated Representative.

4. Protection of Contractor personnel and occupants of the structure and surrounding buildings as necessary to comply with requirements of OSHA, NIOSH and/or governing local authority.

F. When disposing of all refuse or unused materials, observe all EPA, OSHA or local disposal requirements.

1.16 COORDINATION AND PROTECTION

A. Coordinate the work with the installation of associated metal flashings, accessories, appurtenances, etc. as the work of this section proceeds.

B. Building components shall be protected adequately (with tarp or other suitable material) from soil, stains, or spills at all hoisting points and areas of application. Contractor shall be

responsible for preventing damage from any operation under its Contract. Any such damage shall be repaired at Contractor's expense to The City of New York's satisfaction or be restored to original condition.

C. Provide barricades, retaining ropes, safety elements (active/passive) and any appropriate signage required by OSHA, NIOSH, and NSC and/or The City of New York or designated Representative.

D. Protect finished roofing/waterproofing membrane from damage by other trades. Do not allow waste products containing petroleum, grease, acid, solvents, vegetable or mineral oil, animal oil, animal fat, etc. or direct steam venting to come into direct contact with the membrane.

1.17 WARRANTY

A. Manufacturer's Premier Warranty: Provide (20) year manufacturer's premier warranty under provisions of this section. This warranty provides for cost of labor and materials for loss of watertightness, limited to amounts necessary to effect repairs necessitated by either defective material or defects in related installation workmanship, Warranty to include basic removal and replacement of vegetated overburden and pavers as required for performance of warranty repairs to the waterproofing membrane.

B. Waterproofing Contractor's Warranty: Provide (5) year "Applicator Maintenance Warranty" covering workmanship for all work of this section including installation of membrane, flashings, metal work, and roofing/waterproofing accessories.

C. Submit (2) executed copies of both the manufacturer and applicator warranties for the periods stipulated, starting from the date of substantial completion. Each warranty must be signed by an authorized representative of the issuing company.

1.18 MATERIAL SUBSTITUTIONS

A. Materials proposed for use in the performance of the work that are not specified herein must be submitted to The City of New York/Commissioner for evaluation no later than ten days prior to bid.

PART 2 PRODUCTS

2.1 GENERAL

A. The products herein specified are totally pre-engineered products of the listed manufacturer and establish criteria for the approval of substitutions. Products must be part of a, pre-engineered, low-VOC, fully-reinforced, cold-fluid-applied liquid waterproofing membrane system, equivalent in function, quality, composition and method of application to be considered for approval as an "Approved Substitute". Substitute materials must meet or exceed the physical performance characteristics of the specified materials.

2.2 MANUFACTURERS - MEMBRANE

A. The products herein specified are totally pre-engineered products of the listed manufacturer and establish criteria for the approval of substitutions. Products must be part of a, pre-engineered, low VOC, fully reinforced, cold fluid applied liquid waterproofing membrane system, equivalent in function, quality, composition and method for application to be considered for approval as an

"Approved Substitute". Substitute materials must meet or exceed the physical characteristics of the specified materials.

1. Basis of Design: Kemper System's 2K-PUR, Sika Sikalastic 641 1-component low odor resin, Soprema Alsan RS 260 LO PMMA resin, Siplast Parapro Roof System, or Pumadeq PUMA by Henry Company or approved equal.

B. Physical Properties:

Property	Typical Value	Test Method
Color	*Gray-Green	-
Physical state	Cures to solid	-
Nominal thickness (165 fleece)	70 mils	-
Tensile strength @ break	120 lb/in	ASTM D 751
Elongation	50%	ASTM D 751
Tearing strength	5.0 lbs	ASTM D 751
Puncture resistance	140 lbf	FTMS 101-2031
Dimensional stability	0.1%	ASTM D 1204
Water absorption	2.2%	ASTM D 471
Surface hardness	Shore A 85	ASTM D 2240
Water vapor transmission	0.04 perms	ASTM E 96
Usage time*	30 minutes	-
Rainproof after*	6 hours	-
Solid to walk on after*	24 hours	-
Solid to drive on with air rubber tires after*	48 hours	-
Overburden may be applied after	2 days	-
Completely hardened after	3 days	-
Crack spanning	2mm/0.08 inch	-
Resistance to temperatures up to (short term)	250°C/482°F	-

1. Where liquid roofing in applied over metal penthouse roofs coloring shall be added to match architects' sample.

2.3 FLASHINGS

A. Membrane Flashings: A composite of the same resin material as field membrane with manufacturer's recommended fleece reinforcement.

2.4 ACCESSORIES

A. Primer: Primer for use in improving adhesion of membrane to cementitious/masonry substrate surfaces. Monitor application rate and adjust depending on substrate absorbency. Use epoxy primer for damp and green concrete.

B. Catalyst: A reactive agent used to initiate curing of the membrane. Refer to manufacturers recommendation for mixing ratio based on temperature.

C. Accelerator: As required by manufacturer, an additive specifically designed to accelerate the resin reaction time at ambient temperatures below 50ºF (10ºC). Continuously monitor substrate surface temperatures. (only applied to 2K products)

D. Tools, Accessories, and Cleaners: Supplied and/or approved by membrane manufacturer for product installation.

E. Topcoat Surfacing Aggregate: Silica sand, ceramic-coated quartz, or specialty aggregate shall be washed, kiln-dried, and dust-free with the following size specification (provide where drawings call for traffic sandcasting):

1. Aesthetic/Fire Rating: 0.3 - 1.0 mm
2. Alkalinity/Adhesion Key: 0.5 - 1.2 mm
3. Pedestrian Traffic: 0.4 - 1.0 mm
4. Light Vehicular Traffic: 0.5 - 1.2 mm

F. Leveling and Patching Aggregate: Silica sand shall be washed, kiln-dried, and dust-free, suitable for troweling or pourable self-leveling, round grain or angular with the following size specification:

1. For voids less than 1" in depth: 0.3 - 0.6 mm
2. For voids 1" to 2" in depth: 0.5 - 1.2 mm

Mixing Proportions shall be a ratio of resin to sand at 1:2 by volume or as approved by membrane manufacturer.

G. Backer Rod: Expanded, closed-cell polyethylene foam designed for use with cold-applied joint sealant.

H. Caulking: Single component, non-sag elastomeric sealant, as recommended or supplied by membrane manufacturer for use in making airtight and watertight seals where required.

I. Wood Nailers and Cant Strips: New wood nailers and cant strips shall be pressure treated for rot resistance (e.g., "Wolmanized" or "Osmose K-33"), #2 or better lumber. Asphaltic or creosote treated lumber is not acceptable.

J. Miscellaneous Fasteners: and appropriate for purpose intended, length required for thickness of material, with metal plates, and approved by membrane system manufacturer.

K. Drains: Spun/cast aluminum or cast iron roof drain with strainer/grate, strainer, as supplied or approved by membrane manufacturer.

L. Temporary and Night Sealant: As recommended or required by membrane manufacturer.

2.5 INSULATION COVER BOARD

A. Cover Board (Durock, USG Roof Cement Board, and Permabase): High compressive strength underlayment board consisting of aggregated Portland cement slurry with polymer-coated glass fiber mesh, with the following characteristics:

1. Board Weight 3.0 lb/sq. ft.
2. Board Size 48 x 96 inches.
3. Board Thickness 1/2 inch.
4. Thermal Conductivity K factor of 1.92 as determined by ASTM C 177.
5. Board Edges Square

2.6 INSULATION

A. Polyisocyanurate insulation board having non-asphaltic facers meeting or exceeding the requirements for Fed. Spec. HH-I-1972/Gen., with minimum compressive resistance of 18 psi, 1.0 inch minimum thickness, with the following characteristics:

1. Board Density 2.0 lb/cu. ft.
2. Board Size 48 x 96 inches.
3. Board Thickness 3.5 inches (R=20).
4. Thermal Conductivity K factor of 0.17 as determined by ASTM C 177, aged 12 months at 75 degrees.
5. Board Edges Square

2.7 TAPERED INSULATION

A. Tapered polyisocyanurate insulation board having non-asphaltic facers meeting or exceeding the requirements for Fed. Spec. HH-I-1972/Gen., with minimum compressive resistance of 18 psi, 1.0 inch minimum thickness, with the following characteristics:

1. Board Density 2.0 lb/cu. ft.
2. Board Size 48 x 96 inches.
3. Board Taper 1/4 inch per foot
4. Total Thickness 1/2 inch minimum
5. Thermal Conductivity K factor of 0.17 as determined by ASTM C 177, aged 12 months at 75 degrees.
6. Board Edges Square

2.8 VACUUM INSULATED PANELS

A. Vacuum Insulated Panels: Kingspan OPTIM-R Roofing System Rigid Vacuum Insulation Panels (VIP) as manufactured by Kingspan Insulation LLC.

1. Construction: Rigid vacuum insulation panels with a micro-porous core which is evacuated, encased and sealed in a thin, gas-tight envelope, giving outstanding thermal resistance, with the thinnest possible solution to insulation problems. The vacuum

insulated panels are accompanied with insulation (PIR or XPS) infill panels which can be cut to fit around problem areas such as roofing penetrations.

2. Dimensions for vacuum packed insulation:

   a. Width: 11.8 – 23.6 inches
   b. Length: 11.8 – 47.2 inches
   c. Thickness: as required to meet a minimum R30 insulation value.

3. Infill Strips:

   a. Infill strips as manufactured by Kingspan Insulation LLC.
      1). High performance insulation (PIR or XPS)
   b. R-value: 5.0 per inch thickness

2.9 FILTER FABRIC

A. Filter Fabric: Non-woven needle-punched polyester fleece suitable for use over extruded polystyrene insulation as provided by the following manufacturer:

   1. As recommended by primary membrane manufacture

2.10 FLASHING SURFACINGS AND COATINGS

A. Aggregate Finish Coating: Single component polyurethane-based resin suitable for use to seal aggregate, as provided by the following Manufacturer**:**

   1. As recommended by primary membrane manufacture

B. Color Coating: Where a top coat color is required by manufacturer to be applied over completed membrane to achieve an SRI greater than 78, install manufacturers recommended colored coating for exposed and submerged applications, as provided by the following Manufacturer:

   1. As recommended by primary membrane manufacture

   2. Color is required at all non-vegetated horizontal roof surfaces in order to achieve an SRI greater than 78. See drawings for custom colors applied to vertical surfaces.

   3. At exposed gutters and low slope area provide Grey color to match zinc.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck/substrate openings, curbs, and protrusions through deck/substrate, wood cant strips and reglets are in place and solidly set.

C. Verify deck/substrate is structurally supported, secure and sound.

3.3 PREPARATION OF SUBSTRATE

A. General**:** Surfaces to be prepared as a substrate for the new waterproofing system as follows:

1. The Contractor shall determine the condition of the existing structural deck/substrate. All defects in the deck or substrate shall be corrected before new waterproofing work commences. Areas of deteriorated deck/substrate, porous or other affected materials must be removed and replaced with new to match existing.

2. Prepare flashing substrates as required for application of new waterproofing membrane flashings.

3. Inspect substrates, and correct defects before application of new waterproofing. Fill all surface voids greater than 1/8 inch wide with an acceptable fill material.

4. Remove all ponded water, snow, frost and/or ice from the work substrate prior to installing new waterproofing materials.

5. The final substrate for waterproofing shall be clean, dry, free of loose, spalled or weak material including coatings, mineral aggregate, and flood coat/gravel surfacing, oil, grease, contaminants, abrupt changes in level, waterproofing agents, curing compounds, and free of projections which could damage membrane materials.

B. Concrete:

1. New concrete shall have cured a minimum of 28 days in accordance with ACI-308, or as approved by Waterproofing Manufacturer's Technical Department.

2. New or existing concrete shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, bituminous products and previous waterproofing materials.

3. New or existing concrete shall be dry with a maximum moisture content of five (5) percent. Determinations of moisture content shall be performed by the Contractor. Contractor shall be responsible to perform periodic evaluations of moisture content during the work. Moisture evaluation results shall be submitted in writing to The City of New York or his designated Representative and Waterproofing manufacturer for acceptance.

4. Where required, concrete shall be abrasively cleaned in accordance with ASTM D 4259 to provide a sound substrate free from laitance. Achieve an open concrete surface in accordance with ICRI surface profiles CSP 3-5. When using mechanical methods to remove existing waterproofing products or surface deterioration, the surface profile is not to exceed ¼ inch (peak to valley).

5. The substrate shall be sound and all spalls, voids and blow holes on vertical or horizontal surfaces must be repaired prior to placement of the primer coat. Spalls and other deterioration shall be repaired in accordance with the requirements of The City of New York or his designated Representative and Membrane manufacturer.

6. Areas of minor surface deterioration of 0.25" (6 mm) or greater in depth shall be repaired to prevent possible ponding of the system, leading to excessive usage of primer and resin.

7. Extent and location of thin surface patching shall require approval of The City of New York or his designated Representative and Waterproofing Manufacturer prior to the application of any system component.

8. For concrete materials with a compressive strength of less than 3,500 psi contact Waterproofing Manufacturer Technical Department for substrate preparation requirements.

C. Masonry:

1. Walls shall be built with hard kiln dried brick or waterproof concrete block construction.

2. Areas of soft or scaling brick or concrete, faulty mortar joints, or walls with broken, damaged or leaking coping shall be repaired in accordance with the requirements of The City of New York or his designated Representative and Flashing Membrane Manufacturer.

D. Steel/Metal:

1. Clean and prepare metal surfaces to near white metal in accordance with SSPC - SP3 (power tool clean) or as required by membrane manufacturer. Extend preparation a minimum of three (3) inches beyond the termination of the membrane flashing materials. Notch steel surfaces to provide a rust-stop.

2. In addition to cleaning, all metal surfaces shall be abraded to provide a rough open surface. A wire brush finish is not acceptable.

E. Other Flashing Surfaces: Remove all contaminants as required by membrane manufacturer. Surface preparation shall be performed by means approved by The City of New York or his designated Representative.

F. Finish Leveling, Patching and Crack Preparation:

1. General: Use manufacturers recommended primer/resin mix or patching material Concrete and Masonry Substrate Leveling and Patching: Substrate conditions are to be evaluated by the Contractor, The City of New York, or his designated Representative, and Membrane manufacturer. Perform leveling and patching operations as follows:

   a. Level uneven surfaces with a leveling mixture of primer and approved kiln-dried silica sand or manufacturers approved patching material. Spread and plane this compound with a squeegee and trowel to achieve a flat surface.
   b. Fill cavities with a patching mixture of primer and approved kiln-dried sand or patching material in manufacturer's recommended ratio.
   c. Silica sand must be kept absolutely dry during storage and handling.
   d. Any surface to be leveled or filled must first be primed with an appropriate primer.

2. Joint and Crack Preparation: Joints, cracks and fractures in the structural deck/substrate shall be prepared as defined below prior to installation of the waterproofing membrane. for all concrete and masonry substrate finish leveling, crack and wall/deck preparation and patching.
3. NOTE: Joints, cracks, and fractures may telegraph through the waterproofing membrane.

a. Non-Moving Cracks: Determine that crack is non-moving. Clean out crack by brushing and oil-free compressed air. Fill crack with polyurethane sealant. Allow for a minimum of twelve (12) hours cure or as required by sealant Manufacturer.
b. Moving Cracks: Determine that crack is moving. Clean out crack by brushing and oil-free compressed air. Fill crack with polyurethane sealant. Allow for a minimum of twelve (12) hours cure or as required by sealant Manufacturer. Apply resin and min. 4 inch (10 cm) wide strip of membrane (resin and fleece) in strict accordance with Membrane manufacturer's written instructions.

3.4 INSULATION/COVER BOARD INSTALLATION

A. General: Insulation and cover board shall be installed in accordance with the insulation/cover board manufacturer's current published specifications and recommendations for use with adhered roofing.

B. Install Insulation/Cover Board: Install only as much insulation and cover board as can be primed, sealed, and protected before the end of the day's work or before the onset of inclement weather.

C. Fit Insulation/Cover Board: Neatly fit insulation/cover board to all penetrations, projections, and nailers. Insulation shall be loosely butted, with gaps not greater than 1/4". All gaps greater than 1/4" shall be filled with acceptable insulation. Cover board shall be loosely butted, with gaps not greater than 1/4". All gaps greater than 1/8" shall be filled with primer; all gaps greater than ¼" shall be filled with sealant.

D. Strip In Cover Board Joints: Strip all cover board joints with four inch (4") wide strip of flashing membrane. Under no circumstances shall the membrane be left unsupported over a space greater than 1/4".

E. Stagger Insulation/Cover Board Joints: When installing multiple layers of insulation, all joints between succeeding layers shall be staggered a minimum of 6" in each direction.

F. Steel Deck Substrates: Place boards perpendicular to steel deck flutes with edges over flute surface for bearing support. Edges shall be checked so that no edges are left substantially unsupported along the flutes.

G. Drain Sumps: Insulation shall be feathered or tapered to provide a sump area a minimum of 36" x 36" where possible at all drains. Taper insulation around roof drains so as to provide proper slope for drainage. In areas where feathered or tapered insulation leaves insulation core exposed, cover with an appropriate cover board or base sheet/cap sheet assembly to provide a sound and smooth substrate surface.

H. Tapered Insulation: Place the constant thickness first layer and the tapered thickness insulation to the required slope pattern in accordance with insulation manufacturer's instructions.

I. Polyurethane Adhesive Attachment: Follow insulation/cover board and adhesive manufacturers' recommendations for the appropriate adhesive application rate and application procedure. Under normal application rate, dispense the first bead 3" inside the outside edges of the insulation/cover board to be attached, with sequential beads equidistant. Place the boards onto the roofing adhesive beads. Walk on the boards to spread the roofing adhesive for maximum contact. Periodically walk on the boards until firmly attached. Reference FM approvals for adhesive application patterns that satisfy FM wind uplift requirements. Typical application is a 3/4" bead of roofing adhesive at a rate of one lineal foot per square foot of insulation/cover

board to be attached. Note: additional adhesive is required in the corner and perimeter regions of the roof. Secure insulation/cover board in accordance with approval requirements.

3.5 PRIMER APPLICATION

A. General:

1. Mix and apply two-component primer in strict accordance with written instructions of Membrane Manufacturer. Use only proprietary materials, as supplied by the membrane manufacturer.

2. The substrate surface must be dry, with any remaining dust or loose particles removed using clean, dry, oil-free compressed air, industrial vacuum, cloth wipe or a combination of methods.

3. Do not install primer on any substrate containing newly-applied and/or active asphalt, coal-tar pitch, creosote or penta-based materials unless approved in writing by Membrane Manufacturer. Some substrates may require additional preparation before applying primer.

4. Do not thin primer. Determine required primer coverage for each substrate material/condition and apply in strict accordance with written instructions of Membrane Manufacturer.

5. Mix only that amount of primer components A & B that can be used within manufacturers stated open time.

B. Application of Primer:

1. Apply primers in strict accordance with written instructions of Membrane Manufacturer. Use only approved materials, as supplied by the membrane manufacturer.

2. Do not thin primer. Determine required primer coverage for each substrate material/condition and apply in strict accordance with written instructions of Membrane Manufacturer.

3. Apply primer direct in one step utilizing a brush or paint roller. Do not allow ponding.

4. Where required by manufacturer, apply kiln-dried sand into the final coat of primer while still wet at the rate of 20 lbs. per 100 square feet.

5. Allow primer to cure in accordance with individual membrane manufacturers requirements prior to applying waterproofing membrane.

6. Do not apply primer past the required extent of the membrane flashings termination.

7. Exposure of the primer beyond manufacturers overcoat period or premature exposure to moisture may require removal and application of new primer. DO NOT apply new primer over primer exposed beyond manufacturers stated overcoat period, primer prematurely exposed to moisture, or primer used as temporary waterproofing, unless approved in writing by the Membrane Manufacturer.

C. Disposal of Primer:

1. Cured primer may be disposed of in standard landfills. This is accomplished by thoroughly mixing all components.

2. Uncured primer is considered a hazardous material and must be handled as such, in accordance with local, state and federal regulation. Do not through uncured resin away.

3.6 MEMBRANE APPLICATION

A. General:

1. Mix and apply cold fluid-applied reinforced waterproofing membrane in strict accordance with written instructions of Membrane Manufacturer. Use only proprietary membrane resins and materials, as supplied by the membrane manufacturer.

2. The primed substrate surface shall be dry, with any remaining dust or loose particles removed using clean, dry, oil-free compressed air, industrial vacuum, cloth-wipe or a combination.

3. Protect all areas where membrane has been installed. Do not work off installed membrane during application of remaining work before forty-eight (48) hours of curing. Movement of materials and equipment across installed membrane is not acceptable. If movement is necessary, provide complete protection of affected areas.

4. Closely follow the Membrane Manufacturer's recommendation for hot and cold weather application. Monitor surface and ambient temperatures, including the effects of wind chill.

B. Application of Resin/Fleece

1. Apply mixed resin to the prepared surface at the membrane manufacturer’s specified rate. The resin should be rolled or brushed liberally and evenly onto the surface using a broad, even stroke.

2. Roll out dry polyester fleece onto the liquid resin mix, making sure the SMOOTH SIDE IS FACING UP (natural unrolling procedure), avoiding any folds and wrinkles. The fleece will begin to rapidly saturate with the liquid resin mix. Use a medium nap roller or brush to work the resin into the fleece, saturating from the bottom up, and eliminating air bubbles, wrinkles, etc. White spots are indications of unsaturated fleece or lack of adhesion. It is important to correct these faults before the resin cures.

3. Apply additional liquid resin mix on top of fleece at the membrane manufacturer’s specified rate to complete the saturation of the fleece. Roll this final coating into the fleece, which will result in a glossy appearance. The fleece can only hold so much resin and all excess should be rolled forward to the unsaturated fleece, eliminating ponding or excessive build- up of the resin. Any excess resin left on the top of the fleece will weather and peel off. The correct amount of resin will leave no whiteness in fleece and there will be a slightly fibrous surface texture. The final resin coating should be smooth and uniform with no dry fleece, entrapped air, or wrinkles.

4. Prevent contact between mixed/unmixed resin and new/existing membrane. If any unmixed resin contacts membrane surface remove immediately and clean thoroughly with a cloth rag.

5. At all fleece seams, allow a 2" (5 cm) overlap for all side joints and a 4" (10 cm) overlap for all end joints.

6. At membrane tie-offs, clean in-place membrane with MEK (methyl ethyl ketone) solvent once resin has cured. Allow solvents to fully evaporate before application of new resin.

C. Disposal of Resin:

1. Cured resin may be disposed of in standard landfills. This is accomplished by thoroughly mixing all components.

2. Uncured resin is considered a hazardous material and must be handled as such, in accordance with local, state and federal regulation. Do not throw uncured resin away.

3.7 FLASHING APPLICATION

A. General:

1. Install flashing system in accordance with the requirements/recommendations of the Membrane manufacturer and as depicted on standard drawings and details. Provide system with base flashing, edge flashing, penetration flashing, counter flashing, and all other flashings required for a complete watertight system.

2. Wherever possible, install the flashings before installing the field membrane to minimize foot traffic over newly installed field membrane.

3. All membrane flashings shall be installed concurrently with the waterproofing membrane as the job progresses. Temporary flashings are not allowed without prior written approval from the Membrane manufacturer. Should any water penetrate the new waterproofing membrane because of incomplete flashings, the affected area shall be removed and replaced at the Contractor's expense.

4. Provide a minimum vertical height of 8" for all flashing terminations. Flashing height shall be at least as high as the potential water level that could be reached as a result of a deluging rain and/or poor slope. Do not flash over existing through-wall flashings, weep holes and overflow scuppers.

5. All flashings shall be terminated as required by the Membrane Manufacturer.

6. Where alkalinity protection is required, install manufacturer’s recommended products as follows:
   a. Kemper Systems: Install two applications of EP primer and one application of approved broadcast mineral aggregate surfacing over the completed membrane wherever stone, concrete, or masonry elements will be placed directly over the membrane.
   b. Sikalastic RoofPro Systems: Sikalastic 624/644AR resin shall be used in lieu of 641 Resin wherever stone, concrete, or masonry elements will be placed directly over the membrane.
   c. Siplast Parapro Roof Resin: Install one layer of Siplast Parapro Roof Resin and one application of approved broadcast mineral aggregate surfacing over the completed membrane wherever stone, concrete, or masonry elements will be placed directly over the membrane.

B. Metal Flashing – General:

1. Metal flashings shall be fabricated in accordance with the current recommendations of SMACNA and in accordance with standard drawings and project details.

2. Metal flashing flanges to which membrane is to be bonded shall be a minimum of four (4) inches in width, and secured to the substrate six (6) inches on center staggered with fasteners appropriate to the substrate type. The flanges shall be provided with a roughened surface that has been cleaned of all oil and other residue.

3. Metal edges that will be overlaid with membrane shall be provided with a 1/4" min. hemmed edge.

4. Apply primer, resin and fleece to metal flange, extending membrane to outside face of metal edging, and to vertical face of metal base/curb flashing.

C. Membrane Flashing – General:

1. Membrane flashings shall be fabricated with primer appropriate for the substrate surface, resin of the same base chemical type as the field membrane, and fleece of the same weight as the field membrane unless specified otherwise.

2. Primer, resin, and fleece mixing and application methods as specified for field membranes are also suitable for membrane flashing.

3. Fleece shall overlap 2" (5 cm) minimum for all joints. Fleece shall be cut neatly to fit all flashing conditions without a buildup of multiple fleece layers. Work wet membrane with a brush or roller to eliminate blisters, openings, or lifting at corners, junctions, and transitions.

D. Pipes, Conduits, and Unusually Shaped Penetrations:

1. Flash all penetrations using cold fluid-applied reinforced waterproofing membrane. Flashing material shall be the same resin used in the field membrane with manufacturer's recommended fleece reinforcement.

2. Flashing is typically constructed as a two-part assembly consisting of a vertical wrap and a horizontal target patch. There must be a minimum of a two (2) inch (5 cm) overlap between vertical and horizontal flashing components.

E. Drains and Scuppers:

1. Acceptable drain and scupper materials are cast iron, cast aluminum, and copper.

2. Connect new drains and scuppers to existing storm sewer system.

3. Alternatively, replace all broken or damaged parts of existing drains and scuppers, or provide and install an acceptable insert.

4. Flash drains and scuppers using cold fluid-applied reinforced waterproofing membrane. Flashing material shall be the same resin used in the field membrane with manufacturer's recommended fleece reinforcement.

5. Flashing material shall extend four (4) inches minimum onto drain, scupper, or insert flange.

6. Install clamping ring if provided as part of the drain or scupper design. Install a strainer basket to prevent debris from clogging the drainage line.

F. Hot Stacks:

1. Protect the membrane components from direct contact with steam or heat sources when the in-service temperature exceeds 150 degrees F. In all such cases flash to an intermediate "cool" sleeve.

2. Fabricate "cool" sleeve in the form of a metal cone using galvanized metal in accordance with Membrane manufacturer's details.

3. Flash all penetrations using cold fluid-applied reinforced waterproofing membrane. Flashing material shall be the same resin used in the field membrane with 165 fleece reinforcement.

4. Flashing is typically constructed as a two part assembly consisting of a vertical wrap and a horizontal target patch. There must be a minimum of a two (2) inch (5 cm) overlap between vertical and horizontal flashing components.

G. Flexible Penetrations:

1. Provide a weathertight gooseneck of round cross-section for each penetration or group of penetrations. Set in water cut-off mastic and secure to the structural substrate.

2. Acceptable gooseneck material is copper, of a sheet weight appropriate for the application.

3. Flash all penetrations using cold fluid-applied reinforced waterproofing membrane. Flashing material shall be the same resin used in the field membrane with manufacturer's recommended fleece reinforcement.

4. Flashing is typically constructed as a two-part assembly consisting of a vertical wrap and a horizontal target patch. There must be a minimum of a two (2) inch (5 cm) overlap between vertical and horizontal flashing components.

H. Walls, Curbs and Base Flashings

1. Wall, curb and base flashings shall be installed to solid substrate surfaces only. Adhering to gypsum-based panels, cementitious stucco, synthetic stucco, wood or metal siding, and other similar materials is not acceptable.

2. Flash all walls, curbs and base flashings using cold fluid-applied reinforced waterproofing membrane. Flashing material shall be the same resin used in the field membrane with manufacturer's recommended fleece reinforcement.

3. Reinforce all transition locations and other potential wear areas with a four (4) inch wide manufacturer's recommended polyester fleece bottom layer evenly positioned over the transition prior to installing the exposed flashing layer.

4. Reinforce all inside and outside corners with a four (4) inch diameter conical piece of manufacturer's recommended fleece prior to installing the exposed flashing layer.

5. All pins, dowels and other fixation elements shall be flashed separately with a vertical flashing component prior to installing the exposed flashing layer.

6. Extend flashing a minimum of four (4) inches onto the field substrate surface.

I. Field Fabricated Control or Expansion Joint Flashing

1. Control or expansion joints in excess of two (2) inches in width require the use of a separate engineered joint system.

2. Control or expansion joints two (2) inches or less in width may be flashed with two layers of cold fluid-applied reinforced waterproofing membrane and a compressible foam or rubber insert. Use manufacturer's recommended polyester reinforcing fleece bottom layer and polyester fleece top layer.

3. Grind or otherwise bevel the inside edges of the joint opening to provide a smooth transition edge for the fleece.

4. Flashing typically consists of manufacturer's recommended polyester reinforcing fleece bottom layer looped into the joint as a cradle, a compressible foam or rubber insert at 25% compression fitted into the joint, and manufacturer's recommended polyester fleece top layer applied over the joint. Extend both fleece layers four (4) inches minimum onto the field substrate on both sides of the joint.

5. Apply the field membrane over the entire joint area.

J. Electrical Conduit, Gas Lines and Lightning Protection

1. Supports for electrical conduit and gas lines greater than one (1) inch in diameter require the use of a separate engineered support system.

2. Supports for electrical conduit and gas lines one (1) inch or less in diameter, and bases for lightning protection rods and cable, can be adhered directly to the membrane surface with a single-component, high quality sealant.

3.8 SURFACING AND FINISHES

A. Kiln-Dried Aggregate Finish Surfacing

1. Where specified, provide and install approved kiln-dried silica sand, or other approved mineral surfacing to achieve an aesthetic and/or non-skid surface.

2. Broadcast specified and approved sand or aggregate in excess into a bonding coat application of manufacturer's recommended resin applied over clean, freshly-cured membrane at the manufacturer's recommended rate. Aggregate shall be applied at the rate of appx. 60 lbs. per 100 square feet. Obtain uniform and full coverage.

3. Following minimum manufacturer's recommended cure time, remove loose/un-embedded mineral aggregate by blowing with oil-free compressed air or with a vacuum.

4. Apply manufacturer's recommended aggregate coating, over cured and dried aggregate finish to seal surface. After completion of mineral aggregate broadcasting, avoid any traffic for a minimum of two (2) days to allow for surfacing to cure.

B. Coating-Type Finish Surfacing

1. Where specified, provide and install Membrane Manufacturer's approved urethane-based coating applied over clean, fully cured membrane.

2. Apply coating at manufacturer's recommended rate. Avoid any traffic for a minimum of two (2) days to allow for surfacing to cure.

C. Alkalinity Protection

1. Where placement of concrete, mortar or adhesive setting beds are required over sections of the waterproofing membrane or flashing, the application of the following alkalinity protective measure is required:

a. Kemper Systems: Application of one (1) heavy or two (2) lighter coats of Primer EP at 1.5 gal (5.7L)/100 SF (9 m^2) total application, with broadcast of kiln-dried silica sand at the approximate rate of 30 lbs. per 100 square feet into final wet coat of primer.
b. Sikalastic RoofPro Systems: Sikalastic 624/644AR resin shall be used in lieu of 641 Resin wherever stone, concrete, or masonry elements will be placed directly over the membrane.
c. Siplast Parapro Roof Resin: Install one layer of Siplast Parapro Roof Resin and one application of approved broadcast mineral aggregate surfacing over the completed membrane wherever stone, concrete, or masonry elements will be placed directly over the membrane.

2. Protection shall extend a minimum of one (1) foot (0.3m) past the concrete form on all sides.

3. Provide continuous cleaning with water and brush to eliminate settlement of concrete residues on in-place waterproofing membrane adjacent to area of concrete placement.

D. Adhesion Key: Where placement of non-cementitious material such as asphalt pavement is required over sections of the waterproofing membrane or flashing, the application of the following adhesion key measure is required:

a. Kemper Systems: Application of one (1) coat of Primer EP at 1.0 gal (3.8L)/100 SF (9 m^2) total application, with broadcast of kiln-dried silica sand at the approximate rate of 30 lbs. per 100 square feet into wet primer.
b. Sikalastic RoofPro Systems: Apply 1 coat of Sikalastic resin at 1.0 gal/106 SF and while wet, broadcast kiln-dried silica sand to refusal at the approximate rate of 60 lbs. per 100 square feet into wet coat of Sikalastic resin.
c. Siplast Parapro Roof Resin: Install one layer of Siplast Parapro Roof Resin and one application of approved broadcast mineral aggregate surfacing over the completed membrane wherever stone, concrete, or masonry elements will be placed directly over the membrane.

3.9 TEMPORARY CLOSURES AND WATERSTOPS

A. Contractor shall be responsible to ensure that moisture does not damage any completed section of the new waterproofing system. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition. All temporary closures shall be made as recommended or required by the membrane manufacturer.

3.10 VERIFICATION OF MEMBRANE INTEGRITY

A. General: After installing horizontal membrane and before placing overburden, verify installed membrane is waterproof. Provide testing to verify membrane is free of any holes, open seams and capillary defects that will allow water to pass.

1. Installation of EVT impulse conductor wire around perimeter of area to be tested. The testing agency will determine size and shape of area. Areas will typically range between 2000 SF and 7,500 SF. The conductor wire will consist of braided polyethylene (1.5 mm diameter) interwoven with a minimum of nine (9) strands of stainless steel wire. The conductor wire will have a tensile strength of not less than 180 lbs.

2. Place conductor wire 4 inches from perimeter and secure against accidental movement or damage. Place so not to create a tripping hazard. Place wire directly on membrane.

3. Isolate all metal items contacting the membrane by placing isolation strands of conductor wire to isolate the field or by removing the metal items temporarily if possible.

4. Isolate field of membrane from contact with grounded soil or structure contacting the membrane by placing isolation strands of conductor wire to isolate the field.

5. Wet the test area with potable water sufficiently to create a continuous conducting “plate” above the membrane.

6. Attach EVT impulse generator to conductor wire with removable connectors and to ground or building structure creating a potential circuit. (The circuit will complete if water finds a path to ground by way of a breech in membrane.)

7. Deliver a one second long 40 volt potential electrical impulse to the conductor wire at an average rate of one impulse every three seconds.

8. Utilizing a EVT potentiometer and two probes placed at the surface of the membrane detect the presence or absence of electrical flow across the surface to the membrane.

9. If there is no flow detected after a systematic search then the certified inspector shall report the installed membrane in that area tested free of holes, seam and capillary defects and is therefore waterproof at that time.

10. If there is flow detected during the search then the certified inspector shall work to identify the source of electricity and therefore the breach in the membrane. The technician shall report to the waterproofing contractor immediately if possible the exact location of any defects on the installed membrane in that area tested.

11. Defects found shall be repaired and retested.

12. The technician providing the EVT testing shall provide a report of each day’s test results containing a written description and photograph of all defects and any corrections made and a schematic CAD drawing indicating location of stationary conductor wire and of any defects found in testing to within 1 inch of accuracy. This report shall be made in hard copy and submitted to the Commissioner and The City of New York.

3.11 PROTECTION

A. Upon completion of waterproofing and flashings (including all associated work), institute appropriate procedures for surveillance and protection of roofing during remainder of construction period. Protect all areas where membrane has been installed.

3.12 CLOSEOUT

A. Correction of Work: Work that does not conform to specified requirements including tolerances, slopes, and finishes shall be corrected and/or replaced. Any deficiencies of membrane application, termination and/or protection as noted during the membrane manufacturer's inspections shall be corrected and/or replaced at Contractor's expense.

B. Clean-Up: Site clean-up, including both interior and exterior building areas that have been affected by construction, shall be restored to preconstruction condition.

END OF SECTION

SECTION 07 62 00 SHEET METAL WORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the sheet metal work as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Stainless steel cap metal flashing.

2. Field fabricating (including bending, cutting, soldering, etc.), if required, of stainless steel flashing.

3. Stainless steel flashing elsewhere, where metal flashing is indicated on drawings.

4. Separation of contacting surfaces of dissimilar metals.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Unit Masonry - Section 042000.

C. Roofing - Division 7.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)

3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. **Adhesives and Sealants**

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Shop Drawings: Submit, showing all materials, finishes, fastenings, joint details, fabrication, construction and relation to adjoining construction.

C. Samples: Submit 12" x 12" samples of flashing materials and finishes.

1.8 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary at no additional cost to The City of New York.

1.9 WARRANTY

A. The Contractor shall warrant that all Metal Flashing Work executed under this Section will be free from defects in materials and workmanship for a period of ten (10) years from date of acceptance of the Project, and he shall remedy any defects in the Metal Flashing Work.

PART 2 PRODUCTS

1.1 MATERIALS

A. Stainless Steel Flashing Materials

1. Stainless Steel Flashing: ASTM A 240, Type 304, stainless steel, with 2D finish, dead soft temper, fully annealed, as manufactured by International Nickel Co., Republic Steel Corp., United States Steel, or Washington Steel Corp. Thickness of stainless steel shall be as listed below.

   a. Concealed Flashings: 0.012" thick, thirty (30) gauge (U.S. Standard).
   b. Exposed Flashings: 0.015" thick, twenty-eight (28) gauge (U.S. Standard).

c. Edge Strips: 0.025" thick, twenty-four (24) gauge (U.S. Standard).

2. Accessories and Fastenings: AISI, Types 302 and 304 stainless steel.

3. Solder: Composed of sixty (60) percent block tin and forty (40) percent pig lead, except that solder at seams exposed to public view shall be eighty (80) percent tin and twenty (20) percent lead.

4. Flux: An acid type flux manufactured specifically for soldering stainless steel, as approved.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where sheet metal work is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 METAL FLASHING INSTALLATION

A. Reference Standard: Conform to the requirements of 7th Edition of the Sheet Metal and Air Conditioning Contractors Association (SMACNA) Architectural Sheet Metal Manual.

B. General: Fabricate and install metal flashing work in accordance with details and specifications of above Reference Standard, with manufacturer's instructions, and as herein specified, to provide a watertight installation. Apply metal flashing to smooth, even, sound, clean, dry surfaces free from defects. Make provisions to allow for expansion and contraction of metal flashing work. Wherever practicable, shop form all metal flashing work and deliver ready for installation. Form metal flashing work accurately to required profiles, with flat surfaces, straight edges and corners, free from defects. Fold exposed metal edges back not less than 1/2" and form drip.

C. Nailing: Confine to sheets twelve (12) inches or less in width. Confine nailing to one edge only, locate nails where concealed. Use No. 12 x 1" long flat headed, annular threaded, Type 302 stainless steel nails for nailing to wood blocking; use one (1) inch long masonry nails for nailing to concrete. Space nails four (4) inches o.c. maximum.

D. Cleating: Use cleats where sheets are more than twelve (12) inches in width. Space cleats approximately twelve (12) inches o.c. Cleats two (2) inches wide by three (3) inches long, of the same material and weight as the metal flashing being installed. Secure one end of the cleat with two (2) nails and fold edge back over the nail heads. Lock other end into seam or into folded edge of metal flashing sheets. Pre-tin cleats for soldered seams.

E. Joining: Join metal flashings with one (1) inch locked and soldered seams except at slip joints. Mallet seams flat and solder full length of seam as specified below.

F. Soldering: Clean and pre-tin edges of metal flashing to be soldered before soldering is begun with solder on both sides for a width of not less than 1-1/2". Solder slowly with well heated metal surfaces. Use ample solder. Show not less than one full inch of evenly flowed solder on seam. Seams shall have a liberal amount of flux brushed in before soldering is commenced. Where soldering paste or killed acid is employed as a flux, soldering shall follow immediately after application of the flux. Upon completion of soldering, clean surfaces of all flux.

G. Slip Joints: Locate slip joints not more than twenty-four (24) feet apart and not more than eight (8) feet from corners. Form slip joints as three (3) inch wide joints with cover piece behind flashing and fill locked ends neatly with sealant.

H. Cap Flashing: Install over base flashings, in eight (8) to ten (10) foot lengths, lapped six (6) inches at ends. Cap flashing shall be increased longitudinally to produce spring action to hold bottom edge of cap flashing firmly against base flashing. Cap flashing shall lap base flashing at least four (4) inches, with exposed bottom edge at a forty-five (45) degree angle downward and folded back on underside at least 1/2" to form drip. Make cap flashing continuous at corners and angles.

I. Miscellaneous Flashing: Provide all other miscellaneous metal flashing not specifically mentioned herein but indicated on drawings and/or required to provide a watertight installation.

J. Separation of Dissimilar Materials: Back paint surfaces of metal flashing in contact with dissimilar metals or with concrete or masonry with bituminous paint.

K. Reglets

1. Provide watertight reglets in masonry and concrete work to receive cap flashing. Form reglets of stainless steel using same thickness as stainless steel sheet metal specified.

2. In masonry work use open or closed slot reglets with slat at least one (1) inch deep and 3/16" wide. Provide hook dams or turn-ups for anchoring securely into mortar joints. Insert cap flashing into slot full depth using button punch or lead wedges to lock in place.

3. Insert cap flashing full depth into reglet slot, and wedge in place using lead strips spaced on twelve (12) inch centers maximum or lead caulking rope. When lead strips are used for continuous caulked reglets, use approved weather-resistant fibrous compounds.

END OF SECTION

SECTION 07 81 00 SPRAYED FIRE-RESISTIVE MATERIALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the sprayed fire-resistive materials as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Spray-on fireproofing for structural steel and metal decking.
2. Patching of exposed areas requiring fire protection.
3. Seal coat over fireproofing in special areas.
4. Preparation of surfaces.
5. Field quality control.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Structural steel – Section 051200.

C. Metal decking – Section 053100.

D. Firestops and smokeseals – Section 078413.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: For each fire-resistive product specified.

C. Shop Drawings: Submit structural framing plans indicating the following:

1. Locations and types of surface preparations required before applying sprayed fire-resistive material.

2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:

a. Applicable fire-resistive design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.

3. Identify restrained and unrestrained assemblies on shop drawings, show required thickness of fireproofing for each assembly.

D. Product Certificates: Signed by manufacturer of sprayed fire-resistive material certifying that the products furnished comply with requirements.

E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. If primer is to be used steel and/or metal deck, submit certifications by supplier of primer that primer is compatible with materials, and will not impair the required performance of the installed fireproofing. Such certification shall be accompanied by evidence that the primer was

successfully used in conjunction with the fireproofing material in a UL test applicable to the construction. Submit certification prior to application of primer.

7. Coordinate with Section 051200 – Structural Steel and 053100 – Metal Deck, and Structural Drawings prior to application of primer.

H. Product Test Reports: Indicate that physical properties of proposed sprayed fire-resistive materials comply with specified requirements based on comprehensive testing of current product formulations by a qualified testing and inspecting agency according to requirements specified in "Quality Assurance" Article.

I. Code Compliance: Proposed product must comply with prevailing Building Code and be approved by those individuals having jurisdiction.

J. Letter from manufacturer stating that the UL Design selected for the project is not load restricted.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its sprayed fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Submit data indicating that products containing no detectable asbestos as determined according to the method specified in 40 CFR, Part 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

C. Mockups: After processing of initial submittals and before delivery and installation of fireproofing materials, prepare a sample installation of fireproofing work, approximately 100 sq. ft. in area; providing an example of each type required, applied on each different substrate, to produce each different rating as required and reasonably representative of entire sprayed on fireproofing work, for joint approval by representative of fire resistant material manufacturer and The City of New York. Work in other areas shall not proceed until mock-up has been completed. Mock-up work which remains in compliance with requirements and is in undamaged and acceptable condition may be retained as final work in place.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; shelf life, if applicable; and fire-resistance ratings applicable to Project.

B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

C. Store materials inside, under cover, aboveground, so they are kept dry until ready for use. Remove from Project site and discard materials that have deteriorated.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperatures are 40 deg F. or lower, unless temporary protection and heat is provided to maintain temperatures at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of sprayed fire-resistive material to achieve a minimum of four air changes per hour. Use natural means or, where this is inadequate, forced-air circulation until fire-resistive material dries thoroughly.

1.11 SEQUENCING

A. Sequence and coordinate application of sprayed fire-resistive materials with other related work specified in other Sections to comply with the following requirements:

1. Provide temporary enclosures for interior applications to prevent deterioration of fire-resistive material due to exposure to unfavorable environmental conditions.

2. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.

3. Do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material. Fireproofing shall be considered dry when the moisture content is 6% or less.

4. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.

5. Defer installing ducts, piping, and other items that would interfere with applying fire- resistive material until application of fire protection is completed.

6. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, tested, and corrections have been made to defective applications.

7. Protect permanently exposed walls, floor or special surfaces.

1.12 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive The City of New York of other rights The City of New York may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty, executed by Contractor and cosigned by Installer, agreeing to repair or replace sprayed fire-resistive materials that fail within the specified warranty period.

1. Failures include, but are not limited to, cracking, flaking, eroding in excess of specified requirements; peeling; and delaminating of sprayed fire-resistive materials from substrates due to defective materials and workmanship within the specified warranty period.

2. Not covered under the warranty are failures due to damage by occupants and The City of New York's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

C. Warranty Period: Three (3) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

A. General: For concealed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated in this Article for material composition and physical properties representative of installed products.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

B. UL design listings must state that the loading was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL design listings requiring a load restriction factor will not be allowed.

C. Material Composition: As follows:

1. Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or Portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.

D. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property listed as follows:

1. Dry Density: 15 lb./cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistive design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Appendix A, "Alternate Method for Density Determination."

2. Thickness: Provide minimum average thickness required for fire-resistive design shown on approved submittals.

a. Fireproofing shall be of thicknesses and density to meet the requirements of the New York City Building Code.

3. Bond Strength: 430 lbf/sq. ft. per ASTM E 736.

4. Compressive Strength: 5.21 lbf/sq. in. as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb./cu. ft.

5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

6. Deflection: No cracking, spalling, delamination, or the like per ASTM E 759.

7. Effect of Impact on Bonding: No cracking, spalling, delamination, or the like per ASTM E 760.

8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch, maximum dry density is 15 lb./cu. Ft., test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.

9. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

   a. Flame Spread: 10 or less.
   b. Smoke Developed: 0.

10. Fungal Resistance: No observed growth on specimens per ASTM G 21.

E. Products: Subject to compliance with requirements, provide products by one of the following:

1. Cementitious Sprayed Fire-Resistive Material

   a. Monokote Type MK-10HB; GCP Applied Technologies.
   b. Cafco 300HS; Isolatek International Corp., Cafco Products.
   c. Or approved equal.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS FOR EXPOSED FIREPROOFING

A. General: For exposed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

B. UL design listings must state that the loading was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL design listings requiring a load restriction factor will not be allowed.

C. Cementitious Sprayed Fire-Resistive Material: Factory-mixed, dry, cement aggregate formulation, chloride-free formulation of Portland cement binders, additives, and inorganic aggregates, mixed with water at Project site to form a slurry or mortar for conveyance and application, complying with the following requirements:

1. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Appendix A, "Alternate Method for Density Determination," but with an average density of not less than 22 lb./cu. ft.

2. Bond Strength: 2000 psf minimum per ASTM E 736.

3. Compressive Strength: 100 psi per ASTM E 761.

4. Corrosion Resistance: No evidence of corrosion per ASTM E 937.

5. Deflection: No cracking, spalling, delamination, or the like per ASTM E 759.

6. Effect of Impact on Bonding: No cracking, spalling, delamination, or the like per ASTM E 760.

7. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. per ASTM E 859.

8. Combustion Characteristics: Passes ASTM E 136.

9. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

   a. Flame Spread: 10 or less.
   b. Smoke Developed: 0.

10. Fungal Resistance: No observed growth on specimens per ASTM G 21.

D. Products: Subject to compliance with requirements, provide one of the following:

1. Cement-Aggregate Cementitious Sprayed Fire-Resistive Material:

   a. Pyrocrete 239; Carboline Co., Fireproofing Products Div.
   b. Monokote Type Z106HY; GCP Applied Technologies.
   c. F4; Promat Firetemp.
   d. Cafco 400, Isolatek International Corp; Cafco Products.
   e. Or approved equal.

2.3 AUXILIARY FIRE-RESISTIVE MATERIALS

A. General: Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistive designs indicated.

B. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of sprayed fire-resistive material, used where required by manufacturer to insure proper bond.

C. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistive designs indicated and fire-resistive product manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

D. Sealer for Sprayed Fire-Resistive Material in Elevator Shafts and Open Area Plenums: Transparent-drying, water-dispersible protective coating by manufacturer of fire-resistive material.

1. Product: Subject to compliance with requirements, provide "Firebond Concentrate" by GCP Applied Technologies, or similar product recommended by the manufacturer.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Examine substrates, with Installer present, to determine whether they are in satisfactory condition to receive sprayed fire-resistive material. A substrate is in satisfactory condition if it complies with the following:

1. Substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt, or other foreign substances capable of impairing bond of fire-resistive material with substrate under conditions of normal use or fire exposure.

2. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

3. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

B. Do not proceed with installation of fire-resistive material until unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Clean substrates of substances that could impair bond of fire-resistive material, including oil, grease, rolling compounds, incompatible primers, and loose mill scale.

B. For exposed applications, repair substrates to remove any surface imperfections that could affect uniformity of texture and thickness in finished surface of sprayed fire-resistive material. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

C. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application. Provide temporary enclosure as required to confine spraying operations, protect the environment, and ensure maintenance of adequate ambient conditions for temperature and ventilation.

3.4 INSTALLATION

A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to convey and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

B. Install metal lath, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by fire-resistive material manufacturer. Attach lathing accessories where indicated or required for secure attachment to substrate.

C. Coat substrates with adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by fire-resistive material manufacturer for material and application indicated.

D. Extend fire-resistive material in full thickness over entire area of each substrate to be protected.

E. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by method recommended by the manufacturer.

F. Where sealers are used, apply products that are tinted to differentiate them from the sprayed fire-resistive material over which they are applied.

G. Maintain ambient conditions during installation and for cure period following installation, as recommended by manufacturer. Provide ventilation and avoid excessive rate of drying.

H. Fireproofing to the underside of roof deck assemblies shall be done only after roofing application is complete, all roof mounted mechanical equipment is in place, and the roof is watertight.

I. No fireproofing shall be applied prior to completion of concrete work on steel decking.

J. Installation Sequence of Fireproofing: All patching and repairing of sprayed fireproofing, due to cutting by other trades or testing and inspection, shall be performed under this Section.

K. Provisions shall be made for ventilation to properly dry the fireproofing after application. In enclosed areas lacking natural ventilation, air circulation and ventilation must be provided.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: The City of New York will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing and inspecting of completed applications of sprayed fire-resistive material will take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of fire-resistive material for the next area until test results for previously completed applications of fire-resistive material show compliance with requirements.

1. For each 1000-sq. ft. area, or partial area, on each floor, testing and inspecting agency will evaluate the following characteristics. Tested values must equal or exceed values indicated and values required for approved fire-resistance design.

a. Thickness for Floors, Roofs, and Walls: From the average of 10 measurements from a 144-sq. in. sample area, with sample width of not less than 6 inches per ASTM E 605.

2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.

3. For each 10,000 sq. ft. area, or partial area, on each floor, testing and inspection agency will evaluate the following characteristics. Tested values must equal or exceed values indicated and values required for approved fire resistance design.

    a. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: Cohesion and adhesion at frequency and from sample size indicated for determining thickness of each type of construction, per ASTM E 736.

4. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction, per ASTM E 605 or AWCI Technical Manual 12-A, Appendix A, "Alternate Method for Density Determination."

5. When testing discovers applications of fire-resistive material not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.

C. Remove and replace applications of fire-resistive material where test results indicate that they do not comply with specified requirements for cohesion and adhesion or for density, or both.

D. Apply additional fire-resistive material per manufacturer's written instructions where test results indicate that thickness does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 CLEANING, PROTECTING, AND REPAIR

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Cure exposed sprayed fire-resistive material according to product manufacturer's written recommendations to prevent premature drying.

C. Protect fire-resistive material, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at the time of Substantial Completion.

D. Coordinate application of fire-resistive material with other construction to minimize the need to cut or remove fire protection. As installation of other construction proceeds, inspect fire- resistive material and patch any damaged or removed areas.

1. Patch and repair fireproofing where The City of New York’s Testing Agency has performed tests.

E. Repair or replace work that has not been successfully protected.

END OF SECTION

SECTION 07 81 23 INTUMESCENT FIREPROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section, as shown or specified, shall be in accordance with the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the intumescent fireproofing on fireproofed steel exposed view, as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Intumescent fireproofing for interior application.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Structural steel - Section 051200.

C. Painting and finishing - Section 099100.

1.5 REFERENCES

A. ASTM Test Standards

1. ASTM D 2240 – Durometer Hardness (Shore D Only).

2. ASTM D 2794 – Impact Resistance.

3. ASTM D 4060 – Abrasion Resistance.

4. ASTM D 4541 – Bond Strength.

5. ASTM E 84 – Surface Burning Characteristics of Building Materials.

6. ASTM E 119 – Fire Tests of Building Construction and Materials.

B. The Society of Protective Coatings (SSPC):

1. SSPC SP-6: Commercial Blast Cleaning Standard.

C. Underwriters' Laboratories Inc. (UL):

1. Fire Resistive Directory, Volume 1; Current edition. Classification identified as Mastic and Intumescent Coatings (CDWZ)

2. UL 263 - Fire Test of Building Construction and Material

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Adhesives and Sealants
   7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Submit product data including manufacturer's technical information indicating product performance characteristics, performance and limitation criteria for each product specified herein.

C. Submit evidence indicating that manufacturer of the intumescent fireproofing coating has reviewed and approved shop primer to be used by the structural steel fabricator; refer to Section 051200, "Structural Steel," for primer description.

D. Submit evidence indication that manufacturer of the intumescent fireproofing coating has reviewed and approved proposed topcoat.

E. Fire Test Evidence: Submit published third party design listings for fire resistance ratings and product thickness. Include evidence that the fire testing was sponsored by the manufacturer and that the material tested was produced at the manufacturer's facility under the supervision of third party certification personnel.

F. Installation Instructions: Submit manufacturer's written installation instructions.

G. Installer Qualifications: Submit applicator's current certification as a manufacturer trained and approved installer.

H. Shop Drawings: Submit plan, section, elevation and perspective drawings as necessary to depict system configuration, design considerations and application procedures.

I. Selection Samples: For each finish product specified, submit samples representing manufacturer's range of available materials, finishes and shapes.

1.9 QUALITY ASSURANCE

A. Material Manufacturer: Company specializing in manufacturing products listed in this section.

1. Fire Protection Factory Manufacturer: Company specializing in manufacturing the work of this section with a minimum of three years' documented experience, and certified by the material manufacturer.

B. Fire Protection Installer: Company specializing in installing the work of this section with a minimum of three years' documented experience and certified by the material manufacturer.

C. Product

1. All products listed in this section must be manufactured under the appropriate follow-up service with each container bearing the certified label (mark).

2. Intumescent fireproofing shall be a complete system consisting of compatible primer, intumescent fireproofing coating, adhesive, edge sealant and decorative topcoat.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Before proceeding with the work, the installer will apply the primer, intumescent fireproofing, and decorative top coat to a representative substrate section of 10 square feet in size. Areas will be designated by the Commissioner.

2. Materials must be applied in accordance with the project requirements for fire rating thickness, finish texture and color.

3. The application must be witnessed by the Commissioner's representative or Commissioner and is subject to their approval. Once agreed upon in writing, it serves as a guide for the finished work.

4. Do not proceed with remaining work until workmanship, color, and sheen are approved by Commissioner.

5. Refinish mock-up area as required to produce acceptable work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer's original, sealed, undamaged container with identification label intact. Packaged materials must bear the appropriate labels, seals and designated certification mark for fire resistive ratings.

B. Storage: Store materials in strict accordance with manufacturers documented instructions.

C. Documentation: All batch number, product identification and quantities shall be recorded on appropriate QC documents. A copy of the transport document and manufacturers conformance certificate shall be attached to the material delivery QC form.

D. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.11 PROJECT CONDITIONS

A. Project Environmental Requirements: Substrate and air temperature shall be in accordance with the manufacturer's requirements.

1. Protect work area from windblown dust and rain. Protect adjacent areas from over spray of fireproofing material.

2. Provide ventilation in areas to receive work of this section during application and minimum 24 hours after application.

B. Temperature and Humidity Requirements: Maintain air temperature and relative humidity in areas where products will be applied for a time period before during and after application as recommended by manufacturer.

1. Do not install intumescent fire protection system when temperature of substrate and/or surrounding ambient air temperature is below 41 degrees F. Temporary protection and heat shall be maintained at this minimum temperature for 24 hours before, during and 24 hours after material application.

2. Steel substrate temperature shall be a minimum of 5 deg F. above the dew point of the surrounding air for a period of 24 hours prior and during the application of the material.

3. If necessary for job schedule, the Contractor shall provide enclosures and heat to maintain proper temperatures and humidity levels in the application areas.

4. The relative humidity of the application area shall not exceed a maximum of 85 percent for 24 hours prior, during and 24 hours after the application of the material.

1.12 SEQUENCING AND SCHEDULING

A. Sequence and coordinate installation of fireproofing system with Work in other sections which would interfere with efficient fireproofing application.

B. Do not apply fire protection materials to supporting structural steel until the concrete toppings and/or roofing applications have been completed and are substantially dry.

1.13 WARRANTY

A. At project closeout, provide to The City of New York an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

1. Duration: Minimum two years.

PART 2 - PRODUCTS

2.1 INTUMESCENT FIREPROOF COATING FOR INTERIOR APPLICATION

A. Acceptable Products

1. “CFP-SPWB Fire Finish” made by Hilti.

2. "Interchar 1120" made by International Paint.

3. "Thermo-Lag Series" made by Carboline.

4. "Albi Clad TF" made by Albi Mfg. Co.

5. "Cafco Spray Film – WB 5" made by Isolatek International for columns only, and WB-3 for beams, joists and girders.

6. Or approved equal.

B. Description: A single pack, chlorine-free, water borne intumescent coating site applied over shop applied prime coat (see Section 051200). Coating must meet the following minimum physical requirements:

1. PROPERTY TEST METHOD VALUE

2. Dry Applied Density 85 PCF

3. Hardness ASTM D 2440 60

4. Compressive Strength ASTM D 695500 psi

5. Bond Strength ASTM D 4541 145 psi

6. Abrasion Resistance ASTM D 4060 0.16 grams loss @1000 cycles

7. Flame Spread ASTM E 84 Class A

8. Smoke Developed ASTM E 84 Class A

C. Fireproofing Performance: Provide intumescent fireproofing system, tested by independent testing agency in accordance with ASTM E 119/UL 263, and acceptable to authorities having jurisdiction:

1. Listed by UL and bearing the UL label.

D. Structural Steel Fire Resistance Rating

1. Fire Resistance Rating: Provide as shown on Construction Drawings or as required by code.

E. Accessory Materials: Manufacturer's recommended adhesive and edge sealant.

F. Shop Primer Coating: Refer to Section 051200, "Structural Steel."

G. Decorative Topcoat: Approved by the intumescent fireproofing manufacturer and applied in accordance with the topcoat manufacturer's documented instructions, custom colors as selected by the Commissioner.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. All surfaces to receive the fire protection material must be clean, dry and free of oil, grease, loose mill scale, loose shop primer, dirt, dust or other foreign substances which would impair bond of the fire protection material to the substrate.

B. Do not commence installation of the fire protection system until the contractor, installer and fire protection manufacturer’s representative have examined the surfaces to receive the fire protection and determined the surfaces are acceptable to receive the fire protection material. Commencement of installation is acceptance of substrate.

C. Verify that substrate and workspace temperature and humidity conditions are in accordance with requirements of this section.

D. Verify that all clip hangers, piping, ducts, equipment or other items which would interfere with the installation of the factory-manufactured architectural fire protection system are not positioned or installed until installation is complete.

3.3 PREPARATION

A. Provide masking, drop cloths or other suitable coverings to prevent overspray onto surfaces not intended to be affected by Work in this section.

B. Clean substrate free of dust, dirt, grease or other foreign substances that would impair with the bond of the intumescent fireproofing protection adhesive material.

C. Grind smooth all weld spatter and defects prior to commencement of fire protection installation and touch-up shop primer in the field using same paint as shop primer.

3.4 APPLICATION (FIELD APPLIED)

A. Equipment and installation procedures must conform to the manufacturer's installation instructions. The intumescent fireproofing protection material shall be applied at the required dry film thickness to achieve fire resistance rating specified herein.

B. Install fire protection material only to primed surfaces and in accordance with manufacturer's installation instructions. Refer to Section 051200 for steel shop primer.

C. Final texture and finish of the intumescent fireproofing must be completed prior to the application of the decorative top coat and in accordance with the Commissioner's approval and approved mock-up samples. Finish shall be level 4 (high end architectural – spray applied, back rolled and sanded smooth).

D. Apply decorative top coat in accordance with the manufacturer's application instructions. Final color, gloss and finish will be determined and approved by the Commissioner.

3.5 FIELD QUALITY CONTROL

A. The City of New York shall retain the services of an independent testing laboratory to inspect and verify the installation of the intumescent fireproofing material in accordance with the provisions of AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide.

B. The fire protection material inspection must be performed prior to the application of the decorative top coat.

C. All test results must be made available to all parties at the completion of each pre-designated area and approved prior to the application of top-coat.

D. Intumescent fireproofing not in compliance with the specification requirements must be corrected prior to the application of the decorative top coat.

3.6 CLEAN UP AND REPAIR

A. Upon completion of installation, all excess material, overspray and debris must be cleared and removed from the job site.

B. Remove fire protection materials from surfaces not required to be fireproofed.

C. All patching and repair to intumescent fireproofing, due to damage by other trades, shall be performed under this section of work. Patching must be performed by the installer of the intumescent fireproofing and applied in accordance with the manufacturer's installation instructions.

3.7 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 84 13 FIRESTOPS AND SMOKESEALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the firestops and smokeseals as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.

4. Sealant joints in fire-resistance-rated construction.

5. Penetrations at each floor level in shafts and/or stairwells.

6. Construction joints, including those between top of fire rated walls and underside of floors above.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Cast-in-place concrete - Section 033000.

C. Unit masonry - Section 042000.

D. Joint sealers - Section 079200.

E. Gypsum Drywall - Section 092900.

F. Piping penetrations - Division 22.

G. Duct penetrations - Division 23.

H. Cable and conduit penetrations - Division 26.

1.5 REFERENCES

A. ASTM E 814 "Standard Method of Fire Tests of Through-Penetration Firestops."

B. UL 1479, UBC 7-5 (Both are same as A. above).

C. ASTM E 136 "Standard Test Method for Assessing Combustibility of Materials."

D. UL 263, UBC 7-1 "Fire Tests of Building Construction and Materials"

E. UL 2079 "Tests For Fire Resistance of Building Joint Systems."

F. ASTM E 1399 "Test For Dynamic Movement Conditions."

G. ASTM E 1966 (Same as E. above).

H. ASTM G 21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi."

I. Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus."

J. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Firestops."

K. Published Through-Penetration Systems by recognized independent testing agencies.

1. UL Fire Resistance Directory, Volume II of current year.

2. Warnock Hersey Certification Listings, current year.

3. Omega Point Laboratories, current year.

L. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

M. Material must have approval for use in New York City.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)

2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Insulation
8. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Submit manufacturer's product literature for each type of firestop material to be installed. Literature shall indicate product characteristics, typical uses, performance, limitation criteria, test data and indication that products comply with specified requirements.

C. Submit shop drawings detailing materials, installation methods, and relationships to adjoining construction for each firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspection agency evidencing compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, for proposed UL listed (or equal) firestop and smokeseal assembly required for the Project.

D. Material Safety Data Sheets: Submit MSDS for each firestop product.

E. Submit qualifications of firestop installer, including letter from firestop manufacturer of products proposed to be installed, wherein manufacturer approves or recognizes as trained/ or certifies installer for installation of that manufacturer's products.

F. Engineering Judgment: For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

1.9 QUALITY ASSURANCE

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire and the passage of smoke and other gases.

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single sole source firestop specialty contractor.

C. Firestopping materials shall conform to Flame (F) and Temperature (T) ratings as required by local building code and as tested by nationally accepted test agencies per ASTM E 814 or UL 1479. The F-rating must be a minimum of one (1) hour, but not less than the fire resistance rating of the assembly being penetrated. T-rating, when required by code authority, shall be based on measurement of the temperature rise on the penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.

1. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

    a. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
    b. T-Rating: When penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
    c. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

2. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

    a. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.

D. Firestopping products shall be asbestos free and free of any PCBs.

E. Do not use any product containing solvents or that requires hazardous waste disposal.

F. Do not use firestop products which after curing, dissolve in water.

G. Do not use firestop products that contain ceramic fibers.

H. Firestopping Installer Qualifications: Firestop application shall be performed by a single firestopping contractor who specializes in the installation of firestop systems, whose personnel to be utilized have received specific training and certification or approval from the proposed respective firestop manufacturer, and firestop installer shall have a minimum of three years' experience (under present company name) installing firestop systems of the type herein specified.

I. Mock-Up: Prepare job site mock-ups of each typical Firestop System proposed for use in the project. Approved mock-ups will be left in place as part of the finished project and will constitute the quality standard for the remaining work.

J. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

K. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of less than or equal to 1 as determined by ASTM G 21.

L. Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post-installed." Provide cast-in-place firestop devices prior to concrete placement.

M. Firestop systems do not reestablish the structural integrity of load bearing partitions or assemblies, or support live loads and traffic. Installer shall consult the Structural Engineer prior to penetrating any load bearing assembly.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original unopened containers with manufacturer's name, product identification, lot numbers, UL or Warnock Hersey labels, and mixing and installation instructions, as applicable.

B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturer.

C. All firestop materials shall be installed prior to expiration of shelf life.

1.11 PROJECT CONDITIONS

A. Verify existing conditions and substrates before starting work

B. Do not use materials that contain solvents, show sign of damage or are beyond their shelf life.

C. During installation, provide masking and drop cloths as needed to prevent firestopping products from contaminating any adjacent surfaces.

D. Conform to ventilation requirements if required by manufacturer's installation instructions or Material Safety Data Sheet.

E. Weather Conditions: Do not proceed with installation of firestop products when temperatures are in excess or below the manufacturer's recommendations.

F. Schedule installation of firestop products after completion of penetrating item installation but prior to covering or concealing of openings.

G. Coordinate this work as required with work of other trades.

1.12 SEQUENCING AND SCHEDULING

A. Pre-Installation Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

B. Sequence: Perform work of this and other sections in proper sequence to prevent damage to the firestop systems and to ensure that their installation will occur prior to enclosing or concealing work.

C. Install all firestop systems after voids and joints are prepared sufficiently to accept the applicable firestop system.

D. Do not cover firestop systems until they have been properly inspected and accepted by the authority having jurisdiction.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following manufacturers:

1. Hilti, Inc.
2. Metacaulk.
3. Nelson.
4. Specified Technologies Inc.
5. 3M.
6. Tremco.
7. U.S. Gypsum Co.
8. Or approved equal.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:

1. Permanent forming/damming/backing materials including the following:
    a. Semirefractory fiber (mineral wool) insulation.
    b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
    d. Joint fillers for joint sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

D. Smokeseals at top of partitions shall be flexible to allow for partition deflection.

E. Polypropylene Sleeves (PP): (For cast-in device options.)

2.3 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.

B. Intumescent, Latex Sealant: Single-component, Intumescent, latex formulation.

C. Intumescent Putty: Non-hardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

D. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum or polyethylene foil on one side.

E. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

F. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

G. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

H. Moldable putty pads by 3M or approved equal.

I. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, non-shrinking foam.

J. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and non-sag formulation for openings in vertical and other surfaces requiring a non-slumping/gunnable sealant, unless firestop system limits use to non-sag grade for both opening conditions.

K. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic or polypropylene sleeve lined with an intumescent strip, an extended rectangular flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

L. Fire Rated Cable Management Devices: Factory-assembled round metallic sleeve device for use with cable penetrations, containing an integrated smoke seal fabric membrane that can be opened and closed for re-penetration.

M. Drop-In Firestop Devices: Factory-assembled devices for use with combustible or noncombustible penetrants in cored holes within concrete floors. Device shall consist of

galvanized steel sleeve lined with an intumescent strip, an extended rectangular flange attached to one end of the sleeve for fastening to concrete floor, and neoprene gasket.

N. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

O. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

P. Blocks/Plugs: Intumescent flexible block/plug suitable for reuse in re-penetration of openings. Blocks shall allow up to 12" of unreinforced annular space.

2.4 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.

1. Sealant Colors: Color of exposed joint sealants as selected by the Commissioner.

B. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand 33 percent movement in both extension and compression for a total of 66 percent movement.

C. Multi-Component, Non-Sag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated.

D. Single-Component, Non-Sag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

2.5 MINERAL FIBER/CERAMIC WOOL NON-COMBUSTIBLE INSULATION (FIRE SAFING)

A. Provide min. 4 pcf safing insulation; Thermafiber Safing Mineral Wool Insulation by Thermafiber, Inc. (an Owens Corning company), Roxul Safe Fire Safing Insulation by Rockwool, Mineral Wool Safing by Johns Manville or approved equal to suit conditions and to comply with fire resistance and firestop manufacturer's requirements.

B. Material shall be classified non-combustible when tested per ASTM E 136.

2.6 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to

produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Examine substrates and conditions with Installer present, for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.4 CONDITIONS REQUIRING FIRESTOPPING

A. Interior Walls and Partitions

1. Construction joints between top of fire rated walls and underside of floors above, shall be firestopped.

2. Firestop system installed shall have been tested by either UL or Omega Point, including exposure to hose stream test and including for use with steel fluted deck floor assemblies.

3. Firestop system used shall allow for deflection of floor above.

B. Penetrations

1. Penetrations include conduit, cable, wire, pipe, duct, or other elements which pass through one or both outer surfaces of a fire rated floor, wall, or partition.

2. Except for floors on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof, provide firestopping to fill such spaces in accordance with ASTM E 814.

3. These requirements for penetrations shall apply whether or not sleeves have been provided, and whether or not penetrations are to be equipped with escutcheons or other trim. If penetrations are sleeved, firestop annular space, if any, between sleeve and wall of opening.

C. Provide firestopping to fill miscellaneous voids and openings in fire rated construction in a manner essentially the same as specified herein before.

3.5 INSTALLING THROUGH PENETRATION FIRESTOPS

A. General: Comply with the through penetrations firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.6 INSTALLING FIRE RESISTIVE JOINT SEALANTS

A. General: Comply with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool no sag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.7 INSTALLING FIRESAFING INSULATION

A. Install fire safing insulation utilizing welded or screw applied galvanized steel impaling pins and retaining clips; space clips or pins 24" o.c. maximum.

B. Completely fill voids in areas where safing insulation is required. At spandrel conditions/floor edges, depth of insulation top to bottom shall be at least four (4) inches.

C. Cover top of all safing insulation with firestop sealant or spray.

3.8 FIELD QUALITY CONTROL

A. Inspecting agency employed and paid by The City of New York will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.

B. Inspecting agency will report observations promptly and in writing to Contractor, The City of New York and Commissioner.

C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

D. Where deficiencies are found, Contractor must repair or replace firestopping so that it complies with requirements.

3.9 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which openings and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to product firestopping complying with specified requirements.

END OF SECTION

SECTION 07 92 00 JOINT SEALERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the joint sealers work as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Flashing reglets and retainers.
2. Exterior wall joints not specified to be sealed in other Sections of work.
3. Interior wall joints not specified to be sealed in other Sections of work, including caulking to fill between architectural woodwork and any wall, floor and/or ceiling imperfections.
4. Control and expansion joints in walls.
5. Joints at wall penetrations.
6. Joints between items of equipment and other construction.
7. All other joints required to be sealed to provide a positive barrier against penetration of air and moisture.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Roofing - Division 7.

C. Firestops and smokeseals – Section 078413.

D. Glass and glazing - Section 088000.

E. Sealant within drywall construction - Section 092900.

F. Sealant at tile work - Section 093000.

1.5 QUALITY ASSURANCE

A. Qualification of Installers: Use only personnel who are thoroughly familiar, skilled and specially trained in the techniques of sealant work, and who are completely familiar with the published recommendations of the sealant manufacturer.

B. Pre-Construction Field Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to project joint substrates according to the method in ASTM C 794 and C 1521 that is appropriate for the types of Project joints.

C. Perform testing per ASTM C 1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work shall start until results of these tests have been submitted and the Commissioner has given written approval to proceed with the work.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Adhesives and Sealants
   7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Shop Drawings: Submit shop drawings showing all joint conditions, indicating relation of adjacent materials, all sealant materials (sealant, bond breakers, backing, primers, etc.), and method of installation.

   1. Submit joint sizing calculations certifying that movement capability of sealant is not being

exceeded.

C. Samples: Submit the following:

1. Color samples of sealants, submit physical samples (not color chart).

2. Sealant bond breaker and joint backing.

D. Product Data: Submit manufacturer's technical information and installation instructions for:

1. Sealant materials, indicating that material meets standards specified herein.

2. Backing rods.

E. Submit manufacturer's certification as required by Article 1.6 herein.

F. Submit results of testing required in Article 1.4 herein.

1.9 MANUFACTURER'S RESPONSIBILITY AND CERTIFICATION

A. Contractor shall require sealant manufacturer to review the Project joint conditions and details for this Section of the work. Contractor shall submit to the Commissioner written certification from the sealant manufacturer that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vaportight seals (as applicable), and that materials supplied meet specified performance requirements.

1.10 ENVIRONMENTAL CONDITIONS

A. Temperature: Install all work of this Section when air temperature is above forty (40) degrees F. and below eighty (80) degrees F., unless manufacturer submits written instructions permitting sealant use outside of this temperature range.

B. Moisture: Do not apply work of this Section on surfaces which are wet, damp, or have frost.

1.11 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section, before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

C. Storage

1. Store sealant materials and equipment under conditions recommended by their manufacturer.

2. Do not use materials stored for a period of time exceeding the maximum recommended shelf life of the material.

3. Material shall be stored in unopened containers with manufacturers’ name, batch number and date when shelf life expires.

1.12 GUARANTEE

A. Provide a written, notarized guarantee from the manufacturer stating that the applied sealants shall show no material failure for a period of twenty (20) years.

B. Contractor to provide a written, notarized, guarantee stating that the applied sealants shall show no failure due to improper installation for a period of five (5) years.

C. Guarantee shall be in a form acceptable to The City of New York and executed by an authorized individual.

D. Include in guarantee provision, agreement to repair and/or replace, at Contractor's expense, sealant defects which develop during guarantee period, because of faulty labor and/or materials.

PART 2 PRODUCTS

2.1 SEALANT MATERIALS

A. Exterior Wall Sealant: Provide one (1) part non-sag sealant equal to "DOWSIL 790" or "DOWSIL 795" made by The Dow Chemical Company, "Silpruf SCS 2000" or "LM SCS 2700" made by G.E., "Spectrem 1" or "Spectrem 3" made by Tremco or "Sonolastic 150" by Sonneborn conforming to the minimum standards of ASTM C 920, Type S, Grade NS, Class 50.

B. Interior Sealant: Provide a one (1) part acrylic based sealant conforming to ASTM C 834, equal to "AC-20+ Silicone" made by Pecora, Masterseal NP 520 by BASF or equal made by Tremco.

C. Colors: Colors selected from manufacturer's standard selection.

2.2 MISCELLANEOUS MATERIALS

A. Back-Up Materials: Provide back-up materials and preformed joint fillers, non-staining, non-absorbent, compatible with sealant and primer, and of a resilient nature, equal to "HBR" made by Nomaco Inc. or approved equal, twenty-five (25) percent wider than joint width. Materials impregnated with oil, bitumen or similar materials shall not be used. Provide back-up materials only as recommended by sealant manufacturer in writing.

B. Provide bond breakers, where required, of polyethylene tape as recommended by manufacturer of sealant.

C. Provide primers recommended by the sealant manufacturer for each material to receive sealant. Note that each exterior joint must be primed prior to sealing.

D. Provide solvent, cleaning agents and other accessory materials as recommended by the sealant manufacturer.

E. Materials shall be delivered to the job in sealed containers with manufacturer's original labels attached. Materials shall be used per manufacturer's printed instructions.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where joint sealers are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION

A. Sealant Installation Standard: Comply with instructions and recommendations of the manufacturer and in accordance with ASTM C 1193 for use of joint sealants as applicable to materials, applications and conditions required by this Project where more stringent installation requirements are specified herein, such requirements shall apply.

B. Sample Section of Sealant

1. During sealant installation work in exterior wall, the manufacturer of sealant shall send their representative to the site, under whose supervision a section of the wall (used as "control section") shall be completed for purposes of determining performance characteristics of sealant in joints. Commissioner shall be informed of time and place of such installation of control section.

2. Control section shall be installed according to specification given herein and shall not be considered as acceptable until written acceptance is provided by the Commissioner.

3. Accepted control section shall be standard to which all other sealant work must conform.

C. Supervision: The Contractor shall submit to the Commissioner written certification from the sealant manufacturer that the applicators have been instructed in the proper application of their materials. The Contractor shall use only skilled and experienced workmen for installation of sealant.

D. Apply sealant under pressure with a hand or power actuated gun or other appropriate means. Gun shall have nozzle of proper size and provide sufficient pressure to completely fill joints as detailed. Neatly point or tool joint to provide the contour as indicated on the drawings.

E. Preparation and Application

1. Thoroughly clean all joints, removing all foreign matter such as dust, oil, grease, water, surface dirt and frost. Sealant must be applied to the base surface. Previously applied film must be entirely removed.

2. Stone, masonry and concrete surfaces to receive sealant shall be cleaned where necessary by grinding, water blast cleaning, mechanical abrading, or combination of these methods as required to provide a clean, sound base surface for sealant adhesion.

   a. Do not use any acid or other material which might stain surfaces.
   b. Remove laitance by grinding or mechanical abrading.

c. Remove loose particles present or resulting from grinding, abrading, or blast cleaning by blowing out joints with compressed air, oil and water free, or vacuuming joints prior to application of primer or sealant.

3. Clean non-porous surfaces such as metal and glass chemically. Remove protective coatings on metallic surfaces by solvent that leaves no residue and is compatible with sealant. Use solvent and wipe dry with clean, dry lint free paper towels. Do not allow solvent to air dry without wiping. Clean joint areas protected with masking tape or strippable films as above after removal of tape film.

4. Do not seal joints until they are in compliance with drawings, or meet with the control section standard.

5. Joint Size and Sealant Size: Joints to receive sealant shall be at least 1/4" wide. In joint 1/4" to 3/8" wide, sealant shall be 1/4" deep. In joints wider than 3/8" and up to 1" wide, sealant depth shall be one half the joint width. For joints wider than 1", sealant depth shall be as recommended by the sealant manufacturer. Depth of joint is defined as distance from outside face of joint to closest point of the filler.

6. Primer: Thoroughly clean joints and apply primer to all surfaces that will receive sealant. Apply primer on clean, dry surfaces, and prior to installation of joint backing. Completely wet both inner faces of the joint with primer. Mask adjacent surfaces of joint with non- staining masking tape prior to priming. Apply primer with clean brush and only when temperature is above 45 deg. F.

7. Joint Backing: In joints where depth of joint exceeds required depth of sealant, install joint backing (after primer is dry) in joints to provide backing and proper joint shape for sealant. Proper shape for sealant is a very slight "hourglass" shape, with back and front face having slight concave curvature. Use special blunt T-shaped tool or roller to install joint backing to the proper and uniform depth required for the sealant. Joint backing shall be installed with approximately twenty-five (25) percent compressions. Do not stretch, twist, braid, puncture, or tear joint backing. Butt joint backing at intersections.

8. Bond Breaker: Install bond breaker smoothly over joint backing so that sealant adheres only to the sides of the joint and not backing.

9. Sealant Application: Apply sealant in accordance with the manufacturer's application manual and manufacturer's instructions, using hand guns or pressure equipment, on clean, dry, properly prepared substrates, completely filling joints to eliminate air pockets and voids. Mask adjacent surfaces of joint with non-staining masking tape. Force sealant into joint in front of the tip of the "caulking gun" (not pulled after it) and force sealant against sides to make uniform contact with sides of joint and to prevent entrapped air or pulling of sealant off of sides. Fill sealant space solid with sealant.

10. Tooling: Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C 1193. Finished joints shall be straight, uniform, smooth and neatly finished. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Neatly remove any excess sealant from adjacent surfaces of joint, leaving the work in a neat, clean condition.

11. Replace sealant which is damaged during construction process.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

   a. Perform 5 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
   b. Perform one test for each 5,000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

END OF SECTION

SECTION 08 11 13 STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the steel doors and frames work as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Interior hollow metal doors and frames for fire-rated and unrated door openings.
2. Preparation of metal doors and frames to receive door hardware, including reinforcements, drilling and tapping necessary.
3. Preparation of hollow metal doors to receive glazing where required.
4. Steel louvers for hollow metal doors.
5. Furnishing anchors for building into masonry and drywall.
6. Factory prime painting of work of this Section.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Installation of doors and frames - Section 062000.

C. Wood Doors - Section 081416.

D. Door Hardware - Section 087100.

E. Glass and Glazing - Section 088000.

F. Gypsum Drywall - Section 092900.

G. Painting and Finishing - Section 099000.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements. The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Include construction details, material descriptions, core descriptions, label compliance, compliance with standards referenced herein, sound and fire-resistance ratings, and finishes for each type of door and frame specified.

C. Shop Drawings: Show fabrication and installation of doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, reinforcement for surface applied hardware, dimensions of profiles and hardware preparation, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessories.

D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Drawings.

1. Coordinate glazing frames and stops with glass and glazing requirements.

E. Oversize Construction Certification: For door assemblies required to be fire rated and exceeding limitations of labeled assemblies, submit certification of a testing agency acceptable to authorities having jurisdiction that each door and frame assembly has been constructed to comply with design, materials, and construction equivalent to requirements for labeled construction.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing custom steel doors and frames similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

C. Source Limitations: Obtain custom steel doors and frames through one source from a single manufacturer.

D. Fire-Rated Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1. Test Pressure: Test according to NFPA 252 or UL 10C. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40" or less above the sill.

2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire- protection-rated door assemblies except for size.

3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating as required by prevailing Building Code in 30 minutes of fire exposure.

E. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

F. Fire rated assemblies must have UL approved label.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.

B. Inspect doors and frames, on delivery, for damage. Minor damage may be repaired provided refinished items match new work and are approved by Commissioner; otherwise, remove and replace damaged items as directed.

C. Store doors and frames under cover at building site. Conform to the requirements of ANSI/SDI A250.11 for site storage unless more stringent requirements are noted herein. Place units on minimum 4-inch high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 PRODUCTS

2.1 FABRICATION - GENERAL

A. Fabricate hollow metal units to be rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously,

grind, dress, and make smooth, flush and invisible. Metallic filler to conceal manufacturing defects is not acceptable.

B. Unless otherwise indicated, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.

C. Prepare hollow metal units to receive door hardware, including cutouts, reinforcing, drilling and tapping in accordance with Door Hardware Schedule and templates provided by hardware suppliers. Comply with applicable requirements of ANSI A115 "Specifications for Door and Frame Preparation for Hardware."

D. Locate door hardware as shown on final shop drawings in accordance with locations noted herein.

2.2 MANUFACTURERS

A. Provide products manufactured by Steelcraft, Curries, Ceco Door Products, Fleming, Pioneer or approved equal meeting these specifications.

2.3 FRAMES

A. Materials

1. Frames for interior openings shall be either commercial grade cold-rolled steel conforming to ASTM A 1008, Type B or commercial grade hot-rolled steel conforming to ASTM A 1011, Commercial Steel, Type B. Metal thickness shall be not less than sixteen (16) ga. for frames in openings 4'-0" or less in width; not less than fourteen (14) ga. for frames in openings over 4'-0" in width.

B. Design and Construction

1. All frames shall be welded units with integral trim, of the sizes and shapes shown on approved shop drawings. Knock-down frames are not permitted.

2. All finished work shall be strong and rigid, neat in appearance, square, true and free of defects, warp or buckle. Molded members shall be clean cut, straight and of uniform profile throughout their lengths.

3. Jamb depths, trim, profile and backbends shall be as shown on drawings.

a. Frames at drywall partitions shall be formed with double return backbends to prevent cutting into drywall surface.

4. Welded frames shall have corners mitered and reinforced and faces of welded frames shall be continuously back welded full depth and width of frame conforming to NAAMM Standard HMMA-820; face joints shall be hairline.

5. Minimum depth of stops shall be 5/8".

6. Frames for multiple or special openings shall have mullion and/or rail members which are closed tubular shapes having no visible seams or joints. All joints between faces of abutting members shall be securely welded and finished smooth.

a. Mullions shall have 16 ga. internal steel stiffeners welded not less than 4" o.c.

7. Hardware Reinforcements

   a. Frames shall be mortised, reinforced, drilled and tapped at the factory for fully-templated mortised hardware only, in accordance with approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates.

   b. Minimum thickness of hardware reinforcing plates shall be as follows (contractor shall provide larger and thicker plates as required to accommodate weight of door):
      1). Hinge and pivot reinforcements - seven (7) ga., 1-1/4" x 10" minimum size.
      2). Strike reinforcements - twelve (12) gauge.
      3). Flush bolt reinforcements - twelve (12) gauge.
      4). Closer reinforcements - twelve (12) gauge.
      5). Reinforcements for surface mounted hardware - twelve (12) gauge.

8. Floor Anchors

   a. Provide adjustable floor anchors, providing not less than two (2) inch height adjustment.
   b. Minimum thickness of floor anchors shall be fourteen (14) gauge.

9. Jamb Anchors

   a. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the wire type. Anchors shall be not less than 0.156" diameter steel wire. The number of anchors provided on each jamb shall be as follows:
      1). Frames up to 7'-6" height - three (3) anchors.
      2). Frames 7'-6" to 8'-0" height - four (4) anchors.
      3). Frames over 8'-0" height - one (1) anchor for each 2'-0" or fraction thereof in height.
   b. Frames for installation in stud partitions shall be provided with steel anchors of suitable design, not less than eighteen (18) gauge thickness, securely welded inside each jamb as follows:
      1). Frames up to 7'-6" height - four (4) anchors.
      2). Frames 7'-6" to 8'-0" height - five (5) anchors.
      3). Frames over 8'-0" height - five (5) anchors plus one additional for each 2'-0" or fraction thereof over 8'-0".
   c. Frames to be anchored to previously placed concrete or masonry shall be provided with minimum 3/8" concealed bolts set into expansion shields or inserts at six (6) inches from top and bottom and twenty-four (24) inches o.c. Reinforce frames at anchor locations with sixteen (16) gauge sheet steel stiffeners welded to frame at each anchor.

10. Anchors in masonry walls shall be hot dip galvanized per ASTM A 153.

11. Frames for installation in masonry wall openings more than 4'-0" in width shall have an angle or channel stiffener factory welded into the head. Such stiffeners shall be not less than twelve (12) gauge steel and not longer than the opening width and shall not be used as lintels or load bearing members.

12. Dust cover boxes (or mortar guards) of not thinner than twenty-six (26) gauge steel shall be provided at all hardware mortises on frames to be set in masonry or plaster partitions.

13. Ceiling Struts: Minimum 3/8" thick x 2" wide steel.

14. All frames shall be provided with a steel spreader temporarily attached to the feet of both jambs to serve as a brace during shipping and handling.

15. Loose glazing stops shall be of cold rolled steel, not less than twenty (20) gauge thickness, butted at corner joints and secured to the frame with countersunk cadmium-or zinc-plated screws. Interior frames may be provided with snap-on glazing stops.

16. Except on weather-stripped frames, drill stops to receive three (3) silencers on strike jambs of single door frames and two (2) silencers on heads of double-door frames.

C. Finish: After fabrication, all tool marks and surface imperfections shall be removed, and exposed faces of all welded joints shall be dressed smooth. Frames shall then be chemically treated to ensure maximum paint adhesion and shall be coated on all surfaces with one coat of rust-inhibitive baked-on alkyd primer standard with the manufacturer which is fully cured before shipment to a dry film thickness of 2.0 mils.

1. Frames set in masonry walls shall be grouted in as described in Section 042000 "Unit Masonry." These frames shall have surfaces in contact with grout shop coated with epoxy coating equal to Series 27 FC Typoxy made by Tnemec or approved equal spray applied at 4 to 6 mils, passing NFPA 101, Class A for smoke and flame spread, tested per ASTM E 84.

2.4 HOLLOW METAL DOORS

A. Materials: Doors shall be made of commercial quality, level, cold rolled steel conforming to ASTM A 1008, Commercial Steel, Type B and free of scale, pitting or other surface defects. Face sheets for interior doors shall be not less than eighteen (18) gauge.

B. Design and Construction

1. All doors shall be of the types and sizes shown on the approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Minimum door thickness shall be 1-3/4".

2. All doors shall be strong, rigid and neat in appearance, free from warpage or buckles. Corner bends shall be true and straight and of minimum radius for the gauge of metal used.

3. Face sheets shall be stiffened by continuous vertical formed steel sections spanning the full thickness of the interior space between door faces. These stiffeners shall be not less than twenty-two (22) gauge spaced not more than six (6) inches apart and securely attached to face sheets by spot welds not more than five (5) inches o.c. Spaces between stiffeners shall be sound deadened and thermal insulated the full height of the door with an inorganic non-combustible batt type material.

4. Door faces shall be joined at their vertical edges by a continuous weld extending the full height of the door. All such welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.

5. Top and bottom edges of all doors shall be closed with a continuous recessed steel channel not less than fourteen (14) gauge, extending the full width of the door and spot welded to both faces. Exterior doors shall have an additional flush closing channel at their top edges and, where required for attachment of weather stripping, a flush closure also at their bottom edges. Openings shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.

6. Edge profiles shall be provided on both vertical edges of doors as follows:

   a. Single-acting swing doors - beveled 1/8" in two (2) inches.
   b. Double acting swing doors - rounded on 2-1/8" radius.
   c. No square edge doors permitted.

7. Hardware Reinforcements

   a. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only in accord with the approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware (or hardware, the interrelation of which is to be adjusted upon installation - such as top and bottom pivots, floor closers, etc.) is to be applied, doors shall have reinforcing plates.
   b. Minimum gauges for hardware reinforcing plates shall be as follows (contractor shall provide larger and thicker plates as required to accommodate weight of door):
      1). Hinge and pivot reinforcement - seven (7) gauge.
      2). Reinforcement for lock face, flush bolts, concealed holders, concealed or surface mounted closers - twelve (12) gauge.
      3). Reinforcements for all other surface mounted hardware - sixteen (16) gauge.

8. Glass Moldings and Stops

   a. Where specified or scheduled, doors shall be provided with hollow metal moldings to secure glazing by others in accordance with glass opening sizes shown on drawings.
   b. Fixed moldings shall be securely welded to the door on the security side.
   c. Loose stops shall be not less than twenty (20) gauge steel, with mitered corner joints, secured to the framed opening by cadmium or zinc-coated countersunk screws spaced eight (8) inches o.c. Snap-on attachments will not be permitted. Stops shall be flush with face of door.

9. Louvers shall be sixteen (16) gauge sheet steel, stationary type, closely spaced inverted "V" blade design, flush with face sheets of door, integral with and welded to door. Fifty (50) percent free area, unless indicated otherwise on drawings.

C. Finish: After fabrication, all tool marks and surface imperfections shall be dressed, filled and sanded as required to make all faces and vertical edges smooth, level and free of all irregularities. Doors shall then be chemically treated to insure maximum paint adhesion and shall be coated, on all exposed surfaces, with manufacturer's standard rust-inhibitive alkyd primer as specified for frames which shall be fully cured before shipment.

D. Flatness: Doors shall maintain a flatness tolerance of 1/16" maximum, in any direction, including in a diagonal direction.

2.5 LABELED DOORS AND FRAMES

A. Labeled doors and frames shall be provided for those openings requiring fire protection ratings as scheduled on drawings. Such doors and frames shall be labeled by Underwriters' Laboratories or other nationally recognized agency having a factory inspection service.

B. If any door or frame specified by the Commissioner to be fire-rated cannot qualify for appropriate labeling because of its design, size, hardware or any other reason, the Commissioner shall be so advised before fabricating work on that item is started.

2.6 HARDWARE LOCATIONS

A. The location of hardware on doors and frames shall be as noted in "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames" of the Door Hardware Institute unless otherwise required by prevailing Handicapped Codes.

2.7 CLEARANCES

A. Fabricate doors and frames to meet edge clearances as follows:

1. Jambs and Head: 1/8" plus or minus 1/16".

2. Meeting Edges, Pairs of Doors: 1/8" plus or minus 1/16".

3. Bottom: 3/4" if no threshold, 3/8" at threshold.

B. Fire rated doors shall have clearances as required by NFPA 80.

2.8 MANUFACTURING TOLERANCES

A. Manufacturing tolerance shall be maintained within the limits given in HMMA 841 of ANSI/NAAMM, current edition.

2.9 PREPARATION FOR DOOR HARDWARE

A. Prepare door and frames to receive hardware:

1. Hardware supplier shall furnish hollow metal manufacturer approved hardware schedule, hardware templates, and samples of physical hardware where necessary to ensure correct fitting and installation.

2. Preparation includes sinkages and cut-outs for mortise and concealed hardware.

B. Provide reinforcements for both concealed and surface applied hardware:

1. Drill and tap mortise reinforcements at factory, using templates.

2. Install reinforcements with concealed connections designed to develop full strength of reinforcements.

2.10 REJECTION

A. Hollow metal frames or doors which are defective, have hardware cutouts of improper size or location, or which prevent proper installation of doors, hardware or work of other trades, shall be removed and replaced with new at no cost.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where steel doors and frames are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION

A. Refer to Section 062000 for installation procedures for all work of this Section.

END OF SECTION

SECTION 08 14 16 WOOD DOORS

PART 1 GENERAL

1. RELATED DOCUMENTS

   A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

2. GENERAL REQUIREMENTS

   A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

3. SECTION INCLUDES

   A. Work of this Section includes all labor, materials, equipment and services necessary to complete the wood doors as shown on the drawings and/or specified herein, including but not limited to, the following:

      1. Solid core flush wood doors, AV Room, Furniture Storage.

      2. Fire rated flush wood doors, Multi-purpose room wood doors, MER doors.

4. RELATED SECTIONS

   A. Sustainable Design Requirements – Section 018113.

   B. Installation of wood doors - Section 062000.

   C. Hollow metal frames - Section 081113.

   D. Door hardware - Section 087100.

   E. Glass and glazing – Section 088000.

   F. Painting and finishing – Section 099100.

5. SUSTAINABILITY REQUIREMENTS

   A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

   B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
      1. Environmental Product Declarations (EPDs)
      2. New York City's Environmental Preferable Purchasing (EPP)
      3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients

4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Composite Wood & Agrifiber Products
8. Paints & Coatings

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Submit door manufacturer's product data, specifications and installation instructions for each type of wood door.

1. Include details of core and edge construction and trim for openings.

2. Include factory finish specifications.

3. Include certifications to show compliance with specifications.

4. Include certification to show compliance with AWI and WDMA requirements specified herein.

C. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for finishing and other pertinent data.

1. Include requirements for veneer matching.

D. Submit the following

2. Factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated"; latest edition "Premium" grade and WDMA "Extra Heavy Duty" Performance Level.

1. Only manufacturers that are certified and listed by AWI to be QCP qualified are acceptable for this project.

2. Provide letter of licensing for Project indicating that doors comply with requirements of grade specified.

C. Fire Rated Wood Doors: Doors complying with Category A, Positive Pressure or Neutral Pressure testing standards per UBC 7-2-1997 and UL 10-C (UBC 7-2-1994 and UL 10B) that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated on Door Schedule, based on testing according to NFPA 252.

1. Conform to prevailing Code requirements to determine which pressure standard (Positive or Neutral) is required.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) in excess of permitted standard noted in Article 2.5 herein, or show telegraphing of core construction in face veneers.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Solid Core Flush Wood Doors: Life of installation.

PART 2 PRODUCTS

2.1 SOLID CORE FLUSH WOOD DOORS

A. Provide AWI PC-5 Premium Grade hot pressed 5-ply solid core particleboard doors, 1-3/4" thick, conforming to standards specified herein. Subject to meeting standards specified herein, the following manufacturers are acceptable: Masonite, VT Industries, Mohawk or approved equal.

1. Core shall consist of a formed flat panel consisting of wood particles bonded together with synthetic resins or other added binder, with an average density of 30 to 32 lbs. per cubic foot. The material shall meet or exceed the requirements of ANSI A208.1, Grade 1-LD-2 covering mat formed particleboard with face screw holding of 124 lbs., modulus of rupture of minimum 700 psi and modulus of elasticity of not less than 148,000 psi.

2. Core shall be capable of satisfying this WDMA TM-7 cycle slam test for 1 million slams for surface mounted hardware. Where the manufacturer's core does not meet this criteria, stiles and rails must measure a minimum of 5-1/2" and must be fabricated of hardwood.

    a. Surface mounted hardware must be installed with minimum 1-1/4" screw penetrations using threaded to the head screws; coordinate with Section 087100.

B. Cross Bands: Shall be 1/16" thick hardwood extending full width of door and laid with grain at right angles to face veneers. Cross bands and faces shall be laminated to the core with Type I MF or PVA glue.

C. Stiles, Rails: Stile and rail shall be a minimum of 1-3/8" solid hardwood or structural composite lumber (after trimming) laminated to the core. Stiles and rails must be securely glued to the core with no voids allowed. Stiles and rails must be capable of screw holding of 550 lbs. per WDMA TM-10.

D. Vertical door edge must be capable of screw holding of 550 lbs. per WDMA TM-10; horizontal door edge must be capable of screw holding of 400 lbs. per WDMA TM-10.

E. Doors with transparent finish to have center balanced, slip matched, quarter sliced, Select veneer as selected by the Commissioner. Veneer to conform to AWI, "AA" grade veneer with 3" wide leaf. Minimum veneer thickness shall be not less than 1/50" after sanding.

    1. Veneers shall be continuous or end matched at transoms.

F. Doors shall have hinge loading capacity of 500 lbs. per WDMA TM-8.

G. Where glass lites are noted, factory cut openings. Trim openings with solid hardwood moldings of same type of wood as face veneer. Lite openings in 20 minute rated doors shall have manufacturer's 20 minute approved hardwood system.

H. Doors to be field painted shall have MDO face.

2.2 FIRE RATED WOOD DOORS (LABELED)

A. Provide mineral core 1-3/4” thick solid core wood doors conforming to standards specified herein, manufactured by one of the manufacturers noted above. Stile construction on both stiles shall conform to the following:

    1. Stile edge screw withdrawals when tested in accordance with ASTM D 1037-78 shall exceed 650 lbs. This applies to both stiles.

    2. Stile edge split resistance when tested in accordance with ASTM D 143-52 (78) Modified must exceed 950 lbs. This applies to both stiles.

B. Door to have face finish as specified above in Article 2.1.

    1. Where the core is free of urea formaldehyde, provide a layer of veneer over the substrate prior to application of finish veneer to prevent telegraphing of patterns from the adhesive.

C. Blocking: For surface mounted hardware only, provide composite blocking designed to maintain fire resistance of door but with improved screw-holding capability of same thickness as core and with minimum dimensions as follows:

    1. 5-inch top rail blocking.

2. 5-inch bottom rail blocking.

3. 1 – 5" x 18" lock block at cylinder or mortise locksets.

4. 2 – 5" x 18" lock blocks at exit devices.

D. Pairs: Provide fire-rated pairs with fire-retardant stiles that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

2.3 SHOP FINISH

A. Transparent Finish: Finish in the shop with clear satin catalyzed polyurethane finish conforming to AWI System “Catalyzed Polyurethane Transparent”.

B. Opaque Finish: For doors to be field painted, shop prime on all surfaces with one coat of alkyd wood primer applied to a dry film thickness of 1.5 mils.

2.4 FABRICATION

A. Prefit and premachine wood doors at the factory.

B. Comply with the tolerance requirements specified herein. Machine doors for hardware requiring cutting of doors. Comply with final hardware scheduled and door frame shop drawings, and with hardware templates and other essential information required to ensure proper fit of doors and hardware.

C. Take accurate field measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in the factory.

D. Doors shall be factory sized to door opening so that trimming and fitting are not required in the field.

E. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances unless otherwise indicated.

1. Three degree bevel or bevel to suit frame sizes indicated, with 3/16" prefit in width, +0/- 1/32" tolerances. Prefit top of door 1/8" + 1/16"/-0" and undercut as required by floor condition. Undercut shall not exceed 1/8" from bottom of door to top of finished floor; where threshold occurs undercut shall not exceed 1/8" from bottom of door to top of threshold.

2. Comply with requirements in NFPA 80 for fire-rated doors.

F. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3 unless otherwise noted. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2. Provide concealed intumescent seals at fire-rated pairs of doors meeting the requirements of U.L. 10 C.

G. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kinds of doors required.

2.5 SOURCE QUALITY CONTROL

A. Once installed, maximum allowable warp, bow, cut or twist in doors shall be 1/16" as measured by the 1/16 inch feeler gauge and a straight-edge extending from corner to corner of the door face at stiles, top and bottom rails and along both diagonals.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. Refer to Section 062000 for installation of wood doors.

END OF SECTION

SECTION 08 31 13 ACCESS DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the access doors as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Frameless recessed panel access doors at drywall ceilings and walls.

2. Framed flush panel access doors at masonry and tile walls.

3. Provide access doors and frames for access from occupied spaces to the following, where indicated or required, and as directed by the trades of Divisions 23 and 26.

a. All shutoff or balancing valves.
b. Fire dampers, as required.
c. Points of duct access.
d. Pull boxes.
e. Controls of mechanical and electrical items.
f. Masonry shafts for pipes and conduits, as required.
g. Pipe spaces, if required.
h. Inlets of fans.
i. Fusible link and splitter damper at filter bank.
j. Automatic damper and motor.
k. Equipment not otherwise accessible.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Unit Masonry - Section 042000.

C. Gypsum Drywall - Section 092900.

D. Ceramic tile - Section 093000.

E. Valves and connections - Division 23.

1.5 QUALITY ASSURANCE

A. For actual installation of the work of this Section, use only personnel who are thoroughly familiar with the manufacturer's recommended methods of installation and who are completely trained in the skills required.

B. Fire-Resistance Ratings: Wherever a fire-resistance classification is shown, or for construction where access doors are installed, provide required access door assembly with panel door, frame, hinge and latch from manufacturers listed in Underwriters' Laboratories, Inc. "Classified Building Materials Index" for the rating shown.

1. Provide UL label on each access panel.

2. Provide flush, key operated cylinder lock.

C. Size Variations: Obtain Commissioner's acceptance of manufacturer's standard size units which may vary slightly from sizes shown or scheduled.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements. The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Before any materials of this Section are delivered to the job site, submit complete manufacturer's literature to the Commissioner. Submit plans and schedules showing size and location of each and every access door for Commissioner's acceptance prior to installation.

1.9 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 MATERIALS AND FABRICATION

A. Provide access door assembly manufactured by Milcor Inc, or equal made by Nystrom Inc., Karp Associates, Inc. or approved equal. Assembly shall be an integral unit complete with all parts and ready for installation.

B. Fabricate units of continuous welded steel construction. Grind welds smooth and flush with adjacent surfaces. Provide attachment devices and fasteners of the type required to secure access panels to the types of supports shown.

C. Frames for Masonry and Tile Wall Only (Flush Panel Units)

1. Fabricate frame from sixteen (16) gauge steel. Provide frame with exposed flange not less than one (1) inch wide around perimeter of frame for the following construction:

a. Exposed masonry.
b. Tile finish.

2. For installation in masonry construction, provide frames with adjustable metal masonry anchors.

D. Frameless Units for Drywall Surfaces (Recessed Panel Units): Provide access doors without exposed frames for drywall adhered to recessed panel.

E. Panels: Fabricate from fourteen (14) gauge steel, with concealed spring hinges set to open to 175 degrees. Provide removable pin type hinges of the quantity required to support the access panel sizes used in the work. Finish with manufacturer's factory applied baked enamel prime coat applied over phosphate protective coating on steel.

F. Locking Devices

1. For non-rated access doors, provide flush, screwdriver operated cam locks of number required to hold door in flush, smooth plane when closed.

2. For fire rated doors, provide locks as described in paragraph 1.04, B. herein.

G. Inserts and Anchorage: Furnish inserts and anchoring devices which must be built into masonry for the installation of access panels. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where access doors are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 COORDINATION

A. Coordinate all work with the mechanical trades to ensure proper locations and in a timely manner to permit orderly progress of the total work.

B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

C. Adjust hardware and panels after installation for proper operation.

D. Remove and replace panels or frames which are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 49 00 GLAZED FIRE RATED DOOR AND FRAMING SYSTEM

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the fire-rated interior wall framing and door systems as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Sustainable Design Requirements - Section 01 81 13.

B. Door Hardware - Section 087100.

C. Gypsum Drywall - Section 092900.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E119: Methods for Fire Tests of Building Construction and Materials.

2. ASTM E152: Methods for Fire Tests of Door Assemblies.

3. ASTM E163: Methods for Fire Tests of Window Assemblies.

B. National Fire Protection Association (NFPA):

1. NFPA 80: Fire Doors and Windows.

2. NFPA 251: Fire Tests of Building Construction & Materials

3. NFPA 252: Fire Tests of Door Assemblies

4. NFPA 257: Fire Test of Window Assemblies

C. Underwriters Laboratories, Inc. (UL):

1. UL 9: Fire Tests of Window Assemblies

2. UL 10 B: Fire Tests of Door Assemblies

3. UL 263: Fire Tests of Building Construction and Materials

4. UL 10 C: Positive Pressure Fire Tests of Window & Door Assemblies

D. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

E. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed work similar in material, design, and extent to that indicated for this Project and whose work has resulted in installations with a record of successful in-service performance.

B. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 and 257.

C. Certification - Fire-Rated Assemblies: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. An approved independent testing laboratory equal to UL shall conduct fire test.

D. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by an approved independent agency maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer's listing.

E. Mockups: Prior to installing fire-rated interior wall framing and door system, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.

2. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Architect's approval of mockups before start of Work.

5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

a. Approved mockups in an undisturbed condition may become part of the completed Work.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Review methods and procedures related to fire-rated interior wall framing and door system, including, but not limited to, the following:

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

2. Review structural loading limitations.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review required inspecting, testing, and certifying procedures.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Adhesives and Sealants

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Shop Drawings: Show plans, elevations, sections and details including doors, frames, hardware and steel frame components as shown on shop drawings and schedules.

1. Obtain Architect's approval before fabrication.

B. Samples: Submit in the form of 12-inch square samples for glass and of 12-inch long samples for framing and sealants. Install sealant samples between two strips of material representative in color of the adjoining framing system.

C. Glazing Schedule: Use same designations indicated on drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Technical Information: Submit latest edition of manufacturer's product data providing product descriptions, technical data and installation instructions.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Provide signed and sealed calculations and shop drawings by a Professional Engineer licensed in the State of New York demonstrating that partitions comply with lateral load criteria of 5 psf and a maximum L/360 deflection; unless greater load required by Code.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle under provisions specified by manufacturer. For details on storage and product handling, please contact Technical Glass Products and request information on storage and product handling.

B. Deliver materials to specified destination in manufacturer or distributor's packaging undamaged, complete with installation instructions.

C. Store off ground, under cover, protected from weather and construction activities.

1.10 WARRANTY

A. Provide system supplier's limited five-year warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer Fire Rated Glass Material: "Pilkington Pyrostop" fire rated glazing as manufactured by the Pilkington Group and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065; (800-426-0279), or approved equal by Vetrotech, Saint Gobain or approved equal.

B. Interior Door Frame System: “Fireframes Designer Series” fire-rated steel frame system as manufactured supplied by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065; (800-426-0279) or approved equal by Vetrotech, Saint Gobain or approved equal.

2.2 SYSTEM DESCRIPTION

A. Steel fire-rated glazed wall and/or window system, dual aluminum cover cap format.

1. Face widths available:

a. 2"
b. Custom extruded aluminum cover caps; see details for profile.

2. Duration - Doors: Capable of providing a fire rating for 90 minutes.

2.3 MATERIALS - GLASS

A. Fire Rated Glazing: Composed of multiple sheets of Pilkington Optiwhite high visible light transmission glass laminated with an intumescent interlayer. Glass shall comply with ANSI Z97.1 Category I and II.

B. Thickness: As required for 120-minute fire rating.

2.4 MATERIALS - STEEL FRAMES AND DOORS

A. Steel Door System 90 min

1. Manufacturer's standard single leaf and double leaf (as indicated on drawings) doors with manufacturer's standard hardware. Hardware to be finish 619 where applicable; any painted hardware to match door finish.

2. Coordinate door hardware with cylinder specified in Section 087100 Door Hardware.

2.5 FABRICATION

A. Furnish frame assemblies pre-welded when possible. Splice frames too large for shop fabrication or shipping. Fit with suitable fasteners.

B. Field glaze frame assemblies.

C. Fabrication Dimensions: Fabricate fire rated assembly to approved dimensions. Guarantee dimensions where practicable within required tolerance.

D. Obtain approved shop drawings prior to fabrication.

2.6 FINISHES

A. Fire-Rated Steel System: Factory applied baked enamel finish in custom color as selected by the Architect.

B. Finish frames after assembly.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and members to which the work of this section attaches or adjoins prior to frame installation.

B. Provide openings plumb, square and within allowable tolerances.

C. Notify Architect of any conditions which jeopardize the integrity of the proposed fire rated entrance system. Do not proceed until such conditions are corrected.

3.2 INSTALLATION

A. Install systems by a specialty subcontractor with appropriate experience qualifications; and in strict accordance with the approved shop drawings. Employ experienced mechanics familiar with this type of specialized work.

B. Install fire safing/firestopping at edges of system.

C. Install glazing in strict accordance with respective glazing material manufacturer's specifications. Field cutting or tampering is not permissible.

D. Install door hardware provided by manufacturer as part of the tested system.

3.3 ADJUSTING

A. Adjust door function and hardware for smooth operation. Coordinate with other hardware suppliers for function and use of any other attached hardware.

3.4 PROTECTION AND CLEANING

A. Protect glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

SECTION 08 42 28 ALL GLASS DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract City of New York Standard Construction Contract.

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the all glass doors, as shown on the drawings, and/or specified herein, as needed for a complete and proper installation, including the following:

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Door hardware - Section 087100.

C. Glass and Glazing – Section 088000.

1.5 QUALITY ASSURANCE

A. Qualifications of Installers: For actual installation of doors, use only personnel who are thoroughly trained and experienced in installation of the selected products and who are completely familiar with the requirements of this work.

1.6 PERFORMANCE REQUIREMENTS

A. Provide systems, including anchorage, capable of withstanding loads indicated without structural failure, deflection exceeding specified limit, support components transferring stresses to glazing, and glazing-to-glazing or glazing-to-support contact as determined by structural analysis.

1. Deflection Normal to Glazing Plane: Limited to 1/175 of clear span or ¾", whichever is smaller.

1.7 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements. The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor

shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
3. Low-Emitting Materials
4. Regional Content
5. Paints & Coatings

1.8 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.9 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: For each type of product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop Drawings; Show details of fabrication and installation, including the following:

1. Plans, elevations, and sections.
2. Details of fittings.
3. Hardware quantities, locations, and installation requirements.
4. Anchorages and reinforcement.
5. Glazing details.

D. Samples for Verification: Of size indicated below and of same thickness and material indicated for Work. Show the full range of color and texture variations expected.

1. Metal Finishes: 6-inch long sections of patch fittings, rails, and other items.
2. Glass: 6 inches square showing exposed-edge finish.

1.10 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.11 PROJECT CONDITIONS

A. Field Measurements: Verify opening dimensions of all-glass entrances by field measurements before fabrication and indicate measurements on Shop Drawings.

1.12 WARRANTY

A. Submit a written warranty executed by the manufacturer agreeing to repair or replace components of all-glass entrances that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures.

2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

3. Failure of operating components to function normally.

B. Warranty Period: 2 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide all glass doors as scheduled on the drawings manufactured by CR Lawrence, Assa Abbloy Glass Solutions or approved equal.

2.2 MATERIALS

A. Clear Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), Class 1 (clear) requirements. Provide products of thickness indicated that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to CPSC 16 CFR, Part 1201 for Category II materials.

1. Thickness: 3/4 inch.

2. Exposed Edges: Flat polished.

3. Corner Edges: Mitered.

B. Metal: Metal and finish as specified on the drawings.

2.3 COMPONENTS

A. Fittings: Provide fittings and accessories for all-glass entrances of configurations shown on drawings fabricated of stainless steel, minimum 12 ga.

B. Anchors and Fastenings: Manufacturer's standard concealed anchors and fastening.

C. Weather Stripping: Manufacturer's standard sweep-type weather stripping.

2.4 HARDWARE

A. General: Heavy-duty hardware units indicated in sizes, numbers, and type recommended by manufacturer for all-glass entrances indicated. For exposed parts, match fitting metal and finish.

B. Closers: Center-hung, concealed floor closers complying with ANSI/BHMA A156.4, Grade 1 or Grade 2 requirements, including cases, bottom arms, top pivots, plates and accessories required for a complete installation, and as follows:

1. Swing: Single acting.

2. Hold Open: Selective.

3. Positive Dead Stop: Coordinated with hold-open angle.

4. Delayed-Action Closing: Comply with requirements of authorities having jurisdiction of the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," whichever are more stringent.

a. Opening Force: 5 lbf.

C. Push/Pull: 1" diameter with metal finish as specified on the drawings, as shown on drawings.

D. Lockset: No manual locking required for these doors.

E. Make provisions for and coordinate with installation requirements for electro/magnetic lock and door release at door head as specified in Section 087100.

F. Threshold: Manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips. not more than 1/2 inch high with beveled edges providing a floor-level change with a slope of not more than 1:2, and fabricated of stainless steel.

2.5 FABRICATION

A. General: Fabricate all-glass entrance components in sizes, profiles, and configurations indicated.

1. Provide holes and cutouts in glass to receive hardware, fittings, rails, and accessories before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.

2. Fully temper glass using horizontal roller hearth process.

3. Factory assemble components and factory install hardware to greatest extent possible.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where all glass doors are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION

A. Install all-glass entrances and associated components according to manufacturer's written instructions; coordinate installation with structural glass wall fabricator.

B. Set units level and plumb.

C. Maintain uniform clearances between adjacent components.

D. Lubricate hardware and other moving parts according to manufacturer's written instructions.

E. Set, seal, and grout floor closer cases as required by hardware and substrate.

3.4 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer that ensure all-glass entrances are without damage or deterioration.

END OF SECTION

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SECTION 08 51 13 ALUMINUM WINDOWS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the aluminum windows as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Aluminum windows.

2. Miscellaneous insulation at window frames.

3. Anchors, hardware and accessories including trim pieces and panning.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Unit masonry - Section 042000.

C. Joint sealers - Section 079200.

D. Glass and glazing - Section 088000.

1.5 PERFORMANCE REQUIREMENTS

A. Windows shall conform to the "Voluntary Specification for Aluminum Prime Windows & Sliding Glass Doors" as published by ANSI/AAMA 101/I.S.2-97 unless more stringent requirements are specified. Windows shall conform to minimum standards of AW60 for fixed windows.

B. Performance and Testing: Except as otherwise indicated, comply with air infiltration tests, water resistance tests and applicable load tests specified in ANSI/AAMA 101/I.S.2-97 for type and classification of window units required in each case.

1. Testing: Where manufacturer's standard window units comply with requirements and have been tested in accordance with specified tests, provide certification by manufacturer to the Commissioner and The City of New York showing compliance with such tests; otherwise, perform required tests through an AAMA-accredited testing laboratory or agency, and provide certified test results to the Commissioner and The City of New York.

2. Test reports shall be not more than four years old.

3. Sample submitted for tests shall be manufacturer's standard construction and whose overall dimensions shall be at least the lay-out size window and window/door unit required for this Project. Sequence of test shall be optional between manufacturer and the testing laboratory except that in all cases, air infiltration test shall be performed before water resistance test. Sash in sample shall contain the approximate configuration as that of windows to be tested.

4. To evaluate testing and measure product performance, testing shall be conducted on manufacturer's standard product glazed with type of glazing material specified herein.

C. A thermal transmittance test and a condensation resistance test shall be conducted according to AAMA 1503-04, "Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections." Standard test conditions as specified in Section 9.1 of the 1503.1-04 shall be used. Windows shall meet the following minimum criteria:

1. Condensation Resistance Test (CRF)

   a. With window sash and ventilators closed and locked, test unit in accordance with AAMA 1502.7.
   b. Condensation Resistance Factor (CRF): Per drawings.

2. Thermal Transmittance Test (Conductive U-Value)

   a. With window sash and ventilators closed and locked, test unit in accordance with AAMA 1503.0.
   b. Conductive thermal transmittance (U-value) shall per drawings.

D. Manufacturers shall have been engaged in the manufacture of aluminum windows of grades specified for not less than 10 years.

E. Provide anchorage of window to building substrate to withstand pressure or suction winds loads per requirements of the Building Code but not less than 30 psf.

F. Life Cycle Testing: When tested in accordance with AAMA 910-93, there is to be no damage to fasteners, hardware parts, support arms, activating mechanisms or any other damage which would cause the window to be inoperable at the conclusion of testing. Air infiltration and water resistance tests shall not exceed the primary performance requirements specified.

G. Fabricate and install window to allow for thermal movement of materials when subject to a temperature differential from –30 deg. F. to +180 deg. F. without damage of any finish.

H. Take field measurements of existing openings prior to submitting shop drawings and show same on shop drawings for each opening. Note that the Contract Drawings show general locations and sizes of windows, but the Contractor shall remain responsible for all field measurements, quantities, etc.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and

under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1 Environmental Product Declarations (EPDs)
2 New York City's Environmentally Preferable Purchasing (EPP)
3 Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4 Low-Emitting Materials
5 Regional Content
6 Adhesives and Sealants

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Shop Drawings

1. Shop drawings shall show in detail and fully indicate the location and the quantities of all the work, the kind, finish, size, section of each unit, overall and detail dimensions, factory and field joint locations, arrangements and details, location and detail of each piece of anchorage, flashings, supporting construction provisions for the work of others.

2. Submit Shop Drawings and calculations showing fabrication and installation of window system including plans, elevations, sections, details of components, and attachments to other units of Work.

   a. For installed products indicated to comply with certain design loadings, include structural analysis data signed and sealed by a professional engineer licensed in the State of New York responsible for their preparation.

3. Shop drawings shall show all surrounding conditions on elevations and details, including steel, concrete, masonry, lintels, block, and anchorage; all correctly dimensioned.

4. Shop drawings of building elevations shall be at scale of 1/8" = 1'-0", or larger. Other shop drawings shall be at a scale that is normal to trade, or larger if required by Commissioner.

5. Contract drawings may not be used (reproduced, enlarged, reduced, etc.) by Subcontractor for shop drawings.

6. Shop drawings also shall fully demonstrate all requirements respecting the manufacture, finishing, handling, storage, carting sequence and erection of all materials specified herein.

7. Show joinery techniques, provision for horizontal and vertical expansion, drainage and weep systems, glass and metal thicknesses and framing member profiles.

8. Identify all materials, including metal alloys, glass types, fasteners, and glazing materials. Identify all shop and field sealants by product name and locate on drawings. Glazing details shall be at full size scale.

9. Show dimensioned position of glass edge relative to metal rabbet.

10. Shop drawings shall show attachments of window assemblies to adjoining construction and location of all work; kind, finish and size of frames, overall and detail dimensions, location and detail of each anchorage; supporting and adjoining construction; provision for the work of other trades; and all other required information.

11. Contractor shall verify all measurements of existing window openings in the field before commencing fabrication.

12. Any proposed deviations from work shown on the Contract drawings shall be indicated and so identified on shop drawings for Commissioner's review.

C. Samples

1. Submit 12" long sample of extrusion with specified finish.

2. Full size corner section of all types of aluminum frame, showing construction, glass and finishing - 12" x 12".

3. All fasteners, straps, hardware, locks and keys, sealant, etc.

D. Submit certified test results as required herein.

E. Guarantees as noted in 1.8.

F. Window manufacturer and Contractor for work of this section must each submit references of prior projects similar in size, scope and window type.

1.9 DELIVERY, STORAGE AND HANDLING

A. Protection

1. Materials shall be packed, loaded, shipped, unloaded, stored and protected in a manner which will avoid abuse, damage and defacement in accordance with the recommendations contained in the AAMA Aluminum Curtain Wall Manual #10 entitled "Care and Handling of Architectural Aluminum From Shop to Site."

2. Remove all paper type wrappings and interleavings that are wet or which could become wet when unloading materials.

3. Store inside structure in space designated by The City of New York.

4. Stack vertically or on edge so that water cannot accumulate on or within materials using wood or plastic shims between components to provide water drainage and air circulation.

5. Cover materials with tarpaulins or plastic hung on frames to provide air circulation and prevent contaminants from contacting aluminum.

6. Keep water away from stored assemblies.

7. The Contractor shall be responsible for taking the steps necessary to protect the materials from careless handling of tools, weld splatter, acids, roofing tar, solvents, abrasive cleaners, and other items that could damage window components and finish.

1.10 MANUFACTURER'S REPRESENTATIVE

A. Contractor shall require representative of manufacturer of the windows to provide field instructions and supervision of the installation of the windows.

B. Contractor shall require the manufacturer's representative to make sure that the subcontractor's workmen are fully instructed and trained in the handling and application of all the materials, and shall see that all the materials are correctly installed.

C. Upon completion of the installation, the Contractor shall submit to the Commissioner in written form certification that the representative of the manufacturer of the windows has supervised the work of this Section and that all windows are correctly installed.

1.11 GUARANTEE

A. Aluminum Windows and Related Materials: Ten (10) year guarantee on materials and workmanship, including finish on aluminum and on glass and glazing.

PART 2 PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Aluminum windows shall be fixed windows models simulated double hung made by Kawneer, or equal made by EFCO or Wausau, or approved equal.

2.2 FIXED WINDOWS

A. Materials:

1. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070” wall thickness at any location for the main frame and sash members.

2. Recycled Content: Shall have a minimum of 50% mixed pre- and post-consumer recycled content.

   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
   b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
   c. Indicate location recovery of recycled content.
   d. Indicate location of manufacturing facility.

3. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

4. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

5. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

6. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

    a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

7. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

B. Window:

1. Window Type: Fixed Window.

2. Performance Requirements: Provide aluminum windows of performance indicated that comply with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).

    a. Performance Class and Grade: AW-65-H.

C. Glazing:

1. Glass and Glazing Materials: Refer to Division 08 Section "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.

2. Glazing System: Glazing method shall be a wet/dry type in accordance with manufacturer’s standards. Exterior glazing shall be silicone back bedding sealant. Interior glazing shall be snap-in type glazing beads and an interior gasket in accordance with AAMA 702 or ASTM C864.

D. Fabrication:

1. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

    a. Profiles that are sharp, straight, and free of defects or deformations.
    b. Accurately fit joints; make joints flush, hairline and weatherproof.
    c. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
    d. Physical and thermal isolation of glazing from framing members.

e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
f. Provisions for field replacement of glazing.
g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

2. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

3. Fabricate aluminum windows that are re-glazable without dismantling sash or framing.

4. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to- metal contact. Thermal barriers shall be designed in accordance with AAMA TIR A8.

a. Frame thermal barrier shall be polyamide with a minimum of 1” (25.4 mm) separation, installed continuously and mechanically bonded to the aluminum.
b. Sash thermal barrier shall be polyamide with a minimum of 1/2” (12 mm) separation, installed continuously and mechanically bonded to the aluminum.

5. Weather Stripping: Provide full-perimeter weather stripping for each operable sash.

6. Weep Holes: Provide weep holes and internal passages in window frames to conduct infiltrating water to exterior.

7. Provide water-shed members as required above lines of natural water penetration.

8. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

9. Sub frames: Provide sub frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093-inch (2.4-mm) thick extruded aluminum. Miter or cope corners, and join with concealed mechanical joint fasteners. Finish to match window units. Provide sub frames capable of withstanding design loads of window units.

10. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).

11. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash.

E. Glazing:

1. Glass and Glazing Materials: Refer to Division 08 Section "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.

2. Glazing System: Glazing method shall be a wet/dry type in accordance with manufacturer’s standards. Exterior glazing shall be silicone back bedding sealant. Interior

glazing shall be snap-in type glazing beads with an interior gasket in accordance with AAMA 702 or ASTM C864.

3. Glazing: Exterior extruded silicone gasket with 2-part structural silicone; 1" (25.4) insulating glass or 1-3/4" (44.5) triple insulating glass; Interior aluminum glazing bead; open cell foam encased in black thermoplastic elastomeric (TPE) gasket; glass description in paragraph 2.4; glazed by the window manufacturer.

4. Insulating Glass Units:

   a. Materials:
      1). Spacer: extruded thermoplastic butyl with integrated desiccant.
      2). Spacer color: black.
      3). Secondary seal: silicone.
      4). Air space fill: plain air.
   b. Performance:
      1). Dual-seal durability: conformance to ASTM E 2190; visible, permanent IGCC certification label.
   c. Exterior glass lite:
      1). Thickness: 1/4".
      2). Tint: clear.
      3). Type: annealed, tempered, or laminated where required.
      4). Coating:
   d. Center glass lite:
      1). Thickness: 1/8" .
      2). Tint: clear.
      3). Type: annealed, tempered, or laminated where required.
   e. Interior glass lite:
      1). Thickness: 1/4".
      2). Tint: clear.
      3). Type: annealed, tempered, or laminated where required.

2.3 FINISH OF ALUMINUM

A. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Acid-chromate-fluoride-phosphate conversion coating; Organic Coating: As specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

1. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605-02.

2. Custom color and gloss as selected by the Commissioner.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION AND REMOVALS

A. Examine surfaces and conditions where aluminum windows are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

B. Verify dimensions taken at the job site affecting the work. Bring field dimensions which are at variance to the attention of the Commissioner. Obtain decision regarding corrective measures before the start of installation.

3.3 INSTALLATION

A. Use only skilled tradesman with work done in accordance with approved Shop Drawings and specifications.

B. Plumb and align window faces in a single plane for each wall plane and erect windows and materials square and true adequately anchored to maintain positions permanently when subjected to normal thermal and building movement and specified wind loads.

C. Adjust windows for proper operation after installation.

D. Furnish and apply sealants to provide a weathertight installation at all metal-to-metal joints and intersections of frames and at opening perimeters. Wipe off excess material and leave all exposed surfaces and joints clean and smooth.

E. Aluminum shall be insulated from direct contact with steel, masonry, concrete, or non- compatible materials by bituminous paint, zinc chromate primer, or other suitable insulation material.

F. Blanket insulation shall be installed behind aluminum covers, panning and trim to insure thermally insulated seal.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.

2. Air-Infiltration Testing: RATES TO BE CONFIRMED BY COMMISSIONER

   a. Test Pressure: 6.24 PSF.
   b. Fixed Maximum Rate: 0.09 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft.
   c. Operable Maximum Rate: 0.15 cfm/sq. ft. of area at an inward test pressure of 6.24 lbf/sq. ft.

3. Water-Resistance Testing: RATED TO BE CONFIRM BY COMMISSIONER

a. Test Pressure: 12 PSF (Note: No reduction in field test pressure will be allowed).
b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Commissioner and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.

5. Test Reports: Prepared according to AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING AND CLEANING

A. After completion of window installation, windows shall be inspected, adjusted, put into working order and left clean, free of labels, etc.

B. Glass that is broken, damaged, cracked, or permanently stained shall be replaced.

C. Final cleaning of finish shall be in accordance with AAMA 610.1.

END OF SECTION

SECTION 08 63 00 METAL FRAMED SKYLIGHT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes the following:
   1. Metal Framed Structural Skylights.
B. Related Sections may include, but are not limited to the following:
   1. Division 3 Section “Cast in Place Concrete”
   2. Division 8 Section “Glass and Glazing”
   3. Division 7 Section “Joint Sealants” for sealants installed at metal-framed skylight perimeters.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide metal-framed skylights capable of withstanding loads and thermal and structural movements indicated without failure. Failure includes the following:

   1. Deflection exceeding specified limits.
   2. Thermal stresses transferred to the building structure.
   3. Skylight framing members transferring stresses, including those caused by thermal and structural movement, to glazing.
   4. Weakening of fasteners, attachments, and other components.

B. Deflection Limits: As follows:
   1. Deflection Normal to Glazing Plane: Limited to [edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite] [1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans more than 13 feet 6 inches (4.1 m)] <Insert deflection limit> or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.

C. Structural Loads: Provide metal-framed skylights, including anchorage, capable of withstanding the effects the following design loads when supporting full dead loads:
   1. Roof Loads
      a. Concentrated Load: 250lbs applied to framing members at location that produces the most severe stress or deflection.
      b. Snow Loads: Per Code
      c. Roof Loads: Per Code
      d. Wind Loads: Per Code
   2. Seismic Loads: Per Code

D. Structural Performance: Provide metal-framed skylights, including anchorage, capable of withstanding pressures indicated without material and deflection failures and permanent deformation of structural members exceeding 0.2 percent of span when tested according to ASTM E 330.

E. Air Infiltration: Provide metal-framed skylights with maximum air leakage of 0.23 scfm/sq. ft. (1.15 L/s per sq. m) of surface when tested according to ASTM E 283 at a minimum static-air-pressure differential of 6.20lbs/sq. ft. (300 Pa).

F. Water Penetration: Provide metal-framed skylights that do not evidence water penetration when tested according to ASTM E 331 at a minimum differential static pressure of 12 lbs/sq. ft. (718 Pa).

G. Thermal Movement: Provide metal-framed skylights that allow for thermal movements resulting from the following maximum change (range) in ambient temperatures by preventing buckling, sealant failure, and other detrimental effects.
   1. Temperature Change (Range): 100 degrees F.

H. Thermal Performance: Provide metal-framed skylights that meet current State Energy Code requirements (2015 IECC), including:
   1. Refer to drawings for requirements.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions and profiles of components, and finishes for metal-framed skylights.
B. Shop Drawings: For metal-framed skylights. Include plans, elevations, sections, details, and attachments to other work as required.
C. Samples for Initial Selection: Manufacturer’s color charts consisting of sections of units showing the full range of colors available for factory-finished aluminum.
D. Samples for Verification: Provide color sample of selected finish on 2"x3" aluminum sheet.

E. Installer Certificates: If required, signed by manufacturer certifying that installers comply with requirements.
F. Product Test Reports: From a qualified testing agency indicating skylights comply with requirements, based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing metal-framed skylights similar to those indicated for this Project and who is acceptable to manufacturer.
B. Professional Engineer Qualifications: A professional engineer who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of skylights that are similar to those indicated for this Project in material, design, and extent.
C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where metal-framed skylights are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
    1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating skylights without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 WARRANTY

A. Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of metal-framed skylights that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
    1. Structural failures.
    2. Failure of systems to meet performance requirements.
    3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    4. Water leakage; defined as uncontrolled water appearing on normally exposed interior surfaces of skylights from sources other than condensation, resulting from defects in skylight materials or workmanship. (Water controlled by flashing and gutters and drained back to the exterior and that cannot damage adjacent materials or finishes is not water leakage). Water leakage resulting from improper installations not part of this warranty.
B. System Warranty Period: 5 years from date of shipment from the manufacturer.

C. Finish Warranty: Provide written warranty signed by manufacturer agreeing to repair or replace work with finish defects. "Defects" is defined as peeling, chipping, chalking, fading, abnormal aging or deterioration, and failure to perform as required.
    1. Warranty Period for 2605 Powder Finish: 20 years from the date of shipment from the manufacturer.

1.9 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements. The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.
B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

    1. Environmental Product Declarations (EPDs)
    2. New York City's Environmentally Preferable Purchasing (EPP)
    3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    4. Low-Emitting Materials
    5. Regional Content
    6. Adhesives and Sealants
    7. Paints & Coatings

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide extruded aluminum framed skylight equal made by Pinnacle 900 system by Wasco Part of the VELUX Group, Wells, ME (800-388-0293), 20605 Powder Finish.
B. Substitutions: Manufacturers shall not be considered without prior approval in writing no later than ten (10) calendar days prior to bid. Substitute manufacturers must have been in the custom skylight business for not less than a period of 15 years and must submit to the Architect the following:
    1. List of similar projects successfully completed within the last five years.
    2. Proof of financial capability.
    3. Complete details of proposed skylight.
    4. Complete specifications for Architect's review.

2.2 FRAMING MATERIALS

A. Framing Members: Extruded aluminum alloy 6063-T5 or T6, ASTM B 221 with minimum effective

thickness of 0.109 inches.

B. Exterior Pressure Caps: Extruded aluminum alloy 6063-T5 or T6, ASTM B 221 with minimum effective thickness of 0.090 inches.
C. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing; compatible with adjacent materials.
D. Exposed Flashing and Closures: Aluminum sheet alloy and temper of 1100-H14, thickness as require for proper performance.
    1. Minimum Thickness: 0.032 inch Apron Flashing.
    2. Minimum Thickness: 0.062 inch Closures.
E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories; compatible with adjacent materials.
    1. Aluminum Retaining Cap Fasteners and Framing Members Fasteners: ASTM A 193/A 193M, Series 300 stainless-steel screws; type as recommended by manufacturer.
    2. Connections to Supporting Structure: Series 300 Stainless Steel or ASTM A 307, hot dipped galvanized steel fasteners by installer.
F. Framing-System Sealants: Single-component, non-sag, high performance, non-priming, gun-grade elastomeric polyurethane sealant furnished by skylight manufacturer.
    1. Sealant complies with ASTM C920, Type S, Grade NS, Class 25, Use T, NT, M, A, G, and O. Canadian Specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-N.
    2. Sealant conforms to USDA approval standards.
G. Bituminous Paint: Cold-applied asphalt mastic paint complying with SSPC-Paint 12, except containing no asbestos, and formulated for 30-mil thickness per coat.

2.3 GLAZING MATERIALS

A. Sloped Glass: Refer to specification Section 08 80 00 Glazing.
    1. Glass must meet the requirements of the AAMA Glass Design for Sloped Glazing for the project.
B. Glazing Gaskets: Manufacturer's proprietary pressure-glazing gaskets of elastomer type and hardness selected by the skylight manufacturer to comply with requirements. Glazing gaskets to be extruded thermoplastic elastomer by the skylight manufacturer.
C. Spacers, Edge Blocks, and Setting Blocks: Manufacturer's standard permanent non-migrating type of elastomer type and hardness selected to comply with requirements. Spacers, Edge Blocks, and Setting Blocks to be extruded thermoplastic elastomer by the skylight manufacturer.
D. Glazing Weatherseal Sealant: Neutral-curing silicone sealant recommended by skylight and sealant manufacturers for this use and furnished by skylight manufacturer.
    1. Sealant is capable of withstanding 50 percent movement in both extension and compression (total of 100 percent movement) when tested for adhesion and cohesion under maximum cyclic movement according to ASTM C 719.
    2. Sealant complies with ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and, as applicable to substrates including other sealants with which it comes in contact, O.
    3. Color: Black.

E. Flashing Sealant: Single-component, non-sag, high performance, non-priming, gun-grade elastomeric polyurethane sealant furnished by skylight manufacturer.
    1. Sealant complies with ASTM C920, Type S, Grade NS, Class 25, Use T, NT, M, A, G, and O. Canadian Specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-N.
    2. Sealant conforms to USDA approval standards.

2.4 FABRICATION

A. Framing Components: As follows:
    1. Factory fit and assemble components, where practical.
    2. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
    3. Fabricate components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
    4. Fabricate components to accommodate expansion, contraction, and field adjustment, and to provide for minimum clearance and shimming at skylight perimeter.
    5. Fabricate components to ensure that glazing is thermally and physically isolated from framing members.
    6. Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
    7. Fit and assemble components to greatest extent practicable before finishing.
    8. Reinforce members as required to retain fastener threads.
    9. Attach retainer bars with gasketed stainless steel fasteners spaced at a maximum of 12 inches on center.
    10. Weld components before finishing and in concealed locations to greatest extent practicable to minimize distortion.
    11. Before shipping, shop assemble, mark, and disassemble components that cannot be permanently shop assembled.
B. Provide continuous aluminum frame with weatherproof splice joints and locked and sealed or fully welded corners. Locate weep holes in the frame at each rafter connection to drain condensation.
C. Prepare framing to receive anchor and connection devices and fasteners.
D. Field Glazing: Locate and size extruded elastomeric setting blocks and spacers in accordance with the glazing manufacturer’s recommendations. At no point shall the glazing come in contact with the skylight frame or fasteners.

2.5 ALUMINUM FINISHES

A. General: Comply with NAAMM “Metal Finishes Manual” recommendations for application and designations of finishes.
B. Finish designations prefixed by AA conform to the system for designations of aluminum finishes established by the Aluminum Association.
    1. Refer to drawings for finish information.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting skylight performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Metal Protection: As follows:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
   3. Where aluminum will contact pressure-treated wood, separate dissimilar materials by methods recommended by manufacturer.

3.4 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing skylight components.
   1. Fit frame joints to produce hairline joints free of burrs and distortion.
   2. Rigidly secure non-movement joints.
   3. Accommodate thermal and mechanical movements.
   4. Install framing components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
   5. Coordinate installation of flashings at skylight perimeters to maintain continuity of water barriers.
   6. Set continuous curbs and flashings in a full sealant bed, unless otherwise indicated. Comply with requirements in Division 7 Section "Joint Sealants."

B. Erection Tolerances: Install skylight components true in plane, accurately aligned, and without warp or rack. Adjust framing to comply with the following tolerances:
   1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 10 feet; 1/4 inch over total length.
   2. Alignment: Where surfaces abut in line and at corners and where surfaces are separated by less

than 3 inches, limit offset from true alignment to less than 1/32 inch; otherwise, limit offset from true alignment to 1/8 inch.

C. Field Glazing: Locate and size extruded elastomeric setting blocks and spacers in accordance with the glazing manufacturer's recommendations. At no point shall the glazing come in contact with the skylight frame or fasteners
D. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

3.5 CLEANING

A. Clean skylights inside and outside, immediately after installation and after sealants have cured, according to manufacturer's written recommendations.
    1. Remove temporary protective coverings and strippable coatings from pre-finished metal surfaces. Remove labels and markings from all components.
B. Remove excess sealant according to sealant manufacturer's written recommendations.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Steel Doors and Frames”.
2. Division 08 Section “Wood Doors”.
3. Division 08 Section “Aluminum-Windows”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.
    c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary Integrated Wiegand Access Control Products.

E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

F. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Integrated Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.

F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

G. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

H. Keying Conference: Conduct conference to comply with requirements in General Conditions – Article 20 – Job Meetings and Field Office and Article 3 – Progress Schedule and Contract Drawings. Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

J. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” heavy weight.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. McKinney (MK) - TA/T4A Series, 5 knuckle.
b. Or approved equal.

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. McKinney (MK) - QC (# wires) Option.
    b. Or approved equal.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney (MK) - Connector Hand Tool: QC-R003.
    c. Or approved equal.

2. Manufacturers:

    a. McKinney (MK) - QC-C Series.
    b. Or approved equal.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. Rockwood (RO).
    b. Or approved equal.

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
6. Manufacturers:

    a. Rockwood (RO).
    b. Or approved equal.

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer’s Standard.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide concealed key control number permanently inscribed on side of core.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)

2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

F. Construction Keying: Provide construction master keyed cylinders.

G. Construction Keying: Provide temporary keyed construction cores.

H. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).
d. Or approved equal

2.7 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all features and functionality as specified herein.

1. Electromechanical locksets shall have the following features and functionality:

a. Electromechanical locksets shall be provided with universal Molex plug-in connectors that have standardized color-coded wiring and be available in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
b. Options to be available for request-to-exit or enter signaling, latchbolt and deadbolt monitoring.
c. Optional high security monitoring with internal end-of-line monitoring alongside deadbolt privacy and integrated door position monitoring.
d. Two-year limited warranty on electrified functions.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) - ML2000 Series.
b. Sargent Manufacturing (SA) - 8200 Series.

c. Or approved equal.

2.8 MULTI-POINT LOCKS AND LATCHING DEVICES

A. Multi-Point Locksets: ANSI/BHMA A156.37, Certified Products Directory (CPD) listed vertical rod locking devices designed for openings requiring multiple latching points within one locking mechanism. Rods are retracted by dual mounted outside lever trim controls available in a variety of ANSI/BHMA operational functions. Option for single top latching only eliminates the need for bottom strikes.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - MP9800 Series.
b. Sargent Manufacturing (SA) - 7000 Series.
c. Or approved equal.

2.1 INTEGRATED WIRED OUTPUT LOCKING DEVICES - MULTI-CLASS READER

A. Integrated Wired Output Multi-Class Mortise Locks: Wiegand or Open Supervised Device Protocol (OSDP) output ANSI A156.13, Grade 1, mortise lockset with integrated card reader with or without keypad option, request-to-exit signaling, door position status switch, and latchbolt monitoring in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim, 3/4" deadlocking anti-friction latch, and 1" case-hardened steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP compatible access control systems. Latchbolt monitoring and door position switch act in conjunction to report door-in-frame (DPS) and door latched (door closed and latched) conditions.
2. Integrated reader supports the following credentials:

a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
c. 2.4 GHz credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
e. NFC-enabled mobile phones
f. PIN code only or PIN + credential with keypad option.

3. 12VDC external power supply required for reader and lock, with optional 24VDC lock solenoid. Fail safe or fail secure options.
4. Energy Efficient Design: Provide lock bodies which have a holding current draw of 500mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
5. Support end-of-line resistors contained within the lock case.

6. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
7. Installation to include manufacturer's access control panel interface board or module where required for Wiegand or OSDP output protocol.
8. Manufacturers:

    a. Corbin Russwin (RU) - ML2000 SN Series.
    b. Sargent Manufacturing (SA) - SN200/SN210 8200 Series.
    c. Or approved equal.

2.2 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Short-lipped strikes: For locks at double doors.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.3 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with keyed cylinder dogging device to hold the pushbar and latch in a retracted position.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
b. Sargent Manufacturing (SA) - 80 Series.
c. Or approved equal.

2.4 INTEGRATED WIRED OUTPUT EXIT DEVICES - MULTI-CLASS READER

A. Integrated Wired Output Multi-Class Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated card reader with or without keypad option, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
2. Integrated reader supports the following credentials:

a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
c. 2.4 GHz credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
e. NFC-enabled mobile phones
f. PIN code only or PIN + credential with keypad option

3. 12VDC external power supply required for reader. 24VDC required for solenoid operated exit trim. Fail safe or fail secure options.
4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
5. Competitor Alternates Allowed Option: Installation to include manufacturer's access control panel interface board or module where required for Wiegand or OSDP output protocol.
6. Manufacturers:

    a. Corbin Russwin (RU) - ED5000 SN Series.
    b. Sargent Manufacturing (SA) - SN200/SN210 80 Series.
    c. Or approved equal.

2.5 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Cycle Testing: Provide closers which have surpassed 15 million cycles.
4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Large body cast iron surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:

    a. Corbin Russwin Hardware (RU) - DC8000 Series.
    b. Norton Rixson (NO) - 9500 Series.
    c. Sargent Manufacturing (SA) - 281 Series.
    d. Or approved equal.

2.6 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. Rockwood (RO).
    b. Or approved equal.

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

    a. Norton Rixson (RF).
    b. Sargent Manufacturing (SA).
    c. Or approved equal.

2.7 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).
2. Or approved equal.

2.8 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 3280 Series.
b. Securitron (SU) - DPS Series.
c. Or approved equal.

B. Wiegand Test Unit: Test unit verifies proper Wiegand output integrated card reader lock installation in the field by testing for proper wiring, card reader data integrity, and lock functionality including lock/unlock, door position, and request-to-exit status. 12 or 24VDC voltage adjustable operating as Fail Safe or Fail Secure.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - WT2 Wiegand Test Unit.
b. Sargent Manufacturing (SA) - WT2 Wiegand Test Unit.
c. Or approved equal.

C. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
2. Manufacturers:

a. Securitron (SU) - AQL Series.
b. Or approved equal.

2.9 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.10 FINISHES

A. BSP (Black Suede Powder Coat) – North and South Wings; Center Space; Mechanical Room; Pump Room. US32D/630 Satin Stainless Steel (hinges to match) – North and South Elevator Machine Room doors; hallway doors; Restrooms; Showers; Lactation; Electrical; Mechanical; MDF room doors.

B. Standard: Designations indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Integrated Wiegand access control products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.

D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the *latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. GS - ASSA ABLOY Glass Solutions
3. PE - Pemko
4. RO - Rockwood
5. RF - Rixson
6. SA - SARGENT
7. YA - Arrow, formerly known as Yale
8. NO - Norton
9. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 2528-A, 2528-B, 2528-C, 2529
Description: Wood Pivot Pair 45M Rated

2	Pivot Set (fire rated)	F147	RF
2	Intermediate Pivot (fire rated)	FM19	RF
2	Electrified Inter Pivot	EFM19 QC	RF
1	Core	6300	SA
1	SN Vert Rod Exit ELR (by Security)	12 NB 56-SN200-8706 BIPS-0E ETMI	SA
1	Surface Vert Rod Exit, ELR, DT	12 55 56 NB8710 ETMI	SA
2	Concealed Closer w/ Track Bumper	(W)91NDCP (fire doors, non-ADA)	RF
2	Door Stop	RM850 / RM860	RO
2	ElectroLynx Harness - Frame	QC-CXXXXP (device to J-box)	MK
2	ElectroLynx Harness - Door	QC-CXXX (Size as Required)	MK
1	Wiring Diagram (by Security)	Elevation; Point-to-Point	
2	Position Switch (concealed)	By Security	SU
1	Power Supply (by Security)	AQL Series (Amps & Relays as Req'd)	SU

Notes: Track bumper can be removed from closer allowing 180 degree door swing and floor stop mounting. Architect to review.

Operation: Doors are normally closed and locked. Valid card at reader retracts latches for momentary access. Monitoring by door position switches. During a loss of power the door will default to secure. Free egress at all times. Lock status will not change when the fire detection / suppression systems are activated. Depressing pushrail will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

Set: 2.0

Doors: 2503-A, 2503-B
Description: Card Access - Fail Safe

2	Hinge, Full Mortise, Hvy Wt	T4A3786	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	MK
1	Access Control Rim Exit (by Security)	12 SN200-8875 BIPS-0E ETMI	SA
1	Core	6300	SA
1	Surface Closer	9500	NO
1	Door Stop	RM850 / RM860	RO
1	Gasketing	S773BL	PE
1	ElectroLynx Harness - Frame	QC-CXXXXP (device to J-box)	MK
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)	MK
1	Wiring Diagram (by Security)	Elevation; Point-to-Point	
1	Position Switch (concealed)	By Security	SU
1	Power Supply (by Security)	AQL Series (Amps & Relays as Req'd)	SU

Notes:
Operation: Door is normally closed and locked (after hours). Valid card at reader unlocks outside lever for momentary access. Monitoring by door position switch. During a loss of power the door will remain latched, but unlocked. Free egress at all times. Lock status will change to latched, but unlocked when the

fire detection/suppression systems are activated. Depressing pushrail will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

Set: 3.0
Doors: 2506, 2508

3	Hinge, Full Mortise, Hvy Wt	T4A3786	MK
1	Exit Device	12 8815 ETMI	SA
1	Surface Closer	9500	NO
1	Door Stop	RM850 / RM860	RO
1	Gasketing	S773BL	PE

Set: 4.0
Doors: 2544

6	Hinge, Full Mortise	TA2714	MK
2	Multi-Point Lock	12 NB 701315 ETMI	SA
2	Conc Overhead Stop	1-X36	RF
2	Surface Closer	9500	NO
1	Meeting Edge Seal	S771BL	PE
1	Gasketing	S773BL	PE

Set: 5.0
Doors: 2538, 2541, 2548, 2551
Description: Card Access

2	Hinge, Full Mortise, Hvy Wt	T4A3786	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	MK
1	Access Control Lock (by Security)	SN200-82271 BIPS-0E LNMI	SA
1	Core	6300	SA
1	Surface Closer	9500	NO
1	Door Stop	RM850 / RM860	RO
1	Gasketing	S773BL	PE
1	ElectroLynx Harness - Frame	QC-CXXXXP (device to J-box)	MK
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)	MK
1	Wiring Diagram (by Security)	Elevation; Point-to-Point	
1	Position Switch (concealed)	By Security	SU
1	Power Supply (by Security)	AQL Series (Amps & Relays as Req'd)	SU

Notes:
Operation: Door is normally closed and locked. Valid card at reader unlocks outside lever for momentary access. Monitoring by door position switch. During a loss of power the door will default to secure. Free egress at all times. Lock status will not change when the fire detection/suppression systems are activated. Rotating inside lever will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

Set: 5.1
Doors: 2565, 2579, 2580, 2592
Description: Card Access; Fail Safe

3	Hinge, Full Mortise, Hvy Wt	T4A3786	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	MK

1	Access Control Lock (by Security)	SN200-82270 BIPS-0E LNMI	SA
1	Core	6300	SA
1	Surface Closer	9500	NO
1	Door Stop	RM850 / RM860	RO
1	Gasketing	S773BL	PE
1	ElectroLynx Harness - Frame	QC-CXXXXP (device to J-box)	MK
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)	MK
1	Wiring Diagram (by Security)	Elevation; Point-to-Point	
1	Position Switch (concealed)	By Security	SU
1	Power Supply (by Security)	AQL Series (Amps & Relays as Req'd)	SU

Notes:
Operation: Door is normally closed and locked. Valid card at reader unlocks outside lever for momentary access. Monitoring by door position switch. During a loss of power the door will remain latched, but unlocked. Free egress at all times. Lock status will change to latched, but unlocked when the fire detection/suppression systems are activated or upon signal from the Fire Command Center. Rotating inside lever will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

Set: 6.0
Doors: 2532, 2533, 2534
Description: Keypad Access

2	Hinge, Full Mortise, Hvy Wt	T4A3786	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	MK
1	Keypad Lock (by Security)	SN210-82271 BIPS-0E LNMI	SA
1	Core	6300	SA
1	Surface Closer	9500	NO
1	Door Stop	RM850 / RM860	RO
1	Gasketing	S773BL	PE
1	ElectroLynx Harness - Frame	QC-CXXXXP (device to J-box)	MK
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)	MK
1	Wiring Diagram (by Security)	Elevation; Point-to-Point	
1	Position Switch (concealed)	By Security	SU
1	Power Supply (by Security)	AQL Series (Amps & Relays as Req'd)	SU

Notes:
Operation: Door is normally closed and locked. Valid code at keypad unlocks outside lever for momentary access. Monitoring by door position switch. During a loss of power the door will default to secure. Free egress at all times. Lock status will not change when the fire detection/suppression systems are activated. Rotating inside lever will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

Set: 7.0
Doors: 2535, 2536, 2537, 2540
Description: Card Access w/ Privacy

2	Hinge, Full Mortise, Hvy Wt	T4A3786	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	MK
1	Electrified Lock w/ Indicators	V21 PHR NAC-82281 LNMI	SA
1	Core	6300	SA
1	Surface Closer	9500	NO

1	Door Stop	RM850 / RM860	RO
1	Gasketing	S773BL	PE
1	ElectroLynx Harness - Frame	QC-CXXXXP (device to J-box)	MK
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)	MK
1	Wiring Diagram (by Security)	Elevation; Point-to-Point	
1	Position Switch (concealed)	By Security	SU
1	Power Supply (by Security)	AQL Series (Amps & Relays as Req'd)	SU
1	Card Reader	By Security Vendor	

Notes:
Operation: Door is normally closed and locked. Valid card at reader unlocks outside lever for momentary access. Throwing deadbolt from inside disables card reader and changes indicators to "Occupied". Monitoring by door position switch. During a loss of power the door will default to secure. Free egress at all times. Lock status will not change when the fire detection/suppression systems are activated. Rotating inside lever will retract deadbolt and latch, change indicators to "Vacant" and activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

Set: 8.0
Doors: 2576

6	Hinge, Full Mortise	TA2714	MK
1	Dust Proof Strike	570	RO
2	Flush Bolt	555	RO
1	Storeroom Lock	8204 LNMI	SA
2	Door Stop	RM850 / RM860	RO
2	Silencer	608; 609 WD	RO

Set: 9.0
Doors: 2530, 2531

10	Hinge, Full Mortise	TA2714	MK
2	Roller Latch	592	RO
2	Single Dummy Trim	8293 LNMI	SA
2	Conc Overhead Stop	1-X36	RF
2	Silencer	608; 609 WD	RO

Set: 10.0
Doors: 2546

6	Hinge, Full Mortise	TA2714	MK
1	Dust Proof Strike	570	RO
2	Flush Bolt	555	RO
1	Storeroom Lock	8204 LNMI	SA
1	Surface Closer	9500	NO
2	Door Stop	RM850 / RM860	RO
2	Silencer	608; 609 WD	RO

Set: 11.0
Doors: 2553, 2557
Description: Storeroom - No Closer

3	Hinge, Full Mortise	TA2714	MK

1	Storeroom Lock	8204 LNMI	SA
1	Core	6300	SA
1	Door Stop	RM850 / RM860	RO
3	Silencer	608; 609 WD	RO

Set: 12.0
Doors: 2554, 2556
Description: Storeroom - OH Stop

3	Hinge, Full Mortise	TA2714	MK
1	Storeroom Lock	8204 LNMI	SA
1	Core	6300	SA
1	Concealed Overhead Stop	2-X36	RF
3	Silencer	608; 609 WD	RO

Set: 13.0
Doors: 2542, 2543, 2558, 2561, 2562, 2593, 2595
Description: Storeroom - Closer

3	Hinge, Full Mortise	TA2714	MK
1	Storeroom Lock	8204 LNMI	SA
1	Core	6300	SA
1	Surface Closer	9500	NO
1	Door Stop	RM850 / RM860	RO
1	Gasketing	S773BL	PE

Set: 14.0

3	Hinge, Full Mortise	TA2714	MK
1	Classroom Lock	8237 LNMI	SA
1	Core	6300	SA
1	Surface Closer	9500	NO
1	Door Stop	RM850 / RM860	RO
1	Gasketing	S773BL	PE

Set: 15.0

3	Hinge, Full Mortise	TA2714	MK
1	Passage Set	8215 LNMI	SA
1	Door Stop	RM850 / RM860	RO
3	Silencer	608; 609 WD	RO

Set: 16.0
Doors: EX25-34, EX25-35

3	Hinge, Full Mortise	TA2714	MK
1	Passage Set	8215 LNMI	SA
1	Surface Closer	9500	NO
1	Door Stop	RM850 / RM860	RO
1	Gasketing	S773BL	PE

Set: 17.0

Doors: 2552, 2560
Description: Pair - Card Access

5	Hinge, Full Mortise, Hvy Wt	T4A3786	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC	MK
1	Dust Proof Strike	570	RO
2	Flush Bolt	555	RO
1	Access Control Lock (by Security)	SN200-82271 BIPS-0E LNMI	SA
1	Core	6300	SA
1	Surface Closer	9500	NO
1	Astragal	357SP	PE
1	Meeting Edge Seal	S771BL	PE
1	Gasketing	S773BL	PE
1	ElectroLynx Harness - Frame	QC-CXXXXP (device to J-box)	MK
1	ElectroLynx Harness - Door	QC-CXXX (Size as Required)	MK
1	Wiring Diagram (by Security)	Elevation; Point-to-Point	
2	Position Switch (concealed)	By Security	SU
1	Power Supply (by Security)	AQL Series (Amps & Relays as Req'd)	SU

Notes:
Operation: Door is normally closed and locked. Valid card at reader unlocks outside lever for momentary access. Monitoring by door position switch. During a loss of power the door will default to secure. Free egress at all times. Lock status will not change when the fire detection/suppression systems are activated. Rotating inside lever will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.

Set: 18.0
Doors: EX26-01, EX26-02, EX26-03, EX26-04
Description: Existing Exterior Roof (VIF)

3	Hinge, Full Mortise, Hvy Wt	T4A3386	MK
1	Storeroom Lock	8204 LNMI	SA
1	Surface Closer	9500	NO
1	Gasketing	2891APK	PE
1	Sweep	315CN	PE
1	Threshold (coord w/ field conditions)	2010APK FG FHSL14SS-2	PE

Set: 19.0
Doors: 2501, 2505
Description: Tagwall Encore System Bronze Metal Mesh Pair - Card Access; Fail Safe

2	Door Top Rail	DRS Series per elevation (by Glass section)	GS	
2	Door Bottom Rail	DRS Series per elevation (by Glass section)	GS	
2	Pivot (walking beam, ctr hung)	PV-WALKBEAM (by Glass section)	GS	
2	Bottom Pivot (ctr hung, end load)	PV-FM-300END (48"; 300 lbs) (by Glass section)		GS
2	Cylinder	As Required	YA	
2	Core	6300	SA	
2	Exit Device (NL, pull, dogging)	PDU8000-3 (by Glass section)	GS	
2	Electric Strike (fail safe)	ESK-SGL-FS (by Glass section)	RO	
2	Pull (full height, TBD)	RM2510 (12XHD/15XHD TBD)	RO	
2	Concealed Closer/Holder	OHC-609-90HO (42"; 200 lbs) (by Glass section)		GS
2	Door Stop	RM850 / RM860	RO	

2	ElectroLynx Harness - Frame	QC-CXXXXP (device to J-box)	MK
1	Wiring Diagram (by Security)	Elevation; Point-to-Point	
2	Position Switch (concealed)	By Security	SU
1	Power Supply (by Security)	AQL Series (Amps & Relays as Req'd)	SU

Notes: Coordinate finishes with Design Team (typ). Coordinate hardware with door assembly manufacturer. Hardware has been specified to establish design intent. Final details will need to be coordinated.

Operation: Door is normally closed and secured. Valid card at reader releases electric strikes for momentary access. Monitoring by door position switch. During a loss of power the door/strike will default to unsecure/fail-safe. Free egress at all times. Lock/strike status will change to unsecure when the fire detection/suppression systems are activated or upon signal from the Fire Command Center. Approaching door will activate head-mounted request to exit switch (if required by security) for appropriate monitor by EAC systems. Outside key override.

Set: 20.0
Doors: 2567-A, 2567-B, 2568, 2569, 2572, 2573, 2583, 2584, 2585, 2588, 2589
Description: Tagwall Encore System - WD Pivot Door w/ Concealed Closer

1	Pivot Set	147	RF
2	Intermediate Pivot	M19	RF
1	Office/Entry Lock	8205 LNMI	SA
1	Concealed Closer w/ Holder	(W)PH91HDCP	RF
1	Door Stop	RM850 / RM860	RO
3	Silencer	608; 609 WD	RO

Set: 21.0
Doors: 2563, 2564, 2570, 2571, 2586, 2587
Description: Tagwall Encore System - GLASS Pivot Door w/ Closer Patch

1	Bottom Patch (hydraulic)	PFD-HYD 90HO (by Glass section)	GS
1	Top Patch	PFD-20 (by Glass section)	GS
1	Top Pivot (surface mount)	PF-SM-PIVOT (by Glass section)	GS
1	Patch Fittings	As required (by Glass section)	GS
1	Office/Entry Lock	8205 LNMI	SA
1	Door Stop	RM850 / RM860	RO

Notes: Coordinate hardware with door assembly manufacturer.
Hydraulic closer patch is not ADA compliant.

Set: 22.0
Doors: 2663, 2674
Description: Mechanical Penthouse

3	Hinge, Full Mortise, Hvy Wt	T4A3386	MK
1	Storeroom Lock	8204 LNMI	SA
1	Core	6300	SA
1	Surface Closer	9500	NO
1	Door Stop	RM850 / RM860	RO
1	Gasketing	2891APK	PE
1	Sweep	315CN	PE

1 Threshold (coord w/ field conditions) 2010APK FG FHSL14SS-2 PE

END OF SECTION 087100

SECTION 08 80 00 - GLASS AND GLAZING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the glass and glazing as shown on the drawings and/or specified herein, including but not limited to glazing of the following:

1. Windows.
2. Doors.
3. Interior mirrors, frameless.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Hollow metal doors and frames - Section 081113.

C. Windows - Section 085113.

D. Metal Framed skylights - Section 086300.

E. Toilet Accessories - Section 102800.

1.5 REFERENCES

A. Comply with the recommendations of the following references unless more stringent requirements are indicated herein.

1. IGMA Publications: IGMA Glazing Manual.
2. AAMA Publications: AAMA TIR-A7 Sloped Glazing Guidelines and Glass Design for Sloped Glazing.
3. LSGA Publications: LSGA Design Guide.

4. SIGMA Publications: TM-3000 Vertical Glazing Guidelines and TB-3001 Sloped Glazing Guidelines.

5. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201.

6. Fire-Resistive Glazing Products for Door Assemblies: Products identical to those tested per ASTM E l52, labeled and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

7. Fire-Resistive Glazing Products for Window Assemblies: Products identical to those tested per ASTM E 163, labeled and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

8. 16 CFR 1201, Safety Standards for Architectural Glazing, Sealed Insulating Glass Manufacturing Association.

9. ASTM C 920, Elastomeric Joint Sealant.

10. SAFETY ANSI Z97.1.

11. Fire Resistant ASTM E 152.

12. Insulating Glass Criteria - IGCC International Glass Cert. Council.

1.6 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thicknesses indicated on drawings and/or specified herein are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Varies. Refer to drawings.

   a. Specified Design Wind Loads: 30 psf or greater if required by Code.

2. Probability of Breakage for Vertical Glazing:

   a. 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
   b. 1 lite per 1000 for lites installed 15 degrees from the vertical land and under wind action.
   c. Load Duration: 60 seconds or less.

3. Maximum Lateral Deflection: For glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/100 times the short side length or 0.50", whichever is less.

4. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   a. Temperature Change (Range): 120 deg. F ambient; 180 deg F, material surfaces.

5. Thermal Solar Performance: See Article 2.2 herein.

C. Glass units shall be annealed, heat strengthened, fully tempered or laminated where required to meet wind and/or snow loads and safety glazing requirements, as shown, specified or recommended by the glass fabricator and as required by the New York City Building Code.

1.7 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Adhesives and Sealants
   7. Paints & Coatings

1.8 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.9 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Submit manufacturer's printed product data, specifications, standard details, glazing instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements, including

performance requirements.

C. Submit compatibility and adhesion test reports from sealant manufacturer indicating materials were tested for compatibility and adhesion with glazing sealant, as well as other glazing materials including insulation units.

D. Initial Selection Samples: Submit samples of each glass and glazing material showing complete range of colors, textures, and finishes available for each material used.

1. Submit complete range of samples of standard colors and patterns for ceramic frits at insulating glass.

2. Submit complete range of samples of sandblasted glass showing variations of grits and opacity achieved.

E. Verification Samples: Submit representative samples of each glass and glazing material that is to be exposed in completed work. Show full color ranges and finish variations expected. Provide glass samples having minimum size of 144 sq. in. and 6 in. long samples of sealants and glazing materials; all samples shall bear the name of the manufacturer, brand name, thickness, and quality.

F. Calculations: Provide wind load charts, calculations, thermal stress analysis, and certification of performance of this work. Indicate how design requirements for loading and other performance criteria have been satisfied. Document shall be signed and sealed by a Professional Engineer licensed in the State of New York.

G. Test Reports: Provide certified reports for specified tests.

H. Warranties: Provide written warranties as specified herein.

1.10 QUALITY ASSURANCE

A. Source: For each glass and glazing type required for work of this Section, provide primary materials which are products of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.

B. Installer: A firm with a minimum of five years' experience in type of work required by this Section and which is acceptable to manufacturers of primary materials; and with a successful record of in-service installations similar in size and scope to this Project.

C. Glass Thickness: Glass thicknesses shown on drawings and/or specified herein are minimum thicknesses. Determine and provide size and thickness of glass products that are certified to meet or exceed performance requirements specified in this Section.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated.

1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."

2. IGMA Publications: IGMA TM-3000, "Vertical Glazing Guidelines for Sealed Insulating Glass Units."

E. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

F. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

G. Heat Strengthened, Tempered and Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and ANSI Z97.1.

1. Heat Strengthened, Tempered and Safety Glazing Labeling: Where heat strengthened, tempered and safety glazing are indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

H. Insulating Glass Certification Program: Permanently marked on spacers with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.

2. Associated Laboratories, Inc.

3. Insulating Glass Manufacturers Alliance.

I. Manufacturer shall be ISO 9001-2000 Certified.

J. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies

1.11 TESTS

A. Preconstruction Sealant Test: Submit samples of materials to be used to glazing sealant manufacturer to determine sealant compatibility. Include samples of glass, gaskets, glazing materials, framing members, and other components and accessories of glazing work. Test in accordance with ASTM C 794 to verify what type of primers (if any) are required to ensure sealant adhesion to substrates.

1. Submit minimum of nine pieces of each type and finish of framing member, and nine pieces of each type, class, kind, condition, and form of glass, including monolithic, laminated, and insulating glass for adhesion tests.

2. Provide manufacturer's written report and recommendations regarding proper installation.

1.12 PROJECT CONDITIONS

A. Weather: Perform work of this Section only when existing or forecasted weather conditions are within limits established by manufacturers of materials and products used.

B. Temperature Limits: Install sealants only when temperatures are within limits recommended by sealant manufacturer, except, never install sealants when temperatures are below 40 deg. F.

1.13 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations and GANA Manual.

1. Protect materials from moisture, sunlight, excess heat, sparks and flame.

2. Sequence deliveries to avoid delays, but minimize on-site storage.

1.14 WARRANTIES

A. General: Warranties shall be in addition to, and not a limitation of, other rights The City of New York may have under the Contract Documents.

B. Manufacturer's Special Project Warranty on Coated Glass Products: Provide written warranty signed by manufacturer of coated glass agreeing to furnish f.o.b. point of manufacture, within specified warranty period indicated below, replacements for those coated glass units which develop manufacturing defects. Manufacturing defects are defined as peeling, cracking or deterioration in metallic coating due to normal conditions and not due to handling or installation or cleaning practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard but not less than five (5) years after date of substantial completion.

C. Manufacturer's Special Project Warranty on Insulating Glass: Provide written warranty signed by manufacturer of insulating glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, replacements for those insulating glass units developing manufacturing defects. Manufacturing defects are defined as failure of the hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided the manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during the warranty period.

1. Warranty Period: Manufacturer's standard but not less than ten (10) years after date of substantial completion.

D. Manufacturer’s Special Project Warranty on Laminated Glass: Manufacturer’s standard form, made out to The City of New York and signed by laminated glass manufacturer agreeing to replace laminated glass units that deteriorate as defined in “Definitions” Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty period five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/FABRICATORS

A. All glass and glazing used at the exterior of the Project shall be manufactured by the same manufacturer. The same manufacturer and the same furnace shall be used for all tempered and heat strengthened glass used throughout the project. Acceptable manufacturers include the following:

1. Vitro Architectural Glass
2. Guardian Industries.
3. Pilkington.
4. AGC.
5. Viracon.
6. Or approved equal.

2.2 GLASS MATERIALS AND PRODUCTS

A. Clear Float Glass: ASTM C 1036, Type I (Transparent, Flat), Class 1 (Clear), Quality q3, minimum 1/4" thick.

B. Clear Tempered Glass: ASTM C 1048, Condition A (Uncoated), Type I (Transparent, Flat), Class 1 (Clear), Quality q3, Kind FT, minimum 1/4" thick. Tempered glass must be certified by SGCC to meet applicable standards. Tempered glass shall also conform to the following:

1. Length and Width: For 2.9 mm to 6.0 mm; +/-1.6 mm.
2. Diagonal: +/- 3.0 mm.
3. Edgework: Belt seaming or diamond wheels. 1.5 mm seam of upper and lower glass edges. No sharp edges.
4. Corners: No more than 3.0 mm from square.
5. Float Glass Defects: Must meet the requirements of ASTM C 1036. The most common defects are scratches, stones gaseous bubbles and edge chips. Tables in the glass standards have limits for size/quantity of defects.
6. Tempered glass shall have a minimum surface compression of 10,000 psi.
7. Tempered glass to be heat-treated by horizontal (roller hearth) process with inherent roller-wave distortion parallel to the bottom edge of the glass when installed.
8. Flatness Tolerances

a. Roller-Wave or Ripple: The deviation from flatness at any peak shall be targeted not exceed 0.003” as measured per peak to valley for 1/4” (6mm) thick glass.
b. Bow and Warp: The bow and warp tolerances shall not exceed 1/32” per linear foot.
c. Fully tempered glass shall be heat soaked to EN 14179-1:2005-European Heat Soaking Standard.

C. Low 'E' Coated Glass: Provide high-performance, clear, metallic coating. Provide Low 'E' coating which has the following performance characteristics when applied to the No. 2 surface of 1" insulating units, both lites 1/4" clear:

1.	Visible Transmittance:	PER DRAWINGS
2.	Visible Reflectance	PER DRAWINGS
3.	Winter U-value	PER DRAWINGS
4.	Shading Coefficient SC:	PER DRAWINGS
5.	Solar Heat Gain Coefficient (SHGC)	0.25

D. Bird-Friendly Glass: Façade glass, glass railings, and other exterior glass shall comply with amendments to the New York City Building Code (Code) mandated by Local Law 15 of 2020. Bird friendly glass shall meet the definition of Bird Friendly Material as defined by Code.

1. Bird-friendly glass shall be required where shown in architectural drawings, within 75-feet of grade, within 12-feet of green roofs, and at Bird Hazard Installation and Fly-Though Conditions as defined by Code.

2. Threat Factor: Glass shall meet a Threat Factor of not more than 25, or, where allowed by Code, not more than 27.

3. Documentation of threat factor: Threat factor of all proposed glass shall be verified and documented in writing as required by Code. Threat factor of glass shall be established by means of one of the following:

   a. Testing: provide written documentation that glass has been tested by the American Bird Conservancy. Testing by other organizations may be submitted for consideration by the Commissioner of record.
   b. Evaluation: Written documentation from the American Bird Conservancy stating that they have evaluated the proposed glass and found it to be equivalent to a tested bird friendly glass product. Documentation of testing or evaluation shall reflect all proposed bird-friendly glass assemblies, and all components of the assembly including but not limited to inner, outer, and intermediate panes, frits, laminates, low- e coatings, and all treatments or features that affect the appearance of the glass.

4. Acceptable products: The contractor may propose the following products for use within a bird-friendly glass assembly. The proposed pattern and full assembly shall be tested or evaluated, and shall meet the required Threat Factor and all other requirements of this specification. Contractor shall verity that proposed products are available in the sizes required, and without delay to project schedule,

   a. UV-Reflective Pattern:

1). Arnold Glas: Ornilux, Mikado pattern
2). McGrory Glass, BirdProtect, McGrory Glass
3). Guardian Glass, Bird1st
4). Or approved equal.

b. Etched Pattern:
1). Walker Glass, Aviprotek (#1 surface)
2). Skyline Design, Eco Etch (#1 surface)
3). Or approved equal.

c. Fritted Pattern (ceramic frit):
1). Ferro S1de One (#1 surface).
2). Viracon (#2 surface).
3). Or approved equal.

d. Laminated Pattern (non UV-pattern):
1). SEEN / Eastman Window Film
2). Solyx, Bird Safe Film
3). Or approved equal.

E. Laminated Safety Glass: Provide two glass panes of equal thickness, laminated together with a polyvinyl butyl interlayer, conform to ASTM C 1172, and as follows:

1. Interlayer Color: Clear.

2. Interlayer Material: Provide Sentry Glass Plus by Dupont, Kuraray America, 0.030" thick at vertical applications, and 0.060" thick at sloped or horizontal applications. Use ionoplast-type (SGP) interlayer where laminated Glass edges will be exposed to direct wetting or relative humidity (RH) conditions greater than 60%.

3. Minimum thickness of 1/4".

F. Insulating Glass: Insulated glass composition shall consist of 1/4" clear exterior lite of float (or tempered, where required) glass with Low E coating on No. 2 face, 1/2" air space and 1/4" clear interior lite of float (or tempered, where required) glass. Provide factory assembled units of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space, complying with ASTM E 2190, and as follows:

1. Sealing System: Dual Seal.

2. Primary Sealant: Polyisobutylene.

3. Secondary Sealant: Silicone, General Electric IGS 3204 or IGS 3100, or Dow Corning 982.

a. For structurally glazed IG units, secondary seal shall conform to ASTM C 1249.

4. Primary and secondary seals shall not contain voids and must be continuously bonded to the glass structure.

5. Spacer: Clear finish aluminum with welded, soldered, or bent corners, hollow tube types, filled with low nitrogen absorption desiccant.

6. Desiccant: Molecular sieve, silica gel, or blend of both.

7. Air Space Thickness: 1/2".

8. Glass Thickness: 1/4" minimum.

9. Units shall be certified for compliance with seal classification "CBA" by the Insulating Glass Certification Council (IGCC) or by IGMA, and tested in accordance with the above ASTM Test Methods.

10. Insulating glass shall conform to the following tolerances:

    a. Length and Width: + 3.0 mm/ -2.0 mm.
    b. Diagonal: +/- 3.0 mm.
    c. Thickness: As agreed +/- 1.0 mm.
    d. Edge-Deletion of Coating: Minimum 8 mm wide. Width of deletion must be more than the width of the secondary seal. Silver layer(s) must be completely removed. Appearance must be uniform.
    e. Primary PIB Seal: Must be complete with no breaks. Appearance must be uniform. PIB bead must overlap coating. No visible bright line when glass is viewed in transmission. The width of the PIB bead shall be 4.0 mm + 3.0/ - 1.5 mm.
    f. Secondary Seal: Nominal 6 mm + 3.0/ - 1.5 mm. The minimum width of the secondary silicone seal for IG units that are glazed structurally must be determined according to ASTM C 1249. The secondary seal must be uniformly applied without bubbles, cavities or gaps. Avoid excess sealant that will need to be trimmed off later.

11. Additional requirements and properties for primary and secondary insulating glass seals and spacers:

    a. All glass units shall comply with IGMA Guidelines which limits the dimension of the visible edge seal encroachment into the vision area to be no greater than the “sightline infringement of 3mm (0.12”).
    b. Insulating glass unit hermetic seal to consist of butyl primary and silicone secondary seals with bent, welded, or soldered interpane spacer corners; keyed corners are not acceptable unless also soldered or welded. Spacers shall be aluminum or stainless steel. Locate spacer joint at the top or sides of the units, but in no instances at the sill. Design units to minimize the number of spacer joints. Provide solid keys, embedded in butyl sealant on all four sides, at spacer joints.
    c. Hermetic seals must be continuous and intimately bonded to both lites of glass. Provide primary seal of uniform depth with a nominal width of 1/8 to 3/16 in. Hermetic seals shall not be contaminated with debris, fingerprints, or other foreign matter and shall not contain voids or air pockets that decrease the width of the seal below the minimum widths listed in these Specifications, or that breach the seal. The width of the primary seal shall not be less than 1/16 in., and the total cumulative length of the primary seal between 1/16 in. and 1/8 in. shall be less than 12 in. in any one insulating glass unit. The primary seal shall not have a reduced thickness at the corners. An increased thickness of the primary seal at the corners is acceptable.
    d. Provide secondary seal of uniform depth with a nominal width of 1/4 in. Provide a total width of the primary and secondary seal of 1/2 in. Units shall meet SIGMA 65-7- 2, latest edition. Units shall not contain breather or capillary tubes or similar penetrations.

G. Fire-Rated Glazing Material: Proprietary product in the form of clear flat sheets of 5/16" nominal thickness weighting 2.5 lb./sq. ft., and as follows:

1. Fire Protection Rating: As required by Code for the fire rated opening in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

2. Product: "FireLite Plus" by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products.

H. Frameless Mirrors: 1/4", Quality q2, clear float glass with silver, copper, and organic coating, and as follows:

1. Edges: Uniformly ground and polished.

2.3 GLAZING MATERIALS AND PRODUCTS

A. General: Provide sealants and gaskets with performance characteristics suitable for applications indicated. Ensure compatibility of glazing sealants with insulating glass sealants, with laminated glass interlayers, and with any other surfaces in contact.

B. General Glazing and Cap Bead Sealant: Provide sealant with maximum Shore A hardness of 50. Provide one of the following:

1. Dow Corning 795.

2. General Electric Silglaze N 2500 or Contractors SCS-1000.

3. Tremco Spectrem 2.

4. Or approved equal.

C. Weather Seal Sealant: Provide non-acid curing sealant with movement range $\pm$ 50%, ASTM C 719. Provide one of the following:

1. Dow Corning 795.

2. General Electric Silpruf.

3. Tremco Spectrem 2.

4. Or approved equal.

D. Backer Rod: Closed cell non-gassing polyethylene rod with rod diameter 25% wider than joint width.

E. Dense Elastomeric Compression Seal Gaskets: Provide molded or extruded neoprene or EPDM gaskets, Shore A hardness of 75$\pm$5 for hollow profile, and 60$\pm$5 for solid profiles, ASTM C 864.

F. Cellular, Elastomeric Preformed Gaskets: Provide extruded or molded closed cell, integral-skinned neoprene, Shore A 40$\pm$5, and 20% to 35% compression, ASTM C 509; Type II.

G. Preformed Glazing Tape: Provide solvent-free butyl-polyisobutylene rubber with 100% solids content complying with ASTM C1281 AAMA A 800 with integral continuous EPDM shim. Provide preformed glazing tape in extruded tape form. Provide Tremco "Polyshim II" or approved equal.

H. Setting Blocks: Provide 100% or silicone blocks with Shore A hardness of 80-90. Provide products certified by manufacturer to be compatible with silicone sealants. Length to be not less than 4". Width for setting blocks to be 1/16" more than glass thickness and high enough to provide the lite recommended by glass manufacturer. When thickness of setting block exceeds 3/4" the glass manufacturer must be consulted for sizes and configuration. In a vented system, setting block shall be designed so as to not restrict the flow of water within the glazing rabbet to the weep holes.

1. Shims: For shims used with setting blocks, provide same materials, hardness, length and width as setting blocks.

2. Structural Silicone Glazing: Provide silicone setting blocks where structural silicone occurs at sills and at insulating units with silicone edge seals.

I. Edge Blocks: Provide neoprene or silicone as required for compatibility with glazing sealants. Provide blocks with Shore A hardness of 55±5.

J. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place.

K. Miscellaneous Glazing Materials: Provide sealant backer rods, primers, cleaners, and sealers of type recommended by glass and sealant manufacturers.

L. Mirror Adhesive: Palmer's "Mirro-Mastic", or approved equal; mastic must be compatible with mirror backing.

1. Clips: No. 4 finish Type 304 stainless steel.

2.4 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. Grind smooth and polish exposed glass edges.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.4 GENERAL GLAZING STANDARDS

A. Install products using the recommendations from the manufacturer of glass, sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those in the “GANA Glazing Manual”.

B. Verify that Insulating Glass (IG) Unit secondary seal is compatible with glazing sealants.

C. Install glass in prepared glazing channels and other framing members.

D. Install setting blocks in rabbets as recommended by referenced glazing standards in GANA Glazing Manual” and “IGMA Glazing Guidelines”.

E. Provide bite on glass, minimum edge and face clearances and glazing material tolerances recommended by “GANA Glazing Manual”.

F. Provide weep system as recommended by “GANA Glazing Manual”.

G. Set glass lites in each series with uniform pattern, draw, bow and similar characteristics.

H. Distribute the weight of glass unit along the edge rather than the corner.

I. Comply with manufacturers and referenced industry standards on expansion joint and anchors; accommodating thermal movement; glass openings; use of setting blocks, edge, face, and bite clearances; use of glass spacers; edge blocks and installation of weep systems.

J. Protect glass edge damage during handling and installation.

K. Prevent glass from contact with contaminating substances that result from construction operations, such as weld spatter, fireproofing or plaster.

L. Remove and replace glass that is broken, chipped cracked or damaged in any way.

3.5 GLAZING

A. Glazing channel dimensions, as indicated on Shop Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead. Install setting blocks at the one greater points of each lite along the horizontal mullion.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

K. Flush Glazing

1. If the butt joint in the metal framing is in the vertical direction, the glazier shall run the tape initially on the head and sill members going directly over this joint. Should the butt joint in the metal framing run horizontally, tapes must first be applied to the jambs so that it crosses over the joint.

2. Each tape section shall butt the adjoining tape and be united with a tool to eliminate any opening.

3. Do not overlap the adjoining length of tape or rubber shim as this will prevent full contact around the perimeter of glass.

L. Off-Set Glazing

1. Where the glazing legs are off-set, the difference in the rabbet width shall be compensated by employing different glazing tapes with different diameter shims. The difference in shim shall be equal to the size of the off-set. The thinner tape shall be positioned first on the glazing leg closest to the interior. The thicker tape shall be cut to the exact length of the dimension between the applied tapes, and installed on the outermost glazing leg.

2. Immediately prior to setting glass, paper backing shall be removed. Apply a toe bead of sealant 6" in each direction, from each corner.

3. Locate setting blocks in the sill member at quarter points, or if necessary to within 6" of each corner. Setting blocks must be set equal distance from center line of the glass and high enough to provide the recommended bite and edge clearances.

4. Set edge block according to glass manufacturer's recommendations.

5. Set Glass: The glass shall be pressed firmly against the tape to achieve full contact.

6. In a vented system, apply a heel bead (air seal) of sealant around the perimeter of glass, between the sole of the I.G. unit and the base of the rabbet of the metal framing developing a positive bond to the unit and to the metal framing. The bead of the sealant shall be deep enough so that it will partially fill the channel to a depth of 1/4" between the glass edge and the base of the metal framing rabbet.

7. Interior stops shall be set, and glazing tape spline for the appropriate face clearance shall be rolled into place, compressing the glass to the shim within the glazing tape.

3.6 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant as recommended by glass manufacturer or glass frame manufacturer.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape where noted on approved shop drawings.

3.7 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.8 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

1. Exterior glazing gasket shall be set a minimum of 1/8” below exterior glazing stop to create a channel for sealant installation.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.9 FRAMELESS MIRRORS

A. Apply mastic to back of mirror "pats" spaced 4 pats/sq. ft.; adjust mirror so that it is plumb and in place to avoid distortion of reflecting images. Allow 1/8" space between back of mirror and wall surface.

1. Apply "pats" using Palmer Electric Applicator.

B. Apply stainless steel clips at mirror top and bottom; securely clip to substrate using non- corrosive anchors. At drywall back-up anchors must be secured to studs or steel wallplate spanning from stud to stud.

3.10 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by manufacturers.

F. Glass to be cleaned according to:

1. GANA Glass Information Bulletin GANA 01-0300 – “Proper Procedure for Cleaning Architectural Glass Products”.

2. GANA Glass Informational Bulletin GANA TD-02-0402 – “Heat Treated Glass Surfaces are Different”.

G. Do not use razor blades, scrapers or metal tools to clean glass.

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SECTION 09 29 00 GYPSUM DRYWALL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the gypsum drywall as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Gypsum board work for partitions, ceilings, column enclosures, furring, and elsewhere where gypsum drywall work is shown on drawings.
2. Metal supports for gypsum drywall construction.
3. Acoustical insulation for gypsum drywall work.
4. Sealant for gypsum drywall work.
5. Concealed metal reinforcing for attachment of railings, toilet partitions and other items supported on drywall partitions and walls.
6. Taping and finishing of drywall joints.
7. Installing rings and frames in drywall surfaces for grilles, registers and lighting fixtures.
8. Gypsum shaftwall construction.
9. Bracing and connections.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Thermal insulation - Section 072100.

C. Steel doors and frames - Section 081113.

D. Access doors - Section 083113.

E. Painting and finishing - Section 099100.

F. Rings for grilles, registers and light fixtures - Division 23 and 26.

1.5 QUALITY ASSURANCE

A. The following standards, as well as other standards which may be referred to in this Section, shall apply to the work of this Section:

1. The Gypsum Construction Handbook, latest edition, USG.

2. Construction Guide, latest edition, National Gypsum.

3. ASTM A 568 "Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements For"

4. ASTM C 475 "Standard Specification for Joint Treatment Materials for Gypsum Wallboard Construction"

5. ASTM C 645 "Standard Specification for Non-Structural Steel Framing Members"

6. ASTM C 754 "Standard Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products"

7. ASTM C 840 "Standard Specification for Application and Finishing of Gypsum Board"

8. ASTM C 919 "Standard Specification for Use of Sealants in Acoustical Applications"

9. ASTM C 954 "Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs From 0.033 in. to 0.112 in. in Thickness"

10. ASTM C 1002 "Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Board"

11. ASTM C 1177 "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing"

12. ASTM C 1178 "Standard Specification for Glass Mat Water Resistant Gypsum Backing Board"

13. ASTM C 1278 "Standard Specification for Fiber-Reinforced Gypsum Panel"

14. ASTM C 1396 "Standard Specification for Gypsum Board"

15. ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber"

B. Allowable Tolerances: 1/32" offsets between planes of board faces, and 1/16" in 8'-0" for plumb, level, warp and bow.

C. System Design Load

1. Provide drywall shaft systems for elevators designed and tested by manufacturer to withstand a lateral loading (air pressure) of 10 lbs. per sq. ft. for the maximum wall height required, and with deflection limited to L/240 of partition height.

2. Provide standard drywall wall assemblies designed and tested by manufacturer to withstand a lateral load of 5 lbs. per sq. ft. for the maximum wall height required, and with deflection limited to L/240 of partition height.

    a. Drywall assemblies with tile finish shall have a deflection limit of L/360.

3. Provide drywall ceiling assemblies designed, fabricated and installed to have a deflection not to exceed L/360.

D. Fire-Resistance Rating: Where gypsum drywall with fire resistance ratings are indicated, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories, or to design designations in UL "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction, and compliant with UL Test #2079; criteria for cycle movement for all field height wall sections requiring allowance for vertical deflection within framing details.

E. Installer: Firm with not less than 5 years' of successful experience in the installation of specified materials.

F. For projects located in New York City, comply with New York City Official Compilation of the Rules of the City of New York regarding "Impact Resistant Stair and Elevator Enclosures" when such enclosures are of gypsum drywall construction.

G. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
    1. Environmental Product Declarations (EPDs)
    2. New York City's Environmental Preferable Purchasing (EPP)
    3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
    4. Low-Emitting Materials
    5. Regional Content
    6. Adhesives and Sealants
    7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Submit shop drawing for each drywall partition, furring and ceiling system showing size and gauges of framing members, hanger and anchorage devices, wallboard types, insulation, sealant, methods of assembly and fastening, control joints indicating column lines, corner details, joint finishing and relationship of drywall work to adjacent work.

C. Samples: Each material specified herein, 12" x 12", or 12" long, or in manufacturer's container, as applicable for type of material submitted.

D. Manufacturer's Literature: Submit technical and installation instructions for each drywall partition, furring and ceiling system specified herein, and for each fire-rated and sound-rated gypsum board assembly. Submit other data as required to show compliance with these specifications, including data for mold resistant joint compound.

E. Test Reports: This Contractor shall submit test report, obtained by drywall manufacturer, indicating conformance of drywall assemblies to required fire ratings and sound ratings.

F. Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.

1.9 PRODUCT HANDLING AND PROTECTION

A. Deliver, store and handle drywall work materials to prevent damage. Deliver materials in their original, unopened containers or bundles, and store where protected from moisture, damage and from exposure to the elements. Store wallboard in flat stacks.

B. Protect wallboard from becoming wet.

C. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

1.10 ENVIRONMENTAL CONDITIONS

A. Provide and maintain minimum temperature of fifty-five (55) degrees F. and adequate ventilation to eliminate excessive moisture within the building in the area of the drywall work for at least twenty-four (24) hours, prior to, during and after installation of drywall work. Installation shall not start until windows are glazed and doors are installed, unless openings are temporarily closed. Space above suspended ceilings shall be vented sufficiently to prevent temperature and pressure build up.

1.11 JOB MOCK-UP

A. At a suitable location, where directed by the Commissioner, lay up a portion of a finished wall and ceiling demonstrating the quality of work, including finishing, to be obtained under this Section. Omit drywall boards in locations as directed by the Commissioner to show stud spacing and attachments; after acceptance, complete assembly.

B. Adjust the finishing techniques as required to achieve the finish required by the Commissioner as described in this Section of these specifications.

C. Upon approval of the mock-up, the mock-up may be left in place as a portion of the finished work of this Section.

D. All drywall work shall be equal in quality to approved mock-up.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers for Gypsum Drywall Panels and Accessories: U.S. Gypsum Co., Georgia Pacific, CertainTeed Corporation, Certainteed, or National Gypsum Co. meeting specification requirements are acceptable or approved equal.

1. All drywall products must be manufactured in North America.

B. Acceptable Manufacturers for Metal Supports of Drywall Assemblies: Unless otherwise noted, provide products manufactured by ClarkDietrich, Super Stud Building Products, Marino/Ware, or approved equal.

2.2 METAL SUPPORTS

A. Metal Floor and Ceiling Runners

1. Provide vinyl barrier track liner equal to ProTRAK liner or approved equal.

2. Drywall Track: Formed from 0.0312 inch (20 U.S. Std. gauge) (minimum unless otherwise noted or required by performance requirements) cold formed steel, width to suit shaped metal studs. Use 20 ga. top runners with 1-1/4" minimum flanges.

3. Deflection track or head of wall connections at rated partitions shall conform to UL #2079 for cycle movement. Provide positive mechanical connection of framing to structure, allowing for vertical movement within connections. Minimum of 0.0312 (20 ga.) cold formed steel for clips, 25 ga. cold formed steel for deflection track.

   a. Product: ClarkDietrich; BlazeFrame DSL or MaxTrak
   b. Slotted Deflection Track As manufactured by the Steel Network,
   c. VertiClip or VertiTrack or equal made by Metal-Lite Inc.
   d. FireTrak (including stud clips) by FireTrak Corp.
   e. Or approved equal.

4. Shaft Wall "J" Type Runner: Formed from 0.0329 inch (20 U.S. Std. gauge) galvanized steel, 1" x 2-1/2" or 4" wide (to suit detail) x 2-1/4" (for shaft wall).

B. Metal Studs, Framing and Furring

1. C-Shaped Studs: Channel type with holes for passage of conduit formed from minimum 0.0312 inch (20 U.S. Std. gauge) (unless heavier gauge is required to meet deflection limits) cold formed steel, width as shown on drawings.

2. Furring Channels: Hat shaped, formed from galvanized steel, 25 U.S. Std. gauge.

   a. Product: ClarkDietrich; Furring Channel, or comparable product.

3. "C-H," "CT," or "I" Type Stud: 1-1/2" x 2-1/2", 4" or 6" wide (to suit detail) galvanized steel. Use for shaft wall construction; gauge and size as required to meet deflection limits given herein.

   a. Product: ClarkDietrich; CT Stud, or a comparable product.

4. Double "E" Type Stud or "J" Track with Holding Tabs: 1" x 2-1/2", 4" or 6" wide (to suit detail) galvanized steel. Use for shaft wall construction; gauge and size as required to meet deflection limits given herein.

   a. Product: ClarkDietrich; J-Tabbed Track, or a comparable product.

5. Continuous 16 gauge x 8" wide steel wall plate screwed to studs as required for support of railings, toilet partitions and other items supported on drywall partitions and walls.

C. Suspended Ceiling and Fascia Supports

1. Main Runners: 1-1/2" steel channels, cold rolled at 0.475 lbs. per ft., rust-inhibitive paint finish.

2. Furring Members: Screw-type hat-shaped furring channels of 25 ga. zinc-coated steel; comply with ASTM C 645.

3. Hangers: Galvanized, 1" x 3/16" flat steel slats capable of supporting 5x calculated load supported.

4. Hanger Anchorages: Provide inserts, clips, bolts, screws and other devices applicable to the required method of structural anchorage for ceiling hangers. Size devices for 5x calculated load supported.

5. Furring Anchorages: 16 ga. galvanized wire ties, manufacturer's standard clips, bolts or screws as recommended by furring manufacturer.

D. Protective Coating: All cold-formed steel members shall have coating conforming to AISI S220; ASTM A 653, G60 or coating with equivalent corrosion resistance of ASTM A653/A653M, G60. Galvannealed products are not acceptable

2.3 GYPSUM WALLBOARD TYPES

A. Gypsum Wallboard: 1/2" thick and 5/8" thick as indicated on drawings, "Sheetrock" by USG, "Gold Bond" by National Gypsum, or "Regular Gypsum" by CertainTeed Corp. or approved equal, 48" wide, in maximum lengths available to minimize end-to-end butt joints.

B. Fire-Rated Gypsum Wallboard: 1/2" thick and 5/8" thick as indicated on drawings, "1/2" Sheetrock Firecode C" or 5/8" Sheetrock Ecosmart Firecode X by USG, "Gold Bond Fireshield" by National Gypsum, or "Type C" and "Type X" by CertainTeed Corp., or approved equal 48" wide, in maximum lengths available to minimize end-to-end butt joints.

C. Water-Resistant Backing Board for Tile Finish: 5/8" thick, "DUROCK Glass Mat Tile Backerboard" by USG, "Dens-Shield Tile Backer Board" by Georgia Pacific, or "GlasRoc Tile Backer" by CertainTeed Corp. or approved equal. Cover joints with a pressure sensitive woven glass fiber tape equal to Imperial Type P Tape.

D. Moisture/Mold-Resistant Gypsum Wallboard at locations listed below, unless otherwise shown on drawings: 1/2" thick and 5/8" thick as indicated on drawings, "Mold Tough" or "Mold Tough Firecode X" by U.S. Gypsum, "DensArmor Plus" by Georgia Pacific, "Mold Defense" and/or "GlasRoc Interior"or “GlasRoc Type X” by Certainteed, or "Gold Bond EXP Interior Extreme Gypsum Board" by National Gypsum, or approved equal 48" wide, in maximum lengths available to minimize end-to-end butt joints. Board must have a rating of 10 per ASTM D 3273 with a core that meets ASTM C 1396, Section 6 or ASTM C 1658.

1. Areas in toilet rooms, lockers, janitor's closets not scheduled to receive ceramic tile, or where fire rating is required.

2. Walls and ceilings of spaces containing condensers, water tanks, water pumps and pressure reduction valves.

3. Portions of walls within 2 feet of kitchen sinks to a height of 4 feet above the floor.

4. Portions of walls within 2 feet of kitchen stoves to a height of 4 feet above the floor.

5. Walls of bathrooms that are not solely water closet compartments, other than walls specifically required to be cement board.

6. Walls and ceilings in service sink closets.

7. Portion of walls within 2 feet of mop sinks or service sinks to a height of 4 feet above the floor.

8. All perimeter walls and wet shafts.

E. Mold-Resistant Shaft Wall Liner: Solid gypsum board liner for shaft wall construction, 1" thick, 24" wide, as required to suit condition, by standard lengths as required, beveled edges. Provide "Mold Tough Liner Panel" by USG, "DensGlass Shaftliner" by Georgia Pacific, "Gold Bond Brand Fireshield Shaft Liner XP," "Gold Bond Brand EXP Extended Exposure Shaft Liner" by National Gypsum, or "GlasRoc Shaftliner" by CertainTeed Corp. or approved equal

1. Liner board must have a rating 10 per ASTM D 3273 with a core that meets ASTM C 1396 Section 6.

F. Impact-Resistant Gypsum Drywall: ASTM C 1396, ASTM C 1278, core types as required by fire-resistance-rated assembly indicated, and with tapered edges.

1. Products: Subject to compliance with requirements, provide USG "Sheetrock Brand Mold Tough VHI" 5/8" thickness, by United States Gypsum Company, or " Extreme Impact" by CertainTeed Corp. or approved equal

a. Locations: Including, but not limited to, stairwells, to satisfy NYC requirements.

2.4 ACCESSORIES

A. Acoustical Insulation: Paper-less, non-combustible, formaldehyde free semi-rigid mineral fiber mat, 2" thick, in walls (unless otherwise indicated), 3 lb./cu. ft. maximum density; Thermafiber, Inc. (an Owens Corning company) "Thermafiber SAFB FF" or approved equal.

B. Fasteners for Wallboard: USG Brand Screws; Type S Bugle Head for fastening wallboard to lighter gauge interior metal framing (up to 20 ga.). Type S-12 Bugle Head for fastening wallboard to heavier gauge interior metal framing (20 ga. to 12 ga.); Type S and Type S-12 Pan Head for attaching metal studs to door frames and runners; and Type G Bugle Head for fastening wallboard to wallboard. Lengths specified below under "Part 3 - Execution" Articles and as recommended by drywall manufacturer.

1. For Portland cement base boards, fasteners shall be equal to Durock Steel Screws by U.S. Gypsum or approved equal.

C. Laminating Adhesive: "Sheetrock Brand Joint Compound." Or approved equal.

D. Metal Trim - Corner Beads: For 90 degree External Corners - ClarkDietrich; 103 Deluxe Cornerbead or "Dur-A-Bead" No. 103, 30 U.S. Std. ga. galvanized steel, 1-1/4" x 1-1/4", for 90 degree external corners.

E. Metal Trim - Edge Beads: "Sheetrock Brand Paper Faced Metal Bead and Trim."

F. Partition/Concrete Ceiling Trim: Trim-Tex Super Seal Tear Away or approved equal.

G. Metal Trim Treatment Materials and Joint Treatment Materials for Gypsum Drywall Boards: Paper tape for joint reinforcing; Setting Type (Durabond 90) or Lightweight Setting Type Joint Compound for taping and topping; and Ready Mix Compound or approved equal for finishing.

1. For mold-resistant drywall, water resistant drywall, and tile backer board, use glass mesh tape with setting joint compound that is rated 10 when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274. Acceptable joint compound is "Rapid Set One Pass" made by CTS Cement Manufacturing Corp. or approved equal meeting standards noted herein.

H. Control Joints: ClarkDietrich; #093 Control Joint or No. 0.093, USG or approved equal.

I. Acoustical Sealant: USG "Acoustical Sealant" or "Tremco Acoustical Caulking" of Tremco Mfg. Co., Masterseal NP520 by BASF or approved equal.

J. Neoprene Gaskets: Conform to ASTM D 1056.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where gypsum drywall is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. General

1. Install drywall work in accordance with drywall manufacturer's printed instructions and as indicated on drawings and specified herein.

2. All metal framing for drywall partitions shall extend from floor to underside of structural deck above. Provide for vertical deflection with positive mechanical connections of framing members to structure.

3. Provide concealed reinforcement, 16 ga. thick by eight (8) inches wide or as detailed or as recommended by manufacturer, for attachment of railings, toilet partitions, and other items to be supported on the partitions which cannot be attached to the metal framing members. Concealed reinforcement shall span between metal studs and be attached thereto using two (2) self-tapping pan head screws at each stud.

   a. Back of drywall shall be scored or notched to prevent bulging out where reinforcement plate occurs.

B. Fire-Rated Assemblies: Install fire-rated assemblies in accordance with requirements of authorities having jurisdiction, Underwriters' Laboratories and test results obtained and published by the drywall manufacturer, for the fire-rated drywall assembly types indicated on the drawings.

C. Acoustical Assemblies: Install acoustically-rated assemblies to achieve a minimum STC as noted on drawings, in accordance with test results obtained and published by the drywall manufacturer, for the drywall assembly type indicated on the drawings.

D. Sealant

1. Install continuous acoustical sealant bead at top and bottom edges of wallboard where indicated or required for sound rating as wallboard is installed, and between metal trim edge beads and abutting construction.

2. Install acoustical sealant in 1/8" wide vertical control joints within the length of the wall or partitions, and in all other joints, specified below under "Control Joints." Install bead of acoustical sealant around electric switch and outlet boxes, piping, ducts, and around any other penetration in the wallboard; place sealant bead between penetrations and edge of wallboard.

3. Where sealant is exposed to view, protect adjacent surfaces from damage and from sealant material, and tool sealant flush with and in same plane as wallboard surface. Sealant beads shall be 1/4" to 3/8" diameter.

E. Wallboard Application

1. Do not install wallboard panels until steel door frames are in place; coordinate work with Section 081113, "Steel Doors and Frames."

2. See drawings for all board types. Use fire-rated wallboard for fire-rated assemblies. Use water-resistant wallboard where indicated on drawings and where wallboard would be subject to moisture. Install water-resistant wallboard in full, large sheets (no scraps) to limit number of butt joints.

3. Apply wallboard with long dimension parallel to stud framing members, and with abutting edges occurring over stud flanges.

4. Install wallboard for partitions from floor to underside of structure above and secure rigidly in place by screw attachment, unless otherwise indicated.

5. Provide "Thermafiber" safing insulation, or Approved Equal, meeting standards of Section 078413 at flutes of metal deck where partitions carry up to bottom of metal deck.

6. Neatly cut wallboard to fit around outlets, switch boxes, framed openings, piping, ducts, and other items which penetrate wallboard; fill gaps with acoustic sealant.

7. Where wallboard is to be applied to curved surfaces, dampen wallboard on back side as required to obtain required curve. Finish surface shall present smooth, even curve without fluting or other imperfections.

8. Screw fasten wallboard with power-driven electric screw driver, screw heads to slightly depress surface of wallboard without cutting paper, screws not closer than 3/8" from ends and edges of wallboard.

9. Where studs are doubled-up, screw fasten wallboard to both studs in a staggered pattern.

F. Metal Trim: Install and mechanically secure in accordance with manufacturer's instructions; and finish with three (3) coats of joint compound, feathered and finish sanded smooth with adjacent wallboard surface, in accordance with manufacturer's instructions.

1. Corner Beads: Install specified corner beads in single lengths at all external corners, unless corner lengths exceed standard stock lengths.

2. Edge Beads: Install specified edge beads in single lengths at all terminating edges of wallboard exposed to view, where edges abut dissimilar materials, where edges would be exposed to view, and elsewhere where shown on drawings. Where indicated on drawings, seal joint between metal edge bead and adjoining surface with specified gasket, 1/8" wide minimum and set back 1/8" from face of wallboard, unless other size and profile indicated on drawings.

3. Casing beads shall be set in long lengths, neatly butted at joints. Provide casing beads at juncture of board and vertical surfaces and at exposed perimeters.

G. Control Joint Locations: Gypsum board surfaces shall be isolated with control joints where:

1. Ceiling abuts a structural element, dissimilar wall or other vertical penetration.

2. Construction changes within the plane of the partition or ceiling.

3. Shown on approved shop drawings.

4. Ceiling dimensions exceed thirty (30) feet in either direction.

5. Wings of "L," "U," and "T" shaped ceiling areas are joined.

6. Expansion or control joints occur in the structural elements of the building.

7. Partition or furring abuts a structural element or dissimilar wall or ceiling.

8. Partition or furring runs exceed 30' without interruption.

9. Where control joints are required, ceiling height door frames may be used as control joints. Less than ceiling height frames shall have control joints extending to the ceiling from both corners.

H. Joint Treatment and Spackling

1. Joints between face wallboards in the same plane, joints at internal corners of intersecting partitions and joints at internal corners of intersections between ceilings and walls or partitions shall be filled with joint compound.

2. Screw heads and other depressions shall be filled with joint compound. Joint compound shall be applied in three (3) coats, feathered and finish surface sanded smooth with adjacent wallboard surface, in accordance with manufacturer's instructions. Treatment of joints and screw heads with joint compound is also required where wallboard will be covered by finish materials which require a smooth surface, such as vinyl wall coverings.

3.4 FURRED WALLS AND PARTITIONS

A. Use specified metal furring channels. Run metal furring channel framing members vertically, space sixteen (16) inches o.c. maximum. Fasten furring channels to concrete or masonry surfaces with power-driven fasteners or concrete stub nails spaced sixteen (16) inches o.c. maximum through alternate wing flanges (staggered) of furring channel. Furring channels shall be shimmed as necessary to provide a plumb and level backing for wallboard. At inside of exterior walls, an asphalt felt protection strip shall be installed between each furring channel and the wall. Furring channel and splices shall be provided by nesting channels at least eight (8) inches and securely anchoring to concrete or masonry with two (2) fasteners in each wing.

B. Wallboard Installation: Same as specified under Article 3.4 - "Metal Stud Partitions."

3.5 METAL STUD PARTITIONS

A. Unless otherwise noted, steel framing members shall be installed in accordance with ASTM C 754.

B. Runner Installation: Use channel type. Align accurately at floor according to partition layout. Anchor runners securely sixteen (16) inches o.c. maximum with power-driven anchors to floor slab, with power-driven anchors to structural slab above. See "Stud Installation" below for runners over heads of metal door frames. Where required, carefully remove sprayed-on fireproofing to allow partition to be properly installed.

C. Stud Installation

1. Use channel type, positioned vertically in runners, spaced as noted on drawings, but not more than sixteen (16) inches o.c.

2. Anchor studs to floor runners with screw fasteners. Provide snap-in or slotted hole slip joint bolt connections of studs to ceiling runners leaving space for movement. Anchor studs at partition intersections, partition corners and where partition abuts other construction to floor and ceiling runners with sheet metal screws through each stud flange and runner flange.

3. Connection at ceiling runner for non-rated partitions shall be snap-in or slotted hole slip joint bolt connection that shall allow for movement. Seal studs abutting other construction with 1/8" thick neoprene gasket continuously between stud and abutting construction.

4. Connections for fire rated partitions at ceiling runners shall conform to UL Design #2079.

5. Install metal stud horizontal bracing wherever vertical studs are cut or wallboard is cut for passage of pipes, ducts or other penetrations, and anchor horizontal bracing to vertical studs with sheet metal screws.

6. At jambs of door frames and borrowed light frames, install doubled-up studs (not back to back) from floor to underside of structural deck, and securely anchor studs to jamb anchors of frames and to runners with screws. Provide cross braces from hollow metal frames to underside of slab.

7. Over heads of door frames, install cut-to-length section of runner with flanges slit and web bent to allow flanges to overlap adjacent vertical studs, and securely anchor runner to adjacent vertical studs with sheet metal screws. Install cut-to-length vertical studs from runner (over heads of door frame) to ceiling runner sixteen (16) inches maximum o.c. and at vertical joints of wallboard, and securely anchor studs to runners with sheet metal screws.

8. At control joints, in field of partition, install double-up studs (back to back) from floor to ceiling runner, with 1/4" thick continuous compressible gasket between studs. When necessary, splice studs with eight (8) inches minimum nested laps and attach flanges together with two (2) sheet metal screws in each flange. All screws shall be self-tapping sheet metal screws.

D. Runners and Studs at Chase Wall: As specified above for "Runners" and "Studs" and as specified herein. Chase walls shall have either a single or double row of floor and ceiling runners with metal studs sixteen (16) inches o.c. maximum and positioned vertically in the runners so that the studs are opposite each other in pairs with the flanges pointing in the same direction. Anchor all studs to runner flanges with sheet metal screws through each stud flange and runner flange following requirements of paragraph 3.4, B. Provide cross bracing between the rows of studs by attaching runner channels or studs set full width of chase attached to vertical studs with one self-tapping screw at each end. Space cross bracing not over thirty-six (36) inches o.c. vertically.

E. Wallboard Installation - Single Layer Application (Screw Attached)

1. Install wallboard with long dimension parallel to framing member and with abutting edge joints over web of framing member. Install wallboard with long dimension perpendicular to framing members above and below openings in drywall extending to second stud at each

side of opening. Joints on opposite sides of wall shall be arranged so as to occur on different studs.

2. Boards shall be fastened securely to metal studs with screws as specified. Where a free end occurs between studs, back blocking shall be required. Center abutting ends over studs. Correct work as necessary so that faces of boards are flush, smooth, true.

3. Wallboard screws shall be applied with an electric screw gun. Screws shall be driven not less than 3/8" from ends or edges of board to provide uniform dimple not over 1/32" deep. Screws shall be spaced twelve (12) inches o.c. in the field of the board and 8" o.c. staggered along the abutting edges.

4. All ends and edges of wallboard shall occur over screwing members (studs or furring channels). Boards shall be brought into contact but shall not be forced into place. Where ends or edges abut, they shall be staggered. Joints on opposite sides of a partition shall be so arranged as to occur on different studs.

5. At locations where piping receptacles, conduit, switches, etc., penetrate drywall partitions, provide non-drying sealant and an approved sealant stop at cut board locations inside partition.

F. Wallboard Installation - Double-Layer Application

1. General: See drawings for wallboard partition types required.

2. First Layer (Screw Attached): Install as described above for single layer application.

3. Second Layer (Screw Attached): Screw attach second layer, unless laminating method of attachment indicated on drawings or necessary to obtain required sound rating or fire rating. Install wallboard vertically with vertical joints offset thirty-two (32) inches from first layer joints and staggered on opposite sides of wall. Attach wallboard with 1-5/8" screws sixteen (16) inches o.c. along vertical joints and sixteen (16) inches o.c. in the field of the wallboard. Screw through first layer into metal framing members.

4. Second Layer (Laminated): Install wallboard vertically. Stagger joints of second layer from first layer joints. Laminate second layer with specified laminating adhesive in beads or strips running continuously from floor to ceiling in accordance with manufacturer's instructions. After laminating, screw wallboard to framing members with 1-5/8" screws, spaced twelve (12) inches o.c. around perimeter of wallboard.

G. Wallboard Installation - Laminated Application: Where laminated wallboard is indicated, use specified laminating adhesive, install wallboard vertically and maintain tolerances as specified for screw attached wallboard.

H. Insulation Installation: Install where indicated on drawings. Place blanket tightly between studs.

I. Deflection of Structure Above: To allow for possible deflection of structure above partitions, provide top runners for non-rated partitions with 1-1/4" minimum flanges and do not screw studs or drywall to top runner. Where positive anchorage of studs to top runner is required, anchorage device shall be by means of slotted hole (in clip connection with screw attachment to web of steel through bushings located in slots of clips), or other anchorage device approved by Commissioner.

J. Control Joints

1. Leave a 1/2" continuous opening between gypsum boards for insertion of surface mounted joint.

2. Back by double framing members.

3. Attach control joint to face layer with 9/16" galvanized staples six (6) inches o.c. at both flanges along entire length of joint.

4. Provide two (2) inch wide gypsum panel strip or other adequate seal behind control joint in fire rated partitions and partitions with safing insulation.

3.6 DRYWALL FASCIAS AND CEILINGS

A. Furnish and install inserts, hanger clips and similar devices in coordination with other work.

B. Secure hangers to inserts and clips. Clamp or bolt hangers to main runners.

C. Space main runners 4'-0" o.c. and space hangers 4'-0" o.c. along runners, except as otherwise shown.

D. Level main runners to a tolerance of 1/4" in 12'-0", measured both lengthwise on each runner and transversely between parallel runners.

E. Metal Furring Channels: Space sixteen (16) inches o.c. maximum. Attach to 1-1/2" main runner channels with furring channel clips (on alternate sides of main runner channels). Furring channels shall not be let into or come in contact with abutting masonry walls. End splices shall be provided by nesting furring channels no less than eight (8) inches and securely wire tying. At any openings that interrupt the furring channels, install additional cross reinforcing to restore lateral stability.

F. Mechanical accessories, hangers, splices, runner channels and other members used in suspension system shall be of metal, zinc coated, or coated with rust inhibitive paint, of suitable design and of adequate strength to support units securely without sagging, and such as to bring unit faces to finished indicated lines and levels.

1. Provide special furring where ducts are over two (2) feet wide.

G. Apply board with its long dimension at right angles to channels. Locate board butt joints over center of furring channels. Attach board with one (1) inch self-drilling drywall screws twelve (12) inches o.c. in field of board at each furring channel; eight (8) inches o.c. at butt joints located not less than 3/8" from edges.

3.7 SHAFT WALLS

A. Runner Installation: Use "J" metal runners at floor and ceiling, with the short leg toward finish side of wall. Securely attach runners to structural supports with power-driven fasteners at both ends and twenty-four (24) inches o.c.

B. Shaft Wall Liner: Cut shaft wall liner panels one (1) inch less from floor to ceiling height and erect vertically between J-runners.

C. C-H Studs: Cut metal studs 3/8" to not more than 1/2" less than floor to ceiling height and install between shaft wall liner panels so that panels are fitted snugly into the one (1) inch wide "H," "T," or "I" portion of the stud. Space studs twenty-four (24) inches o.c., unless otherwise indicated on drawings. Install full-length steel E-Studs or J-runners vertically at T-intersections, corners, door jambs, and columns. Install full length E-Studs or J-runners over shaft wall liner both sides of closure panels. Frame openings cut within a liner panel with J-Runner around perimeter. For openings, frame with vertical E-Stud or J-runner at edges, horizontal runner at head and sill, and reinforcing as shown on the drawings. Suitably frame all openings to maintain structural support for wall. Install floor-to-ceiling steel E-Studs or J-runners each side of elevator door frames to act as strut-studs. Attach strut-stud to floor and ceiling runners with two (2) 3/8" Type S screws, space twelve (12) inches o.c. Over metal doors, install a cut to length section of runner and attach to strut-studs with clip angles and 3/8" Type S Screws space twelve (12) inches o.c.

D. Wallboard Installation - Double Layer Installation: Erect gypsum wallboard base layer vertically or horizontally to meet fire rating on one side of studs with end joints staggered. Fasten base layer panels to studs with one (1) inch Type S screws twenty-four (24) inches o.c. Caulk perimeter of base layer panels. Apply gypsum wallboard face layer vertically over base layer with joints staggered and attached with 1-5/8" Type S screws staggered from those in base, spaced eight (8) inches o.c. and driven into studs.

E. Wallboard Installation (Where Both Sides of Shaft Wall are Finished): Apply gypsum wallboard face layers vertically both sides of studs. Stagger joints on opposite partition sides. Fasten panels with one (1) inch or two (2) inches Type S screws spaced eight (8) inches o.c. in field and along edges into studs.

F. Where handrails are indicated for direct attachment to drywall shaft system, provide not less than a sixteen (16) ga. x eight (8) inches wide galvanized steel reinforcement strip, accurately positioned and secured to studs and concealed behind not less than one 1/2" thick course of gypsum board in the system.

G. Integrate stair hanger rods with drywall shaft system by locating cavity of system as required to enclose rods.

H. Horizontal Shaftwall Duct and Ceiling Assemblies: Provide I-stud cavity shaftwall system for horizontal duct protection consisting of I-studs 24" o.c. with 1" fire-rated shaft liner panels inserted in the stud tabs, and three layers of 1/2" firecode C gypsum board attached to the stud flanges opposite the shaft liner panels.

3.8 ERECTION AT COLUMN ENCLOSURES

A. Metal furring supports shall be provided under work of this Section, and shall be cut to lengths as necessary for tight fit such that spacing is not more than sixteen (16) inches o.c.

B. Board shall be fastened securely to supports with screws as specified. Place boards in position with minimum number of joints. Where free ends occur between supports, back-blocking or furring shall be required. Center abutting ends over supports. Correct work as necessary so that faces of boards are flush, smooth and true. Provide clips or cross furring for attachment as required.

C. All layers shall be screw attached to furring.

D. When column finish called for on drawings to be in the same plane as drywall finish layer, maintain even, level plane.

3.9 FINISHING

A. Taping: A thin, uniform layer of compound shall be applied to all joints and angles to be reinforced. Reinforcing tape shall be applied immediately, centered over the joint, seated into the compound. A skim coat shall follow immediately, but shall not function as a fill or second coat. Tape shall be properly folded and embedded in all angles to provide a true angle.

B. Filling: After initial coat of compound has hardened, additional compound shall be applied, filling the board taper flush with the surface. The fill coat shall cover the tape and feather out slightly beyond the tape. On joints with no taper, the fill coat shall cover the tape and feather out at least four (4) inches on either side of the tape. No fill coat is necessary on interior angles.

C. After compound has hardened, a finishing coat of compound shall be spread evenly over and extending slightly beyond the fill coat on all joints and feathered to a smooth, uniform finish. Over tapered edges, the finished joint shall not protrude beyond the plane of the surface. All taped angles shall receive a finish coat to cover the tape and taping compound, and provide a true angle. Where necessary, sanding shall be done between coats and following the final application of compound to provide a smooth surface, ready for painting.

D. Fastener Depressions: Compound shall be applied to all fastener depressions followed, when hardened by at least two (2) coats of compound, leaving all depressions level with the plane of the surface.

E. Finishing Beads and Trim: Compound shall be applied to all bead and trim and shall be feathered out from the ground to the plane of the surface. When hardened, this shall be followed by two (2) coats of compound each extending slightly beyond the previous coat. The finish coat shall be feathered from the ground to the plane of the surface and sanded as necessary to provide a flat, smooth surface ready for decoration.

F. Except as otherwise noted, level of finish for surface exposed to view shall conform to Level 4 of ASTM C 840 and GA-214 of the Gypsum Association.

1. For drywall boards with fiberglass facing, provide Level 5 finish of ASTM C 840 and GA-214.

G. Drywall construction with defects of such character which will mar appearance of finished work, or which is otherwise defective, will be rejected and shall be removed and replaced at no expense to The City of New York.

3.10 CLEANING AND ADJUSTMENT

A. At the completion of installation of the work, all rubbish shall be removed from the building leaving floors broom clean. Excess material, scaffolding, tools and other equipment shall be removed from the building.

B. Work shall be left in clean condition ready for painting or wall covering. All work shall be as approved by Commissioner.

C. Cutting and Repairing: Include all cutting, fitting and repairing of the work included herein in connection with all mechanical trades and all other trades which come in conjunction with any

part of the work, and leave all work complete and perfect after all trades have completed their work.

3.11 PROTECTION OF WORK

A. Installer shall advise Contractor of required procedures for protecting drywall work from damage and deterioration during remainder of construction period.

END OF SECTION

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SECTION 09 30 00 CERAMIC TILE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the ceramic tile as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Porcelain Floor Tile.
2. Ceramic Wall Tile.
3. Not used.
4. Stone saddles.
5. Setting beds, grout and sealant.
6. Acoustic mat.
7. Waterproofing membrane.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Concrete - Section 033000.

C. Masonry - Section 042000.

D. Gypsum drywall - Section 092900.

1.5 REFERENCES

A. ANSI A108 Series/A118 Series - American National Standards for Installation of Ceramic Tile.

B. ANSI A136.1 - American National Standards for Organic Adhesives for Installation of Ceramic Tile.

C. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.

D. ASTM C 150 - Standard Specification for Portland Cement.

E. TCNA - Handbook for Ceramic, Glass and Stone Tile Installation; Tile Council of North America, latest 2021 Edition.

F. ISO 13007 - International Standards Organization; classification for Grout and Adhesives.

G. LFT Tile – Large Format Tile, tile 15" or larger in any one direction.

H. Stone Tile – Conform to requirements of MIA (Marble Institute of America) Dimension Stone Design Manual.

1.6 QUALITY ASSURANCE

A. Qualifications of Installers: For cutting, installing and grouting of ceramic tile, use only thoroughly trained and experienced journeyman tile setters who are completely familiar with the requirements of this work, and the recommendations contained in the referenced standards, and the installers are Certified Ceramic Tile Installer (CTI) through the Ceramic Tile Education Foundation (CTEF) or Tile Installer Thin Set Standards (ITS) verification through the University of Ceramic Tile and Stone.

B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the following:

1. Manufacture all tile in accordance with Standard Grade Requirements of ANSI A-137.1.

2. Install all ceramic tile in accordance with the recommendations contained in Handbook for Ceramic, Glass and Stone Tile Installation of the Tile Council of North America, Inc., latest edition noted herein and ANSI A108/A118/A136.

3. Stone tiles shall conform to the requirements of ASTM C1242.

C. Flooring surfaces shall have a minimum wet DCOF AcuTest value of 0.42 and tested per ANSI A326.3 Dynamic Coefficient of Friction of Hard Surface Flooring Materials.

1.7 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
1. Environmental Product Declarations (EPDs)
2. New York City's Environmentally Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs);

Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Flooring Systems
8. Paints & Coatings

1.8 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.9 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Samples

1. Before any tile is delivered to the job site, submit to the Commissioner sample panels, approx. 12" x 12", mounted on hardboard back-up with selected grout color for each color and pattern of tile and grout specified.

2. Submit 6" length of stone saddles.

3. Submit 12" x 12" samples of waterproofing membrane.

C. Master Grade Certificates: Prior to opening ceramic tile containers, submit to the Commissioner a Master Grade Certificate, signed by an officer of the firm manufacturing the ceramic tile used, and issued when the shipment is made, stating the grade, kind of tile, identification marks for tile containers, and the name and location of the project.

D. Mock-ups

1. At an area on the site where approved by the Commissioner, provide a mock-up ceramic tile installation.

   a. Make the mock-up approximately 3 feet x 3 feet in dimension.
   b. Provide one mock-up for each type, class, and color of installation required under this Section.
   c. The mock-ups may be used as part of the Work, and may be included in the finished Work, when so approved by the Commissioner.
   d. Revise as necessary to secure the Commissioner's approval.

2. The mock-ups, when approved by the Commissioner, will be used as datum for comparison with the remainder of the work of this Section for the purposes of acceptance or rejection.

3. If the mock-up panels are not permitted to be part of the finished Work, completely demolish and remove them from the job site upon completion and acceptance of the work of this Section.

1.10 PRODUCT HANDLING

A. Delivery and Storage

1. Deliver all materials of this Section to the job site in their original unopened containers with all labels intact and legible at time of use.

2. Store all materials under cover in a manner to prevent damage and contamination; store only the specified materials at the job site.

B. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.11 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

C. Maintain temperatures at not less than 50 deg. F. in tiled areas during installation and for 7 days after completion.

1.12 EXTRA STOCK

A. Extra Stock Material: Deliver stock of maintenance material to The City of New York. Furnish Five percent (5%) extra materials, from same production run of each type, size and color, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver stock of maintenance material to The City of New York. Provide ten percent (10%) extra materials of CT1 – porcelain tile.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

2. Obtain waterproof/crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.

2. Waterproof membrane.

3. Metal edge strips.

2.2 TILE

A. Provide tile as specified on the drawings.

2.3 WALL TILE AND BASE

A. Provide ceramic wall tile as scheduled on the drawings or approved equal.

B. -Base as shown on drawings.

2.4 FLOOR TILE

A. Provide mosaic floor tile with all-purpose edge in size, color and pattern as scheduled on the drawings or approved equal. Tile to have water absorption not to exceed 0.5%.

B. Provide non-slip tile where scheduled, of same characteristics as ceramic mosaics specified herein with the addition of 7-1/2% abrasive grain by weight.

2.5 TRIM AND SPECIAL SHAPES

A. Provide external and internal corners, trim shapes at openings, and all other trim and special shapes to match the tile specified herein, as required by field conditions and drawing details.

2.6 STONE SADDLES

A. Provide sound stone saddles as selected by the Commissioner, minimum 3/4" thick, with an abrasive hardness of not less than 10.0, when tested in accordance with ASTM C 241. Cut saddle to fit jamb profile, honed finish.

2.7 SURFACE PREPARATION

A. Self-Leveling Underlayment for rapid leveling of concrete, Portland cement mortar bed, plywood, and existing stone or ceramic tile floors to achieve flatness. Meeting minimum compressive strength of 4400 psi and application from feather edge to 1-1/2” or per manufacturer’s recommendation.

1. Laticrete NXT Level Plus and NXT Primer.
2. Mapei UltraPlan 1 Plus and Primer.
3. SikaLevel 325.
4. Bostik SL-100 and Universal Primer Pro.
5. Custom Tech T-150.
6. Or approved equal.

2.8 MORTAR BED, BOND COAT AND GROUT

A. Portland Cement: ASTM C 150, Type I.

B. Hydrated Lime: ASTM C 207, Type S.

C. Sand: ASTM C 144, clean and graded natural sand.

D. Reinforcing for Mud Set Systems: 2" x 2" x 16/16 ga. welded wire mesh.

E. Latex Modified Mortar Bed

1. Laticrete 3701 Fortified Mortar Bed
2. MAPEI, “4 to 1 Mud Bed Mix” with “Planicrete AC”
3. Pro Spec, Floor Mud with B-710 SBR Acrylic Additive
4. SikaLevel 050 Rapid Slope
5. Bostik, Mud in a Bag with 425 latex admixture
6. Custom Building Products Thick Bed Mortar and Thin-set Mortar Admix
7. Or Approved Equal.

F. Latex – Portland Cement Bond Coat, complying with ANSI A118.15 and ISO 13007, C2ES1P1 with minimum compressive strength of 400 psi.

1. Laticrete, 254 Platinum
2. MAPEI, Keraflex Super
3. Pro Spec – Permalastic System consisting of Permalastic Dryset Mortar and Permalastic Admixture
4. SikaTile 350 Flex Set
5. Custom Building Products Pro-Lite Premium Mortar
6. Or Approved Equal.

G. Improved Modified Cement Mortars, complying with ANSI 118.15 and ISO 13007, CSES1P1.

(Also for use with LFT Tile and Stone Tile)

1. Laticrete, MultiMax Lite

2. Mapei; Keraflex Super,

3. SikaTile 475 LHT Premium Set or SikaTile 500 LHT Lite (above products are lightweight and non-lightweight),

4. Bostik, BAM,

5. Custom Building Products Mega-Lite Ultimate LHT Mortar

6. Or Approved Equal

H. Wall and Base Tile

1. Over drywall use ANSI A136.1-1967 Organic Adhesive for installation of Ceramic Tile, Type I and ISO 13007 D2TE. Shear strength shall be 50 psi minimum. Adhesive primer as recommended by adhesive manufacturer. Manufacturer shall certify, in writing, that adhesive and primer used are proper types for the intended tile types and application. Conform to TCNA Detail W-242.

   a. Laticrete Premium 15 Adhesive.
   b. MAPEI Type 1 Mastic.
   c. ProSpec B-1000 Tile Adhesive
   d. ProSpec B-1000 Tile Adhesive
   e. Bostik Multi-Purpose Floor & Wall Mastic
   f. Custom Building Products Reliabond or T1-60 Tile Adhesive.
   g. Or Approved Equal.

2. Over masonry and concrete use a mortar bed leveling coat conforming to ANSI A108.1A followed by a Latex Portland Cement Bond Coat, Laticrete TriLite, MAPEI, Keraflex Super or Ultralite Mortar, Customs Pro-Lite, SikaTile 475 LHT Premium Set, or Approved Equal; and for non-LHT SikaTile 350 Flex Set or equal by Pro Spec, Bostik Big Tile & Stone conforming to ANSI A118.15, ISO 13007-C2ES1P1, and TCNA Detail W-211.

3. Over glass mat water resistant gypsum backer board use a Latex Portland cement mortar bond coat, Laticrete TriLite, MAPEI, Keraflex Super or Ultralite Mortar, Customs Pro-Lite, SikaTile 475 LHT Premium Set, or Approved Equal; and for non-LHT SikaTile 350 Flex Set or equal by Pro Spec, conforming to ANSI A118.15, ISO 13007-C2ES1P1, and TCNA Detail W-245.

I. Floor Tile and Stone Saddle - Mud Set: Set floor tile and stone saddle using Portland Cement mortar setting bed conforming to ANSI A108.1A and latex modified Portland cement bond coat, Basis of Design, Laticrete 254 Platinum, MAPEI, Keraflex Super, Customs Pro-Lite, SikaTile 350 Flex Set, or Approved Equal conforming to ANSI A118.15, ISO 13007-C2ES1P1, and TCNA Detail F-112.

1. For installation of (LFT and Stone Tile), Improved Modified Cement Mortars and medium bed, Basis of Design, Laticrete MultiMax Lite, MAPEI, Ultraflex LFT, Customs Mega-Lite, SikaTile 475 LHT Premium Set, Bostik BAM, or Approved Equal conforming to ANSI 118.15, ISO 13007- C2ES1P1.

J. Floor Tile and Stone Saddle - Waterproof Setting Bed: Set floor tile and stone saddle using thin set latex Portland cement bond coat, Basis of Design, Laticrete 254 Platinum, MAPEI, Keraflex Super, Customs Pro-Lite, SikaTile 350 Flex Set, Bostik Big Tile & Stone, or Approved Equal conforming to ANSI A118.15, ISO 13007-C2ES1P1, and waterproofing membrane conforming to TCNA Detail F- 122/122A.

1. For installation of (LFT and Stone Tile), Improved Modified Cement Mortars and medium bed, Basis of Design, Laticrete MultiMax Lite, MAPEI, Ultraflex LFT Customs Mega-Lite, SikaTile 475 LHT Premium Set, Bostik BAM, or Approved Equal conforming to ANSI 118.15, ISO 13007- C2ES1P1.

K. Waterproofing Membrane complying with ANSI A118.10 and ANSI A118.12; and having IAPMO certification as a shower pan liner: “Hydro Ban” made by Laticrete International, “Mapelastic Aquadefense” by MAPEI with factory blended “Bio-Block Antimicrobial”, “Red Gard” made by Custom Building Products, SikaTile 100 Moisture Guard or ProSpec B6000, Bostik GoldPlus, or Approved Equal.

1. Reinforce membrane with polyester fabric where recommended by manufacturer.

L. Showers: B-415 with waterproof membrane full height.

M. Water: Clean, fresh and suitable for drinking.

N. Grout complying with A118.7; and ISO 13007, CG2WAF: For grouting ceramic tile, provide a commercial Portland cement grout “Laticrete PermaColor or Laticrete PermaColor Select”, SikaTile 815 Secure Grout or “Ultracolor Plus FA” (additive not required) made by MAPEI; “Prism Ultimate Grout” made by Custom Building Products (additive not required), (addition not required) Bostik Hydroment Vivid, or Approved Equal; color as selected by the Commissioner.

1. All stone and glass tile grout shall be non-sanded grout.

2. Use sanded grouts only for joints larger than 3/8”.

O. Physical Properties: The setting beds and grouts must meet the following physical requirements:

1. Compressive Strength – 3000 psi min.

2. Shear Bond Strength – 500 psi min.

3. Service Rating (ASTM C 627) – Extra Heavy Duty.

P. Sealer: Seal all grout joints and all unglazed tile using “StoneTech Heavy Duty Sealer” by Laticrete, “Sealer’s Choice 15 Gold” by Aqua Mix Inc, “Ultracare Penetrating Plus Stone, Tile, and Grout Sealer” by MAPEI, Merkrete Grout Sealer, or Approved Equal.

Q. Temporary Protective Coating: Either product indicated below that is applied in the tile manufacturer’s factory and formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, applied hot, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg. F. per ASTM D 87.

2. Grout release in form of manufacturer’s standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

R. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, equal to “StoneTech Stone & Tile Cleaner” by Laticrete, “Concentrated Stone & Tile Cleaner” made by Aqua-Mix, “Ultracare Concentrated Tile & Grout Cleaner” by MAPEI, Aqua Mix Heavy Duty Grout N Tile Cleaner, or approved equal, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.9 SEALANT

A. Joint Backing: Preformed, compressible, resilient, non-extruding, non-staining strips of foam neoprene, foam polyethylene, or other material recommended by sealant manufacturer.

B. Bond Breaker: Polyethylene tape, 3 mils thick or other material recommended by sealant manufacturer.

C. Sealant Primer: Colorless, non-staining, or type to suit substrate surface, as recommended by sealant manufacturer.

D. Sealant: One-part silicone based sanitary sealant, conforming to ASTM C 920, Type S, Grade NS, Class 25. Sealant hardness upon full cure shall be between 20-30 Shore "A" Durometer. Color of sealant to blend with or match adjacent materials, and as selected by the Commissioner. Sealant shall be equivalent to 1700 Sanitary Sealant made by General Electric or approved equal.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where ceramic tile is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 CONDITION OF SURFACES

A. Allowable Variations in Substrate Levels

1. Floors: + 1/8" in 10'-0" distance and 1/4" total max. variation from levels shown.

B. Grind or fill concrete and masonry substrates as required to comply with allowable variations.

C. Concrete substrates must meet ANSI A108.01 tolerances and surface textures in preparation for tile work; coordinate with concrete trades.

3.4 PREPARATION

A. Coordinate the following with Section 033000:

1. Steel trowel and fine broom finish concrete slabs that are to receive ceramic tile. Cure concrete slabs that are to receive tile before tile application. Do not use liquid curing compounds or other coatings that may prevent bonding of tile setting materials to slabs. Slab shall be dry at time of tile installation.

2. Tile floors with floor drains must have a slope to direction of 1/4” per foot; coordinate this with concrete trades.

B. Etch concrete substrate as may be required to remove curing compounds or other substances that would interfere with proper bond of setting bed. Rinse with water to remove all traces of treatment. Surface must meet finish requirements as noted in ANSI 108.01.

C. Blending: for tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at project site before installing.

D. Field Applied Temporary Protective Coating: Pre-coat tile with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.5 JOINTS IN TILE WORK

A. Joint Widths: 1/16" wide in ceramic tile.

B. Alignment: Wall, base and floor joints shall align through the field and trim. Direction and location of all joints as directed by Commissioner.

C. Movement Joints: Conform to TCNA Detail EJ171. Locate where movement joints are in back-up material. Provide movement joint at joints between mop receptors and ceramic tile. Provide movement joint at all vertical internal joints of wall tile. Movement joints 1/8" wide in ceramic tile. Fill all movement joints with specified backing and sealant. Use bond breaker where sufficient space for joint backing does not exist.

1. Provide sealant between ceramic tile and plumbing fixtures, mirrors, pipes, countertops and other dissimilar materials penetrating or adjacent to ceramic tile.

3.6 INSTALLATION

A. Comply with the following installation standards

1. Wall tile over drywall using organic adhesive - ANSI A136.1 and ISO 13007, D2TE.

2. Wall tile over cement board or glass mat backer board using dry set mortar with latex additive - ANSI A118.15 and ISO 13007, C2ES1P1.

3. Wall tile over masonry or concrete using dry set mortar with latex additive - ANSI A118.15 and ISO 13007, C2ES1P1.

4. Floor tile using full mud set mortar - ANSI A118.15, and ISO 13007, C2ES1P1.

5. Floor tile using dry set mortar with latex additive - ANSI A118.15, and ISO 13007, C2ES1P1.

6. Floor tile over waterproofing membrane - A118.15, and ISO 13007, C2ES1P1.

B. Backs of tile must be cleaned before installation.

C. All setting beds and/or adhesives shall provide for an average contact area of not less than 95% coverage.

D. Allowable Variations in Finished Work: Do not exceed the following deviations from level and plumb, and from elevations, locations, slopes and alignment shown.

1. Floors: 1/8" in 10'-0" run, any direction; +/- 1/8" at any location; 1/32" offset at any location.

2. Walls: 1/8" in 8'-0" run, any direction; 1/8" at any location; offset at any location, 1/32".

3. Joints: +/- 1/32" joint width variation of any location; 1/16" in 3'-0" run deviation from plumb and true.

E. Waterproofing Membrane

1. Install the membrane in strict accordance with manufacturer's written recommendations.

2. Upon completion of work, test horizontal membrane for leaks by flood testing per ASTM D 5957. Inspect for leakage. Make necessary adjustments to stop all leakage and retest until watertight. If membrane is not covered by another surface immediately, provide protection until membrane is covered.

F. Handle, store, mix and apply setting and grouting materials in compliance with the manufacturer's instructions.

G. Extend tile work into recesses and under equipment and fixtures, to form a complete covering without interruptions. Terminate work neatly at obstructions, edges and corners without disruption of pattern or joint alignment.

H. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight, aligned joints. Fit tile closely to electrical outlets, piping and fixtures so that plates, collars, or covers overlap tile.

I. Lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are the same size. Lay out tile work and center tile fields both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths.

3.7 INSTALLATION OF STONE SADDLES

A. Install stone saddles cut to profiles and sizes shown, accurately fitted to jambs, coped at stops, set in full bed of mortar herein specified, and with grouted edge joints as specified for floor tile.

3.8 CLEANING AND PROTECTION

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer’s written instructions but no sooner than 10 days after installation. Use cleaners only after determining that cleaners are safe to use by testing on samples of tile and other surfaces

to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning to insure removal of all cleaning material.

3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. Apply coat of sealer to all grout joints and all unglazed tile.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings from tile surfaces.

E. Leave finished installation clean and free of cracked, chipped, broken, unbonded or otherwise defective tile work.

END OF SECTION

SECTION 09 30 16 STONE TILE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the tiling as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Stone and glass mosaic tile floors and matching base.

2. Setting beds, grout, sealant, and waterproofing membrane.

1.3 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Concrete slab - Section 033000.

C. Ceramic tiling - Section 093000.

1.4 QUALITY ASSURANCE

A. Qualifications of Installers: For cutting, installing, and grouting of stone tile, use only thoroughly trained and experienced journeyman tile setters who are completely familiar with the requirements of this work and the recommendations contained in the referenced standards and are “TITC Certified”.

B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the following:

1. Install all tile in accordance with the recommendations contained in Handbook for Ceramic, Glass and Stone Tile Installation of the Tile Council of North America, Inc., latest version and ANSI A108/A118/A136.

C. All surfaces shall have a minimum wet DCOF AcuTest value of 0.42.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project’s Sustainable Design Requirements as well as New York City’s Environmental Preferable Purchasing (EPP). The “Sustainable Design Requirements” are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the “Sustainability Requirements” section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. **Adhesives and Sealants**
   7. **Ceilings**
   8. **Composite Wood & Agrifiber Products**
   9. **Flooring Systems**
   10. **Furniture & Seating**
   11. **Insultation**
   12. **Paints & Coatings**
   13. **Wall Panels**

*red means select 4

C. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Composite Wood.
2. Environmental Product Declarations (EPDs).
3. Health Product Declarations (HPDs).
4. Low-Emitting Materials.
5. Regional Content.

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Samples

1. Before any stone tile is delivered to the job site, submit to the Architect sample panels, approx. 12" x 12", mounted on hardboard back-up for each color and pattern of tile specified.

B. Master Grade Certificates: Prior to opening tile containers, submit to the Architect a Master Grade Certificate, signed by an officer of the firm manufacturing the tile used, and issued when the shipment is made, stating the grade, kind of tile, identification marks for tile containers, and the name and location of the project.

C. Submit independent test reports indicating that setting beds and grout conform to the physical requirements specified herein.

1.8 PRODUCT HANDLING

A. Delivery and Storage

1. Deliver all materials of this Section to the job site in their original unopened containers with all labels intact and legible at time of use.

2. Store all materials under cover in a manner to prevent damage and contamination; store only the specified materials at the job site.

B. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

C. Maintain temperatures at not less than fifty (50) degrees F in tiled areas during installation and for seven (7) days after completion.

PART 2 PRODUCTS

2.1 TILE

A. As specified on drawings.

B. Provide trim, cove base and special shapes as required for complete installation of same material, size, color, and finish of field tile.

2.2 SURFACE PREPARATION

A. Self-Leveling Underlayment for rapid leveling of concrete, Portland cement mortar bed, plywood, and existing stone or ceramic tile floors to achieve flatness. Meeting minimum compressive strength of 4400 psi and application from feather edge to 1-1/2” or per manufacturer’s recommendation.

1. Laticrete NXT Level Plus and NXT Primer.

2. Mapei UltraPlan 1 Plus and Primer.

3. SikaLevel 325.

4. Bostik SL-100 and Universal Primer Pro.

5. Custom Tech T-150.

6. Or Approved Equal.

2.3 MORTAR BED, BOND COAT AND GROUT

A. Portland Cement: ASTM C 150, Type I.

B. Hydrated Lime: ASTM C 207, Type S.

C. Sand: ASTM C 144, clean and graded natural sand.

D. Latex – Portland Cement Bond Coat, complying with ANSI A118.15 and ISO 13007, C2ES1P1 with minimum compressive strength of 400 psi.

1. Laticrete, 254 Platinum

2. MAPEI, Keraflex Super.

3. Pro Spec – Permalastic System consisting of Permalastic Dryset Mortar and Permalastic Admixture

4. SikaTile 350 Flex Set

5. Custom Building Products Pro-Lite Premium Mortar.

6. Or Approved Equal.

E. Floor Tile and Stone Saddle - Waterproof Setting Bed: Set floor tile and stone saddle using thin set latex Portland cement bond coat, Basis of Design, Laticrete 254 Platinum, MAPEI, Keraflex Super, Customs Pro-Lite, SikaTile 350 Flex Set, Bostik Big Tile & Stone, or approved equal conforming to ANSI A118.15, ISO 13007-C2ES1P1, and waterproofing membrane conforming to TCNA Detail F- 122/122A.

1. For installation of (LFT and Stone Tile), Improved Modified Cement Mortars and medium bed, Basis of Design, Laticrete MultiMax Lite, MAPEI, Ultraflex LFT Customs Mega-Lite, SikaTile 475 LHT Premium Set, Bostik BAM, or Approved Equal conforming to ANSI 118.15, ISO 13007- C2ES1P1.

F. Grout complying with A118.7; and ISO 13007, CG2WAF: For grouting tile, provide a commercial unsanded Portland cement grout “Laticrete PermaColor Select NS”, or Approved Equal; color as selected by the Commissioner.

1. All stone tile grout shall be non-sanded grout.

2.4 SEALANT AND ACCESSORIES

A. Joint Backing: Preformed, compressible, resilient, non-extruding, non-staining strips of foam neoprene, foam polyethylene or other material recommended by sealant manufacturer.

B. Sealant: Two-part polyurethane sealant, self-leveling, equal to "THE/900" made by Tremco or approved equal.

PART 3 EXECUTION

3.1 CONDITION OF SURFACES

A. Examine the areas and conditions where tile is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 CONDITION OF SURFACES

A. Allowable Variations in Substrate Levels for Floors: +/-1/8" in 10'-0" distance and 1/4" total maximum variation from levels shown.

B. Grind or fill concrete substrates as required to comply with allowable variations.

3.3 PREPARATION

A. Etch concrete substrate as may be required to remove curing compounds or other substances that would interfere with proper bond of setting bed. Rinse with water to remove all traces of treatment. Surface must meet finish requirements per ANSI 108.01.

B. Seal substrate with sealer as recommended by manufacturer of mortar or adhesive.

3.4 JOINTS IN TILE WORK

A. Joint Widths: See drawings.

B. Alignment: Base and floor joints shall align through the field and trim. Direction and location of all joints shall be as directed by the Architect.

C. Provide expansion joints where tile abuts restraining surfaces and directly over joints in structural floor. Install expansion joints in accordance with TCA "Handbook for Ceramic Tile Installation."

3.5 INSTALLATION

A. Allowable Variations in Finished Work: Do not exceed the following deviations from level and plumb, and from elevations, locations, slopes and alignment shown.

1. Floors: 1/8" in 10'-0" run, any direction; +\-1/8" at any location; 1/32" offset at any location.

2. Joints: +1/32" joint width variation of any location; 1/16" in 3'-0" run deviation from plumb and true.

B. Waterproofing Membrane: Install the membrane in strict accordance with manufacturer's written recommendations. Upon completion of work, test horizontal membrane for leaks by plugging the drain or damming areas and filling with water for a period of 48 hours minimum. Inspect for leakage. Make necessary adjustments to stop all leakage and retest until watertight. If membrane is not covered by another surface immediately, provide protection until membrane is covered.

C. Comply with the ANSI standard installation specifications floor tile over waterproofing membrane - A118.15, and ISO 13007, C2ES1P1.

D. Provide minimum temperature limits and installation practices as recommended by mortar and grout materials manufacturers.

1. Setting bed shall provide for an average contact area of not less than 95%.

E. Extend tile work into recesses and under equipment and fixtures to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disruption of pattern or joint alignments.

F. Comply with manufacturer's instructions for the mixing and installation of materials.

G. Neutralize and seal substrates in accordance with the mortar manufacturer's instructions.

H. Lay tile on grid pattern. Align joints when adjoining tiles on floor, base and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Provide uniform joint widths. Adjust to minimize tile cutting.

3.6 CLEANING AND PROTECTION OF TILE

A. Clean and seal tile prior to grouting

B. Upon completion of placement and grouting, clean all tile surfaces so they are free of foreign matter. Tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Flush surface with clean water before and after cleaning.

C. Apply to all clean completed tile a protective coating of neutral cleaner solution, 1 part cleaner to 1 part water.

D. Leave finished installation clean and free of cracked, chipped, broken, unbonded or otherwise defective tile work.

E. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent damage and wear. Prohibit foot and wheel traffic from tiled floors for at least 3 days after grouting is completed. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.7 SEALING

A. Sealing of all stone tile must be completed prior to installation of grout.

B. Installer must comply with and follow all TCNA standards for stone tile installation.

END OF SECTION

SECTION 09 51 13 ACOUSTIC PANEL CEILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the acoustic panel ceilings as shown on the drawings and/or specified herein, including but not limited to, the following:

1. Acoustical panel units.

2. Exposed "T" suspension system, including hangers and inserts.

3. Provisions for the installation of lighting fixtures, diffusers, grilles and similar items provided under other Sections.

4. Cutting, drilling, scribing and fitting as required for electro-mechanical penetrations.

5. Perimeter and column moldings, trim and accessories for acoustical ceilings.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Steel deck - Section 053100.

C. Gypsum Drywall - Section 092900.

D. Diffusers, grilles and related frames - Division 23.

E. Lighting fixtures - Division 26.

1.5 QUALITY ASSURANCE

A. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations published by the Ceilings and Interior Systems Construction Association (CISCA).

B. Qualifications of Installers

1. The suspended ceiling subcontractor shall have a record of successful installation of similar ceilings acceptable to Commissioner and shall be currently approved by the manufacturer of the ceiling suspension system.

2. For the actual fabrication and installation of all components of the system, use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.

C. The work is subject to the following standards:

1. ASTM C 635 "Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings," American Society for Testing and Materials.

2. ASTM C 636 "Standard Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels," American Society for Testing and Materials.

D. In addition to suspension system specified, provide seismic struts and seismic clips to meet seismic standards as required by prevailing Codes and Ordinances.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Shop Drawings: Submit completely dimensioned ceiling layouts for all areas where acoustical ceilings are required, showing:

1. Any deviations from Commissioner's reflected ceiling plan layouts, especially lighting fixture and dimensions. Also indicate if any light fixtures will not fit into Commissioner's ceiling layout due to dimensional restrictions of field conditions.

2. Direction and spacing of suspension members and location of hangers for carrying suspension members.

3. Direction, sizes and types of acoustical units, showing suspension grid members, and starting point for each individual ceiling area.

4. Moldings at perimeter of ceiling, at columns and elsewhere as required due to penetrations or exposure at edge of ceiling tiles.

5. Location and direction of lights, air diffusers, air slots, and similar items in the ceiling plane.

6. Details of construction and installation at all conditions.

7. Materials, gauges, thickness and finishes.

C. Samples and Product Literature: Submit the following samples and related manufacturer's descriptive literature.

1. Twelve (12) inch long sample of each component of suspension systems, including moldings.

2. Acoustical units — full size.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.10 PROJECT CONDITIONS

A. Do not install acoustical ceilings until wet-work in space is completed and nominally dry, work above ceilings has been completed, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

1.11 COORDINATION

A. Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, fire suppression system components, and partition system.

1.12 EXTRA STOCK

A. Extra Stock: Deliver stock of maintenance material to The City of New York. Furnish maintenance material matching products installed, packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units (each tile type, size and color): Furnish quantity of full size units equal to 5.0% of amount installed.

PART 2 PRODUCTS

2.2 ACOUSTICAL UNITS

A. Provide mineral fiber panels as scheduled on the drawings, as manufactured by Armstrong World Industries, or equal made by Roxul Rockfon or USG Interiors, Inc., or approved equal.

2.3 SUSPENSION SYSTEM

A. Provide exposed "T" suspension system, steel, with low sheen white baked enamel finish as scheduled on the drawings made by Armstrong World Industries, or equal made by USG Interiors, Inc. or Chicago Metallic Corp., or approved equal.

B. The suspension system shall support the ceiling assembly shown on the drawings and specified herein, with a maximum deflection of 1/360 of the span, in accordance with ASTM C 635.

C. Hanger for suspension system shall be 1" x 3/16", galvanized steel flats or 1/4" diameter galvanized pencil rods spaced 4'-0" o.c. conforming to New York City Code requirements.

D. Main carrying channels, to which suspension systems shall be fastened, shall be 1-1/2" cold rolled galvanized steel channel; spaced 4'-0" o.c., conforming to New York City Code requirements.

E. Provide ceiling clips and inserts to receive hangers, type as recommended by suspension system manufacturer, sizes for pull-out resistance of not less than five (5) times the hanger design load, as indicated in ASTM C 635.

F. Suspension systems shall conform to ASTM C 635, intermediate duty.

G. Provide manufacturer’s standard wall moldings with off-white baked enamel finish to match suspension systems. For circular penetrations of ceilings, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas where acoustic panel ceilings are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected to permit proper installation of the layout.

3.3 PREPARATION

A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans.

3.4 INSTALLATION

A. Codes and Standards: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations and industry standards.

B. Install suspension systems to comply with ASTM C 636, with wire hangers supported only from building structural members. Locate hangers not more than 6" from each end and spaced 4'-0" along direct-hung runner, leveling to tolerance of 1/8" in 12'-0".

C. Space rod or flat iron hangers not more than 4'-0" o.c. along main carrying channels; attach by clips or wire ties to building structure. Locate hangers not more than 6" from each end. Space main carrying channels 4'-0" o.c. Attach suspension system to carrying channels using clips or ties, leveling to a tolerance of 1/8" in 12'-0".

D. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, reinforcing, countersplaying or other equally effective means.

E. Install edge moldings at edges of each acoustical ceiling area, and at locations where edge of acoustical units would otherwise be exposed after completion of the work.

1. Secure moldings to building construction by fastening through vertical leg. Space holes not more than 3" from each end and not more than sixteen (16) inches o.c. between end holes. Fasten tight against vertical surfaces.

2. Level moldings with ceiling suspension system, to a level tolerance of 1/8" in 12'-0".

F. Install acoustical units in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

G. Install hold-down clips in toilet areas, and in areas where required by governing regulations; space 2'-0" o.c. on all cross tees.

H. Light fixtures or other ceiling apparatus shall not be supported from main beams or cross tees if their weight causes the total load to exceed the deflection capability of the ceiling suspension

system. In such cases the load shall be supported by supplemental hangers furnished and installed by this Section of work.

I. Where fixture or ceiling apparatus installation causes eccentric loading on runners, provide stabilizer bars to prevent rotation.

3.5 ADJUST AND CLEAN

A. Clean exposed surfaces of acoustical ceilings, including trim, edge molding, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 19 RESILIENT TILE FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the resilient tile flooring, as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Luxury Vinyl Tile.
2. Rubber base.
3. Transition strips.
4. Accessories.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Concrete slab – Section 033000.

C. Gypsum drywall – Section 092900.

D. Static Dissipative Tile – Section 096536.

E. Carpet tile- Section 096813.

1.5 QUALITY ASSURANCE

A. Qualifications of Installers: Use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and

under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
3. Low-Emitting Materials
4. Regional Content
5. Adhesives and Sealants
6. Flooring Systems
7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Manufacturer's Data: For information only, submit manufacturer's technical information and installation instructions for type of resilient tile.

C. Samples

1. Submit full-size sample tiles for each type and color required, representative of the expected range of color and pattern variation. Sample submittals will be reviewed for color, texture and pattern only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

2. Submit six (6) inch long samples of base and strips.

D. Submit manufacturer's warranty as noted herein.

1.9 DELIVERY AND STORAGE

A. Deliver materials to the project site in the manufacturer's original unopened containers, clearly marked to indicate pattern, gauge, lot number and sequence of materials.

B. Carefully handle all materials and store in original containers at not less than seventy (70) degrees F. for at least forty-eight (48) hours before start of installation.

1.10 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F. or more than 95 deg F., in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.

2. During installation.

3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F. or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.11 EXTRA STOCK

A. Extra Stock Material of each tile type, size and color: Furnish Five percent (5%) extra materials, from same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver stock of maintenance material to The City of New York.

1.12 WARRANTY

A. Provide manufacturers 5 year limited warranty.

PART 2 – PRODUCTS

2.2 TILE

A. Provide luxury vinyl tile as scheduled on the drawings or approved equal. Provide tile units with uniformly distributed color and pattern throughout the thickness of tile. Variations in shades and off-pattern matches between containers are not acceptable.

2.3 BASE

A. Provide1/8” thick, height as specified on drawings, continuous vinyl, top set cove base with pre-formed internal and external corner pieces, color as selected by the Commissioner. For areas to receive carpet, provide flat base, no cove. Base shall conform to ASTM F 1861, Type TV, Group 1 as manufactured by Burke Mercer, Marley Flexco, Johnsonite, Armstrong, or approved equal.

2.4 ACCESSORIES

A. Adhesives: Waterproof, stabilized type, as recommended by the tile manufacturer for the type of service indicated based on a RH of 90%.

B. Concrete Slab Primer: Non-staining type recommended by the tile manufacturer.

C. Leveling Compound: Novoplan 2 made by Mapei, Ardex K-15 or approved equal.

D. Edging Strips: 1/8" thick, homogeneous vinyl or rubber composition, tapered or bullnose edge, color as selected by the Commissioner from manufacturer's standards.

E. Metal Transition strips: Provide metal transitions strips as scheduled on the drawings, or approved equal.

F. Finish:

1. Cleaner shall be equal to "Super Shine All" made by Hillyard Chemical Co., or approved equal.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where resilient tile flooring is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 CONDITION OF SURFACES

A. Allowable Variations in Substrate Levels (Floors): ± 1/8" in 10'-0" distance and 1/4" total maximum variation from levels shown.

B. Grind or fill concrete substrates as required to comply with allowable variation.

3.4 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum **75** percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.5 INSTALLATION

A. Install tile only after all finishing operations, including painting, have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by tile manufacturer.

B. Place tile units with adhesive cement in strict compliance with the manufacturer's recommendations. Butt tile units tightly to vertical surfaces, thresholds, nosings, and edgings. Scribe around obstructions and to produce neat joints, laid tight, even and in straight, parallel lines. Extend tile units into toe spaces, door reveals, and into closet and similar openings.

C. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on the finish tile as marked in the subfloor. Use chalk or other non- permanent marking devices.

D. Lay tile from center marks established with principal walls, discounting minor off-sets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.

E. Match tiles for color and pattern by using tile from cartons in the same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures. Broken, cracked, chipped or deformed tile is not acceptable.

F. Tightly cement tile to sub-base without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks through tile, or other surface imperfections.

G. Lay tile with grain in all tile running in the same direction.

H. Place resilient edge strips tightly butted to tile and secure with adhesive. Provide edging strips at all unprotected edges of tile, unless otherwise shown.

I. Bases: In all spaces where base is indicated, install bases tight to walls, partitions, columns, built-in cabinets, etc., without gaps at top or bulges at bottom, with tight joints and flush edges, with molded corner pieces at internal and external corners. Provide end stops adjacent to flush type door frames and where base does not terminate against an adjacent surface. Keep base in full contact with walls until adhesive sets.

3.6 CLEANING AND PROTECTION

A. Remove any excess adhesive or other surface blemishes from tile, using neutral type cleaners as recommended by the tile manufacturer. Protect installed flooring from damage by use of heavy Kraft paper or other covering.

B. Finishing: After completion of the project and just prior to the final inspection of the work, thoroughly clean tile floors and accessories.

END OF SECTION

SECTION 09 65 36 STATIC-DISSIPATIVE RESILIENT FLOORING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the static-dissipative resilient flooring, as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Static-dissipative vinyl composition tile (VCT).
2. Adhesive.
3. Accessories.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Resilient Tile Flooring – Section 096519.

1.5 QUALITY ASSURANCE

A. Qualifications of Installers: Use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold

certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Manufacturer's Data: For information only, submit manufacturer's technical information and installation instructions for type of resilient tile.

C. Samples: Submit full-size sample tiles for each type and color required, representative of the expected range of color and pattern variation. Sample submittals will be reviewed for color, texture, and pattern only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

D. Maintenance Instructions: Submit two (2) copies of manufacturer's written instructions for recommended maintenance practices for each type of resilient flooring.

1.9 DELIVERY AND STORAGE

A. Deliver materials to the project site in the manufacturer's original unopened containers, clearly marked to indicate pattern, gauge, lot number and sequence of materials.

B. Carefully handle all materials and store in original containers at not less than seventy (70) degrees F. for at least forty-eight (48) hours before start of installation.

PART 2 – PRODUCTS

2.1 STATIC-DISSIPATIVE RESILIENT FLOORING

A. Static-Dissipative Tile: Provide 12" x 12" x 1/8" thick "Excelon SDT" tile (through-pattern), as manufactured by Armstrong World Industries, or ESD Rubber Static Control Tile by Roppe or Delane ESD Vinyl Tile by Flexco or ColoRex SD/EC by Forbo flooring or approved equal, color as scheduled on the drawings.

1. Product shall meet or exceed the following performance criteria:

a. Critical Radiant Flux: ASTM E 648, Class 1, 0.45 or more watts/cm^2.

b. Smoke Developed: 450 or less per ASTM E 662.

c. Static Load Limit: 75 psi per ASTM F 970.
d. Static Generation: ESD STM 97.2 at 40% R.H. <10 volts; at 12% R.H. <100 volts.
e. Electrical Resistance: ESD-STM-S7.1 and ASTM F 150 10e6 to 10e9 ohms.
f. Static Decay: Fed. Test 101c, Method 4046 (5000 volts to zero) in <0.5 seconds.

2.2 ACCESSORIES

A. Concrete Slab Primer: Non-staining type recommended by the tile manufacturer.

B. Leveling Compound: Latex/Portland cement flash patching and leveling compound as provided or approved by the flooring manufacturer for application indicated.

C. Static-Control Adhesive: Adhesive product of the flooring manufacturer that produces conductive continuity of floor covering system. Provide copper ground-connection strips for under the tile as recommended by the flooring manufacturer.

D. Edging Strips: 1/8" thick, homogeneous vinyl composition, tapered or bullnose edge, color as selected by the Commissioner.

E. Maintenance Tiles: Tiles inscribed "Conductive floor. Do not wax."

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where static-dissipative resilient flooring is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 CONDITION OF SURFACES

A. Allowable Variations in Substrate Levels (Floors): ± 1/8" in 10'-0" distance and 1/4" total maximum variation from levels shown.

B. Grind or fill concrete substrates as required to comply with allowable variation.

3.4 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

   a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours.
   b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.5 INSTALLATION

A. Install tile only after all finishing operations, including painting, have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by tile manufacturer.

B. Embed grounding strips in static-control adhesive. Extend strips beyond perimeter of static-control resilient floor covering surfaces to ground points.

C. Place tile units in static-control adhesive in strict compliance with the manufacturer's recommendations. Butt tile units tightly to vertical surfaces, thresholds, nosings and edgings. Scribe around obstructions and to produce neat joints, laid tight, even and in straight, parallel lines. Extend tile units into toe spaces, door reveals, and into closet and similar openings.

D. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on the finish tile as marked in the subfloor. Use chalk or other non- permanent marking devices.

E. Lay tile from center marks established with principal walls, discounting minor off-sets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.

F. Match tiles for color and pattern by using tile from cartons in the same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures. Broken, cracked, chipped, or deformed tile is not acceptable.

G. Tightly adhere tile to sub-base without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks through tile, or other surface imperfections.

H. Lay tile with grain in all tile running in the same direction.

I. Place resilient edge strips tightly butted to tile and secure with adhesive. Provide edging strips at all unprotected edges of tile, unless otherwise shown.

3.6 CLEANING AND PROTECTION

A. Remove any excess adhesive or other surface blemishes from tile, using neutral type cleaners as recommended by the tile manufacturer. Protect installed flooring from damage by use of heavy Kraft paper or other covering.

END OF SECTION

SECTION 09 66 23 THIN SET EPOXY TERRAZZO

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the thin set epoxy terrazzo as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Thin set epoxy terrazzo floor.

2. Divider strips, expansion strips, and accessory strips.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Concrete slab – Section 033000.

C. Gypsum drywall – Section 092900.

1.5 QUALITY ASSURANCE

A. Qualification of Installers: Use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work and have a minimum of ten (10) years' experience in this type of floor system and are members in good standing of the National Terrazzo and Mosaic Association (NTMA).

B. Comply with applicable specifications and recommendations of the National Terrazzo and Mosaic Association, Inc. (NTMA).

C. The Installer shall meet with the Architect for a pre-installation meeting prior to commencement of the work. The Architect shall review installation and position of all divider strips prior to installation of terrazzo.

D. Manufacturer shall be a member of NTMA.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP) .. The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Submit manufacturer's technical information and installation instructions for each type of terrazzo, accessory item, and material required.

C. Certifications

1. Submit supplier's/manufacturer's written certification that terrazzo materials meet or exceed specified NTMA properties.

2. Submit supplier's/manufacturer's written certification that the concrete substrates have been tested and that the moisture vapor transmission rate does not exceed the supplier's/manufacturer's recommendations. All tests shall be performed according to ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride Moisture Emissions Test," or ASTM F 2170 "Standard Test Method for Determining Relative Humidity on Concrete Floor Slabs Using In-Situ Probes," or ASTM F 710 "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring (Tramex Meter)."

a. If moisture vapor transmission levels exceed the manufacturer's recommended levels, the Contractor shall submit the terrazzo manufacturer's recommended remediation method for the Architect's approval.
   1). Manufacturer and Contractor shall provide to the Owner a three-year Joint and Several Warranty, starting from the date of Substantial Completion, stating that the Moisture Vapor Barrier shall protect the epoxy terrazzo installation from moisture-related blistering or disbondment, and that in the event of any defects related to moisture vapor transmission within the stipulated period, the manufacturer and Contractor shall jointly or severally effect all repairs or replacement necessary to remedy defects. A copy of the warranty shall be submitted to the Architect for approval during submittal process.
   2). Contractor shall provide an add alternate with his bid to provide the recommended moisture vapor transmission remediation in the event it is required.

3. Submit manufacturer's written certification that the terrazzo installer is an authorized installer of the manufacturer's epoxy terrazzo system.

D. Shop Drawings: Submit shop drawings showing layout of divider strips, control joint strips, abrasive strips and base and border strips.

1. Submit shop drawings of precast work showing large scale details of jointing and edge conditions and showing elevations and plans for layout of work. Include details of anchorage and other special features required.

E. Samples: Submit twelve (12) inch square samples of each pattern, color and type of terrazzo required, together with minimum twelve (12) inch long samples of each type of accessory item. Submit full set of sample colors for abrasive strips, and, once color is selected, 12" sample of the strip in selected color. Contractor should anticipate multiple submissions as required to obtain color to Architect's satisfaction. All samples must be submitted two (2) of each.

F. Maintenance Instructions: Submit two (2) copies of written instructions for recommended periodic maintenance of terrazzo.

1.9 WARRANTY

1. The Contractor shall furnish a guarantee of the Epoxy Terrazzo Flooring System for a period of three (3) years after installation. The labor and material guarantee shall include loss of bond, blistering and wear-through to the concrete substrate from normal use.

1.10 MOCK-UP

A. Construct 100 sq. ft. mock-up of terrazzo floor and base for Architect's approval. Do not proceed with any other terrazzo work until mock-up is adjusted and approved by the Architect. Approved mock-up may be incorporated into final work and shall become the standard to which all other terrazzo work must conform. Rejected mock-up must be removed completely and the substrate returned to its original condition.

PART 2 PRODUCTS

1.1 MATERIALS

A. Manufacturer/System

1. The Epoxy Thin-Set Terrazzo Flooring System shall consist of a primer coat; 100% solids epoxy terrazzo matrix binder mixed with marble fines and #0, #1, and #1 marble chips (as selected by the Architect); 100% solids epoxy terrazzo matrix grout coat; and maintenance sealer. The total system thickness shall be 3/8" nominal.

   a. Subject to compliance with the requirements of this Specification, the following are approved manufacturers:
      1). Sika Flooring, "Sikafloor 195."
      2). General Polymers, "Thin-Set Epoxy Terrazzo #1100."
      3). Key Resins, "Key Epoxy Terrazzo #108."
      4). Or approved equal

2. Apply Epoxy Thin-Set Terrazzo Flooring System over 40 mils thick Flexible Epoxy Membrane as manufactured by epoxy terrazzo resin manufacturer on all concrete floors to receive epoxy terrazzo as shown on drawings.

B. Epoxy Thin-Set Terrazzo Typical Physical Properties at 73 deg. F.

Fungus and Bacteria Resistance, MIL-F-5250, Sec. 4.4.2.11	Will not support the growth of fungus or bacteria when subjected to mildew and bacteria tests specified in TT-P-34.
Impact Resistance, Sec. 4.7.3	Withstands 16 ft. lbs. without cracking, delamination or chipping.
Indentation, MIL-D3134F, Sec. 4.7.4	Withstands 2,000 psi for 30 min. without indentation.
Resistance to Elevated Temperature, MIL-D-3134F, Sec. 4.7.5	No slip or flow at required temperature of 158 deg. F.
Abrasion Resistance, ASTM D 4060, CS-17 Wheel	0.1 grams lost
Water Absorption, ASTM D 570-98	10% max. (24 hr. immersion)
Bond Strength to Concrete, 7 days	350 psi (100% concrete failure)
Water Immersion, ACI Comm. #403, Bulletin 59-43	
Flammability, ASTM D 635	Self-extinguishing

Critical Radiant Flux, ASTM E 648	0.95 W/cm^2
Compressive Strength, psi, ASTM D 695	10,000 min.
Tensile Strength, psi, ASTM C 307	2,500
Flexural Strength, psi, ASTM C 580	3,000 min
Thermal Coefficient of Expansion, ASTM C 531	20 x 10^{-6} in/in/deg. F.

C. Terrazzo Membrane Typical Physical Properties at 73 deg. F.

Adhesion, psi, ACI 503R	350 (100% concrete failure)
Hardness, Shore D, ASTM D 2240	23
Tensile Strength, psi, ASTM D 412	1050
Elongation, ASTM D 412	125%
Thermal Cycling, ASTM C 884	No cracking (24 hr., -21 deg. C. to 225 deg. C.)
Flammability, ASTM D 635	Self-extinguishing over concrete
Heat Aging, Exposure to 140 deg. F for:	
2 days	No change in elongation
30 days	No change in elongation
Primary Glass Transition, deg. F	70 to 80
Lower Glass Transition, deg. F	-13 to -22
VOC	Zero

The epoxy elastomer must be free of solvent, external plasticizers, coal tar, known carcinogens, rubber compounds or nitrile butadienes.

D. Accessory Materials

1. Divider Strips: Depth and style as required for type and thickness of terrazzo.
   a. Provide exposed top in widths as indicated on drawings unless otherwise indicated. Comply with NTMA recommendations.
   b. Material shall be “White” metal, zinc or aluminum per NTMA standards.
   c. Space strips in patterns shown on drawings.

d. Divider strip adhesive shall be mixture of fine sand and bonding agent, specially compounded by manufacturer for this use.

2. Control or Expansion Strips: Double or split units, 1/8" wide, of same materials and color as the divider strips. Provide epoxy terrazzo manufacturer's recommended flexible joint filler in color to match terrazzo formulation.

3. Accessory Strips: Match width, material and color of divider strips. Provide the following accessory strips as required for a complete installation:

   a. Base beads.
   b. Cove base dividers.

4. Cleaner: "4505 Best Yet Neutral Cleaner" by General Polymers, or approved equal.

5. Sealer: Colorless, slip- and stain-resistant, non-yellowing, penetrating sealer which will not disturb the color or physical properties of the terrazzo surface. Provide "4401 Terrazzo Wet Look Sealer" by General Polymers, or approved equal. Sealer shall be UL listed for "Slip Resistance" and required to produce a static coefficient of friction (SCOF) applicable to code

6. Leveling Compound: Epoxy base material as recommended by terrazzo flooring manufacturer, applied over properly prepared substrate.

7. Fill: Epoxy base mortar as recommended by terrazzo flooring manufacturer.

1.2 MIXES

A. Matrix color and chip size to match approved samples.

B. Marble Chips

1. Size to conform to NTMA gradation standards.

2. Hardness to conform to ASTM C 241, Ha-10 minimum.

3. 24-hour absorption rate not to exceed 0.75%.

4. Chips shall contain no deleterious or foreign matter.

5. Dust content less than 1% by weight.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where terrazzo is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

B. Do not start work of this Section until all HVAC systems and environmental controls are in place and operating.

3.3 CONDITION OF SURFACES

A. Allowable Variations in Substrate Levels: Refer to Section 033000, “Cast-in-Place Concrete,” for required tolerances of concrete sub-slab.

B. Grind or fill concrete substrates as required to comply with allowable variations.

3.4 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

1. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.

2. Repair damaged and deteriorated concrete according to terrazzo manufacturer’s written recommendations.

3. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer’s written instructions.

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer’s written instructions.

1. Moisture Testing: Perform tests indicated below.

a. Calcium Chloride Test: Perform anhydrous calcium chloride test per ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours.
   1). Perform tests so that each test area does not exceed 200 sq. ft, and perform not less than two tests in each installation area and with test areas evenly spaced in installation areas.

b. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

c. Test Method: Test for moisture content following ASTM F 1869. Proceed with installation only after substrates have a moisture – vapor emission rate of 3 lbs. of water/1000 sq. ft. in 24 hours. Proceed with installation only after substrates pass testing.

D. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.5 INSTALLATION

A. General

1. Comply with NTMA specifications and manufacturer's recommendations for preparation of substrate, installation of metal strips, and for placing, grinding, grouting and finishing.

2. Complete terrazzo installation before the application of other items that might be damaged by this work.

B. Expansion Joints: Where expansion joints are shown, install two (2) divider strips, separated by the joint width shown with removable strips, extending the full depth of the topping and under bed. Do not bridge expansion joints with reinforcement or cross strips.

1. Expansion joints shall not exceed 30'-0" o.c. unless otherwise noted on drawings.

C. Flooring

1. Work shall be done only under optimum conditions as recommended by manufacturing firm and NTMA recommendations. Surfaces over which matrix is to be applied shall be completely dry and thoroughly clean. Atmospheric and substrate temperature shall be sixty (60) degrees F. or above.

a. Moisture testing of concrete slab must be performed following terrazzo manufacturer's recommendations. If slab contains moisture above recommended levels of the terrazzo manufacturer, the Contractor must provide a moisture barrier that can reduce the vapor emissions level to acceptable limits. Manufacturer's representative must submit written conformation to the Architect verifying that the concrete slab has been properly prepared to receive epoxy terrazzo.

2. Apply primer over entire area to receive floor surfacing. Spread uniformly over surfaces using clean rubber squeegee, or clean steel trowels. Do not allow primer to collect in depressions. Porous areas may require double application of primer.

3. Apply flexible epoxy membrane at 40 mils thick over primer.

4. Terrazzo matrix and chips shall be mixed and applied according to manufacturer's instructions.

5. Allow surfacing to set undisturbed for minimum period of twelve (12) hours or until surfaces are hard and sure. Temperatures throughout curing time shall be maintained at minimum of fifty (50) degrees F. It shall be the complete responsibility of the Contractor to protect and maintain system until such cure is attained.

6. Grind using #24-120 grit stone by wet process method utilizing standard terrazzo grinding equipment. Dry grinding using diamond stones is acceptable for rough grind only. Use vacuums adequate to control grinding dust. Finish grind with #120 grit stone or finer as specified.

7. Grout as required using resin as recommended by the manufacturer. Apply grout according to manufacturer's instructions. After curing for a minimum of twelve (12) hours, grind using #120 grit stone using same method and equipment as used for initial grinding operation.

8. After completion of grinding operation, clean floor of all dirt and abrasive particles by washing with a neutral cleaner and mopping down and rinsing with clean water. When floor is perfectly clean and dry, treat surfaces with terrazzo sealer. Do not apply waxes.

9. Finished surfaces shall be approximately 3/8" thick, true to plane and line, and shall conform to the tolerances specified for the concrete substrate; refer to Section 033000 for concrete slab tolerances.

10. Contractor to coordinate location and proper setting of all items to be installed in floor (i.e. drains, electrical outlets, door closers, etc.).

11. Install terrazzo at floor closer pans as required to match adjacent floor. Grind and seal to align with adjacent floor.

3.6 CLEANING AND SEALING

A. Clean and seal terrazzo in accordance with the instructions of the terrazzo sealer manufacturer after installation and finishing operations are completed.

3.7 PROTECTION

A. Protect Contractor shall protect terrazzo flooring from damage until Project completion; any damage that does occur shall be the responsibility of the Contractor to repair or replace to the satisfaction of the Architect.

3.8 MAINTENANCE SEMINAR

A. The manufacturer and installer shall jointly provide a one (1) day seminar to Owner's maintenance staff describing the procedures, methods and materials required to maintain the terrazzo surfaces in excellent condition for the life of the facility. Included in this seminar shall be any hands-on training for maintenance of finish.

END OF SECTION

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SECTION 09 68 13 CARPET TILE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor materials, equipment and services necessary to complete the carpet tile as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Carpet tile.

2. Adhesive.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Concrete sub-floor – Section 033000.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Firm with not less than five (5) years' of experience in installation of commercial carpeting of type, quantity and installation methods similar to work of this Section.

B. General Terminology/ Information Standard: Refer to current edition of "Carpet Specifier's Handbook" by The Carpet and Rug Institute; for definitions of terminology not otherwise defined herein, and for general recommendations and information.

C. Carpet used on Project must be from same dye lot for each carpet type.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP).. The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Submit manufacturer's complete technical product data for each type of carpet, cushion and accessory item required.

C. Samples: Submit full size samples of carpet tile and six (6) inches long samples of each type exposed edge stripping.

D. Certification: Submit manufacturer's certification stating that carpet materials furnished comply with specified requirements.

1. Include listing of mill register numbers for carpet furnished.

2. Include supporting certified laboratory test data indicating that carpet meets or exceeds specified test requirements.

E. Maintenance Data: Submit manufacturer's printed maintenance recommendations, including methods and frequency recommended for maintaining carpet in optimum conditions under anticipated traffic and use conditions.

1.9 EXTRA STOCK (EACH TYPE, COLOR AND SIZE)

A. Produce and deliver to project at least five (5) percent overrun on calculated yardage. Deliver stock of maintenance material to The City of New York. Provide required overrun exclusive of carpet needed for proper installation, waste and usable scraps.

1.10 PRODUCT DELIVERY AND STORAGE

A. Deliver carpeting materials in original mill protective wrapping with mill register numbers and tags attached. Store inside, in well ventilated area, protected from weather, moisture and soiling.

1.11 WARRANTY

A. Provide special project warranty, signed by Contractor and Manufacturer (Carpet Mill), agreeing to repair or replace defective materials and workmanship of carpeting work during two (2) year warranty period following substantial completion. Attach copies of product warranty.

PART 2 PRODUCTS

2.1 CARPET TILE

A. Provide carpet tile as scheduled on the drawings as manufactured by Shaw Contract. Design and color as scheduled on the drawings.

2.2 ACCESSORIES

A. Adhesive for Carpet Tile: Provide release type adhesive as recommended by the carpet tile manufacturer for use with carpet tile specified. Provide adhesive which complies with flame spread rating required for the carpet installation.

B. Miscellaneous Materials: Provide the types of adhesives and tape, and other accessory items recommended by the carpet manufacturer and Installer for the conditions of installation and use.

C. Leveling Compound: Latex/Portland cement flash patching and leveling compound equal to No. DSP-520 made by H.B. Fuller or No. 226 with 3701 admixture made by Laticrete or equal made by Mapei, or approved equal.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where carpet tile is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 PRE-INSTALLATION REQUIREMENTS

A. Floor shall be clean and free of cracks and protrusions. Any gaps or cracks more than 1/16” wide to be filled in with latex leveling compound. Protrusions must be sanded down smooth, the floor cleanly swept and vacuumed if necessary to remove all dust and grit.

B. Floor temperature shall be 65 deg., at least 24 hrs. prior to installation; and 48 hrs. after carpet is installed.

C. Conduct a moisture test. The presence of moisture in the concrete floor will interfere with the curing and subsequent performance of the adhesive. Conduct the test as follows:

1. Drive a concrete nail a half inch into the floor. Then remove the nail.

2. Place a small amount of anhydrous calcium chloride or calcium sulphate crystals over the hole.

3. Cover the crystals and the hole with a piece of flat glass and seal the edges with waterproof tape or putty. Since concrete pourings vary, repeat the test every 1500 sq. ft.

4. Leave in place 72 hrs. Any color change in the crystals indicates the presence of moisture. Do not apply carpet until slab is free of moisture and meets with approval of carpet adhesive manufacturer.

D. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period.

3.4 INSTALLATION

A. General

1. Comply with manufacturer's instructions and recommendations. Maintain direction of pattern and texture, including lay of pile.

2. Adhere all tiles with a full spread of adhesive. Dry-fit cut tiles and apply adhesive to tile back after tile has been cut.

3. Tiles shall be installed in a monolithic corner to corner manner following arrows printed on back of each tile indicating pile direction. Tiles shall be installed to achieve patterns as directed by the Commissioner.

4. Vinyl or metal transition per Drawings shall be used along any necessary open edges so as to maintain the fixed perimeter.

3.5 CLEANING UP

A. Upon completion of the carpeting installation in each area, visually inspect all carpet installed in that area and immediately remove all dirt, soil, and foreign substance from the exposed face; inspect all adjacent surfaces and remove all marks and stains caused by the carpet installation: remove all packaging materials, carpet scraps, and other debris from the carpet installation to the area of the job site set aside for its storage.

3.6 PROTECTION

A. In all areas, provide a temporary non-staining paper pathway in the direction of traffic.

END OF SECTION

SECTION 09 72 00 WALLCOVERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the wallcovering as shown on the drawings and/or specified herein.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Gypsum drywall - Section 092900.

C. Painting and Finishing - Section 099100.

1.5 QUALITY ASSURANCE

A. Qualifications of Installers: For actual cutting and installation of wallcovering, use only thoroughly trained and experienced installers completely familiar with the installation recommendations of the manufacturer of the wallcovering used and completely familiar with the requirements of this work.

B. Manufacturer's Recommendations: The installation recommendations of the manufacturer of the wallcovering used, when approved by the Commissioner, shall be the basis for acceptance or rejection of actual installation methods used in this work.

C. Test Panels: Install three (3) test panels of full usable width, including one corner, in areas designated by the Commissioner. Replace test panels which are not acceptable to the Commissioner until satisfactory installation is achieved.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Samples: Before any wallcovering is delivered to the job site, submit to the Commissioner samples of the full range of colors and patterns of wallcovering available from the selected manufacturer in the quality and type specified. Samples shall be a min. 36" x 36" in size.

C. Manufacturer's Recommendations: Accompanying the samples, submit to the Commissioner copies of the manufacturer's current installation recommendations for the material proposed to be furnished and installed under this Section.

D. A Certificate of Compliance shall be furnished indicating conformance to the specification requirements. This requirement may be waived if fabric and adhesive packages and containers delivered to the job carry labels indicating weight of materials and fire hazard classification.

1.9 MAINTENANCE INSTRUCTION

A. Furnish The City of New York with a copy of the fabric manufacturer's maintenance instructions. These instructions shall contain recommended cleaning materials, application methods, and precautions to be followed in the use of cleaning materials which may be detrimental to the surface if improperly applied.

1.10 EXTRA WALLCOVERING

A. Deliver to The City of New York sizable remnants for future patching purposes. Also furnish to The City of New York one (1) complete roll of each wallcovering used.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver and store all wallcovering in undamaged condition as packaged by the manufacturer,

with manufacturer's seal and labels intact. Exercise care to prevent damage during delivery, handling and storage. Store all materials flat in a clean, dry area with maintained temperature above 40 deg. F.

1.12 ENVIRONMENTAL CONDITIONS

A. Wallcovering should be installed only when normal temperature and humidity conditions approximate the same conditions that will exist when the building is occupied.

B. Areas to receive wallcovering shall be a constant temperature of 70 deg. F. measured at base elevation and shall be maintained for 72 hrs. before, during and 48 hrs. after the application.

C. Remove wallcovering from its packaging and allow to acclimatize to the area of installation 24 hours.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide wallcovering as scheduled on the drawings or approved equal, conforming to ASTM F-793, Category VI, Type III, weight not less than 22 oz. per sq. yd. with min. coating (less fabric) 12 oz. per sq. yd. Material shall comply with the following fire hazard classification as determined by ASTM E84:

1. Flame spread not more than 25.

2. Fuel contributed not more than 15.

3. Smoke developed not more than 25.

B. Provide Class 2 mildew resistant backing and comply with the requirements of ASTM D1308 for determining stain resistance.

2.2 ACCESSORIES

A. Adhesive: “Sure Grip Plus Mold and Mildew-Proof Commercial Wall Covering Adhesive” made by The Zinsser Co. Inc. or approved equal.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where the wallcovering is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 PREPARATION

A. Remove wallcovering material from its packaging and allow to acclimatize to the area of installation 24 hrs. before application.

B. Remove switchplates, wall plates, and surface-mounted fixtures, where wallcovering is to be applied.

C. Prime and seal substrates in accordance with the wallcovering manufacturer's recommendations for the type of substrate materials to be covered.

D. Surfaces to receive wallcovering shall be free from grit, loose particles and surface irregularities and shall meet the minimum requirements established by the wallcovering manufacturer. Fill all cracks and holes in gypsum board with patching compound and sandpaper smooth.

E. Provide tarpaulins, drop cloths and other suitable covers to protect adjacent and underlying surfaces which are likely to be stained, spotted or otherwise marked by wallpaper paste and application operations.

3.4 INSTALLATION

A. Place wallcovering panels consecutively in the order they are cut from rolls, including filling of spaces above or below openings. Hang by reversing alternate strips, except on match patterns.

B. Apply adhesive to back of wallcovering following adhesive manufacturer's instructions, using roller or paste brush. Install seams vertically and plumb, and at least 6" away from any corner; horizontal seams will not be permitted. Place wallcovering continuously over internal and external corners, going 12" beyond outside corners and 6" at inside corners. Overlap seams and double-cut to assure tight closure. Roll, brush or use a broad knife to remove air bubbles, wrinkles, blisters and other defects. Cut wallcovering evenly to the edges of the outlet box or support.

C. Trim selvages as required to assure color uniformity and pattern match at seams.

D. Remove excess adhesive along finished seams using warm water and a clean sponge, and wipe dry.

E. Install wallcovering with an intimate substrate bond, smooth, clean, without wrinkles, gaps and overlaps.

F. Replace removed plates and fixtures to verify cut edges of wallcovering are completely concealed.

G. Verify that pattern and color are as specified. If pattern is not random, examine for repeat in design.

H. Hang smooth, non-match patterns by pasting strips on the wall, overlapping the edges, and "Double-Cutting" through both thicknesses. Use a 0.04" or 0.06" zinc or aluminum strip between wall and strip when cutting, to avoid gouging the wall.

I. Use stiff-bristled brush or flexible board knife to eliminate air pockets and to secure the wallcovering to the wall surface.

J. Fill spaces above and below doors and similar areas in sequence from the roll, not later than when all full length pieces have been installed.

K. Examine each seam carefully when completed. Trim additional selvage where required to achieve a color and pattern match at seams.

L. Apply wallcovering before the installation of plumbing fixtures, casings, bases and cabinets.

3.5 PROTECTION

A. Protect finished work installed by other trades prior to work under this Section. Replace any work damaged by workmen of this trade without cost to The City of New York.

3.6 CLEAN-UP

A. Any hardware, accessories, plates, etc., which are removed during wallcovering installation shall be replaced level and square.

B. All debris resulting from work covered in this Section shall be removed from the building on a daily basis.

END OF SECTION

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SECTION 09 75 00 - INTERIOR STONE CLADDING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the interior stone cladding as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Interior stone facing panels, special shapes, piecework, and all other stone elements for interior walls.

2. Salvaging of existing stone marble walls for reuse at reception desk.

3. Furnishing, cutting, fabricating, delivery, and setting of all stonework.

4. Anchors, dowels, cramps, bolts, nuts, threaded studs, expansion shields, inserts, loose clips, loose angles, struts, relieving angles, support angles, shims, steel frame supports, wire anchors, tape, and all other fastening devices and accessories necessary for complete setting and anchorage of stone wall facings to masonry backing.

5. Protection of stone during transit, storage, erection, and installation. Cleaning of stone prior to acceptance.

6. Shop drawings, setting drawings, and samples for work of this section.

1.3 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Unit Masonry - Section 042000.

1.4 DOCUMENTATION

A. The drawings (floor plans and design details) and specifications are an outline of the criteria and performance requirements of the work. The requirements shown by the details are intended to establish basic dimensions of the module and the site lines and profiles of members. Within these parameters, the Contractor is responsible for the design and engineering of the system, including whatever modifications or additions may be required to meet the specified requirements and maintain the visual design concept for the entire work of this Section.

B. It is recognized that the design details do not cover every condition. It is, however, intended that any conditions not detailed shall be developed through the Contractor's shop drawings to the same level of aesthetics and in compliance with performance criteria, as indicated for detailed areas and stipulated in these specifications. The Contractor, by accepting a contract

for the work, acknowledges this and agrees that the Architect shall have the final say as to all matters whether detailed or not on the design details.

1.5 QUALITY ASSURANCE

A. The work of this Section shall be performed by Contractor who is regularly engaged in the installation and sealing of similar work. Contractor shall demonstrate to satisfaction of the Architect that he has successfully performed on comparable projects over the previous five years.

B. Stonework Foreman: Installation firm for stonework of this project shall have on staff a Supervising Foreman assigned full time to this Project, from time of mock-up installations, who shall have at least 10 years total stonework installation experience. Submit detailed resume of past experience with dates, duration and scope identification, project name and location, and work function of previous projects worked on.

C. Use numbers of skilled workmen equal to work requirement or occasion. The skilled workmen shall be thoroughly trained and experienced in the necessary crafts and shall be completely familiar with the specific requirements and methods needed for performance of the work of this Section.

D. The Architect reserves the right to visit the fabricating facilities of the Contractor at any time when the work is in progress. All shop and field materials and workmanship shall be subject to inspection by the Architect and his representatives at all times. Such inspections do not relieve the Contractor from obligations to provide materials conforming to all requirements of the Contract Documents.

E. The Contractor, by commencing the work of this Section, assumes overall responsibility, as part of his warranty of the work, to assure that all assemblies, components and parts shown or required within the work of this Section, comply with the Contract Documents. The Contractor shall further warrant:

1. That all components, specified or required to satisfactorily complete the installation, are compatible with each other and with the conditions of installation and expected use.

2. The overall effective integration and correctness of individual parts and the whole of the system.

3. Compatibility with adjoining substrates, materials and work of other trades.

4. There shall be no premature material failure due to improper design and fabrication of the stone. All materials are to fully perform to their normal life expectancy.

5. Each and every piece of stone shall be subject to the Architect's approval, and any piece or pieces which may be rejected after having been set shall be carefully cut out and replaced with new suitable stone without delay, and without cost to the Owner. Any piece or pieces damaged in the removal and resetting of defective pieces shall also be removed, and suitable, approved pieces provided and set.

F. Architect's inspection of the stone does not relieve the Contractor from his responsibility to provide all stonework in accordance with the approved samples and shop drawings.

G. Examination Criteria: All examinations, selections and approvals shall be for the purpose of achieving a final appearance of stone with the greatest possible uniformity, and will be based upon the following criteria:

1. Color within approved, pre-selected color ranges and finish.

2. Sequence matching of adjacent stone units, as approved by the Architect.

3. Only one source of each type of stone shall be used throughout the work. Stone shall match the type, pattern, color, texture and finish of samples available for inspection in the office of the Architect.

4. Conformance to approved shop drawings and details within specified dimensions and tolerances.

5. Other criteria as specified in Part 2 - Products, herein.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Adhesives and Sealants

C. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Composite Wood.

2. Environmental Product Declarations (EPDs).

3. Health Product Declarations (HPDs).

4. Low-Emitting Materials.

5. Regional Content.

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Shop Drawings: Prior to construction of mock-up, submit shop drawings for the fabrication and installation of all work and associated components. Include:

1. Wall elevations at 1/4" scale, typical unit elevation at 1" scale.

2. Show details of all conditions for every member, joint, anchorage and provision for expansion and contraction and joint treatment.

3. Include coordination details for related and adjoining work, insert drawings and erection diagrams. Show relative layout for all adjacent walls, beams, columns and slabs, all correctly dimensioned.

4. The Architect shall consider alternative stone anchor systems in lieu of system shown on drawings. Contractor shall submit complete engineering calculations as specified herein for alternative system, as well as any cost savings achieved.

5. Stone: Submit complete cutting and setting drawings to Architect for approval. Shop sizes, shapes, thicknesses, jointing, anchoring, connection with other work, typical and special anchoring details, supports, dimensions, setting numbers, and color range for each piece of stone. Clearly indicate dimensions for locating slots in stone and for locating inserts to be built into concrete and masonry. Do not fabricate any stone (except for samples) until shop drawings have been approved by the Architect. Shop drawings shall be based upon actual field measurements to determine exact dimension of each stone piece and anchorage required. Dimensions shown on shop drawings shall be actual field dimensions.

B. Manufacturer's Data

1. Submit copies of manufacturer's specifications and installation instructions for each stonework accessory required. Include data substantiating that materials comply with specified requirements. Indicate that installer has received copy of manufacturer's instructions.

2. Manufacturer's instructions for handling and storage at job site; installation and protection of stone. Indicate that erector of stonework has received a copy of each instruction.

C. Samples: Submit samples of all materials to be encompassed in the work in size and quantity, as required by the Architect. These will include, but not be limited to, samples of:

Each type of Stone	Two sets of 1' x 1' indicating full Typical range of color and texture
Each type of Stone, Corners, Special Shapes	1'-0" x 1'-0" approx. w/all edgework, and adhesive joinery, ea. type
Fastenings, Devices, Anchors, Shims, and	Each type

Setting pads
Grout Color

D. Provide structural calculations, prepared in compliance with referenced documents and these specifications. Where specifications and code differ, the more stringent requirement shall govern. Calculations shall be legible and shall incorporate sufficient cross references to shop drawings to make the calculations readily understandable and reviewable. Test reports are not an acceptable substitute for calculations. Calculations shall include the following information:

1. Analysis for all applicable loads on framing members.

2. Analysis for all applicable loads on anchors, including anchors embedded in concrete.

3. Section property computations for steel framing members.

4. Analysis of stress in stone.

5. Stone physical characteristics.

6. Seal and signature of professional engineer registered in The State of New York. The Architect and/or his consultants will not provide said seal and signature.

1.9 FABRICATION TOLERANCES

A. Conform to the following dimensional tolerances; all tolerance measurements are + or – unless otherwise noted.

1. Marble and Limestone: 1/32” in length, width and thickness (at exposed edges).

2. Granite, Slate, and Quartz Based Stone

a. Smooth face. 1/8” in length and width. 1/16” at exposed edges.
b. Sawn Face. 1/8” in length and width and exposed edges.
c. Thermal, course stippled finishes and natural cleft slate. 1/8” in length and width. 3/16” at exposed edges.

3. Natural Stone Veneer Panels: 1/16” in length and width.

4. Square: One half the joint size, but not more than 1/16” for stones with the largest edge dimension not greater than 39”.

5. Flatness Tolerance: (All tolerance measurements are + or - and measured along a 4-foot dimension in any direction.) Smooth finished stones: 1/16”.

6. Joint Size: Joint width between stone panels shall be 1/16”; 0 tolerance. Joints to materials other than stone shall be 1/8” wide.

1.10 PERFORMANCE REQUIREMENTS

A. Structural Requirements: The work, as erected, shall be designed to withstand a lateral force of 5 psf applied over field surface normal to face of stone without failure of stone or anchors.

B. Methods and fabrication and assembly (except as specified herein) shall be at the discretion of the Contractor provided that the visible architectural effect is not changed, the work of other Contractors is not affected and the strength qualities, as demonstrated by engineering calculations are not reduced.

C. Remedial measures, which may be necessary on the building, shall maintain standards of quality and durability and are subject to approval by the Architect.

D. Anchors

1. Adequate number and size of anchors shall be provided to satisfy the load requirements and design criteria.

E. Variations in Structure: The work shall be designed to accommodate variation in location of surrounding and supporting work, as defined as allowable variations in the work, as specified in other Sections of the project Specifications.

1.11 CODES AND STANDARDS

A. All work shall be performed in accordance with the City of New York Building Code, or the requirements of this Specification, whichever are more stringent.

B. Stone Cladding System shall conform to, but not be limited to, the following codes and standards as a minimum:

1. National Building Granite Quarries Assoc. (NBGQA).

2. American National Standards Institute (ANSI).

3. Marble Institute of America (MIA) “Dimension Stone Design Manual”, latest edition.

4. Building Stone Institute (BSI).

5. American Society for Testing and Materials (ASTM).

1.12 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect stone during storage and construction against moisture, soiling, staining, and physical damage.

B. Handle stone to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials. Lift with wide-belt type slings wherever possible; do not use wire rope or ropes containing tar or other substances which might cause staining. If required, use wood rollers and provide cushion at end of wood slides.

C. Store stone on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones. Protect stored stone from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around stone.

D. Protect mortar materials and stonework accessories from weather, moisture, and contamination with foreign materials.

1.13 JOB CONDITIONS

A. Installer must review installation procedures and coordination with other work with Contractor and other subcontractors whose work will be affected by stonework.

1.14 PROTECTION

A. Protect adjacent surfaces from damage. Protect exposed surfaces of stone units from damage or defacement. Prevent materials used for installing work of this Section from staining or damaging the exposed surfaces of stone units or the exposed surfaces of the adjoining construction.

B. Protect all stonework from other materials that will cause staining or defacement. Stone subject to damage after setting shall be properly covered or protected.

C. No lumber or other material liable to stain or deface the stone shall be used.

1.15 GUARANTEE

A. Unless stated otherwise in these Specifications, guarantee shall state that all work is in accord with drawings and Specifications, as amended by any changes thereto authorized by the Architect, free from defects in materials and workmanship for a period of five (5) years from date of acceptance of the work by the Owner. Contractor shall agree to repair or replace defective materials and workmanship during the guarantee period at no additional cost to the Owner.

B. Defective materials and workmanship are hereby defined to include evidence of abnormal deterioration, aging, structural failure of components resulting from exposure to normal load and forces, failure of operating parts to function normally, sealant failures, deterioration or discoloration of finishes in excess of normal aging, and failure to fulfill other specified performance.

C. Contractor and respective subcontractors shall be responsible for damage to the building and furnishings occasioned by defective materials or workmanship or damage as part of repairs to the interior stone cladding.

D. The guarantee, the enforcement or lack of enforcement thereof, shall not deprive the Owner of other actions, rights or remedies available to him. Guarantee shall be in form approved by the Architect.

PART 2 PRODUCTS

2.1 STONE

A. Stone shall be as scheduled on the drawings.

B. Stone shall have a polished finish, mirror glass with sharp reflections, on all exposed surfaces; concealed surfaces may be sawn.

C. Quarrying Supervision

1. Quarrying shall be supervised and coordinated by the stone fabricator to insure that the as-quarried block orientations will yield finished material with characteristics as described herein.

2. All stone shall be cut from matched blocks. Matched blocks shall mean blocks extracted from a single bed of stratum in the quarry. The use of blocks chosen at random, though similar in general character and color to that of the approved stone shall not be permitted, except by written permission of the Architect.

D. Examinations

1. Examination at the Quarry: Quarried blocks shall be made available for inspection by the Architect at his request.

2. Examination at the Fabrication Plant: Production units shall be made available for inspection by the Architect at his request. To this end, the Contractor shall, after approval of final shop drawings, advise the Architect when production has begun and of the earliest possible opportunity to inspect a representative sampling of production work.

3. Contractor shall provide lighting that is sufficient in intensity and color range to permit an adequate examination to the satisfaction of the Architect.

E. Criteria for Stone

1. Visual: All examinations, selections, and approvals shall be for the purpose of achieving a final appearance of stone with greatest possible uniformity, and will be based upon the following criteria:

   a. All stone shall be of sound stock and uniform texture, and shall be free from holes, seams, shakes, clay pockets, spalls, stains, starts, and other defects which would impair the strength, durability, and appearance of the work, as determined by the Architect.
   b. Inherent variations characteristic of the stone and the quarry from which the stone is to be obtained shall be brought to the attention of the Architect at the time the samples are submitted for approval, and shall be subject to approval of the Architect.
   c. All stone shall be selected for background color, veining, marking and matching, shall run in even shades, and shall be set accordingly.

F. Physical and Mechanical: All design of stone support system shall be based on the mechanical and physical properties of the selected stone. Performance data for these properties shall have been derived from tests by an independent engineering laboratory acceptable to the Architect, and shall be furnished by the contractor to the Architect for the stone selected. This performance data shall include:

1. Absorption by Weight (ASTM C97)

2. Flexural Strength (ASTM C880)

3. Compressive Strength (ASTM C170)

4. Modulus of Rupture (ASTM C99)

2.2 ACCESSORY MATERIALS FOR STONEWORK

A. Mortar Materials

1. White Portland Cement: ASTM C150, Type 1 or Type II, non-staining. Cement shall in no case contain more than .03% by weight of soluble alkali (calculated as Na20). Submit mill certificates of cement and certified analysis from an approved testing laboratory.

2. Sand: ASTM C144, except graded with 100% passing No. 16 sieve, non-staining.

3. Hydrated Lime: ASTM C207, Type S.

4. Water: Potable, clear and free of deleterious materials which would impair the quality of the mortar.

5. Color Mortar Pigments for Joint Mortar: Natural and synthetic iron and chromium oxides, compounded for use in joint mortar/grout mixes. Use only pigments that have proved through testing and experience to be satisfactory for use in Portland cement mixes with latex admixtures. Provide integral, non-fading colorant made by Davis Colors, Scoffield, or approved equal color selected by the Architect.

6. Plaster of Paris: ASTM C59.

7. Shims: Hard plastic or stainless steel.

B. Stone Support

1. Manufacturer and General: Stone support systems, anchors and accessories shall be manufactured by a company specializing in the design and fabrication of stone approved by the Architect. Provide all fastening devices, wire anchors, support angles, relieving angles, anchors, coping anchors, dowels, cramps, bolts, nuts, shims, expansion shields, flashing, etc., necessary to properly secure stone walls to the structure.

2. Stainless Steel to be used for stone supports shall conform to the following:

   a. Sheet, Bar and Plate: AISI Type 304 non-magnetic, conforming to ASTM A666.
   b. Fasteners, Anchor Bolts, Nuts and Washers: AISI Type 304 non-magnetic, ASTM A167.

3. For wire anchors, provide No. 8 gauge half hard yellow brass wire anchors.

2.3 USE OF EXISTING SALVAGED STONE

A. Remove stone in manner to minimize damage.

B. Pack and take stone back to fabrication shop.

C. Fabricate stone to fit design intent of reception desk furniture. Attach by clips as indicated in this section based on conditions encountered.

2.4 FABRICATION

A. All stone work shall be executed by mechanics skilled in the trade. All stone shall be well-cured and seasoned before cutting. Cut stone units with bed, unless otherwise approved by the Architect.

B. Stone shall be accurately cut to sizes, shapes, profiles and dimensions. There shall be no deviation from jointing.

C. Exposed surfaces and edges of stone units shall be free from cracks, broken corners, chipped arrises, scratches or other defects affecting appearance. Patching or filling not permitted.

D. Backs of stone units shall be sawn to true planes, parallel to face plane.

E. Cut stone units full and true on faces, reveals, beds, joint and top, to the full dimensions required by drawings. All edges shall be straight and true with sharp and true arrises. All stone shall fit together accurately.

F. Make faces of stone units in same plane flush at joints. All finished surfaces shall be true in line and face.

G. Sawn surfaces and edges shall be cleaned of all rust stains and iron particles.

H. No patching or use of stone with chipped edges or faces shall be permitted.

I. Thickness: Provide stone panel of thickness shown on drawings. Saw-cut back surfaces which will be concealed in the finished work. Provide greater stone thickness than shown where thickness shown is insufficient for the sizes or where extent of cut-outs shown decreases effective strength of the remaining material, or for proper and sufficient anchorage, suitable and adequate bearing areas for surfaces.

J. Adhesive Bonded Units

1. Adhesive shall be a 2-component epoxy resin designed specifically for structural bonding of stone units.

2. Prepare stone, mix adhesive and fabricate bonded units in accordance with the recommendations of the NBGQA and adhesive manufacturer's instructions. Color shall match stone.

3. Adhesively bonded units shall be fabricated with a non-continuous stone liner reinforcing that is mechanically secured to both face stones and stainless steel dowels. Size and spacing shall be designed to achieve a mechanical support should the adhesive fail.

4. Finish joints shall be smooth and without staining or excess adhesive on exposed surfaces. Remove adhesive from exposed joints after hardening and leave finish surfaces without damage, or impairment of the polished finish.

2.5 CUTTING, DRILLING AND FITTING

A. Provide holes and sinkages required for anchors, dowels, other devices required to support and/or suspend stone, and to accommodate other items which connect to or penetrate the stone.

B. Include all cutting, drilling and fitting of stone work required to accommodate the work of other trades. In cutting and fitting, carefully cut and grind edges to a neat tight fit. Do cutting in such manner so as not to impair strength or appearance of stone. Use physical templates for all cutting and drilling; obtain required templates from proper trades.

C. Refer to Article 1.7 herein for fabrication tolerances.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where interior stone cladding is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

B. Review installation procedures and coordinate with other work, and with other trades whose work will be affected by the stonework.

C. Advise other trades of requirements relating to their placement of any inserts which are to be used for anchoring and supporting of stonework.

3.2 INSTALLATION

A. Sample Section of Interior Stone Cladding

1. Prior to general installation of interior stone cladding, install a section of the wall (used as "control section") in accordance with final approved shop drawings. Architect shall be informed of time and place of such installation of control section.

2. Obtain Architect's acceptance of visual qualities of control section before start of general installation. Replace unsatisfactory work, as directed, until acceptable to the Architect. Retain control section in permanent work as a standard for judging completed work.

B. Qualification of Workmen: All work shall be performed by skilled workmen, especially trained and experienced in this type of work.

C. Lines and Grades: Benchmarks for elevations and building line offset marks for alignment shall be established on each floor level by the Contractor, who shall be responsible for their accuracy. Should any error be found in their location, the Installation Contractor shall so notify the Contractor in writing and installation work shall not proceed in the affected areas until the errors have been corrected.

D. Workmanship: All parts of the work shall be erected plumb and true, in proper alignment and relation to established lines and grades, and as shown on approved shop and/or erection drawings.

E. Erection Tolerances

1. Permissible dimensional tolerance in the building frame and/or work surrounding or supporting the work of this Section are stated in the appropriate Trade Sections of these Specifications.

2. The work shall be designed to accommodate all tolerances and anticipate dead and live load movement, creep, sway and torsion of the structure without any harmful effects.

3. Stone erection tolerances shall be as follows:

a. Joint width 1/16", ± 0" tolerance.
b. Variation from Plumb: For lines and surfaces of walls and arrises, do not exceed 1/8" in 20 ft. max. For external corners, expansion joints and other conspicuous lines, do not exceed 1/8" in any story or 20 ft. max.
c. Variations from Level: For grades shown for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/8" in any bay or 30 ft. max.
d. Variation of Linear Building Line: For position shown in plan and related portion of grid lines, walls and partitions, do not exceed 1/8" in any bay or 30 ft. max.
e. Offset at Joints: Do not exceed plus or minus 1/32".

F. Do not use stone units with chips, cracks, voids, stains or other defects which might be visible in the finished work. Patching or hiding defects in stone will not be permitted.

G. Clean stone before setting by scrubbing with fiber brushes followed by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh fillers or abrasives. If not thoroughly wet at time of setting, drench or sponge stone. Do not wet expansion or control joint surfaces.

H. Shims used to maintain joint width must be removed prior to pointing.

3.3 SETTING STONE

A. Mortar

1. 1 part non-staining cement with color ingredient

2. 2 parts clean selected sand to be compatible with the colored cement

3. Lime to make as still a mix as can be worked

4. Water as required

B. Mixing

1. Mix cementitious materials, admixtures, and aggregate with the proper amount of water consistency which will result in a homogeneous, still and plastic mix.

2. Mix mortar in small batches by approved mechanical mixes. Monitor volume of materials per batch carefully.

3. Retempering of mortar will not be permitted, and mortar that has been allowed to stand more than one or two hours shall not be used. Mortar shall be mixed and kept tempered so that it will, at all times, contain as much water as it is able to carry.

4. Setting grouts and mortar work shall be prepared for use in strict conformance with the recommendations and instructions of the manufacturer.

C. Anchors

1. A minimum of 2 anchors shall be required on all pieces up to 2 square feet in area.

2. A minimum of 4 anchors shall be required on all pieces up to 20 square feet in area.

3. A minimum of 2 additional anchors shall be required on each additional 10 square feet.

D. Set stone and install stone support systems in accordance with drawings and final shop drawings for stonework. Provide anchors, supports, fasteners, and other attachments shown, or necessary to secure stonework in place. Shim and adjust accessories as required for proper setting of stone. Completely fill holes, slots and other sinkages for anchors, dowels, fasteners, and supports with epoxy adhesive/grout during setting of stones.

E. Erect walls plumb and true with 1/16" joints, unless otherwise shown on shop drawings, uniform in width and accurately aligned.

F. Joints: Fully butter with mortar and tool flush. Maintain an even joint between units 1/16" max. Surplus grout shall be immediately cleaned from the face of the stone. Use colored mortar as directed by the Architect.

G. Cleaning: After final cleaning of stone, repoint any open joints with grout.

H. Where stone is supported by wire anchors, conform to the requirements noted above and the following:

1. Back-up standing stone required to be set against masonry with Plaster of Paris spots.

2. Place spots not over 16" apart in both directions. Securely anchor stone to structural backing with sufficient number of wire anchors properly wedged into holes cut or drilled into edges of stone. Embed wire anchors in mortar used for spots. Loop or hook and extend anchors into holes cut into masonry backing.

3. Thoroughly fill holes with mortar used for spots. Make anchor hole in backing larger at back than in front so that, when filled, it will form a plug which cannot be pulled loose.

I. Anchors or dowels shall not show in finished work.

J. Wet masonry surfaces before applying anchors and Plaster of Paris spots or Portland cement spots.

3.4 PROTECTION OF STONEWORK

A. Prevent materials used for installing work of this Section from staining or damaging the exposed surfaces of stone units or the exposed surfaces of the adjoining construction. Immediately

remove mortar, grout or other detrimental materials from exposed surfaces of stone or adjoining construction.

B. Protect all stonework from other materials that will cause staining or defacement. Stone subject to damage after setting shall be properly covered or protected.

C. Provide additional protection for finished work such as exposed edges, corners, and all other stone liable to physical injury or staining. Protection shall include but is not limited to non- staining approved coverings, and clean non-staining wood boxing. All fastenings or hold-back devices shall be stainless steel. Fastening to stone joints is prohibited.

D. At completion of construction work, remove all temporary protection installed as work of this Section.

E. After installation, protect stonework from damage during subsequent construction activities.

3.5 ADJUSTING, CLEANING, AND REPAIRING

A. Examine all work and repair all damage. Clean soiled or stained surfaces. In the event damage is irreparable, or soiled or stained surface cannot be cleaned, then remove and replace such items at no additional cost to Owner.

B. Remove and replace stonework of the following description:

1. Defective, broken, chipped, stained, or otherwise damaged stone units installed as work of this Section.

2. Unfilled or defective joint.

3. Stone joints not matching approved samples and mockups.

C. Replace in manner that results in stonework matching approved samples and mockups.

D. In-Progress Cleaning: Clean stonework as work progresses. Remove mortar fins and smears before tooling joints.

E. Final Cleaning: After setting mortar and, as applicable, mortar is thoroughly set and cured, clean stonework as follows:

1. After completion of any repair work, clean exposed surfaces of all stone surfaces and units installed as work of this Section with clean water and stiff fiber brushes until all dirt, stains, efflorescence, mortar, and other defacements are removed. Use cleaner and procedures recommended by stone quarry and stone fabricator and approved by Architect. Do not use wire brushes, metal scrapers or acids. Protect adjacent surfaces from damage during cleaning operations.

2. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

3. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect’s approval of sample cleaning before proceeding with cleaning of each area or element of stonework.

END OF SECTION

SECTION 09 77 13 STRETCHED FABRIC WALL SYSTEMS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the acoustic wall panels as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Acoustical absorption panels wrapped in selected fabric.

1.3 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Carpentry - Section 062000.

C. Gypsum drywall - Section 092900.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualification: At least 5 years' experience fabricating and installing comparable work, employing skilled mechanics under competent supervision for all phases of the Work.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants

7. Insulation
8. Paint Coatings
9. Wall Panels

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Shop Drawings/Product Data

1. Base drawings on field measurements.

2. Show dimensioned wall elevations with seam and joint locations, cutout sizes and locations, anchor locations, relation to adjacent work; large scale joint and mounting details; materials type, weight/thickness, design, color; and other data necessary to fabricate and install work and coordinate work with affected trades.

B. Samples: Two 12" x 12" (minimum) panels in selected finish, showing seam, edge and cutout conditions.

C. Certification

1. Acoustical Performance: Certified reports of acoustical performance tests conducted and/or witnessed by a recognized, independent, testing agency. Tests shall have been done by specified methods or recognized equivalent. Sound absorption tests shall be not more than three years old. Reports on earlier tests are acceptable if it can be established to the Architect's satisfaction, that they are valid indications of compliance with Project requirements.

2. Fire Hazard: Evidence of compliance with regulatory agency and specifications requirements.

D. Cleaning and Maintenance Instructions: Recommendations for Owner maintenance and cleaning per Section 017300 requirements. Identify cleaning/spotting products generically or by trade name.

E. Manufacturer Qualifications: List comparable installations with 3-year (minimum) service histories. Describe installations and give Owner/building manager names and addresses.

1.8 REFERENCES

A. ASTM C 423 Test for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM E 84 Test for Surface Burning Characteristics of Building Materials.

1.9 DELIVERY, STORAGE AND HANDLING

A. Allow materials to become acclimated to Project conditions before installation, if necessary to prevent sag and distortion during service life.

1.10 PROJECT CONDITIONS

A. Environmental Conditions

1. Work areas shall be at or near ambient occupancy temperature and relative humidity.

2. Painting, dust-raising activities, and work that introduces dampness shall be completed.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide products manufactured by one of the following:

1. TRAK TEX BY DFB SALES.

2. WHISPER WALLS.

3. FABRIK TRACK.

4. STRETCH WALL.

5. or approved equal.

B. Fabricate panels to sizes and configurations indicated; attach facing materials to cores to produce installed panels with visible surfaces fully covered and free from waves in fabric weave, wrinkles, sages, blisters, seams, adhesive or other foreign matter.

1. Fabricate back mounted panels in factory to exact sizes required to fit wall surfaces based on field measurements of completed substrates indicated to receive acoustical wall panels.

2. Where radius corners are indicated, attach facing material so there are no seams or gathering of material.

C. Dimensional Tolerances of Finished Units: Overall height and width of panels - plus or minus 1/16".

2.2 STRETCHED FABRIC WALL SYSTEM

A. Manufacturer's standard construction consisting of facing material laminated to front, edges, and back Manufacturers standard field assembled upholstered wall systems consisting of a perimeter frame, core materials and specified fabric

1. Track to be formed with an extruded polystyrene material natural polystyrene.

2. Track dimension to be a 1” square depth with a .03125 slight eased contour

3. Track compression to generate enough pressure to hold fabric from .010 - .10 exclusive of a liner of .010

4. Panels to conform to drawings including diagonal panels, irregular shapes, and contoured radius panels.

5. Core materials.

   a. Tackable core shall be Micore CV 230 by USG Interiors, Inc., with NRC rating of 0.35 per ASTM C 423, 1” inch nominal thickness.

   b. Aoustical Quiet Core substrate is an acoustical inorganic glass fibers compressed to 7 lbs per cu. ft. bonded by a thermosetting agent with an NCR rating of 0.90. 1” inch nominal thickness.

   c. Acoustical fill meets Greenguard Gold standard rated by UL environment. The 1” acoustical substrate uses a glass mineral wool with a plant based sustainable binding process. Contains no harmful materials or chemicals evaluated by the International Living Building Institute. Acoustical rating of .80 and meets all ASTM E 84 and California title 24 requirements

6. Fabric: Shall be upholstered so that the fabric is taut and all vertical and horizontal patterns match. Fabric shall be tested for suitability and stability. Proper backing shall be applied if

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where acoustic wall panels are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. General

1. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's printed instructions for installation of panels using type of mounting accessories indicated or, if none indicated, as recommended by manufacturer.

2. Construction Tolerances

   a. Variation from Plumb and Level: +/- 1/16".
   b. Variation of Joints from Hairline: Not more than 1/16".

B. Anchoring to Drywall: Anchor clips to unreinforced gypsum board with toggle or Molly anchors. Anchor clips to metal drywall framing with tapping sheet metal screws.

C. Panels shall be pressed against wall and slid down engaging "Z" clips into wall brackets.

D. Remove and replace panels that are damaged and are unacceptable to Architect.

3.3 ADJUSTING AND CLEANING

A. Correct non-complying and damaged/defective Work. Replace work that cannot be satisfactorily repaired.

B. Restretch and reinstall sagging and distorted fabric and correct other defects that occurred during normal service.

C. Carefully and thoroughly clean completed work by vacuuming and/or other means. Remove soil, stains, loose threads.

D. Protect work from soiling and other damage.

END OF SECTION

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SECTION 09 84 33 ACOUSTIC WALL PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the acoustic wall panels as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Acoustical absorption panels wrapped in selected fabric.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Carpentry - Section 062000.

C. Gypsum drywall - Section 092900.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualification: At least 5 years' experience fabricating and installing comparable work, employing skilled mechanics under competent supervision for all phases of the Work.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP)

3. Material Transparency Documentation, one of: Health Product Declarations (HPDs);

Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Insulation
8. Paints & Coatings
9. Wall Panels

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Shop Drawings/Product Data

1. Base drawings on field measurements.

2. Show dimensioned wall elevations with seam and joint locations, cutout sizes and locations, anchor locations, relation to adjacent work; large scale joint and mounting details; materials type, weight/thickness, design, color; and other data necessary to fabricate and install work and coordinate work with affected trades.

C. Samples: Two 12" x 12" (minimum) panels in selected finish, showing seam, edge and cutout conditions.

D. Certification:

1. Acoustical Performance: Certified reports of acoustical performance tests conducted and/or witnessed by a recognized, independent, testing agency. Tests shall have been done by specified methods or recognized equivalent. Sound absorption tests shall be not more than three years old. Reports on earlier tests are acceptable if it can be established to the Commissioner's satisfaction, that they are valid indications of compliance with Project requirements.

7. Fire Hazard: Evidence of compliance with regulatory agency and specifications requirements.

E. Cleaning and Maintenance Instructions: Recommendations for The City of New York maintenance and cleaning per Section 017300 requirements. Identify cleaning/spotting products generically or by trade name.

F. Manufacturer Qualifications: List comparable installations with 3-year (minimum) service histories. Describe installations and give The City of New York/building manager names and addresses.

1.9 REFERENCES

A. ASTM C 423 Test for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM E 84 Test for Surface Burning Characteristics of Building Materials.

1.10 DELIVERY, STORAGE AND HANDLING

A. Allow materials to become acclimated to Project conditions before installation, if necessary to prevent sag and distortion during service life.

1.11 PROJECT CONDITIONS

A. Environmental Conditions

1. Work areas shall be at or near ambient occupancy temperature and relative humidity.

2. Painting, dust-raising activities, and work that introduces dampness shall be completed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide products as scheduled on the drawings as manufactured by one of the following:

1. “Swell” by DFB Sales Inc.

2. “Aro Plank” by Filz Felt.

3. Or approved equal.

2.2 GENERAL

A. Fabricate panels to sizes and configurations indicated; attach facing materials to cores to produce installed panels with visible surfaces fully covered and free from waves in fabric weave, wrinkles, sages, blisters, seams, adhesive or other foreign matter.

1. Fabricate back mounted panels in factory to exact sizes required to fit wall surfaces based on field measurements of completed substrates indicated to receive acoustical wall panels.

2. Where radius corners are indicated, attach facing material so there are no seams or gathering of material.

B. Dimensional Tolerances of Finished Units: Overall height and width of panels - plus or minus 1/16".

C. Sound Absorption Performance: Provide acoustical wall panels with minimum noise reduction coefficients (NRC) indicated, as determined by testing per ASTM C 423 for mounting type specified under individual product requirements.

D. Colors, Textures, and Patterns: Where manufacturer's standard material is indicated, provide acoustical wall panels faced with manufacturer's material complying with the following requirements:

1. Provide Commissioner's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.

2.3 BACK MOUNTED ACOUSTICAL WALL PANELS

A. Back Mounted, Edge Reinforced Acoustical Wall Panels: Manufacturer's standard panel construction consisting of facing material laminated to front, edges, and back border of molded glass fiber board core; with edges chemically hardened to reinforce panel perimeter against warpage and damaged; and complying with the following requirements:

1. Basis of Design Product: Swell Acoustical Panels™: Option #1.

2. BOD Manufacturer: DFB Sales Inc.

a. 2107 Borden Ave.
L.I.C. N.Y. 11101
718 729 8310

3. Content: Foam-Core, Plywood & Felt.

4. Sizes in : Width Thickness

2	2 3/8
4	2 3/8
6	2 3/8
8	2 3/8
10	2 3/8
12	2 3/8

5. ASTM E84: Class A by components.

6. NRC average: 0.95.

7. Maintenance: Vacuum clean and refer to fabric manufactures for cleaning instructions

8. Installation & Job Requirements:

a. Product to conform to the elevations per finish plan
b. All shop drawing must be approved before fabrication can commence
c. Sample to be submitted for approval
d. Inspect job site before finial measurements are taken
e. Work shall not proceed until all unsatisfactory conditions have been fully resolved
f. Install panels in proper alignment and in strict accordance with manufacturer’s instructions and shop drawings
g. Install fabric so texture and grain shall run in the same direction or as designed
h. All areas to be signed off as accepted before leaving accessories.

B. Back Mounting Accessories: Manufacturer's standard or recommended accessories for securely mounting panels of type and size indicated to substrates provided, and complying with the following requirements:

1. Quick grab formula and concealed nails.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where acoustic wall panels are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION

A. General

1. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's printed instructions for installation of panels using type of mounting accessories indicated or, if none indicated, as recommended by manufacturer.

2. Construction Tolerances

a. Variation from Plumb and Level: +/- 1/16".
b. Variation of Joints from Hairline: Not more than 1/16".

B. Remove and replace panels that are damaged and are unacceptable to Commissioner.

3.4 ADJUSTING AND CLEANING

A. Correct non-complying and damaged/defective Work. Replace work that cannot be satisfactorily repaired.

B. Restretch and reinstall sagging and distorted fabric and correct other defects that occurred during normal service.

C. Carefully and thoroughly clean completed work by vacuuming and/or other means. Remove soil, stains, loose threads.

D. Protect work from soiling and other damage.

END OF SECTION

SECTION 09 84 36 ACOUSTIC BAFFLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

B. Work of this Section includes all labor, materials, equipment and services necessary to complete the acoustic baffles as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Acoustical absorption baffle panels.

1.3 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Miscellaneous Metals – Section 055000. For slotted channel supports.

C. Carpentry - Section 062000.

D. Gypsum drywall - Section 092900.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualification: At least 5 years' experience fabricating and installing comparable work, employing skilled mechanics under competent supervision for all phases of the Work.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP) .. The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP).
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Ceilings
8. Composite Wood & Agrifiber Products
9. Insulation
10. Paints & Coatings

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Shop Drawings: Shop drawings are to be wholly created by the contractor in CAD, drawn to scale and fully dimensioned, and specific to the project showing all typical and unique conditions. Do not submit copies of the design drawings, manufacturer's typical details, or details from industry standard publications as shop drawings. Shop drawings are to show all materials intended for installation and integration with work by adjacent trades. Shop drawings are to show conditions listed herein, including, but not limited to:

1. Base drawings on field measurements.

2. Show dimensioned ceiling plans with seam and joint locations, cutout sizes and locations, anchor locations, relation to adjacent work; large scale joint and mounting details; materials type, weight/thickness, design, color; and other data necessary to fabricate and install work and coordinate work with affected trades.

C. Samples: Two 12" x 12" (minimum) panels in selected finish, showing seam, edge and cutout conditions.

D. Mock-Ups: Provide an in-place mock-up, of 4' x 8', to be approved by the Commissioner prior to installation of the remainder of the ceiling. Mock-up shall include interfacing elements (sprinkler head and light fixture) for evaluation of alignments.

E. Certification

1. Acoustical Performance: Certified reports of acoustical performance tests conducted and/or witnessed by a recognized, independent, testing agency. Tests shall have been done by specified methods or recognized equivalent. Sound absorption tests shall be not more than three years old. Reports on earlier tests are acceptable if it can be established to the Commissioner's satisfaction, that they are valid indications of compliance with Project requirements.

2. Fire Hazard: Evidence of compliance with regulatory agency and specifications requirements.

F. Cleaning and Maintenance Instructions: Recommendations for The City of New York maintenance and cleaning per Section 017300 requirements. Identify cleaning/spotting products generically or by trade name.

G. Manufacturer Qualifications: List comparable installations with 3-year (minimum) service histories. Describe installations and give The City of New York/Commissioner names and addresses.

1.8 REFERENCES

A. ASTM C 423, Test for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM E 84, Test for Surface Burning Characteristics of Building Materials.

1.9 DELIVERY, STORAGE AND HANDLING

A. Allow materials to become acclimated to Project conditions before installation, if necessary, to prevent sag and distortion during service life.

1.10 PROJECT CONDITIONS

A. Work areas shall be at or near ambient occupancy temperature and relative humidity.

B. Painting, dust-raising activities, and work that introduces dampness shall be completed.

1.11 EXTRA STOCK

A. Extra Stock Material: Deliver stock of maintenance material to The City of New York. Furnish Five percent (5%) extra materials, from same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide Acoustical Ceiling Baffles as manufactured by Acoufelt as scheduled on the drawings or comparable product by Sonus, Arktura, Conwed, or approved equal.

2.2 GENERAL

A. Fabricate panels to sizes and configurations indicated; attach facing materials to cores to produce installed panels with visible surfaces fully covered and free from waves in fabric weave, wrinkles, sages, blisters, seams, adhesive or other foreign matter.

1. Fabricate panels in factory to exact sizes required to fit ceiling surfaces based on field measurements of completed substrates indicated to receive acoustical ceiling baffles.

B. Dimensional Tolerances of Finished Units: Overall height and width of panels, plus or minus 1/16".

C. Sound Absorption Performance: Provide acoustical ceiling panels with minimum noise reduction coefficients (NRC) indicated, as determined by testing per ASTM C 423 for mounting type specified under individual product requirements.

D. Colors, Textures, and Patterns: Where manufacturer's standard material is indicated, provide acoustical ceiling panels faced with manufacturer's material complying with the following requirements:

1. Provide Commissioner's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.

2.3 SUSPENSION SYSTEM

A. Provide slotted channel supports and manufacturers support system as indicated on drawings.

B. The suspension system shall support the ceiling assembly shown on the drawings and specified herein, with a maximum deflection of 1/360 of the span, in accordance with ASTM C 635.

C. Comply with all NYC black iron suspension system.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where acoustic ceiling panels are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION

A. General: Install acoustical panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's printed instructions for installation of panels using type of mounting accessories indicated or, if none indicated, as recommended by manufacturer.

B. Space rod or flat iron hangers not more than 4'-0" o.c. along main carrying channels; attach by clips or wire ties to building structure. Locate hangers not more than 6” from each end. Space main carrying channels 4'-0" o.c. Attach suspension system to carrying channels using clips or ties, leveling to a tolerance of 1/8" in 12'-0".

C. Install edge moldings at edges of each acoustical ceiling area, and at locations where edge of acoustical units would otherwise be exposed after completion of the work.

3.4 ADJUSTING AND CLEANING

A. Correct non-complying and damaged/defective Work. Replace work that cannot be satisfactorily repaired.

B. Restretch and reinstall sagging and distorted fabric and correct other defects that occurred during normal service.

C. Carefully and thoroughly clean completed work by vacuuming and/or other means. Remove soil, stains, loose threads.

D. Protect work from soiling and other damage.

END OF SECTION

SECTION 09 91 00 PAINTING AND FINISHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Prime painting unprimed surfaces to be painted under this Section.
2. Painting all items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
3. Painting all ferrous metal (except stainless steel) exposed to view.
4. Painting all galvanized ferrous metals exposed to view.
5. Painting gypsum drywall exposed to view.
6. Painting plaster surfaces.
7. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
8. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
9. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers, lighting fixtures, and the like, which are exposed to view through these items.
10. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
11. Painting of any surface not specifically mentioned to be painted herein or on drawings, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, shall be included as though specified.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Shop priming is required on some, but not all of the items scheduled to be field painted. Refer to other Sections of work for complete description.

C. Shop Coat on Machinery and Equipment: Refer to the Sections under which various items of manufactured equipment with factory applied shop prime coats are furnished, including, but not necessarily limited to, the following Sections. All items of equipment furnished with prime coat finish shall be finish painted under this Section.

1. Plumbing - Division 22.

2. Heating, ventilation and air conditioning - Division 23.

D. Wallcovering - Section 097200.

E. Color Coding of Mechanical Piping and Electrical Conduits - Divisions 22 and 26.

1. This Color Coding consists of an adhesive tape system and is in addition to painting of piping and conduits under this Section, as specified above.

1.5 MATERIALS AND EQUIPMENT NOT TO BE PAINTED

A. Items of equipment furnished with complete factory finish, except for items specified to be given a finish coat under this Section.

B. Factory-finished toilet partitions.

C. Factory-finished acoustical tile.

D. Non-ferrous metals, except for items specified and/or indicated to be painted.

E. Finished hardware, excepting hardware that is factory primed.

F. Surfaces not to be painted shall be left completely free of droppings and accidentally applied materials resulting from the work of this Section.

1.6 QUALITY ASSURANCE

A. Job Mock-Up

1. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 10 feet wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the Commissioner. Paint mock-ups to include door and frame assembly.

2. These applications when approved will establish the quality and workmanship for the work of this Section.

3. Repaint individual areas which are not approved, as determined by the Commissioner, until approval is received. Assume at least two paint mock-ups of each color and gloss for approval.

B. Qualification of Painters: Use only qualified painters for the mixing and application of paint on exposed surfaces.

C. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Commissioner in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

D. All paints must conform to the Volatile Organic Compounds (VOC) standards of prevailing codes and ordinances.

1.7 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants
7. Paints & Coatings

1.8 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.9 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Materials List

1. Before any paint materials are delivered to the job site, submit to the Commissioner a complete list of all materials proposed to be furnished and installed under this portion of the work.

2. This shall in no way be construed as permitting substitution of materials for those specified or accepted for this work by the Commissioner.

C. Samples

1. Accompanying the materials list, submit to the Commissioner copies of the full range of colors available in each of the proposed products.

2. Upon direction of the Commissioner, prepare and deliver to the Commissioner two (2) identical sets of Samples of each of the selected colors and glosses painted onto 8-1/2" x 11" x 1/4" thick material; whenever possible, the material for Samples shall be the same material as that on which the coating will be applied in the work.

D. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these specifications, submit for the Commissioner's review the current recommended method of application published by the manufacturer of the proposed material.

E. Close out Submittal

1. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or plant manufacturer/supplier shall furnish a coating maintenance manual such as Sherwin Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, MSDS, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.10 PRODUCT HANDLING

A. Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use.

B. Protection

1. Store only the approved materials at the job site, and store only in a suitable and designated area restricted to the storage of paint materials and related equipment.

2. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.

3. Use all means necessary to protect paint materials before, during and after application and to protect the installed work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.11 EXTRA STOCK

A. Upon completion of this portion of the Work, deliver to The City of New York an extra stock of paint equaling approximately ten (10) percent of each color and gloss used and each coating material used, with all such extra stock tightly sealed in clearly labeled containers.

1.12 JOB CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds eighty-five (85) percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.

D. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 PRODUCTS

2.1 PAINT MANUFACTURERS

A. Except as otherwise noted, provide the painting products listed for all required painting made by one of the manufacturers listed in the paint schedule (Section 2.4). These companies are Benjamin Moore, PPG Paints (PPG), and Sherwin Williams (S-W) or approved equal. Comply with number of coats and required minimum mil thicknesses as specified herein.

2.2 MATERIALS

A. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer and use only to recommended limits.

B. Colors and Glosses: All colors and glosses shall be as selected by the Commissioner. Certain colors will require paint manufacturer to prepare special factory mixes to match colors selected by the Commissioner. Color schedule (with gloss) shall be furnished by the Commissioner.

C. Coloring Pigment: Products of or furnished by the manufacturer of the paint or enamel approved for the work.

D. Linseed Oil: Raw or boiled, as required, of approved manufacture, per ASTM D 234 and D 260, respectively.

E. Turpentine: Pure distilled gum spirits of turpentine, per ASTM D 13.

F. Shellac: Pure gum shellac (white or orange) cut in pure denatured alcohol using not less than four (4) lbs. of gum per gallon of alcohol.

G. Driers, Putty, Spackling Compound, Patching Plaster, etc.: Best quality, of approved manufacture.

H. Heat Resistant Paint: Where required, use heat resistant paint when applying paint to heating lines and equipment.

2.3 GENERAL STANDARDS

A. The various surfaces shall be painted or finished as specified below in Article 2.4. However, the Commissioner reserves the right to change the finishes within the range of flat, semi-gloss or gloss, without additional cost to The City of New York.

B. All paints, varnishes, enamels, lacquers, stains and similar materials must be delivered in the original containers with the seals unbroken and label intact and with the manufacturer's instructions printed thereon.

C. All painting materials shall bear identifying labels on the containers with the manufacturer's instructions printed thereon.

D. Paint shall not be badly settled, caked or thickened in the container, shall be readily dispersed with a paddle to a smooth consistency and shall have excellent application properties.

E. Paint shall arrive on the job color-mixed except for tinting of under-coats and possible thinning.

F. All thinning and tinting materials shall be as recommended by the manufacturer for the particular material thinned or tinted.

G. It shall be the responsibility of the Contractor to see that all mixed colors match the color selection made by the Commissioner prior to application of the coating.

2.4 SCHEDULE OF FINISHES

A. High Performance Coating on Exterior Galvanized Ferrous Metals

First Coat: "PittGuard Rapid Coat Epoxy 95-245 Series by PPG, "Series 27WB Typoxy" by Tnemec; "Epoxy Mastic Coating V 160" by Benjamin Moore Corotech or "Recoatable Epoxy Primer 867-45" by Sherwin Williams or Approved Equal.

Second Coat: "Pittthane Ultra 95-812 (Gloss)" or "High Build 95-8800 (Semi-Gloss)" by PPG; "Series 1080 (gloss) Endura-Shield WB" or "Series 1081 (semi-gloss) Endura-Shield WB" by Tnemec; "Acrylic Aliphatic Urethane V 500 (Gloss)" or "V 510 (Semi-Gloss)" by Benjamin Moore Corotech or "Hi-Solids Urethane B65-300/350" by Sherwin Williams or Approved Equal.

B. High Performance Coating on Exterior Non-Galvanized Ferrous Metals

Prime Coat: "Amercoat 68HS Epoxy Zinc-Rich Primer" by PPG; "Series 94-H_2O Hydro-Zinc" by Tnemec; "Organic Zinc Rich Primer V 170" by Benjamin Moore Corotech or "Zinc Clad II Plus Inorganic Zinc Rich Coating B69V212" by Sherwin Williams or Approved Equal.

Second Coat: "Pitt Guard Rapid Coat Epoxy 95-245" by PPG; "Series 27WB Typoxy" by Tnemec; "Epoxy Mastic Coating V 160" by Benjamin Moore Corotech or "Macropoxy 646 Fast Cure Epoxy B58-600" by Sherwin Williams or Approved Equal.

Third Coat: "Pitthane Ultra 95-812 (Gloss)" or "High Build 95-8800 (Semi-Gloss)" by PPG; "Series 1070V (gloss) Fluoronar" or "Series 1071V (semi-gloss) Fluoronar" by Tnemec; "Acrylic Aliphatic Urethane V 500 (Gloss)" or "V 510 (Semi-Gloss)" by Benjamin Moore Corotech or "Hi-Solids Polyurethane B65-300/350" by Sherwin Williams or Approved Equal.

C. Interior Ferrous Metal

Satin Finish/Latex

Primer: Benj. Moore Ultra Spec HP Acrylic Metal Primer (HP04)
PPG Pitt Tech Plus DTM Acrylic Primer 4020 PF
S-W Pro-Industrial Pro-Cryl Universal Primer B66-1300 Series
or Approved Equal

First Coat: Benj. Moore Ultra Spec-HP DTM Acrylic Low Luster (HP25)
PPG Pitt Glaze WB1 Pre-Catalyzed Eggshell Epoxy 16-310
S-W Pro Industrial Acrylic Eg-Shel, B66-660 Series
or Approved Equal

Second Coat: Benj. Moore Ultra Spec-HP DTM Acrylic Low Luster (HP25)
PPG Pitt Glaze WB1 Pre-Catalyzed Eggshell Epoxy 16-310
S-W Pro Industrial Acrylic Eg-Shel, B66-660 Series
or Approved Equal

a. Total DFT not less than: 3.9 mils

Semi-Gloss Finish/Latex

Primer: Benj. Moore Ultra Spec-HP Acrylic Metal Primer (HP04)
PPG Devflex 4020 PF DTM Primer/Flat Finish
S-W Pro-Industrial Pro-Cryl Universal Primer B66-1300 Series
or Approved Equal

First Coat: Benj. Moore Ultra Spec HP DTM Acrylic Semi-Gloss (HP29)
PPG Pitt Glaze WB1 Pre-Catalyzed Semi-Gloss Epoxy 16-510
S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series
or Approved Equal

Second Coat: Benj. Moore Ultra Spec HP DTM Acrylic Semi-Gloss (HP29)
PPG Pitt Glaze WB1 Pre-Catalyzed Semi-Gloss Epoxy 16-510
S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series
or Approved Equal

a. Total DFT not less than: 4.0 mils

D. Interior Drywall

Matte Finish/Vinyl Acrylic Latex

Primer: Benj. Moore Regal® Select Premium Interior Paint & Primer, Matte (N548)
PPG Speedhide Zero Interior Latex Primer 6-4900XI
S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
or Approved Equal

First Coat: Benj. Moore Regal Select Interior Paint- Matte (548)
PPG Speedhide Zero Interior Latex Flat 6-4110XI
S-W ProMar 200 Zero VOC Interior Latex Flat, B30-12600 Series
or Approved Equal

Second Coat: Benj. Moore Regal Select Interior Paint- Matte (548)
PPG Speedhide Zero Interior Latex Flat 6-4110XI
S-W ProMar 200 Zero VOC Interior Latex Flat, B30-12600 Series
or Approved Equal

a. Total DFT not less than: 3.6 mils

Pearl Finish/Vinyl Acrylic Latex

Primer: Benj. Moore Regal® Select Premium Interior Paint & Primer, Pearl (550)
PPG Speedhide Zero Interior Latex Primer 6-4900XI
S-W ProMar 200 Zero VOC Interior Latex Primer, B28-2600
or Approved Equal

First Coat: Benj. Moore Regal Select Interior Paint- Pearl (550)
PPG Speedhide Zero Interior Latex Eggshell 6-4310XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
or Approved Equal

Second Coat: Benj. Moore Regal Select Interior Paint- Pearl (550)
PPG Speedhide Zero Interior Latex Eggshell 6-4310XI
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
or Approved Equal

a. Total DFT not less than: 3.8 mils

E. Interior Painted Wood Satin Finish/Latex

Primer: Benj. Moore Fresh Start Latex Primer (0023)
PPG Seal Grip Int./Ext. Acrylic Universal Primer/Sealer 17-921
S-W Multi-Purpose Latex Primer/Sealer B51 Series
or Approved Equal

First Coat: Benj. Moore Ultra Spec 500 Interior Latex Semi-Gloss (N539) PPG Speedhide Zero Interior Latex Satin, 6-5410
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
or Approved Equal

Second Coat: Benj. Moore Ultra Spec 500 Interior Latex Semi-Gloss (N539)
PPG Speedhide Zero Interior Latex Satin, 6-5410
S-W ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-1900 Series
or Approved Equal

a. Total DFT not less than: 4.0 mils

Semi-Gloss Finish/Latex

Primer: Benj. Moore Fresh Start Latex Primer (0023)
PPG Seal Grip Int./Ext. Acrylic Universal Primer/Sealer 17-921
S-W Multi-Purpose Latex Primer/Sealer B51 Series
or Approved Equal

First Coat: Benj. Moore Ultra Spec 500 Interior Latex Gloss (N540)
PPG Speedhide Zero Interior Semi-Gloss Latex, 6-5510
S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series
or Approved Equal

Second Coat: Benj. Moore Ultra Spec 500 Interior Latex Gloss (N540)
PPG Speedhide Zero Interior Semi-Gloss Latex, 6-5510
S-W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series
or Approved Equal

a. Total DFT not less than: 3.8 mils

F. Primer for Fiberglass Faced Drywall:

1 coat Benjamin Moore 046 Fresh Start Acrylic Superior Primer
1 coat PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer 17-921
1 coat Pratt & Lambert "Suprime" Interior Latex Enamel Undercoater Z1013/F1013
1 coat Sherwin Williams "Builders Solution."
or Approved Equal

G. Interior Drywall to Receive Wallcovering

Primer: 1 coat "Shield Z Mold and Mildew Proof Commercial Wallcovering Primer" made by Zinsser or Approved Equal.
1 coat Moore One Prep Wallpaper Primer WP-3001 by Insl-X or Approved Equal.
1 coat Multi-Purpose Interior/Exterior B51-450 by Sherwin Williams or Approved Equal

2.5 EXISTING SURFACES TO BE PAINTED

A. Existing surfaces shall be painted in accordance with schedule given in Article 2.4 herein except that first or prime coat may be eliminated where existing paint is sound. Where existing paint must be removed down to base material, provide first or prime coat as specified.

2.6 PIPING AND MECHANICAL EQUIPMENT EXPOSED TO VIEW

A. Paint all exposed piping, conduits, ductwork and mechanical and electrical equipment. Use heat resisting paint when applied to heating lines and equipment. The Contractor is cautioned not to paint or otherwise disturb moving parts in the mechanical systems. Mask or otherwise protect all parts as required to prevent damage.

B. Exposed Uncovered Ductwork, Piping, Hangers and Equipment: Latex Enamel Undercoater and one (1) coat Acrylic Latex Flat.

C. Exposed Covered Piping, Duct Work and Equipment: Primer/Sealer and one (1) coat Acrylic Latex Flat.

D. Panel Boards, Grilles and Exposed Surfaces of Electrical Equipment: Latex Enamel Undercoater and two (2) coats Latex Semi-Gloss.

E. Equipment or Apparatus with Factory-Applied Paint: Refinish any damaged surfaces to match original finish. Do not paint over name plates and labels.

F. All surfaces of insulation and all other work to be painted shall be wiped or washed clean before any painting is started.

G. All conduit, boxes, distribution boxes, light and power panels, hangers, clamps, etc., are included where painting is required.

H. All items of Mechanical and Electrical trades which are furnished painted under their respective Contracts shall be carefully coordinated with the work of this Section so as to leave no doubt as to what items are scheduled to be painted under this Section.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 GENERAL WORKMANSHIP REQUIREMENTS

A. Only skilled mechanics shall be employed. Application may be by brush or roller. Spray application only upon acceptance from the Commissioner in writing.

B. The Contractor shall furnish the Commissioner a schedule showing when he expects to have completed the respective coats of paint for the various areas and surfaces. This schedule shall be kept current as the job progresses.

C. The Contractor shall protect his work at all times and shall protect all adjacent work and materials by suitable covering or other method during progress of his work. Upon completion of the work, he shall remove all paint and varnish spots from floors, glass and other surfaces. He shall remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and shall leave his part of the work in clean, orderly and acceptable condition.

D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide ample in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.

E. Remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

F. All materials shall be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

G. Coverage and hide shall be complete. When color, stain, dirt or undercoats show through final coat of paint, the surface shall be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to The City of New York.

H. All coats shall be dry to manufacturer’s recommendations before applying succeeding coats.

I. All suction spots or “hot spots” in plaster after the application of the first coat shall be touched up before applying the second coat.

J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

3.4 PREPARATION OF SURFACES

A. Existing Surfaces: Clean existing surfaces requiring paint or finishing, remove all loose and flaking paint or finish and sand surface smooth as required to receive new paint or finish. No “telegraphing” of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, Contractor shall be required to sand smooth and re-finish until surface meets with Commissioner’s approval.

B. General

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished shall be perfectly dry, clean and smooth.

2. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer’s instructions and as herein specified, for each particular substrate condition.

3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

C. Metal Surfaces

1. Weld Fluxes: Remove weld fluxes, splatters, and alkali contaminants from metal surfaces in an approved manner and leave surface ready to receive painting.

2. Bare Metal: Thoroughly clean off all foreign matter such as grease, rust, scale and dirt before priming coat is applied. Clean surfaces, where solder flux has been used, with benzene. Clean surfaces by flushing with mineral spirits. For aluminum surfaces, wipe down with an oil free solvent prior to application of any pre-treatment.

   a. Bare metal to receive high performance coating specified herein must be blast cleaned SSPC SP-6 prior to application if field applied primer; coordinate with steel trades furnishing ferrous metals to receive this coating to ensure that this cleaning method is followed.

3. Shop Primed Metal: Clean off foreign matter as specified for "Bare Metal." Prime bare, rusted, abraded and marred surfaces with approved primer after proper cleaning of surfaces. Sandpaper all rough surfaces smooth.

4. Galvanized Metal: Prepare surface as per the requirements of ASTM D 6386.

5. Metal Filler: Fill dents, cracks, hollow places, open joints and other irregularities in metal work to be painted with an approved metal filler suitable for the purpose and meeting the requirements of the related Section of work; after setting, sand to a smooth, hard finish, flush with adjoining surface.

D. Plaster Surfaces: Scrape off all plaster nibs or other projections and sand smooth or finish to match adjoining surface texture. Cut out all scratches, cracks, holes, depressions and similar voids and fill with non-shrinking grout, spackles, patching plaster or other approved patching material; allow to dry, refill if necessary, then sand smooth (or refinish) to provide a flush, smooth surface of the same texture as the adjacent plaster surface.

1. Allow at least 28 days, from installation of final plaster coat, before starting work.

E. Gypsum Drywall Surfaces: Scrape off all projections and splatters, spackles all holes or depressions, including taped and spackled joints, sand smooth. Conform to standards established in Section 092900, "Gypsum Drywall."

F. Wood Surfaces: Sand to remove all roughness, loose edges, slivers, or splinters and then brush to remove dust. Wash off grease or dirt with an approved cleaner. Fill all cracks, splits, nail holes, screw holes, and surface defects with putty after the priming coat has been applied. Putty shall be brought up flush with the surface and sanded smooth and touched-up with primer when dry.

G. Testing for Moisture Content: Contractor shall test all plaster, masonry, and drywall surfaces for moisture content using a reliable electronic moisture meter. Contractor shall also test latex type fillers for moisture content before application of top coats of paint. Do not apply any paint or sealer to any surface or to latex type filler where the moisture content exceeds seven (7) percent as measured by the electronic moisture meter.

H. Touch-Up: Prime paint all patched portions in addition to all other specified coats.

3.5 MATERIALS PREPARATION

A. Mix and prepare painting materials in strict accordance with the manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

C. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.

D. Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are to be applied. Tint undercoats to match the color of the finish coat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.6 APPLICATION

A. General

1. Apply paint by brush or roller in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.

2. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. Sand between each enamel or varnish coat application with fine sandpaper, or rub surfaces with pumice stone, where required to produce an even, smooth surface in accordance with the coating manufacturer's directions.

3. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.

4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.

   a. "Exposed surfaces" is defined as those areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, etc., are in place in areas scheduled to be painted.

5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint, before final installation of equipment.

6. Paint the back sides of access panels, removable or hinged covers to match the exposed surfaces.

7. Finish doors on tops, bottoms, and side edges the same as the faces, unless otherwise indicated.

8. Enamel finish applied to wood or metal shall be sanded with fine sandpaper and then cleaned between coats to produce an even surface.

9. Paste wood filler applied on open grained wood after beginning to flatten, shall be wiped

across the grain of the wood, then with a circular motion, to secure a smooth, filled, clean surface with filler remaining in open grain only. After overnight dry, sand surface with the grain until smooth before applying specified coat.

B. Scheduling Painting

1. Apply the first coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

2. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Prime Coats: Re-coat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

D. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage.

E. “Touching-Up” of Factory Finishes: Unless otherwise specified or shown, materials with a factory finish shall not be painted at the project site. To “touch-up,” the Contractor shall use the factory finished material manufacturer’s recommended paint materials to repair abraded, chipped, or otherwise defective surfaces.

3.7 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Leave all such work undamaged. Correct any damages by cleaning, repairing or replacing, and repainting, as acceptable to the Commissioner.

B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.8 CLEAN UP

A. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

B. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION

SECTION 10 14 00 SIGNAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the signage as shown on the drawings and/or specified herein, including the following:

1. Interior panel signs.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Exit signs - Division 26.

1.5 QUALITY ASSURANCE

A. For actual installation of signage, use only personnel who are thoroughly familiar with the manufacturer's recommended methods of installation and who are completely trained in the required skills.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements. The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

1. Low-Emitting Materials
2. Regional Content
3. Wall Panels

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Submit manufacturer's technical data and installation instructions for each type of signage required.

C. Samples: Submit samples of each type of signage showing finishes, colors, surface textures and qualities of manufacture and design of each sign component including graphics.

D. Shop Drawings: Submit shop drawings for fabrication and erection of signage. Include plans, elevations, and large scale details of sign wording and lettering layout. Show anchorage and accessory items. Furnish location template drawings for items supported or anchored to permanent construction.

1.9 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 INTERIOR PANEL SIGNS

A. Fire egress, floor, and other signs required by Code shall be as follows:

1. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, manufactured from manufacturer's standard acrylic sheet, unframed. Comply with requirements indicated for finishes, colors, designs, shapes, sizes, and details of construction (as selected by the Architect).

2. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth. Fill engraved copy with enamel.

3. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surfaces, in contrasting color.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where signage is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install units and components at the locations directed by the Architect, securely mounted with concealed theft-resistant fasteners. Attach to substrates in accordance with the manufacturer's instructions.

B. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair or replace damaged units as directed by the Architect.

END OF SECTION

SECTION 10 14 23 ROOM PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes:

1. Room-identification signs that are directly attached to the building.

1.3 Sustainable Design Requirements: NOT USED

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

1.5 SUBMITTALS

A. Action Submittals

1. Product Data: For each type of product.

2. Shop Drawings: For room-identification signs

3. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

    a. Include representative Samples of available typestyles and graphic symbols.

4. Samples for verification: For each type of sign assembly showing all components and with the proper finish, in manufacturer's standard size unless otherwise indicated and as follows:

   a. Room-Identification Size: Full size Sample

   b. Exposed Accessories: Full size Sample of each accessory type.

   c. Full-size Samples, if approved, will be returned to Contractor for use in Project

5. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

B. Informational Submittals

1. Full size Sample Qualification Data: For Installer and manufacturer.

C. Closeout Submittals

1. Include maintenance manuals for signs

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Special Experience Requirements may apply to the firm that will install, erect or assemble specified work required for the Project. If applicable, such Special Experience Requirements are set forth in the Bid Booklet and the Addendum.

B. Manufacturer Qualifications: Special Experience Requirements may apply to the firm that will manufacture equipment, products or systems specified for the Project. If applicable, such Special Experience Requirements are set forth in the Bid Booklet and the Addendum.

C. Fabricator Qualifications: Special Experience Requirements may apply to the firm that will fabricate material, products or systems specified for the Project. If applicable, such Special Experience Requirements are set forth in the Bid Booklet and the Addendum.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign SN930 and SN931: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to phenolic material backing sheet to produce composite sheet.
   a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
   b. Surface-Applied Graphics: Applied paint.
   c. Color: Black.

2. Sign-Panel Perimeter: Finish edges smooth.
   a. Edge Condition: As indicated on Drawings.
   b. Corner Condition in Elevation: As indicated on Drawings.

3. Frame: Entire perimeter.
   a. Material: Aluminum.
   b. Material Thickness: 1/32”.
   c. Frame Depth: 094”.
   d. Profile: Square>.
   e. Corner Condition in Elevation: Rounded to radius indicated.
   f. Finish and Color: Mill, Clear anodized.

4. Mounting: Surface mounted to wall with concealed anchors.

5. Text and Typeface: Accessible raised characters and Braille Helvetica Upper Cas

6. typeface. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

D. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings[and suitable for exterior applications].

E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.

3. Exposed Metal-Fastener Components, General:
   a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
   b. Fastener Heads: Use countersunk Torx Pinhead flat head screws unless otherwise indicated.

4. Sign Mounting Fasteners:
   a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
   b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.

D. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on sign back and looped side on mounting surface.

E. Magnetic Tape: Manufacturer's standard magnetic tape with adhesive on one side.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly

mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

D. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by The City of New York.

2. For frame to hold changeable sign panel, fabricate frame without burrs or constrictions that inhibit function. Furnish initial sign panel. Subsequent changeable sign panels are by The City of New York.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. General Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Install signs so they do not protrude or obstruct according to the accessibility standard.

3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to

support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

5. Hook-and-Loop Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply sign component of two-part tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage; push to engage tape adhesive. Keep tape strips 0.250 inch (6.35 mm) away from edges to prevent visibility at sign edges when sign is initially installed or reinstalled. Apply substrate component of tape to substrate in locations aligning with tape on back of sign; push and rub well to fully engage tape adhesive to substrate.

6. Magnetic Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by The City of New York

END OF SECTION 10 14 23

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SECTION 10 21 13 SOLID PHENOLIC TOILET PARTITIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the toilet partitions as shown on the drawings and/or specified herein, including but is not necessarily limited to the following:

1. Floor-mounted, overhead-braced, solid phenolic toilet partitions.

2. Wall-mounted urinal screens.

3. Hardware and accessories.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Gypsum Drywall - Section 092900.

C. Ceramic Tile - Section 093000.

D. Toilet Accessories - Section 102800.

1.5 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to fabrication to ensure proper fitting of the work.

B. Inserts and Anchorages: Furnish inserts and anchoring devices which must be built into other work for the installation of toilet partitions and related work. Coordinate delivery with other work to avoid delay.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor

shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Adhesives and Sealants
   7. Flooring Systems
   8. Paints & Coatings

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Shop Drawings: Before any of the materials of this Section are delivered to the job site, submit the following:

   1. Room layouts and elevations for all areas, with dimensions based on actual dimensions taken at job site.

   2. Materials, finishes, details of construction, gauges of metal, hardware, fastening and \anchoring conditions and relation to adjoining constructions.

C. Samples: Submit the following:

   1. Samples: Solid phenolic panel, each color - 12" x 12".

   2. All hardware and fitting items, including related fasteners. Include all items listed in Article 2.3.

D. Templates: Submit templates to other trades as required for support of toilet partitions.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.

B. Store products indoors in manufacturer's original containers and packaging with labels clearly identifying product name and manufacturer. Protect from damage.

C. Lay cartons flat, with adequate support to ensure flatness and to prevent damage to prefinished surfaces.

D. Do not store where ambient temperature exceeds 120 degrees.

1.10 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's limits.

B. Do not deliver material or begin installation until building is enclosed, with complete protection from outside weather, and building temperature is maintained at a minimum of 60 degrees F.

1.11 WARRANTY

A. Manufacturer's Standard Warranty: Provide warranty for phenolic material against delamination, breakage or corrosion for 10 years.

PART 2 PRODUCTS

2.1 TOILET PARTITIONS

A. Toilet Partition: Provide floor-mounted solid-phenolic assemblies with non-corrosive doors, panels, and pilasters as scheduled on the drawings, or approved equal.

B. Urinal Screen: Provide wall-mounted urinal screens of same material and. manufacturer as toilet partitions.

2.2 MATERIALS AND COMPONENTS

A. Panels, doors, and pilasters shall be fabricated from solid phenolic material constructed of solidly fused plastic laminate with matte finish melamine surfaces, colored face sheets, and through-colored phenolic-resin core that are integrally bonded. See spec forASI Global ALPACO Elegance Toilet Compartments.

1. Face Sheet Color: As selected by Commissioner from manufacturer's standard range.

2. Provide privacy style partitions; no sightlines with gap-free interlocking doors and stiles to prevent line-of-sight into the toilet compartment.

B. Solid phenolic material shall meet National Fire Protection Association Class A, Uniform Building Code Class I, ASTM E 84 Fire Resistance Standards; flame spread 20, smoke density 95.

C. Finish Thickness

1. Stiles and Doors: 3/4 inch.

2. Panels: 1/2 inch.

D. Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge stainless steel with satin finish; 1 inch x 1-1/2 inches x 58 inches high.

E. Stiles: Floor-Anchored stiles furnished with expansion shields and threaded rods.

1. Leveling Devices: 7 gauge, 3/16 inches thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.

2. Stile Shoes: One-piece, 22 gauge, 18-8, Type 304 stainless steel, 4 inch height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch or 1 inch stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

F. Anchors: Expansion shields and threaded rods at floor connections as applicable.

G. Hardware:

1. Compliance: Operable with one hand, without tight grasping, pinching, or twisting of the wrist, and force to operate does not exceed five pounds.

2. Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish. Chrome-plated "Zamak," aluminum, or extruded plastic hardware not acceptable.

3. Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable.

a. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 1500 lb. per insert.

4. Clothes Hooks: Projecting no more than 1-1/8 inch from face of door.

5. Mounting: Hinges, keepers, latches, clothes hooks and their fasteners concealed inside compartment. Exposed hinges, keepers, latches, clothes hooks and their fasteners on exterior of compartment not acceptable with the exception of accessible compartments.

6. Hardware and Accessories: Manufacturer's standard operating hardware and accessories. Refer to manufacturer’s standard hardware package. See spec for ASI Global ALPACO Elegance Toilet Compartments with full height doors.
   a. Material: See drawings for finishes.
   b. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door.
   c. Latch and Keeper: Manufacturer's standard surface-mounted latch unit on door for out-swinging doors and pilaster for in-swinging doors designed for occupancy indication and emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
   d. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
   e. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
   f. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

H. Overhead Bracing: Manufacturer's standard continuous, stainless steel head rail with round profile and in manufacturer's standard finish.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where toilet partitions are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION

A. Install work of this Section in a rigid and permanent manner, straight and plumb, with all horizontal lines level.

B. Toilet compartment doors shall be centered on water closets, unless otherwise indicated.

C. Maintain uniform clearance of approx. 1/2" between pilasters and panels, and 1/2" between pilasters or panels and finished wall.

D. Maintain uniform clearance of 1/4" or less between vertical edges of doors and pilasters.

E. Set pilaster units with anchorages having not less than two (2) inches penetration into structural floor. Level, plumb, and tighten installation with devices furnished. Hang doors and adjust so that tops of doors are level with tops of pilasters when doors are in closed position.

END OF SECTION

SECTION 10 22 19 DEMOUNTABLE PARTITIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the demountable partitions as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Demountable partition system.

2. Glazed panels.

3. Doors.

1.3 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Structural steel framing - Section 051200.

C. Carpentry - Section 062000.

1.4 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2013.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements. The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product

Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

3. Low-Emitting Materials
4. Regional Content
5. Adhesives and Sealants
6. Furniture & Seating
7. Wall Panels

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Product Data: Provide data on panel system, components and accessories.

B. Shop Drawings: Indicate panel layout in plan and elevation, opening locations and sizes, relationship to adjacent construction, components and accessories.

C. Samples

1. 3 x 3 inch finish sample showing specified color/finish.

2. 12 inches long sample of each framing and trim profile.

3. 12 x 12 inches infill panel samples for each panel type.

4. Each hardware component.

D. Certificates: Certification that doors meet requirements of applicable handicapped accessibility code.

E. Operation and maintenance data.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this section with minimum 2 years of documented experience and approved by partition system manufacturer.

1.9 PROJECT CONDITIONS

A. Do not begin installation until building is weathertight and environmental conditions in building are approximately equivalent to those that will exist after Substantial Completion.

1.10 WARRANTY

A. Provide manufacturer's 2 year warranty providing coverage against defects in materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Tagwall; refer to drawings or approved equal.

2.2 DOOR AND GLAZED PANEL COMPONENTS

A. Frames: Manufacturer's standard. Refer to drawings.

B. Doors and Panels: See Door Schedule.

C. Door Hardware: As specified in Section 087100.

D. Glazing: Single and double glazed per Drawings.

1. Glass Type: Refer to the drawings for glazing types and locations.

2. Glass Thickness: Varies – refer to drawings.

3. Glazing Method: Varies – refer to drawings.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify that building conditions are ready to receive partitions and that field measurement dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Partition Panels: Install panels in accordance with partition system manufacturer's instructions.

1. Provide mitered joints at inside and outside corners unless otherwise noted.

B. Frames: Install in accordance with partition system manufacturer's instructions; erect vertical members plumb, horizontal members level.

C. Doors: Install in accordance with partition system manufacturer's instructions; hang to fit square within frame and to swing freely, without binding.

D. Door Hardware: Install in accordance with partition system manufacturer's instructions.

E. Glazing: Install in accordance with partition system manufacturer's instructions.

3.3 TOLERANCES

A. Maximum Variation from True Plane of Partition Surfaces: 1/8 inch in 10 feet in any direction.

B. Maximum Variation from Dimensioned Location: 1/4 inch in any direction.

3.4 ADJUSTING

A. Adjust doors and frames to provide smooth door operation from open to closed position without gravity movement of door from any position.

B. Touch up minor scratches to match factory finish.

3.5 PROTECTION

A. Do not permit subsequent construction activities to cause damage to appearance or operation of installed partition components.

3.6 DEMONSTRATION

A. Demonstrate proper dismantling, relocation and reinstallation of all system components to Owner.

END OF SECTION

SECTION 10 22 26 OPERABLE PARTITIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the operable partitions as indicated on the drawings and/or specified herein.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Structural steel framing – Refer to the structural Drawings.

C. Carpentry - Section 062000.

1.5 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Furniture & Seating

1.6 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.7 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Submit manufacturer's product literature and installation instructions for each type of operable partition and installation accessory required.

1. Submit written data on physical characteristics, durability, resistance to fading and flame resistance characteristics.

C. Shop Drawings: Submit shop drawings showing location and extent of operable partitions. Include plans, elevations, and large-scale details of anchorages, and accessory items. Indicate location of each unit with building, conditions at openings, typical for special details, location and installation requirements for hardware and operators.

1. Include methods of installation for each type of support structure and fastening condition.

D. Template Drawings: Submit location template drawings for items supported or anchored by permanent construction.

E. Maintenance Data: Include complete Maintenance Manual.

F. Samples for Initial Selection Purposes: Manufacturer's standard color charts showing full range of colors and materials for each component exposed to view, available for each type of operable partition required.

G. Samples for Verification Purposes

1. 12" square samples of finish selected.

2. Prepare samples form same material to be used for the work.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm (material producer) with not less than three (3) years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Installer Qualifications: Firm specializing in operable partition installation with not less than two (2) years of experience in installation of operable partitions similar to those required for this project.

C. Single Source Responsibility: Provide material produced by a single manufacturer partitions and mounting hardware.

D. Physical Properties: Provide operable partitions identical to those tested for the following physical properties, according to the test method indicated.

1. Sound Insulation

   a. Rating: NIC of not less than 42, STC of not less than 54.
   b. Test Method: ASTM E 336, ASTM C 423.

E. Certification: Submit manufacturer's certificate stating that materials furnished comply with specified requirements. Include supporting certified laboratory testing data indicating that material meets specified test requirements.

1.9 REFERENCED STANDARDS

A. ASTM C 423: Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM E 90: Method for Laboratory of Airborne Sound Transmission Loss of Building Partitions.

D. ASTM E 557: Practices for Architectural Application and Installation of Operable Partitions.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, quality or grade, fire hazard classification, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat, blocked off ground to prevent sagging and warping. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.11 SEQUENCING AND SCHEDULING

A. Sequence operable partition installation with other work to minimize possibility of damage and soiling during remainder of construction period.

1.12 WARRANTY

A. This warranty shall be in addition to and not a limitation of other rights The City of New York may have against the Contractor under the Contract Documents.

   1. Warranty period is two (2) years after the date of substantial completion.

1.13 MAINTENANCE

A. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against materials and methods which may be detrimental to finishes and performances.

PART 2 PRODUCTS

1.1 OPERABLE PARTITION SYSTEM

A. Operable Partition System: Provide series of individual flat panels, manually operated, top supported with operable floor seals and automatic top seals; "Acousti-Seal Encore - Single Panel" by Modernfold or equal system made by Panelfold, Kwik-Wall Co., or approved equal.

1.2 PANEL CONSTRUCTION

A. Nominal 4.25" thick panels in manufacturer's standard 51-inch widths. All panel horizontal and vertical framing members shall be fabricated from minimum 16-gauge formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.

B. Panel Skin: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction.

1. Acoustical Rating of Panels: 56 STC.

C. Panel Trim: No vertical or horizontal trim required or allowed on edges of panels; minimal groove appearance at panel joints.

1.3 PANEL FINISH

A. Panel shall be finished with fabric as scheduled on the drawings.

B. Panel Trim: No exposed panel trim required or allowed. Hardware shall be one consistent color; color as selected by Commissioner.

1.4 SOUND SEALS

A. Vertical Interlocking Sound Seals between Panels: Roll-formed steel astragals, with tongue and groove configuration in each panel edge. Rigid plastic or aluminum astragals are not acceptable.

B. Horizontal Top Seals: Modernfold "SureSet" automatic operable top seals; manually operated operable top seals not required or permitted.

C. Horizontal Bottom Seals: Modernfold "SureSet" bottom seal as specified below.

1. SM2 - Manually activated seals providing nominal 2" operating clearance with an operating range of + 1/2" to -1-1/2". Seal shall be operable from panel edge or face. Extended seal shall exert nominal 120 pounds downward force to the floor throughout operating range.

1.5 SUSPENSION SYSTEM

A. #17 Suspension System - Smart Track

1. Suspension Tracks: Minimum 11-gage, 0.12-inch roll-formed steel track, supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track,

connected to structural support by pairs of 3/8-inch diameter threaded rods. Aluminum track is not acceptable.

a. Exposed track soffit: Steel, integral to track, and pre-painted off-white.

2. Carriers: Two all-steel trolleys with steel-tired ball bearing wheels. Non-steel tires are not acceptable. Suspension system shall provide automatic indexing of panels into stack area using preprogrammed switches and trolleys without electrical, pneumatic, or mechanical activation.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where operable partition is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION

A. Install operable partitions and accessories after finishing operations, including painting, have been completed.

B. Install operable partitions in conformance with drawings, approved shop drawings and using method indicated in strict compliance with manufacturer's written installation instructions; complying as applicable with ANSI E-557, Standard Recommended Practice for Architectural Application and Installation of Operable Partitions.

C. Lubricate bearings and sliding parts; adjust to ensure smooth, easy operation.

D. Match operable partitions for color and pattern by using partitions from cartons in same sequences as manufactured and packaged, if so numbered. Broken, cracked, chipped, or deformed partitions are not acceptable.

3.4 FIELD TESTS

A. The City of New York will engage an independent testing service to provide in place tests of each operable partition for Noise Isolation Class (NIC). Tests for measurement of noise isolation between rooms will be performed in general conformance with ASTM E 336; NIC rating will be calculated in accordance with ASTM E 413.

B. If any operable partition does not initially meet NIC requirements stated in 1.5, D, installer will be responsible for modifying and adjusting partition assembly as required, after which partition will be retested until compliance is achieved.

1. The City of New York will pay cost of initial in place field test for each operable partition. Cost of additional testing will be borne by the Contractor.

3.5 CLEANING

A. Clean all operable partition surfaces and clean adjacent surfaces soiled by work of this Section. Avoid use of abrasive cleaners or solutions containing corrosive solvents.

B. Remove debris created by operable partition work from work site.

C. Protect partitions against damage during construction period. Ensure that partitions will be without damage or deterioration at time of substantial completion.

3.6 DEMONSTRATION

A. Demonstrate proper operation and maintenance procedures to The City of New York's personnel.

END OF SECTION

SECTION 10 28 00 TOILET ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the toilet accessories as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Toilet Paper Dispenser.
2. Napkin Receptacle.
3. Paper Towel Dispenser.
4. Electric Hand Dryer.
5. Baby Changing Station.
6. Grab Bars.
7. Mirror.
8. Device Holder/Hook.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Gypsum drywall - Section 092900.

C. Ceramic tile - Section 093000.

D. Solid Phenolic Toilet partitions - Section 102113.

1.5 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

B. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units. Accessories shall be installed at heights in compliance with prevailing Handicapped Code.

C. Products: Unless otherwise noted, provide products of same manufacturer for each type of unit and for units exposed in same areas.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content
   6. Adhesives and Sealants

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Submit manufacturer's technical data, catalogue cuts and installation instructions for each toilet accessory.

C. Setting Drawings: Provide setting drawings, templates, instructions, and directions for installation of anchorage devices in other work

D. Submit schedule of accessories indicating quantity and location of each item.

1.9 PRODUCT HANDLING

A. Deliver accessories to the site ready for use in the manufacturer's original and unopened containers and packaging, bearing labels as to type or material, manufacturer's name and brand name. Delivered materials shall be identical to approved samples.

PART 2 PRODUCTS

2.1 MATERIALS

A. Refer to the drawings for Metal finishes.

B. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gauge minimum, unless otherwise indicated.

C. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

D. Galvanized Steel Sheet: ASTM A 653, G60.

E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

F. Mirrors: ASTM C 1503, mirror glazing quality, clear glass mirrors, nominal 1/4" thick.

2.2 FASTENING DEVICES

A. Exposed Fasteners: Theftproof type, chrome plated, or stainless steel; match finishes on which they are being used.

B. Concealed Fasteners: Galvanized (ASTM A 123) or cadmium plated.

C. No exposed fastening devices permitted on exposed frames.

D. For metal stud drywall partitions, provide ten (10) gauge galvanized sheet concealed anchor plates for securing surface mounted accessories.

2.3 FABRICATION

A. General: Stamped names or labels on exposed faces of toilet accessory units are not permitted. Unobtrusive labels on surfaces not exposed to view are acceptable. Where locks are required for a particular type of toilet accessory, provide same keying throughout project. Furnish two keys for each lock.

B. Surface-Mounted Toilet Accessories, General: Fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage.

C. Recessed Toilet Accessories, General: Fabricate units of all welded construction, without mitered corners. Hang doors of access panels with full-length stainless steel piano hinge. Provide anchorage which is fully concealed when unit is closed.

2.4 MANUFACTURERS

A. Provide products manufactured by Bobrick Washroom Equipment Co., American Specialties, Inc., Bradley Corp., A & J Washroom Accessories or approved equal.

2.5 ACCESSORY SCHEDULE

A. Refer to the accessory schedule on the drawings. Other manufacturers as listed herein may substitute their products with the approval of the Commissioner.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where toilet accessories are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 PREPARATION

A. Accessories which are to be partition mounted shall be closely coordinated with other trades, so that the necessary reinforcing is provided to receive the accessories.

B. Furnish templates and setting drawings and anchor plates required for the proper installation of the accessories at gypsum drywall and masonry partitions. Coordinate the work to assure that base plates and anchoring frames are in the proper position to secure the accessories.

C. Verify by measurements taken at the job site those dimensions affecting the work. Bring field dimensions which are at variance with those on the approved shop drawings to the attention of the Commissioner. Obtain decision regarding corrective measures before the start of fabrication of items affected.

D. Cooperate in the coordination and scheduling of the work of this Section with the work of other Sections so as not to delay job progress.

3.4 INSTALLATION

A. Install accessories at locations indicated on the drawings, using skilled mechanics, in a plumb, level and secure manner.

B. Concealed anchor assemblies for gypsum drywall partitions shall be securely anchored to metal studs to accommodate accessories. Assemblies shall consist of plates and/or angles tack welded to studs.

C. Secure accessories in place, at their designated locations by means of theftproof concealed set screws, so as to render removing of the accessory with a screwdriver impossible.

D. Unless otherwise indicated, accessories shall conform to heights from the finished floor as shown on the drawings. Where locations are not indicated, such locations shall be as directed by the Commissioner.

E. Installed accessories shall operate quietly and smoothly for use intended. Doors and operating hardware shall function without binding or unnecessary friction. Dispenser type accessories

shall be keyed alike. Prior to final acceptance, master key and one duplicate key shall be given to The City of New York's authorized agent.

F. The Commissioner shall be the sole judge of workmanship. Workmanship shall be of the highest quality. Open joints, weld marks, poor connections, etc., will not be permitted. The Commissioner has the right to reject any accessory if he feels the workmanship is below the standards of this project.

G. Grab bars shall be installed so that they can support a three hundred (300) lb. load for thirty minutes per ANSI A117.1 and ADA US Department of Justice Guidelines.

3.5 CLEANING AND PROTECTION

A. Upon completion of the installation, clean accessories of dirt, paint and foreign matter.

B. During the installation of accessories and until finally installed and accepted, protect accessories with gummed canvas or other means in order to maintain the accessories in acceptable condition.

C. Replace and/or repair installed work which is damaged or defective to The City of New York's satisfaction, at no additional cost.

END OF SECTION

SECTION 10 44 16 FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the fire extinguishers and cabinets as shown on the drawings and/or specified herein.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Gypsum drywall - Section 092900.

C. Fire suppression systems - Division 22.

D. Fire hose cabinets and valve cabinets - Division 22.

1.5 QUALITY ASSURANCE

A. Provide portable fire extinguishers, cabinets and accessories by one manufacturer.

B. UL-Listed Products: Provide new portable fire extinguishers which are UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product

Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)

4. Low-Emitting Materials
5. Regional Content

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: Submit manufacturer's technical data and installation instructions for all portable fire extinguishers required. For fire extinguisher cabinets include roughing-in dimensions, and details showing mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, style and materials. Where color selections by Commissioner are required, include color charts showing full range of manufacturer's standard colors and designs available.

C. Samples: Submit samples, 6" square, of each required finish. Prepare samples on metal of same gauge as metal to be used in the work. Where normal color variations are to be expected, include 2 or more units in each sample showing the limits of such variations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following:

1. J.L. Industries.
2. Larsen's Mfg. Co.
3. Potter Roemer.
4. Or approved equal.

2.2 EXTINGUISHERS

A. General: Provide fire extinguishers for each extinguisher cabinet and other locations indicated, in colors and finishes selected by Commissioner from manufacturer's standard which comply with requirements of governing authorities.

B. Abbreviations indicated below to identify extinguisher type related to UL classification and rating system and not necessarily to type and amount of extinguishing material contained in extinguisher.

C. Multi-Purpose Dry Chemical Type: UL rated 2A-10B:C, 5 lb. nominal capacity, in enameled steel container, for Class A, Class B and Class C fires.

2.3 MOUNTING BRACKETS

A. Provide manufacturer's standard bracket designed to prevent accidental dislodgment of extinguisher, of proper size for type and capacity of extinguisher specified, in manufacturer's standard enamel finish; color to match extinguisher.

2.4 CABINETS

A. Type and Style: Fire extinguisher cabinets shall be metal, semi recessed, with plexiglass panel, sized to fit within the partition or wall depth. Provide fire rated cabinets within fire rated partitions.

B. Color: Fire extinguisher cabinets shall be factory pre-finished with baked enamel in the colors selected by the Commissioner from the standard range of colors of the selected manufacturer.

C. Design is based on "Model G-2409-5R" of Larsen's Mfg. Co. Other manufacturers noted herein may substitute their equivalent cabinet upon acceptance by the Commissioner.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Examine the areas and conditions where fire extinguishers and cabinets are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 INSTALLATION

A. Install items included in this Section in locations indicated and at heights to comply with applicable regulations of governing authorities.

1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.

2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

B. Where exact location of cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by the Commissioner.

3.4 IDENTIFICATION

A. Identify fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" painted on door by silk-screen process or die cut lettering. Provide lettering on door as selected by Commissioner from manufacturer's standard letter sizes, styles, colors and layouts.

B. Identify bracket-mounted extinguishers with red letter decals spelling 'FIRE EXTINGUISHER' applied to wall surface. Letter size, style and location as selected by the Commissioner.

3.5 SERVICE

A. Determine the approximate completion date of the work and then inspect, charge, and tag the fire extinguishers at a date not more than 10 days before or not less than one day before actual completion date of the work.

END OF SECTION

SECTION 11 31 00 APPLIANCES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the appliances as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Sustainable Design Requirements - Section 01 81 13.

B. Sinks and related plumbing fixtures - Division 22.

C. Electrical - Division 26.

1.4 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:
   1. Environmental Product Declarations (EPDs)
   2. New York City's Environmental Preferable Purchasing (EPP)
   3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
   4. Low-Emitting Materials
   5. Regional Content

1.5 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.6 SUBMITTALS

A. Submit catalog cuts, product information and technical data for each appliance.

1.7 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.8 DELIVERY AND STORAGE

A. Deliver products to project site in manufacturer's undamaged protective containers.

B. Delay delivery until spaces to receive them have been fully enclosed and utility rough-ins are complete.

PART 2 PRODUCTS

2.1 APPLIANCES

A. Refer to the drawings.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where appliances are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use.

C. Upon completion of installation and hookup to utilities, put each operating component of each appliance through at least five (5) complete operating cycles, adjusting as needed to secure optimum operation level.

D. Touch up scratches and abrasions to be completely invisible to the unaided eye from a distance of five (5) feet.

E. Promptly remove from the job site all cartons and packing material associated with the work of this Section.

END OF SECTION

SECTION 12 24 13 WINDOW SHADES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the window shades as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Manually-operated window shades.

2. Field measurements of as-built conditions.

3. Accessories and hardware required for complete installation and operation.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

1.5 QUALITY ASSURANCE

A. Provide assemblies which are complete assemblies produced by one manufacturer, including hardware, accessory items, mounting brackets, and fastenings.

B. Provide materials in colors as selected by the Commissioner from manufacturer's standard colors.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmental Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)

2. New York City's Environmental Preferable Purchasing (EPP)
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

C. Shop Drawings: Submit floor layout and elevations, indicating location of all window treatments, mechanism details, type and size of each unit, type and location of controls. Shop drawings must also show seaming of shade fabric. Submit shop drawings showing details of installation and relation to adjoining construction and conditions.

D. Samples: Submit full size sample of each shade type for Commissioner's acceptance.

E. Mock-Up

1. Install each type of shade assembly on one complete column bay for Commissioner's acceptance of installation details, workmanship and operation.

2. Approved mock-up shall be used as the standard for installation of work under this Section, and no further installation work shall proceed before Commissioner's acceptance of the mock-up.

1.9 WARRANTY

A. Manufacturer's standard non-depreciating 25-year limited warranty covering all hardware, chains, motors, motor control system and shade cloth.

1.10 DELIVERY, STORAGE AND HANDLING

A. Protect shades from damage, soiling and deterioration during transit, storage and handling to, until The City of New York's acceptance.

PART 2 PRODUCTS

2.1 MANUALLY-OPERATED SHADES

A. Provide manually operated shade system equal to “Sol-R-Control” complete with valance made by DFB Sales or approved equal conforming to standards specified herein.

B. Shade system shall be pre-engineered overrunning clutch design that disengages to 90% during the raising and lowering of the shade. The brake can stand a pull force of 40 lb. in the stop position. Requires no adjustment. Self-lubricating hub on to which the brake system is mounted includes an articulated brake assembly which ensures smooth, non-jerky operation in raising and lowering the shades. System shall include the following components:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and remounting of the shade bands without having to remove the shade tube, drive, or operating support brackets.

3. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.

4. Provide shade hardware system that allow for operation of multiple shade bands (multi-banded shades) by a single chain operator. Connectors shall be offset to ensure alignment from the first to the last shade band.

5. Provide shade hardware constructed of minimum 1/8" thick plated steel or heavier as required to support 150% of the full weight of each shade.

6. Drive Bracket / Brake Assembly:

    a. Shade Drive Bracket: Standard with manufacturer.
    b. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. minimum breaking strength: Nickel plate chain shall not be accepted.

C. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be the same, for all shades within one room.

2. Shade Band and Shade Roller Attachment:

    a. Provide extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without deflection. Provide for positive mechanical engagement with drive/brake mechanism.

b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable/replaceable with a snap-on/snap-off spline mounting without having to remove shade roller from shade brackets.
c. Mounting spline shall not require use of adhesives, adhesive tapes, staples and/or rivets.

2.2 SHADE CLOTH

A. Shade Cloth Fabric: as selected by the Commissioner.

2.3 FABRICATION

A. The shade and the fabric shall hang flat without buckling or distortion. The edge, when trimmed, shall hang straight without curling or raveling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than +/- 1/8" in either direction due to warp distortion or weave design. Shades shall fill window openings from head to sill and jamb to jamb.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where window treatments are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Coordinate with the work of other trades to ensure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the indicated design and the installation recommendations of the manufacturer as approved by the Architect.

C. Upon completion of the installation, put all components through at least ten (10) complete cycles of operation, adjusting as necessary to achieve optimum operation.

D. Manual Roller Shades

1. Install roller shades level, plumb, square, and true according to manufacturer's written instructions and located so shade band is not closer than 2" to interior face of glass. Allow proper clearances for window operation hardware.

2. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

4. Reverse roll.

3.3 PROTECTION AND CLEANING

A. Protect installed units to ensure proper operating condition, without damage or blemishes. Repair or replace damaged units as directed by the Architect.

END OF SECTION

SECTION 12 36 61 ENGINEERED QUARTZ COUNTERTOPS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.3 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the engineered quartz countertops as shown on the drawings and/or specified herein including, but not limited to, the following:

1. Quartz-based fabricated stone countertops.

2. Stainless steel anchoring and fastening devices.

1.4 RELATED SECTIONS

A. Sustainable Design Requirements – Section 018113.

B. Lavatories - Division 22.

1.5 QUALITY ASSURANCE

A. Fire Test Response Characteristics: Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E 84) or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame Spread Index: 25 or less.

2. Smoke Developed Index: 450 or less.

1.6 SUSTAINABILITY REQUIREMENTS

A. The Contractor shall implement practices and procedures to meet the Project's Sustainable Design Requirements as well as New York City's Environmentally Preferable Purchasing (EPP). The "Sustainable Design Requirements" are defined as all requirements included in 01 81 13 Sustainable Design Requirements – LEED v4 ID+C and under the "Sustainability Requirements" section within each specification. The Contractor shall ensure that the Sustainable Design Requirements are implemented to the fullest extent and all Substitutions and changes to the Project meet the Sustainable Design Requirements.

B. Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C includes requirements for the following:

1. Environmental Product Declarations (EPDs)
2. New York City's Environmental Preferable Purchasing (EPP).
3. Material Transparency Documentation, one of: Health Product Declarations (HPDs); Cradle to Cradle v3 Gold or Material Health Gold certificates; Declare labels; Product Lens certificates; or a publicly available manufacturer inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
4. Low-Emitting Materials
5. Regional Content
6. Adhesives and Sealants

1.7 LEED SUBMITTALS

A. LEED Submittals: Refer to Section 01 81 13 Sustainable Design Requirements – LEED v4 ID+C for additional LEED-related project requirements, including but not limited to performance and submittal requirements for the LEED credits that may apply to any product herein specified.

1.8 SUBMITTALS

A. Submittal Procedures: Refer to General Conditions Article 4.

B. Shop Drawings for Engineered Stone: Submit complete cutting and setting drawings to the Commissioner for approval. Show sizes, shapes, thicknesses, jointing, anchoring, connection with other work, typical and special anchoring details, supports, dimensions, setting numbers, and color range for stone. Clearly indicate dimensions for locating cutouts in stone. Do not fabricate any stone tops (except for samples) until shop drawings have been approved by the Commissioner.

C. Samples

1. Stone: Submit 3 sets of 12" x 12" samples of engineered stone. Include full range of color and texture to be expected. Commissioner will review for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

2. Anchoring and Fastening Devices: Submit 3 samples of each type of anchoring and fastening device.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect stone during storage and construction against wetting, soiling, staining and damage.

B. Handle stone to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials.

C. Store stone on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones. Protect stored stone from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around stones.

PART 2 PRODUCTS

2.1 QUARTZ STONE

A. Provide quartz agglomerate countertops and window sills by WilsonArt, Cambria, Dupont, Silestone, or approved equal; finish to be polished on all exposed surfaces.

1. Color/Pattern: See Finish Schedule.

2. Thickness: As indicated in drawings.

3. Size: Slabs shall be not less than 56.5 x 120 inches to minimize the number of joints.

B. Exposed Edges and Corners:

1. Countertops:

a. Edges: Square. Miter joint with 1/8" bevel where countertop wraps down side of cabinet.
b. Outside Corners: Square.

2. Backsplash:

a. Edges: Square, miter joint with 1/8" bevel edge profile.
b. Outside Corners: Square butt joints.

2.2 ACCESSORIES

A. Mounting Adhesives:

1. Provide structural-grade silicone or epoxy adhesives of type recommended by manufacturer for application and conditions of use.

2. Acceptable Silicone Manufactures:

a. Dow Corning.
b. GE Sealants and Adhesives.
c. Or approved equal.

3. Acceptable Epoxy Manufacturers:

a. Akemi North America.
b. Bonstone Material Corporation.
c. Tenax USA.
d. Or approved equal

4. Provide spacers, if required, of type recommended by adhesive manufacturer.

5. Color: Adhesive or sealant which will be visible in finished work shall be tinted to match quartz surfacing.

B. Fasteners: Type 304, stainless steel meeting ASTM A 666.

C. Joint Sealants

1. Provide anti-bacterial type.

2. Acceptable Manufactures:

a. Dow Corning.
b. GE Sealants and Adhesives.
c. Or approved equal.

D. Solvent: Product recommended by adhesive manufacturer to clean surface of quartz surfacing to assure adhesion of adhesives [and sealants].

E. Cleaning Agents: Non-abrasive, soft-scrub type kitchen cleansers.

F. Sealer: "S-32" by HMK, or equal.

2.3 FABRICATION

A. Fabricator: Firm shall have five years' experience fabricating stone and shall have water-cooled cutting tools.

B. Shop Assembly: Observe proper safety procedures and comply with manufacturer's instructions.

C. Layout: Layout joints to minimize joints and to avoid L-shaped pieces of quartz surfacing.

D. Inspection

1. Inspect material for defects prior to fabrication.

2. Color Match: Materials throughout Project shall be from the same batch and shall bear labels with same batch number. Visually inspect materials to be used for adjacent pieces to assure acceptable color match. Inspect in lighting conditions similar to those on Project.

3. Variation in distribution of aggregates in quartz surfacing which are within manufacturer's tolerances is not a defect.

E. Tools: Cut and polish with water-cooled power tools.

F. Cutouts

1. Cutouts shall have 3/8" minimum inside corner radius. Inside corners shall be reinforced in an acceptable manner to prevent cracking.

2. Where edges of cutout will be exposed in finished work, polish edges.

PART 3 EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 SETTING STONE COUNTERTOPS

A. Cut-outs and Drilling: Provide countertops with cut-outs for sinks, faucets, etc. Cut-outs shall be carefully made in accordance with templates furnished under the Plumbing Section. Stone shall be drilled as required to receive anchoring and fastening devices.

B. Setting: Set countertops in required pattern over cabinet work using stainless steel anchors. Counter fascias, where shown, shall be doweled to countertop. Set countertops and counter fascias level, plumb and square.

C. Stone shall be set so that adjacent sections of stone are sequence matched for veining.

D. Joints: Maintain an even joint between units, 1/16" max. Point joints with approved elastic non-staining mastic pointing compound, color to match stone. Tool joints flush. Clean exposed surfaces carefully.

3.3 REPAIR, CLEANING AND SEALING

A. Remove and replace stone units which are broken, chipped, stained or otherwise damaged. Where directed, remove and replace units which do not match adjoining stonework. Patching or hiding chips or cracks in stone will not be permitted. Provide new matching units, install as specified and reseal joints to eliminate evidence of replacement. Reseal defective and unsatisfactory joints to provide a neat, uniform appearance.

B. Clean and seal stonework after completion using cleaner and sealer specified herein and as recommended by stone manufacturer; follow manufacturer’s instructions.

3.4 PROTECTION

A. After installation and cleaning, protect stone work from damage during subsequent construction activities.

B. Provide protection for finished work such as exposed edges, corners, and all other stone liable to physical injury or staining. Protection shall include, but is not limited to, non-staining approved coverings.

END OF SECTION

SECTION 21 05 00 - GENERAL FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. The contractor shall provide all labor and materials required to install, test and place into operation the fire protection systems as called for in the Contract Documents, and according to applicable codes and regulations. The contractor shall be responsible for all work associated with the design and installation of fire protection systems for this project. This shall include, but not be limited to; code review, securing current flow test information, design and layout of fire sprinkler systems, coordination with all trades and building structure, detailed piping layouts prepared in accordance with NFPA and State and Local authorities, hydraulic calculations proving proper system sizing, pipe sizing, water distribution and required water coverage for all hazards involved with this project. Piping layouts, supports and documents and hydraulic calculations shall be signed and sealed by a Professional Engineer licensed in the State of New York and shall be submitted for review by all State and Local agencies involved and response to all review comments.
2. Provide submission of all required shop drawing submittals for review by the Commissioner, complete installation of the fire sprinkler systems, all valves, alarms, supports, appropriate sprinkler heads, all testing and system corrections, accurate as- built drawings submitted as CAD drawings to the Commissioner and all required certificates
3. Furnish and install all labor, materials, apparatus and appliances essential to the complete functioning of the systems described and/or indicated herein, or which may be reasonably implied as essential whether mentioned in the Contract Drawings and Specifications or not.
4. Sizes indicated on contract documents are minimum sizes and shall not be reduced regardless of hydraulic calculations.

B. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete: Execution requirements for inserts and sleeves specified by this section.
2. Section 09 91 00 - Painting: Execution requirements for piping painting specified by this section.
3. Section 23 05 00 - General Mechanical Requirements.
4. Divisions 22 and 23 sections as noted herein.

1.3 REFERENCE STANDARDS

A. New York City Building Code 2022 (NYCBC).

B. New York City Fire Code 2022 (NYCFC).

C. American Society of Mechanical Engineers:

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
5. ASME B16.25 - Butt Welding Ends.
6. ASME B16.3 - Malleable Iron Threaded Fittings.
7. ASME B16.4 - Gray Iron Threaded Fittings.
8. ASME B16.5 - Pipe Flanges and Flanged Fittings.
9. ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.

D. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
3. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
4. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
7. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

F. American Water Works Association:

1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

G. National Fire Protection Association:

1. NFPA 13 (2016) - Installation of Sprinkler Systems, as modified by the New York City Building Code - 2022.
2. NFPA 14 (2016) - Standard for the Installation of Standpipe, Private Hydrants and Hose Systems, as modified by the New York City Building Code – 2022.
3. NFPA 20 (2016) - Standard for the Installation of Stationary Pumps for Fire Protection, as modified by the new York City Building Code – 2022.
4. NFPA 25 (2016) - Standard for Inspection, Testing and Maintenance of Water-Based Fire Protection Systems, as modified by the New York City Building Code – 2022.

1.4 ABBREVIATIONS AND DEFINITIONS

A. Abbreviations:

1.	ABMA	American Boiler Manufacturers Association
2.	AGA	American Gas Association
3.	ANSI	American National Standards Institute
4.	ARI	Air Conditioning and Refrigeration Institute
5.	ASA	Acoustical Society of America
6.	ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
7.	ASME	American Society of Mechanical Engineers
8.	ASPE	American Society of Plumbing Engineers
9.	ASSE	American Society of Sanitary Engineers
10.	ASTM	American Society for Testing and Materials
11.	AWS	American Welding Society
12.	AWWA	American Water Works Association
13.	DCAS	Department of Citywide Administrative Services
14.	EPA	Environmental Protection Agency
15.	FM (FMS)	Factory Mutual (Factory Mutual System)
16.	FS	Federal Specifications
17.	IEEE	Institute of Electrical and Electronic Engineers
18.	NAPHCC	National Association of Plumbing, Heating, Cooling Contractors
19.	NEC	National Electrical Code
20.	NEMA	National Electrical Manufacturers Association
21.	NFPA	National Fire Protection Association
22.	NYCBC	New York City Building Code
23.	NYCMC	New York City Mechanical Code
24.	NYCFGC	New York City Fuel Gas Code
25.	OSHA	Occupational Safety and Health Administration
26.	SAE	Society of Automotive Engineers
27.	U.L.	Underwriters Laboratories

B. Definitions:

1. “Provide” means to “Furnish” and “install”.
2. “Install” means to erect, join, units, fasten, link, attach, set up, connect, test and turn over to the City of New York, complete and ready for regular operation, the particular work referred to.

3. "Furnish" means to purchase and supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application for the particular work referred to.
4. "As Directed" means as directed by the Commissioner.
5. "Concealed" means embedded in masonry or other construction, installed behind wall furring or within double partitions, installed within hung ceilings, pipe shafts and pipe spaces.
6. "Submit' means submit to Commissioner for review. Refer to Architectural, General and Special Conditions for proper procedures.

1.5 REVIEW OF CONTRACT DOCUMENTS AND SITE

A. With the submission of his Bid, Contractor shall give written notice to the Commissioner of any materials or apparatus believed in-adequate or unsuitable, in violation of laws, ordinances, rules or regulations of the City of New York, and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that the Contractor has included the cost of all required items in his Proposal for a complete project.

B. Contractor shall acknowledge that he has examined the Plans, Specifications and Site, and that from his own investigations he has satisfied himself as to the nature and location of the work; the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials; availability of labor, water, electric power, roads and uncertainties of weather; the conformation and condition of the ground; the character, quality and quantity of surface and subsurface materials to be encountered; the character of equipment and facilities needed preliminary to and during the execution of the work; all federal, state, county, township and municipal laws, ordinances and regulations particularly those relating to employment of labor, rates of wages, and construction methods; and all other matters which can in any way affect the work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with the available information concerning these conditions will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work.

C. The City of New York assumes no responsibility for any understanding or representation made during or prior to the negotiation and execution of this Contract unless such understanding or representations are expressly stated in the Contract, and the Contract expressly provides that the responsibility, therefore, is assumed by the City of New York.

1.6 MEASUREMENTS

A. Contractor shall base all his measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. He shall verify all measurements at site; and check the correctness of same as related to the work.

1.7 BID DOCUMENTS

A. The drawings show the general layout of the various items of equipment; however, layout of equipment, accessories, specialties, and piping systems are diagrammatic unless specifically dimensioned, and do not necessarily indicate every required fitting, support or similar items required for a complete installation. Consult the architectural drawings and details for exact locations of fixtures and equipment located in finished construction and/or surfaces. Where

same is not definitively located, obtain the information from the Commissioner before proceeding by submitting a dimensioned submittal for review. Any reasonable changes in locations indicated shall be made by this Contractor without additional cost to the City of New York.

B. The Contractor shall follow the drawings in laying out the work and check drawings of all trades to verify spaces in which work shall be installed. Maintain maximum headroom and where space conditions appear inadequate, the Commissioner shall be notified before proceeding with the installation.

C. In general, specifications describe quality and type of material and equipment.

D. The drawings show the various systems schematically. No added compensation shall be granted for variations due to field conditions or resulting from coordination with other trade Contractors working under other divisions of the specifications and/or design documents.

E. Work that is reasonably inferable scope of work not shown on the drawings but called for in the specifications, or vice versa, shall be provided by the Contractor without additional expense to the City of New York.

F. Where variance occurs between the drawings and specifications, or within either document itself, the Contractor shall request clarification in writing from the Commissioner as to which item and manner in the work shall be installed.

G. The commercially standard items of equipment and the specified names mentioned herein are intended to identify standards of quality and performance necessary for the proper functioning of the work.

H. Equipment shown on the drawings with particular manufactures identified has been coordinated for structural penetrations, electrical connection, operating and service (maintenance) requirements, and physical size with regard to the space where the equipment is shown. If they comply with the project specifications, these and the other specified manufacturers of this equipment shall be acceptable, contingent on the Contractor providing a complete installation and maintaining full responsibility to provide, at no additional cost, any modifications to the structure or electrical service that are required to properly install, operate and service the equipment being used. These modifications shall not include additional area for equipment unless approved by the Commissioner.

1. The Contractor shall note these changes on the equipment submittal and shall show all differences in equipment being supplied from that shown on the drawings. Failure of the Contractor to provide this information with the submittal shall indicate the submitted equipment meets or exceeds in performance the equipment shown on the drawings and is physically no larger than the equipment specified.

I. Failure of the Contractor to comply with the above and any discrepancy found shall result in the Contractor providing equipment equal to that specified at the Contractor’s expense.

1.8 SPACE LIMITATIONS

A. The equipment selections used in the preparation of the Contract Documents shall fit into the physical spaces provided and indicated, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearance in accordance with Code requirements, the requirements of DCAS and the equipment manufacturer's recommendations.

B. In the preparation of drawings, a reasonable effort to accommodate acceptable equipment manufacturer's space requirements has been made; however, since space requirements and equipment arrangement vary according to each manufacturer, the responsibility for initial access, maintenance access, Code-required access and proper fit rests with the Contractor.

C. Physical dimensions and arrangements of equipment to be installed shall be subject to the Commissioner's review.

D. Coordinate the installation of equipment, ductwork, conduit, bus duct, piping, cable, cable trays, etc., installation with lighting fixtures, special ceiling construction, air distribution equipment and the structure. Provide additional rises, drops and offsets as required. If, after installed, new ductwork, conduit, bus duct, piping or cable is found to be in conflict with the architecture, structure or other trade work which is either existing or shown on the Contract Documents, the ductwork, conduit, bus duct, piping or cable shall be relocated without additional cost to the City of New York.

E. The Contractor shall follow the drawings in laying out the work and check drawings of all trades to verify spaces in which work shall be installed. Maintain maximum headroom and, where space conditions appear inadequate, the Commissioner shall be notified before proceeding with the installation.

1.9 LABOR AND MATERIALS

A. All materials and apparatus required for the work shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces.

B. Contractor shall remove all materials delivered, or work erected, which does not comply with Contract Drawings and Specifications, and replace with proper materials, or correct such work as directed, at no additional cost to the City of New York.

1.10 COVERING OF WORK

A. No pipe, fitting or other work of any kind shall be covered up or hidden from view before it has been examined or approved by the Commissioner over same. Any unacceptable work, or unauthorized or disapproved materials discovered shall be removed and corrected immediately after being condemned.

B. Any type of equipment shown or specified to be installed outdoors, on grade or on roof, shall have appropriate protection against outdoor weather. Equipment such as motors, panels, etc. shall have rain hood or appropriate protection as provided under Division 21. Insulated pipes shall have aluminum covers or as specified. Where no protection is feasible, such as in

exposed vibration springs, hangers, pipe or steel members, such items shall be hot dipped galvanized or as approved by the Commissioner.

1.11 PROTECTION

A. Contractor shall protect the work and material of all trades from damage by his work or workmen and shall replace all damaged material with new.

B. Contractor shall be responsible for work and equipment until his work is finally inspected, tested, and accepted; he shall protect his work against theft, injury or damage; and carefully store material and equipment received on site which is not immediately installed; close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.

C. Contractor shall be responsible for the preservation of all public and private property, along and adjacent to the work, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits and other underground structures or utilities, and shall carefully protect from disturbance or damage all property marks until the Commissioner has witnessed or otherwise referenced their location, and shall not remove them until directed.

D. All mechanical and electrical equipment delivered to the site shall have appropriate wrapping to protect them from rain, flood, wind, construction debris and all types of water damage normally encountered at the construction sites. Protection of equipment such as fans, coils, valves and similar equipment shall be the responsibility of the Contractor receiving such equipment at the jobsite for installation under Division 21 Contract.

1.12 CUTTING AND PATCHING

A. Provide all cutting and patching required for systems and equipment included in these specifications. Provide all finished patching.

B. Provide all sleeves and inserts required before the floors and walls are built; Contractor shall pay the cost of cutting and patching required for pipes where sleeves and inserts were not installed in time, or where incorrectly located. Provide all drilling required for the installation of hangers.

C. All holes cut through concrete slabs or arches shall be punched or drilled from the underside. No structural members shall be cut without the written approval of the Commissioner and all such cutting shall be done in a manner directed by him.

D. Contractor shall not do any cutting that may impair strength of building construction. No holes, except for small screws, may be drilled in beams or other structural members without obtaining prior approval. All work shall be done in a neat manner by mechanics skilled in their trades and as approved.

E. Provide sleeves and firestopping at piping and ductwork floor, wall and roof penetrations in accordance with recognized standards.

1.13 SUBMITTAL PROCEDURES

A. Refer to 00 72 00 General Conditions and Division 01 – General Requirements for Submittal Procedures.

B. Procedure:

1. Prepare a schedule of specific submissions at the outset of the Project for the Commissioner's review and approval; make submissions listed below and in the other Sections of Division 21.
   a. If submissions listed in other Sections of Division 21 are more specific than those listed below, comply with the more specific requirements.
   b. Failure of the Contractor to submit Shop Drawings in ample time for checking shall not entitle him to an extension of Contract time, and no claim for extension by reason of such default will be allowed.
   c. Piecemeal submittals are unacceptable and will not be reviewed. No submittal shall be considered for review, the review of which is contingent upon acceptance of other features for which submittals have not been submitted.
   d. Submittals from Vendor without Contractor's review and approval stamp will not be reviewed.
   e. Submittals shall not be used by the Contractor as a means to secure approval of a substitution. Contractor must indicate all deviations, omissions and substitutions in his submittal; if there are none of these 3 exceptions, he shall then state on the submittal: "No Exception Taken". Any submittal without stated exceptions, or without statement that no exception is taken will not be reviewed and will be rejected and returned to Contractor for rectification.
   f. All products of a similar nature (i.e., valves, pipe, fixtures) shall be provided by one manufacturer.

C. Shop Drawings:

1. Manufacturer's Drawings:
   a. Submit equipment listed in all applicable Sections - include material specifications, operating characteristics and finishes, specified agency listings or approvals.
   b. Cuts, brochures or other literature submitted for expeditious approval but incomplete or missing items of hardware or software (performance data) shall be re-submitted until all system or equipment components have been reviewed and approved. Any item not included in the original or first submission shall be considered outstanding work until such item of equipment or work has been sub- mitted or installed in place exactly conforming to the intent of the contract documents.
   c. Contractor shall provide preliminary layout drawings of all major pieces of equipment, confirming that the submitted product physically fits within the architectural enclosures. This drawing is required along with the manufacturer's product data.
   d. Contractors shall be responsible for all costs related to substitutions as they affect other contractors.

2. Installation Drawings:
    a. Furnish coordinated drawings of equipment installation, including interconnecting piping and ductwork. Minimum scale for these drawings shall be 1/4 inch equals one foot for piping and 3/8 inch equals one foot for ductwork.
    b. Coordinate space requirements for electrical, HVAC and other trades in the vicinity of work.
    c. Include connections, anchorages and fastenings for piping, conduit and equipment.
    d. Make allowance for clearances for access to and maintenance of equipment.
    e. Do not install any piping or equipment, in any area, prior to obtaining approval of its layout by means of submitting shop drawings.
    f. Any missing items of equipment, material or labor, during initial submission of shop drawings, are to be completed and re-submitted for final approval. Shop drawing should not be used as a vehicle for obtaining variances, deviation or omission from the scope of contract documents. Approval of a submittal shall pertain to the portions that conform to the intent of the contract documents.
    g. Submission of any missing, incomplete or otherwise deviant layout is subject to re-submission until all contract requirements have been properly included or shown on the same layout.
    h. Submit drawings indicated on equipment and piping loads to the Commissioner for review.

D. Required Samples:

1. Color samples, for prefinished items.
2. Natural finish metals, for quality of finish.

E. Reports:

1. Compliance with listings and approvals for equipment and for fire ratings.
2. Acceptance certificates from inspecting agencies.
3. Complete printed and illustrated operating instructions where required in report format.
4. Manufacturer's pressure tests on vessels.
5. Manufacturer's performance tests on operating equipment.
6. Field pipe testing reports.
7. Welder's certificates and field test reports.
8. Field operating test results for operating equipment.
9. Performance report on the balancing of water systems.
10. Performance reports for vibration isolation equipment.
11. Manufacturer's reports on motorized equipment alignment and installation.
12. Additional reports as noted in other sections.

F. Specific references to any article, device, product or material, fixture or item of equipment by name, make or catalog number shall be interpreted as establishing a standard quality. All devices shall be of the make and type listed by Special Agencies, such as the Underwriters' Laboratories.

G. Contractor shall be responsible for any deviations in equipment size, motor horsepower and access requirement, from specified products, including coordination with and costs associated with the related work of other Trades.

1.14 COMPLETE PERFORMANCE OF WORK

A. Contractor, under this section of the specifications, shall provide all labor, materials, supervision, supplies, tools, scaffolding, machinery, equipment, appliances and services (including transportation, rigging, storage utilities, etc.) and all required permits and licenses necessary to complete the work under this Contract. All systems and equipment shall be complete in every respect and all items of material, equipment and labor shall be furnished, installed, tested and commissioned for a fully operational system.

B. Contractor shall coordinate his work with the work of the other trades so as to resolve conflicts without impeding job progress or the project construction schedule. Provide notice with the bid proposal of any concrete work required by this section that is not indicated on the structural or architectural drawings or drawings of other trades.

C. Contractor shall examine all Contract Documents for all sections of the specifications in order to determine the extent of work required to be completed under this section. Failure to examine all the Contract Documents for this project shall not relieve this Contractor of the responsibility to perform all the work required for a complete, fully operational and satisfactory installation.

D. Work shall be executed in strict accordance with the best practice of the trades in a thorough, workmanlike manner by competent, skilled technicians and trade personnel.

E. Contractor shall provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. All labor, materials, apparatus and appliances essential to the complete and proper functioning of the systems described and/or indicated herein, or which may be reasonably implied as essential, whether mentioned in the Contract Drawings and specifications or not, shall be furnished and installed by the Contractor. The entire installation shall be ready in every respect for the satisfactory and efficient operation when completed.

G. In cases of doubt as to the work intended, or in the event of need for explanation thereof, request supplementary written instructions in the form of a Request For Information (RFI) from the Commissioner.

H. Prior to commencing with the fabrication and/or installation, shop drawings must be prepared and approved, and the work specified herein and shown on the Contract Drawings must be coordinated with all other trades.

I. Contractor shall be responsible for material and workmanship until completion and final acceptance. Replace any of same which may be damaged, lost or stolen, without additional cost to the City of New York. Guard the building and its contents against damage by this Contractor, his employees or subcontractors, and make good any damage free of charge.

J. Where, due to union regulations or trade agreements, any of the work shown on the drawings or specified herein is not considered this trade's work, subcontract the work in question, but

assume full responsibility for the complete installation. Except for such changes as may be specifically approved by the Commissioner, in accordance with alternates or options stated hereinafter, all work must be in full accordance with the intent of the plans and specifications, complete in every way and ready for satisfactory and efficient operation when delivered to the City of New York.

K. Provide signs as required by the City of New York.

L. Provide all rigging required for complete installation and furnish drawings showing necessary points of support, reactions and supplementary bracing. This shall be submitted for approval by Commissioner. Should any shoring be required, provide same after Commissioner's approval. Rigging plan shall be provided to the Commissioner for review prior to scheduling rigging. Rigging plan must be stamped by a Professional Engineer licensed in the State of New York.

M. Become thoroughly acquainted with the work involved and obtain and verify at the building all measurements necessary for the proper installation of work. Furnish to subcontractors any information relating to work of this division necessary for the proper installation of their Contracts. Confer with subcontractors for finish adjacent to work of this division and arrange to have visible portions of the work (such as access doors, grilles, escutcheons, etc.) fit in with the finish in a manner satisfactory to the Commissioner.

N. Certain materials may be furnished, installed or furnished and installed under other sections of the specifications. Examine the Contract Documents to ascertain these requirements.

O. Carefully check space requirements with other trades to ensure that all material can be installed in the spaces allotted thereto. Finished suspended ceiling elevations are indicated on the General Construction Drawings.

P. Transmit to other trades all information required for work to be provided under their respective divisions (such as water connections, foundations, electric wiring, access doors and the like) in ample time for installation.

Q. Wherever the Contractor's work interconnects with work of subcontractors, Contractor shall coordinate his work with the subcontractors to ensure that all information is necessary so that they may properly install all the necessary connections and equipment. Identify all work items (valves, dampers, pull boxes, etc.) in an approved manner in order that the other trades may know where to install such items such as access doors, panel, etc.

R. Where disagreements occur between the plans and the specifications or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the Base Bid.

S. Provide required supports and hangers for piping, ductwork, conduit and equipment, so that loading shall not exceed allowable loadings of structure. Submittal of a bid shall be deemed a representation that the Contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

T. Set all inserts in ample time to allow the work of the other trades to be performed on scheduled time.

U. Furnish and set all sleeves for passage of pipes through structural masonry and concrete walls and floors and elsewhere as required for proper protection of each pipe passing through building surfaces. Coordinate this work with the Commissioner in order to expedite and properly perform this work.

V. Field drilling, cutting and/or reinforcing of holes in structural metal deck required for work under this division shall be coordinated and approved by the Commissioner. All such drilling, cutting and reinforcing costs shall be borne by the Contractor.

W. Should the Contractor neglect to perform preliminary work, and should cutting be required in order to install equipment, the expense of this cutting and restoring of surfaces to their original condition shall be borne by the Contractor.

X. Architectural drawings shall be checked for ceiling height requirements.

Y. Due to the type of installation, a fixed sequence of operation is required to properly install the complete systems. It shall be the responsibility of this Contractor to coordinate, protect and schedule his work with other trades in accordance with the construction sequence

1.15 COORDINATION

A. Contractor shall prepare preliminary shop drawings suitable for use in coordinating his work with the work of other trades. The HVAC Section shall prepare and furnish background with ductwork at 3/8" = 1'-0" scale for all trades to indicate piping, cable tray and conduit in relation to all structural elements of the construction, including floor elevations; steel locations, size and elevations; partitions locations; door locations and direction of swing; and all other information required to assure coordination of the electrical, sheetmetal and piping trades and fire protection in relation to the Architectural function of the project. Coordination meetings shall be held under the supervision of the Commissioner. Each trade shall have proper representation at all coordination meetings for the purpose of detailing, on the drawings mentioned above, the exact location and routing of their work. After the conclusion of the coordination at the working meetings, each trade shall sign the coordinated originals, copies of which shall be distributed by the Commissioner. Final shop drawings of all trades shall be in accordance with the coordinated drawing, after which final shop drawings shall be submitted for final approval.

B. If the contractor installs work so as to cause interference with work of other trades, he shall make necessary changes in work to correct the condition immediately without delaying project and without extra charge.

C. Dimensional layout plans of equipment rooms shall be made showing all bases, pads and inertia blocks required for mechanical equipment. Include dimensions of bases, bolt layouts, details, etc.

D. Contractor shall furnish all necessary templates, patterns, etc., for installing work and for purpose of making adjoining work conform, furnish setting plans and shop details to other trades as required.

1.16 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Instructions and Demonstration for City of New York Personnel:

1. After all equipment is functioning properly, each system is to be automatically operated for ten (10) working shifts, and not to be adjusted during this period, 80 hours in heating and 80 hours in cooling seasons, scheduled at the convenience of the Commissioner. Any adjustments will void the test and start the time period all over again.
2. The hours of operation are to include the City of New York's designated personnel in each shift, for each season.
3. During this period, instruct the City of New York's personnel in the use, operation and maintenance of all equipment of each system. Instructing will include a lecture-type instruction given in a non-machine room environment. During the lesson, normal operation of the system installed and operating will be explained, along with troubleshooting procedures. This will be followed by a field inspection and demonstration of equipment.
4. The above instruction is exclusive of that required of specified equipment manufacturers. If more stringent or longer instruction is indicated for specific equipment or systems, these shall supersede the above requirements.

B. Operating and Maintenance Data:

1. Provide four (4) complete sets of manufacturer's catalogues, instructions, maintenance and repair information and parts lists for operating equipment and devices for each building.
   a. Include performance curves for fans and pumps, factory furnished wiring diagrams and control diagrams, and applicable flow diagrams.
   b. Submit seven sets of instructions for distribution.
2. Data for the equipment installed is to be submitted.
3. The data is to be carefully checked for accuracy by comparison with the installed equipment nameplates.
4. Provide a recommended list of spare parts for equipment and list of special, non-standard tools to service equipment.
5. Index and assemble the instructions in durable loose-leaf binders.
6. The completed binders are to be available at the time the equipment installation begins.
7. In addition, follow all execution and closeout requirements in the General Conditions and Division 01 – General Requirements..

1.17 RECORD DRAWINGS

A. Provide and maintain a currently up-to-date record set of reproducible prints showing all changes, additions or omissions made during construction. Contractor shall, at his own expense, produce the Record Drawings.

B. Deliver four (4) sets of all as-built drawings and one (1) set of reproducible drawings of the record drawings to the City of New York before submitting requisition for final payment.

C. Shop Drawings shall be cross-referenced on the mylar copies for this requirement where applicable.

D. Submit AutoCAD compatible as-built drawing files.

1.18 WARRANTY

A. The following supplements the General Conditions for Mechanical Work:

1. Non-durable, expendable items such as replaceable (not cleanable) water filter media are not subject to replacement after the date of acceptance.
2. Warranty time limits for equipment exceeding those indicated in General Conditions are specified in the applicable Sections of Division 21.

B. In addition, follow all requirements of General Conditions Article 26: Closeout Requirements.

1.19 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and tag numbering.

1.20 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform Work in accordance with NYCBC.

C. Comply with current governing codes, ordinances and regulations, as well as with requirements of EPA, NFPA, U.L. and all other applicable codes.

D. Comply with the requirements of DCAS over any part of the work and secure all necessary permits.

E. Where codes or standards are listed herein, the applicable portions apply.

F. Plans, specifications, codes and standards are minimum requirements. Where requirements differ, apply the more stringent.

G. Should any change in plans or specifications be required to comply with governing regulations, notify the Commissioner.

H. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workmanlike manner by competent workmen. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

1.21 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within proximity of Project.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.22 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Product storage and handling requirements.

B. Deliver and store valves in shipping containers, with labeling in place.

C. Furnish cast iron and steel valves with temporary protective coating.

D. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.23 SITE INVENTORY

A. Refer to DCAS General Conditions.

B. Furnish spare sprinkler heads and cabinet in accordance with NFPA-13.

C. Furnish two (2) sets of valve stem packing for each size and type of valve installed.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. If products and materials are specified or indicated on the drawings for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of the Commissioner.

B. Provide products and materials that are new, clean, free of defects and free of damage and corrosion.

C. All products and materials used in this project will not contain asbestos, P.C.B.'s or any other material which is considered hazardous by the Department of Environmental Protection or DCAS.

D. Replace materials of less than specified quality as designated by the Commissioner and relocate work incorrectly installed as determined by the Commissioner.

E. Provide name/data plates on major components of equipment with manufacturer's name, model number, serial number, capacity data and electrical characteristics attached in a conspicuous place.

F. Install materials and equipment with qualified trades people.

G. Maintain uniformity of manufacture for equipment used in similar applications and sizes.

H. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards, and as approved by DACS.

I. Fully lubricate equipment when installed.

J. Do not operate water systems until piping has been cleaned and tested and all required equipment is in place.

K. Locate all floor-mounted equipment on a concrete pad.

L. Provide steel channel support system for all wall or floor-mounted panels, devices, etc.

M. Secure equipment with bolts, washers and locknuts of ample size to support equipment. Embedded anchor bolts to have bottom plate and pipe sleeves. Grout machinery set in con- crete under the entire bearing surface. After grout has set, remove wedges, shims and jack bolts and fill space with grout.

N. Locate valves, access doors, etc. to be easily accessible, either in mechanical spaces or through access panels specified herein. Obtain Commissioner's approval of access panel locations.

O. Follow manufacturers' instructions for installing, connecting and adjusting equipment. Provide one copy of such instructions to the Commissioner before installing any equipment. Provide a copy of such instructions and attach to the equipment for reference during work on the equipment.

P. Pressure vessel and relief valves shall be selected, built and labeled in accordance with ASME. Obtain a certificate from the Building Inspector showing such acceptance, and mount this certificate in a black frame under glass or laminated plastic adjacent to each pressure vessel and relief valve.

Q. Where factory testing of equipment is required to ascertain performance and attendance by the Commissioner is required to witness such tests, associated travel costs and subsistence shall be borne by the Contractor.

R. Equipment capacities, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be de-rated with the method of de-rating identified on shop drawings.

2.2 EQUIPMENT AND SYSTEMS CRITERIA

A. The criteria of design and performance to produce the required operation is based on equipment shown or scheduled, and as specified.

B. Equipment of other manufacturers will be considered, subject to its acceptability and the following:

1. The equipment must conform to the structural design provisions for loads applied to the structure; to the dimensions established by drawings for spaces and other (service, etc.) clearances; and for inlet and outlet locations and relationships to associated equipment and piping.
2. Changes to the building arrangement or structure, which are required to suit equipment offered must be by the Contractor at no extra expense to the City of New York.
3. Changes to the electrical requirements such as circuit breaker or starter size, conduit or wire size shall be coordinated by the Contractor and the expense borne by him with no additional cost to the City of New York.
4. Changes to other Contractor's scope of work shall be the responsibility of this Contractor, at no extra expense to the City of New York.

C. Operating equipment, operating systems and other products are specified by names and models and also by performance criteria standards:

1. Where both specifying media are employed, the names and models establish a standard for manufacturing quality, while the performance criteria governs the capacity, rating or output.
2. In any question regarding intent, the capacity, rating or output which is compatible with the other systems, is intended to be of prime concern and is to be provided.
3. Contractor shall follow the City of New York's Standards for Turn-Over Acceptance, Commissioning and Testing. Where there is a conflict between these requirements and Building Department's requirements, the more stringent requirements shall apply.

D. The descriptions of equipment and systems cover basic equipment and operation, but not all the details of design and construction.

1. The use of singular in descriptions does not limit the quantities to be furnished to produce the complete system, together with the results specified.
2. Furnish equipment required to provide specified performance under installed conditions.
3. Factory wiring and piping is to conform to specifications for field work, unless otherwise specified.
4. Provide trim, enclosures, transition pieces and accessories required to make complete installation in each instance.

E. All Mechanical Drawings of Division 21 are schematic and diagrammatic.

1. Symbols and diagrams are used to indicate the various items of work and the complete systems, but they do not necessarily have dimensional significance, neither do they necessarily include all related and subsidiary parts and equipment. Contractor shall provide all parts, elements, transition pieces, etc. as required for a complete and operational system.
2. The work is to be installed complete and ready for operation in conformity with the intent expressed on the Drawings and in the Specifications.
3. Coordinate work with the requirements of the Architectural and Structural drawings for dimensions, locations and clearances.
4. Locations of mechanical and electrical items which are exposed to view shall be taken from the Architectural Drawings where available or are to be located as directed by the Commissioner.
5. Contractor shall provide all transition pieces and rises/drops for piping.

6. Minimum height of piping, valves, etc. in mechanical rooms excluding drops to equipment, shall be 7’-0” unless otherwise noted.

2.3 IDENTIFICATION MARKINGS

A. Every valve, control, and apparatus installed under the Contract shall be tagged, labeled or stenciled as follows: Tags and labels securely fastened by brass chains, screws or mastic as applicable. Equipment controls numbered according to equipment schedules on Plans. Tags numbered to conform to a directory listing number, location and use. Directories to be mounted under glass in aluminum self-closing frames, 8-1/2" x 11" in size.

1. Apply identification after testing, insulation and field painting are completed.

B. Valve Identification:

1. Provide an identification tag for each valve, including control valves.
2. Differentiate between the different classes of service in the numbering systems.
3. Use 2" brass tags stamped with designation numbers 1" high, filled in with black enamel.
4. Attach tags securely to handles or spindles of valves with heavy brass "S" hooks or brass chains.
5. Provide six (6) copies of valve charts with one of each framed under glass and mounted where directed.

C. Piping Identification:

1. Provide on bare and covered pipes for all services.
2. Use a system of marking and colors conforming to ANSI A-13.1.
3. Install to provide permanent adhesion.
4. Install in readily visible location.
5. Apply legend and flow markers as required for maintenance purposes, with at least one marker in every 50'-0" of each line and at every change of direction.
6. All new and existing sprinkler and standpipe fire protection mains shall be painted in accordance with New York City Department of Buildings Local Law 58/09. All sprinkler and standpipe riser piping exposed or concealed (and exposed during construction) shall be painted red. Dedicated standpipe control valve handles shall be painted red. Combined sprinkler/standpipe control valve handles shall be painted yellow. Dedicated sprinkler valve handles shall be painted green.
    a. Sprinkler system piping downstream of the floor control assembly shall be painted in accordance with architectural direction.

D. Equipment Identification:

1. Provide stencil lettering on operating equipment and units:
    a. Use black oil base paint, except where equipment finish is dark, use white paint.
    b. Make all characters distinguishable from the floor, but not less than 2" high.

2. For each motor starter, controller and similar accessory provide a lamicore nameplate attached with screws or rivets to a fixed part of the equipment in a visible location.
    a. Make plates not less than 2" x 1" x 1/8" thick with 1/4" high characters.

3. Equipment such as tanks, access doors to equipment such as filters, neatly stenciled with letters not less than 1 inch high. Any equipment too small to receive such stenciling shall be provided with brass name tags 2" x 1" in size.
4. In areas where removable ceilings occur, install appropriate color-coded tile markers to indicate location of valves and other equipment or fittings that may require maintenance service.

E. Refer to Division 23 for additional requirements.

2.4 REVIEWS

A. The Commissioner's review is for general compliance with the design concept and contract documents. Markings or comments or the lack thereof does not relieve the Contractor from compliance with the project plans and specifications. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing his work in a safe manner and for coordinating his work with that of other trades.

B. No part of the work shall be started in the shop or in the field until the Commissioner has reviewed the shop drawings and samples for that portion of the work.

C. A minimum period of ten (10) working days, exclusive of transmittal time, will be required in the Commissioner's office each time a shop drawing, product data and/or samples are submitted for review. This time period must be considered by the Contractor when scheduling his work.

D. Submit two (2) prints of all equipment and piping drawings. Submit six (6) copies of catalog cuts.

2.5 ALTERNATIVE MATERIALS AND EQUIPMENT

A. Contract Documents are based on materials specified and on equipment manufacturers indicated on the Drawings. Approval by the Commissioner of equipment manufacturers other than indicated on the Drawings or materials other than specified, does not relieve Contractor of any responsibility to provide equipment and materials which will meet the performance as stated or implied by the Contract Documents.

B. Only the equipment manufacturers listed in individual sections are acceptable for this project, subject to requirements of contract documents.

C. Submit proposals to supply alternative materials or equipment, in writing, to the Commissioner with sufficient lead time for review by the Commissioner prior to the date equipment must be ordered to maintain project schedule. Contractor submitting alternative will reimburse the City of New York for all costs associated with the review of the proposed alternative whether alternative is accepted or rejected.

D. Include all revisions required to adapt alternatives in such proposals, including revisions by other trades. Acceptance of an alternative will only be considered if there is no increase in the contract price.

E. Wherever operating results such as quantity delivered or pressure obtained are scheduled, or when the make and size of apparatus, for which such quantities are readily determinable, is specified, the substitution being proposed must conform substantially to the quantities specified or implied. The substitution must fit into available space conditions and must function properly in coordination with the rest of the system.

F. Proposed changes and substitutions of systems, apparatus, equipment and manufacturers will be considered, subject to the approval of the Commissioner. Include the following information with the proposal.

1. A description of the difference between the existing contract requirements and that proposed, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on subcontractors and acknowledge the inclusion of implementation costs.
2. Schematic drawings and details to supplement the description.
3. A list of the contract requirements that must be revised if the change is accepted, including any suggested specification revisions.
4. Complete list of materials and equipment proposed for use in the change.
5. Include a description and estimate of costs the City of New York may incur in implementing the change, such as test, evaluation, operating and support costs.
6. A projection of any effects the proposed change would have on collateral costs to the City of New York.
7. A statement of the time by which a contract modification accepting the change must be issued, noting any effect on the contract completion time or the delivery schedule.
8. A statement indicating the reduction to the contract price if the City of New York accepts the change. Be responsible for appropriate modifications to all trades.

2.6 PROTECTION OF ELECTRICAL EQUIPMENT

A. Keep piping 2'-0" outside the vertical line of unprotected electrical equipment or provide non-corrosive metal (soldered 20 gauge copper or welded stainless steel), watertight support, pans piped to an open drain.

1. Construct and support pans to hold minimum depth of 3 inches of water.

2.7 ACCESS DOORS

A. General:

1. Provide steel, flush four-sided frame and door assembly, chemically cleaned after fabrication and painted with rust inhibitive primer.
2. Provide hardware and locking devices.
3. Provide access doors required for access to mechanical work through finished wall construction and non-removable ceiling construction.
4. Deliver doors and location information to appropriate trade for installation.

B. Provide flush type access door or panel no smaller than 18" x 18" and no larger than 30" x 30" for all dampers, valves, cleanouts, or apparatus located in chases, walls, non-accessible hung ceilings or floors; finish shall be prime coat, except floor panels which shall be polished brass or chrome plate. Doors and trim 14 gauge steel, frame 16 gauge steel, with flush concealed and

standard flush locks, screwdriver operated cams, of Milcor manufacturer, Karp Associates, Nystrom or approved equal.

1. All panels and their exact location subject to approval of the Commissioner.
2. Where space conditions prevent door swinging open, provide removable door on lift-up hinges. This will only be accepted on a case-by-case basis. This condition must be submitted to the City of New York and Commissioner for approval prior to installation.
3. Furnish a complete list locating all access doors required in finished walls, ceilings, partitions, shafts and other inaccessible locations.

2.8 PRIME PAINTING

A. All piping, supports, auxiliary steel and miscellaneous iron within all MER's shall be prime painted as specified herein.

B. All exposed uninsulated piping, fittings, equipment stands, supports, platforms, cradles, and hangers; except chrome finished materials, shall be painted. All ungalvanized surfaces shall be painted with zinc chromate, or approved equal, and all galvanized surfaces shall be prime coated with a phosphate pretreatment coating, dry film thickness of 0.35 with a 0.50 mil. one coat Glid-Guard galvanized steel primer Y5229 or approved equal.

C. Upon completion of the prime coat of all mechanical equipment specified above, all insulated and exposed piping shall be painted with finish coating, as specified under Division 09 90 00 and/or other Sections. This Section shall complete stenciling and color identification, specified under Division 22, following the finish painting.

D. Except where otherwise specified, steel piping in concrete and buried steel piping and steel tanks:

1. Provide heavy coat of bituminous solution primer.
2. In accordance with NFPA and other applicable codes.

E. Provide factory finishes, except as noted, to match the Commissioner’s color samples, for items appearing in exposed finished work, and including:

1. Equipment
2. Enclosures on equipment

F. All damaged factory painted surfaces shall be repaired to match original surface. If, in opinion of the Commissioner, such repairs are unsatisfactory, item in question shall be completely refinished or replaced with new.

2.9 WELDING

A. General:

1. All welding procedures, welders, and welding operators shall be qualified in accordance with the requirements of ASME/ANSI B31.9 and Section IX of the ASME Code, latest editions.

2. Welding procedures shall be reported on ASME Section IX Forms "QW," or its equivalent. Joint preparation sketches (to be included with the welding procedures) shall show all dimensions including tolerances, for bevel angle, land size, offset and root gap.
3. Contractor shall be responsible for the welding performed by personnel of his organization and shall conduct the required qualification tests and submit results to the Commissioner for his review and approval.
4. All welding procedures shall meet requirements of New York Fire Department Certified Requirements. The filing of MSDS form shall be held in the field office.
5. A copy of the welders and fire watch certificate shall be held in the field office of the sight.

B. Processes:

1. Employ the Manual Shielded Metal-Arc (SMAW) welding process.
2. Double butt welding shall be permitted on all joints accessible from both sides. Where double butt-welding is employed, the first root pass shall be back-chipped.
3. Welding of pressure parts shall be performed with low hydrogen type electrodes. Electrodes of Classifications E6012, E6013, E7014 and E7024 shall not be used.
4. Brazing and Soldering:
   a. The Contractor shall prepare applicable "Brazing and Soldering Procedures" forms for approval of the City of New York.
   b. Brazing shall conform to ASME Section IX.
   c. Soldering shall conform to the relevant procedures in the manuals of the Copper Development Association.
   d. The City of New York may reject any brazed or soldered joint for lack of penetration or for other applicable grounds. These defective joints shall be redone until satisfactory.

C. Quality of Workmanship - In addition to conformance with the procedural and quality requirements set forth in the applicable Code or material specification, all welding shall meet the following requirements.

1. Butt welds shall have full penetrations and shall be slightly convex with uniform height.
2. Each weld shall be uniform in width and size throughout its full length.
3. Each layer of welding shall be smooth, free of slag, cracks, pinholes, undercut in excess of 1/32" and completely fused to adjacent weld beads and base metal.
4. Cover passes shall be free of coarse ripples, irregular surface, non-uniform bead patterns, high crown, and deep ridges or valleys between heads. The surface smooth- ness of the finished weld shall be suitable for the proper interpretation of non-destructive examination of the weld.
5. Surfaces of parts to be joined by welding shall be cleaned of all oil, grease, paint, scale and rust with solvent and/or wire brushing.
6. Fillet weld size shall be in accordance with the applicable code or as specified on the drawings with full throat and legs of equal length.
7. Welding filler metal and welding flux shall be properly stored in such a manner as to ensure that no damage to the coating or corrosion of weld rod will occur. Low hydrogen type electrodes shall be stored in enclosures which provide a regulated temperature as prescribed by the electrode manufacturer. All electrodes shall be properly identified.

8. Socket welds shall have a gap of approximately 1/16" between the bottom of the socket and the end of the pipe prior to welding. Socket welds shall have a minimum of two weld layers.

D. Repair and Weld Defects:

1. A weld is defective and shall be repaired if it does not meet the acceptance standard of each applicable non-destructive examination as defined ASME/ANSI B31.9, latest edition.
2. Repairs shall be made in accordance with ASME/ANSI B31.9, latest edition.

E. Welding Identification and Weld Marking:

1. All welds must be identified with the welder's identifying symbol. Welds, where more than one welder performs the work, shall be stamped by each welder.
2. Marking shall be done by a permanent method that will not result in sharp discontinuities.
3. Where stamping or marking on the base materials is not practical or feasible, permanently affixed metal bands of the same material may be applied. Stamping or any method of permanent marking on the bands is acceptable.

2.10 CLEANING AND ADJUSTING

A. Notification:

1. Inform the City of New York and Commissioner of all cleaning, blowing out and fill-up schedules one week prior to starting.
2. Notify the City of New York and Commissioner again, 48-hours prior to each event. If neither attends the procedures, notify in writing, the specific task performed 24-hours after each event.
3. Leaks appearing during the various pressure tests shall be corrected by replacing all defective materials or welds and subsequent tests shall not be made until the piping is found in perfect condition. Caulking of screwed joints or peaning of welds is prohibited. Wherever it is necessary to cut out a weld and the ends of the pipe cannot be conveniently brought together, then a short piece shall be fitted in and welded.
4. Damage to the building and equipment resulting from tests shall be repaired at no additional cost to the City of New York.
5. Tests claimed to have been performed without following above procedures shall be deemed as not performed.

B. Cleaning:

1. Blow out, clean and flush each piping system and equipment, to clean thoroughly. MSDS forms for cleaning agent and procedure shall be presented to the field office. After cleaning, the systems shall be tested by an independent organization, approved by the Commissioner prior to testing.
2. Clean all materials and equipment; leave in condition ready to operate and ready to receive succeeding finishes where required.
3. Clean the operating equipment and systems to be dust free inside and out.
4. Clean concealed and unoccupied areas such as plenums and pipe spaces and equipment rooms to be free of rubbish and dust.

5. After completion of all pressure tests, properly clean every piece of apparatus furnished and remove caps and other provisions made for testing purposes only.
6. Cutting oil, excess pipe joint compound, finely divided solids and other similar foreign material shall be removed from all circulating water systems before they go into operation. Before chemical cleaning of water systems flush with clean water. Each system shall be cleaned chemically with circulating solution. Fill, vent and circulate the system with this solution at maximum operating temperature for required duration. During cleaning procedure, circulation shall be stopped periodically followed by blow off at all low points. Immediately following chemical cleaning, system to be drained and then refilled with clean water to which treatment shall then be added. After systems have been drained, flushed and refilled, a chemical test shall be made to determine that the cleaning solution remaining in the system does not impart alkalinity to the water in excess of 300 ppm.
7. After the water piping system has been properly cleaned as indicated above, each water system shall be operated for a minimum of 3 days with 1/2" surgical felt, bonded to baskets on each pump strainer. Felt filters shall be run for as long a time as necessary to thoroughly clean all piping until approved by the Commissioner. During the cleaning period, heat exchangers and coil valves shall be kept closed for the entire cleaning period. Provide one (1) inch manual bypass at equipment to permit flushing of branch piping. For flushing and blow-off for main risers, provide drain valves at the bottom in the horizontal runout to the riser. Also provide an additional valve in the cyclo-clean separator piping for pumps with mechanical seals so that separator discharge water may be wasted during the cleaning procedure.
8. All pipe strainers shall be removed and cleaned upon completion of blowdown period.
9. After this period of operation, all systems shall be drained and refilled with fresh water as specified.
10. All equipment installed shall be thoroughly cleaned in preparation of the finished painting.
11. All dowels shall be aligned after system is running.

C. Adjusting:

1. Adjust and align equipment interconnected with couplings or belts. After one week of continuous operation, the technician will return to check and realign all shafts, bearings, seals, couplings and belt drives as needed. Provide report indicating completion of this work.
2. Adjust valves of all types and calibrate equipment of all types to provide proper operation.
3. Clean all strainers after system cleaning and flushing and again before final system startup.
4. Motors, fans, pumps, compressors, etc. shall be properly oiled and left ready for operation.
5. Verify that each and every fixture is in proper operating condition. All fixtures shall be cleaned, adjusted and inspected.
6. Submission of certified tests shall, in no way, relieve the Contractor of fulfillment of guarantee.
7. Gauges, instruments, thermometers and meters shall be checked and tested to specified accuracy.
8. Alarms shall be tested to fulfill satisfactory operating conditions.
9. Allow sufficient time to perform all tests, adjustments, etc., necessary to place the various systems in final operating condition, verify performance requirements and check all safety devices. Labor, instruments, etc., required for various tests shall be furnished by

Contractor. The Contractor shall see that all his subcontractors, manufacturer's representatives or Field Engineers necessary to check and adjust various systems are present, with sufficient forms, and that all test results are recorded properly and turned over to City of New York for approval.

10. The Commissioner will make final check for all systems only after Contractor has completed and returned to the City of New York all recorded test data together with letter that his work is 100% complete. Additional tests may be required to meet the requirements of the City of New York's documents for demonstration of various systems, whether or not specified, to verify performance, workmanship or for adjustments.
11. Unless otherwise specified, equipment shall be installed and adjusted in accordance with manufacturer's recommendations to function properly with capacities required or specified.

D. Running Test of Piping Systems:

1. Any section of the work, after it has been completed and otherwise satisfactorily tested, shall be put in actual operation by Contractor and operated by him for a period of 2 days of 24 hours each, during which time any defects which may appear shall be remedied and any necessary adjustments shall be made. Test shall be performed in the presence of the Commissioner and serve as part of the Instructions Program.
2. During the time of the tests, repack all valves, make all adjustments and otherwise put the apparatus in perfect condition for operation, and shall instruct the Commissioner in the use of management of the apparatus. All joints shall be made absolutely tight under tests. Caulking of pipe joints or makeshift methods of repairing leaks shall not be allowed. Piping which is not tight under tests shall be taken down and reassembled.
3. All gauges, thermometers, alarms, instruments, etc. shall be tested to demonstrate that they are functioning properly and within the range of these devices, and to show their degree of accuracy.
4. If during the first test run, the system cannot be completely vented within 24 hours, install additional air vents at high points of system to facilitate quick venting of all water systems.

E. Permanent Equipment Operating During Construction:

1. Use only in same service as the permanent applications, provided that written approval is granted by the Commissioner.
2. Use disposable filters during temporary operation.
3. Expendable media, including belts used for temporary operation and similar materials are to be replaced just prior to acceptance.
4. Packings in equipment operated during construction must be repacked just prior to system acceptance, using materials and methods specified by the supplying manufacturer.

F. Retouch or repaint equipment furnished with factory finish as required to provide same appearance as new.

G. Tools:

1. Provide one set of specialized or non-standard maintenance tools and devices required for servicing the installed equipment.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 GENERAL

A. Temporary Protection:

1. Provide and maintain protection for the work whether completed or in progress.
2. Provide suitable coverings and enclosures.

B. Scaffolding, Rigging and Hoisting:

1. Provide all scaffolding, rigging and hoisting services necessary for erection, and/or delivery into the premises, of any equipment and apparatus furnished. Remove from the premises when no longer required.

C. Waterproofing:

1. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Commissioner before work is done. This Contractor shall provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

3.3 COORDINATION OF WORK

A. The fire protection drawings show the general arrangement of equipment, piping and appurtenances. Follow these drawings as closely as the actual construction and as the work of other trades will permit. Provide offsets, fittings and accessories that may be required but not shown on the drawings. Investigate the site, structural and finish ground conditions affecting the work, and arrange the work accordingly. Provide such work and accessories as may be required to meet such conditions.

B. Carefully check space requirements with other trades to ensure that material can be installed in the spaces allotted thereto including finished suspended ceilings.

C. Wherever work interconnects with work of other trades, coordinate with other trades, ensure that they have the information to properly install the necessary connections and equipment. Identify items (valves, etc.) requiring access in order that the Ceiling Trade will know where to install access doors and panels.

D. Consult with other trades regarding equipment so that, wherever possible, motors, motor controls, pumps and valves are of the same manufacture.

E. Furnish and set sleeves for passage of pipes through structural masonry and concrete walls and floors and elsewhere as will be required for the proper protection of each pipe passing through building surfaces.

F. Properly provide firestopping around all pipes, sleeves, etc., which pass through rated walls, partitions and floors. Refer to Section 21 05 05 for requirements.

G. Provide detailed information on openings and holes required in precast members for fire protection work. Cast holes 4 inches and larger in diameter. Field-cut holes smaller than 4 inches. Obtain structural engineer's approval before cutting any openings or holes.

H. Provide required supports and hangers for piping and equipment, designed so as not to exceed allowable loading of structures.

I. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades, and report any discrepancies between them to the Commissioner and obtain from him written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.

J. Wherever the work is of sufficient complexity, prepare additional detail drawings, to scale similar to that of the design drawings, prepared on tracing medium of the same size as contract drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the drawings as to the area to which it applies. Submit these drawings to the Commissioner for review. At completion include a set of such drawings with each set of as-built drawings.

K. Before commencing work, examine adjoining work on which this work is in any way dependent for perfect workmanship and report conditions which prevent performance of first-class work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

L. Adjust location of pipes, panels, equipment, etc., to accommodate the work and to prevent interferences, both anticipated and encountered. Determine the exact route and location of each pipe prior to fabrication.

1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. For example: condensate, steam and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way lines whose elevations can be changed.
2. Make offsets, transitions and changes in direction in pipes, as required to maintain proper head room and pitch on sloping lines. Furnish and install traps, air vents, drains, etc., as required to effect these offsets, transitions and changes in direction.

M. Install fire protection work to permit removal (without damage to other parts) of coils, heat exchanger plates and tube bundles, filters, belt guards, sheaves and drives, and other parts requiring periodic replacement or maintenance. Arrange pipes and equipment to permit access to valves, cocks, traps, starters, motors and control components, and to clear the openings of swinging doors and access panels.

N. Provide access panels in equipment, etc., as required for inspection and maintenance of internal equipment.

O. In case of doubt as to the work intended, or in the event of need for explanation thereof, request supplementary instructions from the Commissioner.

P. Immediately upon the award of this Contract, but prior to commencing any work, confer together with designated major subcontractors, and with the Commissioner concerning the work under this Contract.

3.4 CUTTING AND PATCHING

A. Lay out the work carefully in advance. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of piping or other equipment, do the work carefully. Repair any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc., using skilled mechanics of the trades involved at no additional cost to the City of New York.

B. Do no cutting, channeling, chasing or drilling of unfinished masonry, tile, etc., unless permission from the Commissioner is first obtained. If permission is granted, perform this work in a manner approved by the Commissioner.

C. Where piping or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.

D. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required to install piping. Be responsible to properly locate such openings and for any cutting and patching caused by the neglect to do so.

3.5 RESPONSIBILITY FOR EVALUATION

A. The Commissioner makes no representations, regarding the character or extent of the sub- soils, water levels, existing structural, plumbing, fire protection, mechanical and electrical installations, above or below ground, or other subsurface conditions which may be encountered during the work. The Contractor must make his own evaluation of existing conditions which may affect methods or cost of performing the work, based on his own examination of the facility or other information. Failure to examine the drawings or other information does not relieve the Contractor of his responsibility for satisfactory accomplishment of the work.

3.6 ACCESS TO FIRE APPARATUS

A. Do not interfere with access to hydrants and fire alarm boxes. In no case allow material or equipment to be within 20’ of a hydrant or fire alarm box.

3.7 EQUIPMENT PAD AND ANCHOR BOLTS

A. Provide concrete pads for all pieces of equipment and all piping restraint systems.

B. Where control panels, motor controllers, etc., are mounted on gypsum board partitions, provide steel channel support system and the mounting screws will pass through the gypsum board and

be securely attached to the partition studs. Toggle bolts installed in gypsum board partitions will not be acceptable.

3.8 DELIVERY AND HAULING

A. Include all hauling, hoisting, shoring and placement in the building of equipment specified herein. Be responsible for the timely delivery and introduction of equipment to the project as required by the construction schedule for this project. If any item of equipment is received prior to the time it is required, be responsible for its proper storage and protection until such time as it may be required. Pay for all costs of demurrage or storage.

B. If any item of equipment is not delivered to or installed at the project site in a timely manner as required by the project construction schedule, be solely responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. No additional cost or delays to be incurred by the City of New York.

3.9 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment and material of all other trades from damage by work or workmen of this trade, and correct all damage thus caused without additional cost to the City of New York.

B. Be responsible for all work, materials and equipment until finally inspected, tested and accepted; protect work against theft, injury or damage; and carefully store material and equipment received on site which are not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect in an acceptable manner to the City of New York, all equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc. Coordinate all new work with existing systems to maintain all required systems in operation. Ensure proper transitions of existing to new systems with minimum downtime and schedule with City of New York.

C. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts kept clean and dry. If items are damaged, do not install, but take immediate steps to obtain replacement or repair.

3.10 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

A. In general, do not install piping not included as part of the electrical work, in any switchgear, transformer, elevator equipment, telephone, or electrical equipment room unless shown on drawings.

B. Do not install piping above switchboards, panel boards, control panels, motor control centers, individual motor controllers, etc.

C. Provide drip pans under all piping installed in any electrical equipment room. Pan shall be water tight copper, extending 4" in each direction from the pipe wall and turned up at least one- half the diameter of the pipe but not less than 2". The pan shall extend at least 1 foot beyond the electrical equipment. Provide a drip pipe to spill into floor drain or service sink.

3.11 LUBRICATION

A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a metallic lubrication tube with suitable fitting to an accessible location and suitably identify it.

B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer until the City of New York issues a Certificate of Substantial Completion for the specific equipment item or system.

3.12 DATE OF COMPLETION AND TESTING OF FIRE PROTECTION SYSTEMS

A. Comply with the project construction schedule for the date of final performance and acceptance testing, and be sufficiently in advance of the Contract completion date to permit the execution of the testing prior to occupancy and the closeout of the Contract. Complete any adjustments and/or alterations that the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. See individual sections for extent of testing required.

B. Provide a detailed schedule of completion indicating when each system is to be completed and outlining when tests will be performed. Submit completion schedule to the Commissioner and the City of New York for review within six (6) months after the notice to proceed by the Commissioner has been given. Update this schedule periodically as the project progresses.

C. Provide all temporary piping and associated equipment, devices, testing, etc. as required to allow for a phased occupancy of the building.

3.13 OPERATING INSTRUCTIONS

A. Provide the services of a factory-instructed specialist to supervise the operation of all equipment specified herein and to instruct the City of New York's operators for the time specified herein. The operating instruction period is defined as straight time working hours and not including nights, weekends or travel time to and from the project.

B. Notify the City of New York in writing at least two (2) weeks before each operating instruction period begins. Commence no instruction period until the City of New York has issued his written acceptance of the starting time.

C. Operating Instruction Period

1. Standpipe/Sprinkler system: Reserve time as required to complete instructing personnel properly.

3.14 RECORD DRAWINGS

A. Maintain on a daily basis at the project site a complete black and white set of "As-Built Drawings", reflecting an accurate dimensional record of all deviations between work shown on drawings and that actually installed.

B. Record dimensions clearly and accurately to delineate the work as installed; suitably identify locations of all equipment by at least two dimensions to permanent structures. In addition, mark the Record Drawings to show the precise location of concealed work and equipment, including concealed or embedded piping and valves and all changes and deviations in the mechanical work from that shown on the Contract Documents. This requirement is not construed as authorization for the Contractor to make changes in the layout or work without written instructions from the Commissioner.

C. Upon completion of the installation, prepare "As-Built" drawings of the project in a compatible AutoCAD drawing file format, with the Commissioner's seal and firm name removed. Submit three (3) sets of black and white prints of these drawings to the Commissioner for review of completeness. After review by the Commissioner, make necessary changes to the drawing files and then deliver them, along with three (3) sets of black and white prints to the Commissioner for transmittal to the City of New York. The Commissioner will not review these drawings for accuracy nor will the Commissioner bear any responsibility for accuracy or completeness.

D. Mark all "As-Built Drawings" on the front lower right-hand corner with a rubber stamp impression that states the following:

1. "As-Built Drawings" "To be used for recording - (3/8" high letters)
2. Field Deviations and Dimensional Data Only" - (5/16" high letters)

E. The Record Drawings will also consist of a set of prints of the final "Signed Off" Contractor's "Coordination Drawings" prepared by the Subcontractors.

3.15 CERTIFICATION

A. Any certifications required by the Specifications, in addition to those required for shop drawings, product data, equipment and other items, are to be so certified by the City of New York, a Partner, or a Corporate Officer of the firm required to provide the Certification, or by another person duly authorized to sign binding agreements for and in behalf of the City of New York, Partner or Corporation.

3.16 FINAL REVIEW

A. At a time designated by the City of New York, the entire system will be reviewed for compliance with the Contract Drawings and Specifications. Be available at all times during this review.

B. Demonstrate to the Commissioner prior to the Final Review that all systems and all equipment have been properly balanced and adjusted and are in compliance with the requirements of the Contract Documents. After these demonstration tests are satisfactorily completed, but prior to the Final Review field visit, the Contractor will submit to the Commissioner a written certification that: 1) attests to the Contract document compliance for this Project, prior to the Commissioner's Final Review field visit, and 2) certifies that the equipment and materials installed in this project under this Division contain no asbestos or P.C.B.

C. Operate the entire system properly with all systems balanced and all controls adjusted.

D. Certificates and Documents required herein to be in order and presented to the Commissioner at least two (2) weeks prior to the Final Review.

E. After the review, any changes or corrections noted as necessary for the work to comply with these specifications and the Drawings to be accomplished without delay in order to secure final acceptance of the work.

3.17 PROTECTION

A. Contractor shall protect the work and material of all trades from damage by his work or workmen, and shall replace all damaged material with new material. The plan shall outline corrective action to repair and/or replace the object(s) including all materials to be utilized. Implementation of corrective plan shall be subject to final approval from the Commissioner.

B. The Building systems are to remain active during the project as the construction will be phased. Refer to Scope of Work document prepared by the Commissioner.

C. Contractor shall be responsible for protecting and maintaining the systems for the duration of the project. Contractor shall note that the building shall remain in operation throughout the duration of construction.

D. Contractor shall be responsible for work and equipment until his work is finally inspected, tested and accepted; he shall protect his work against theft, injury or damage; and carefully store material and equipment received on site which is not immediately installed; close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.

E. Contractor shall be responsible for the preservation of all public and private property, along and adjacent to the work, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits and other underground structures or utilities, and shall carefully protect from disturbance or damage all property marks until the Commissioner has witnessed or otherwise referenced their location, and shall not remove them until directed.

F. Where pipe, ductwork, insulation or equipment to remain is inadvertently damaged or disturbed, cut out and remove damaged section and provide new pipe, ductwork, insulation or equipment of equal capacity and quality.

G. Where conduit and wiring to remain are inadvertently damaged or disturbed, cut out and remove damaged portion and all damaged wiring from the source switchboard, panelboard or pullbox to the destination connection point. Provide new wiring of equal capacity.

H. Vibration: Contractor shall reduce the construction dust not to adversely affect operation of the building. Contractor shall keep vibration to a minimum and not have adverse effect to the operation of the building.

I. Dust Control: Provide adequate filters and dust collectors as required for building operation. Provide duct end caps for all open-ended ducts.

3.18 EXISTING CONDITIONS

A. The existing building will remain occupied and operational throughout the duration of the renovation. Contractors shall protect existing systems that are to remain operational and shall

take all precautions to minimize dust, debris, vibration and noise in order to limit any impact on the existing facility.

3.19 DEMOLITION WORK RELATED TO EXISTING WORK

A. Contractor shall disconnect and remove all abandoned, unused or discarded equipment (piping, conduits, wires, ductwork, tubing, supports, etc.) from the areas of work as indicated on Drawings.

B. Provide Fire Watch for all periods when existing fire suppression system is taken off-line.

C. Provide firestopping at all conduit/pipe penetrations at rated construction, where ducts, piping/conduit, etc. have been removed.

D. Whenever existing equipment is disconnected from its services, remove all pipe, conduit or duct branches or runnouts to the point of connection to the existing pipe riser or electrical panel or duct shaft as the case may be. Cap off pipes or ducts near the risers, valved outlets or at mains. Remove all ductwork as indicated on plans and provide sheet metal cap (minimum 24 gage) at all connections to existing ductwork that is to remain. Provide temporary ducts with dampers and valved pipes as required to keep system in operation and occupancy of building.

E. Remove all piping as indicated on plans and provide capped outlets at the point of connection to the existing risers or as indicated on plans. For steel piping to be removed, provide Steel Schedule 40 welded cap.

F. All welding and soldering shall conform to the following:

1. General:
   a. All welding procedures, welders, and welding operators shall be qualified in accordance with the requirements of ASME/ANSI B31.9 and Section IX of the ASME Code, latest editions.
   b. Welding procedures shall be reported on ASME Section IX Forms "QW," or its equivalent. Joint preparation sketches (to be included with the welding procedures) shall show all dimensions including tolerances, for bevel angle, land size, offset and root gap.
   c. Contractor shall be responsible for the welding performed by personnel of his organization and shall conduct the required qualification tests and submit results to the Commissioner for his review and approval.

2. Processes:
   a. Employ the Manual Shielded Metal-Arc (SMAW) welding process.
   b. Use backing rings for welds above 6" diameter pipe.
   c. Double butt welding shall be permitted on all joints accessible from both sides. Where double butt-welding is employed, the first root pass shall be back-chipped.
   d. Welding of pressure parts shall be performed with low hydrogen type electrodes. Electrodes of Classifications E6012, E6013, E7014 and E7024 shall not be used.
   e. Provide ventilation and exhaust.

3. Brazing and Soldering:

a. Contractor shall prepare applicable "Brazing and Soldering Procedures" forms for approval of the City of New York.
b. Brazing shall conform to ASME Section IX.
c. Soldering shall conform to the relevant procedures in the manuals of the Copper Development Association.
d. The City of New York may reject any brazed or soldered joint for lack of penetration or for other applicable grounds. These defective joints shall be redone until satisfactory.

4. Quality of Workmanship - In addition to conformance with the procedural and quality requirements set forth in the applicable Code or material specification, all welding shall meet the following requirements.
   a. Butt welds shall have full penetrations and shall be slightly convex with uniform height.
   b. Each weld shall be uniform in width and size throughout its full length.
   c. Each layer of welding shall be smooth, free of slag, cracks, pinholes, undercut in excess of 1/32" and completely fused to adjacent weld beads and base metal.
   d. Cover passes shall be free of coarse ripples, irregular surface, non-uniform bead patterns, high crown, and deep ridges or valleys between heads. The surface smoothness of the finished weld shall be suitable for the proper interpretation of non-destructive examination of the weld.
   e. Surfaces of parts to be joined by welding shall be cleaned of all oil, grease, paint, scale and rust with solvent and/or wire brushing.
   f. Fillet weld size shall be in accordance with the applicable code or as specified on the drawings with full throat and legs of equal length.
   g. Welding filler metal and welding flux shall be properly stored in such a manner as to ensure that no damage to the coating or corrosion of weld rod will occur. Low hydrogen type electrodes shall be stored in enclosures which provide a regulated temperature as prescribed by the electrode manufacturer. All electrodes shall be properly identified.
   h. Socket welds shall have a gap of approximately 1/16" between the bottom of the socket and the end of the pipe prior to welding. Socket welds shall have a minimum of two weld layers.

5. Repair and Weld Defects:
   a. A weld is defective and shall be repaired if it does not meet the acceptance standard of each applicable non-destructive examination as defined ASME/ANSI B31.9, latest edition.
   b. Repairs shall be made in accordance with ASME/ANSI B31.9, latest edition.

G. Cutting shall be done carefully in order not to disturb systems or services in areas where demolition is not required.

H. Fully charged fire extinguisher and/or active hoses are to be on sight for fire watch during all burning conditions that require Oxygen/Accel gas for cutting or welding, soldering and the creation of dust, that may activate the fire alarm system, requires that the system be put on bypass for the affected zones. Coordinate shutdown with City of New York.

I. Equipment specified or indicated to be demolished shall be removed from the project site. All ballasts shall be tested for PCBs and mercury before removal. Test results shall be submitted to the City of New York, and ballasts shall be disposed of properly.

J. Provide additional support for all existing conditions, cabling and devices to remain which are affected by demolition of existing ceilings and partitions.

K. Protect existing systems, pipes, conduits and communications wiring to remain with flame retardant plywood.

L. Drawings are general in nature and do not indicate full extent of removal required, including all hangers, supports, ancillary devices, etc.

3.20 MODIFICATIONS TO EXISTING WORK

A. Contractor shall perform all work as shown or as specified, within the existing site and structures as part of this Contract without detriment to the existing systems or equipment to be kept in operation or maintained in their places.

B. For full extent of modifications to be done to existing systems, Contractor shall inspect existing systems and site conditions to familiarize himself with the complexity of his work related to removals and relocations required, and the existing finishes to be preserved without any damage resulting from possible careless installation procedures. Upon written request by the bidders, the City of New York shall make the existing schematic plans available for inspection without any responsibility for their completeness or accuracy.

C. As-Built drawings are not available on the existing installations. Any drawings that may be available to the Contractor are for information only. All field criteria must be field verified by Contractor.

D. All cutting shall be done only by mechanics skilled in the particular trade which is affected. No cutting shall be done without proper protections against damage, dirt and dust resulting therefrom or without proper safeguards to workmen, the public, and occupants of buildings.

E. Before cutting is started in any location, Contractor shall carefully investigate conditions influencing human and structural safety. Existing piping, wiring and items concealed in walls and slabs, wherever these walls and slabs are removed, shall be properly relocated, rerouted or removed as the case may require.

F. General Construction trades shall perform all finish masonry, repairing, restoring and finishing of all cut openings, closing up of existing openings, and removing and restoring the affected sections of the suspended ceilings.

G. If, during partial occupancy of the building, circumstances necessitate temporary shutdown of any facilities or otherwise interfere with access to building, the City of New York shall be given a minimum of 48 hours' notice before doing such work.

H. Provide Fire Watch for all periods when existing fire suppression system is taken off-line.

I. In all areas where interface, relocation or alternation work is to be done, Contractor shall disconnect and remove from the premises all existing ductwork, piping, etc., that will not be required to remain in service after the alterations are completed. All such equipment (except as requested as salvage by the City of New York) shall become the property of the Contractor, and he shall remove same from the premises immediately upon disconnection. Existing ductwork, piping, etc., being removed shall not be reused.

J. Contractor shall move or relocate any existing mechanical equipment, piping, ductwork, etc., which may temporarily interfere with the construction, (to a temporary location) if the existing equipment is to be kept in operation during construction. He shall also install temporary piping, ductwork or equipment that might be required (during demolition or excavation and during the construction of tunnels, retaining walls, footings or columns) for offsetting all piping around the construction area in order to maintain services to the existing systems. Provide temporary piers, supports and hangers as required for excavation.

K. Provide all cuts and openings through structural slabs and walls. Contractor shall coordinate his work with concrete contractor and provide necessary dimensions for all openings.

L. Upon completion, remove all temporary piping and equipment, shoring, scaffolds, etc., and leave all areas clean and free from material and debris resulting from work performed under this Section. Provide rough patching in areas shown.

M. Test all piping to be retained or shown to be re-used together with the new extensions connected to them. Install isolation valves as required.

3.21 CODES, RULES, PERMITS & FEES

A. The Contractor shall give all necessary notices, obtain all permits and filings including, but not limited to NYCMC, NYCBC, NYCFGC and pay all government sales taxes, fees, and other costs, in connection with his work. However, all utility connections, extensions, and tap fees for water, storm, sewer, gas, telephone, and electricity shall be paid directly to utility companies and/or agencies by the City of New York, unless otherwise indicated. The Contractor shall file all necessary plans, prepare all documents and obtain all necessary approvals of the City of New York; obtain all required certificates of inspection for his work and deliver same to the Commissioner before request for acceptance and final payment for the work.

B. The complete design and construction shall conform to the requirements of the NYCMC, NYCBC, NFPA, NEC, FM, UL and any other local or state code which may govern.

C. Provide all New York City and New York State permits as required.

3.22 ADDITIONAL REQUIREMENTS

A. Oxygen/Accel tanks that are not in use are to be chained to carry truck. Tanks are to be securely chained to columns. Storage of tanks inside/outside of building shall follow FDNY requirements.

B. All gas hoses are to be in good condition. Hoses with multiple repairs are not to be used and will be confiscated.

C. Gas regulators will be checked for leakage.

D. Electric welding lines are to be in good condition or job will be stopped.

E. Fully charged fire extinguisher and/or active hoses are to be on sight for fire watch during all burnings.

3.23 PHASING

A. The work provided under this project will take place in an occupied building. All existing utilities and services including, but not limited to, HVAC, Electrical, Plumbing, Fire Protection, Data and Security Services, must remain active throughout the duration of construction. Coordinate all work with the Commissioner, including phasing of removals and installation of new systems.

3.24 GUARANTEE

A. Submit a single guarantee stating that all portions of the work are in accordance with Contract requirements. Guarantee all work against faulty and improper material and workmanship for a period of five (5) years from date of final acceptance by the City of New York, except that where guarantees or warranties for longer terms are specified herein, such longer term shall apply. At no additional cost to the City of New York, within 72 hours after notification, correct any deficiencies which occur during the guarantee period, all to the satisfaction of the City of New York and Commissioner.

B. Guarantee that the materials and workmanship supplied under this division will be of the best quality currently available, that the equipment will be erected in a practical manner and in accordance with best practices, that it will be complete in operation, nothing being omitted in the way of labor and material required to make this so, although not specifically shown or mentioned herein and that it will be delivered in proper working order, complete and perfect in every respect without additional cost – whether or not shown in detail on the drawings or described in detail in this specification.

C. Be responsible for all damage to or caused by the work performed under this division for a period of one year from date of acceptance of work under the Contract. Repair at no cost to the City of New York all such damage which occurs within 24 hours' notice thereof by the City of New York. Damage which occurs prior to the completion of this work shall be repaired at once.

END OF SECTION 21 05 00

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SECTION 21 05 03 - PIPES AND TUBES FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:

1. Fire Suppression water piping within 5 feet of building.
2. Pipe joints and fittings.

B. Related Sections:

1. Section 09 90 00 - Painting: Product and execution requirements for painting specified by this section.
2. Section 21 05 04 - Valves for Fire Suppression: Product requirements for valves for placement by this section.
3. Section 21 05 05 - Hangers and Supports for Fire-Suppression Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
4. Section 21 05 16 - Expansion Fittings and Loops for Fire-Suppression Piping: Product requirements for piping expansion compensation devices for placement by this section.
5. Section 21 12 00 - Fire Suppression Standpipes: Product requirements for fire standpipe piping for placement by this section.
6. Section 21 13 13 - Wet-Pipe Sprinkler Systems: Product requirements for wet sprinkler piping for placement by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.4 - Gray Iron Threaded Fittings.
3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
4. ASME B31.9 - Building Services Piping.
5. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
6. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM A536 - Standard Specification for Ductile Iron Castings.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.

C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

D. Design Data: Indicate pipe sizes. Indicate pipe sizing methods. Indicate calculations used.

E. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.5 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

C. Perform Work in accordance with NYCBC.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience approved by manufacturer.

C. Design pipe hangers and supports under direct supervision of a Professional Engineer licensed in the State of New York and experienced in design of this Work.

1.7 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Refer to Section 00 72 00 General Conditions and Division 01 – General Requirements for product requirements related to environmental conditions on site. See also Section 01 81 13 – Sustainable Design Requirements.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Refer to Section 00 72 00 General Conditions and Division 01 – General Requirements for all coordination requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Mechanical Couplings:

1. Victaulic
2. Tyco
3. Grinnell
4. Or Approved Equal

B. Piping:

1. Allied Tube and Conduit Corp.
2. Berger Pipe Co.
3. Wheatland Tube Co.
4. Or Approved Equal

C. Fittings:

1. Flagg
2. Nibco
3. Stockham
4. Victaulic
5. Or Approved Equal

2.2 BLACK STEEL PIPE (SCHEDULE 40) SPRINKLER PIPE

A. Pipe:

1. Standard weight black steel pipe, Schedule 40, welded or seamless, with manufacturer's name rolled into each length.
2. Schedule 10 and other thinwall pipe is not permitted on this project.

B. Fittings:

1. Threaded: Standard malleable iron couplings with flat band. Red or white lead and oil or approved compound.
2. Welded or Flanged: Standard weight steel.
3. Mechanical Couplings: Victaulic Style 07, rolled groove.

C. Application:

1. Threaded: All wet pipe sprinkler systems, 2 inches in size and below.
2. Mechanical: All wet pipe sprinkler systems, 2 -1/2 inches in size and above.
3. Welded: All fire standpipe over 175 PSIG.

2.3 GALVANIZED STEEL PIPE (SCHEDULE 40) DRAIN PIPES

A. Pipe:

1. Standard weight galvanized steel pipe, Schedule 40, with makers name rolled into each length.

B. Fittings:

1. Threaded: Galvanized malleable iron with flat band pattern.
2. Mechanical Couplings: Victaulic Style 07, rolled groove.

C. Joints: Red or white lead and oil or approved compound.

D. Application: Auxiliary drain piping and Dry systems subject to periodic wetting and drying.

2.4 BLACK STEEL PIPE (SCHEDULE 40) FIRE STANDPIPE

A. Pipe:

1. Standard weight black steel pipe, Schedule 40, welded or seamless, with manufacturer's name rolled into each length. Schedule 10 piping is not acceptable.

B. Fittings:

1. Threaded: black, malleable cast iron or flanged cast steel with a pressure rating of 350 psi water working pressure. Pressure ratings shall be cast in or on the fittings.
2. Welded or Flanged: Schedule 40 steel.

3. Mechanical Couplings: Victaulic Style 77, rolled groove.

C. Joints: Red or white lead and oil or approved compound.

D. Application:

1. Threaded: All standpipe systems.
2. Mechanical: All standpipe systems, 2-1/2 inches in size and above.
3. Welded: All fire standpipe over 175 PSIG.

2.5 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 250, malleable iron, threaded.
2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Gaskets: 1/16 inch thick preformed neoprene gaskets.
3. Flanges shall be of same weight as the fittings and valves in each service category. Welding neck flanges shall be used with flanged valves and equipment on welded lines. Galvanized screwed flanges shall be used on galvanized screwed lines. Flanges shall be drilled in conformance with 150 lbs. or 300 lbs. standard and shall be faced and spot- faced. Threaded and loose flanges on brass piping shall be brass. Laps shall be machined on front, back and edge. Threaded flanges shall have faces perpendicular to adjoining pipe.

2.6 PIPE FITTINGS

A. Each pipe fitting shall have cast, stamped, or indelibly marked on it the marker's name or mark, weight, and quality of the product when such marking is required by the approved standard.

B. Welding fittings shall be of same material and schedule as pipe to which they are welded. Welding fittings including laterals shall be approved factory reinforced to develop full working pressure of connecting piping main. Welding elbows shall be long radius pattern. Welding fittings shall be used exclusively, except as otherwise specified. Weldolets may be used for branches only where branch is two (2) or more nominal pipe sizes smaller than main or riser. All welding "lateral" fittings shall have pressure ratings equal to the pipe with which they are to be used. Welding fittings shall be of Tube-Turn, Walworth manufacture or approved equal, to conform to ASTM-A-234 specifications.

C. Nipples shall be extra heavy shoulder type of same material as pipe, close nipples are not acceptable.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to SELECTIVE DEMOLITION AND ALTERATION WORK - 02 41 19 for requirements regarding verification of existing conditions before starting work.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. Route pipe in straight line.

F. Install pipe to allow for expansion and contraction without stressing pipe or joints.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 21 05 16.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Establish invert elevations, slopes and for drainage. Maintain gradients.

J. Slope piping and arrange systems to drain at low points.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

L. Install valves in accordance with Section 21 05 04.

M. Install pipe identification in accordance with Section 22 05 53.

3.5 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Fire standpipe and fire sprinkler systems shall be tested in accordance with NFPA-13-2007 and NFPA-14 2007, and the NYC Building Code.

3.6 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for cleaning.

END OF SECTION 21 05 03

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SECTION 21 05 04 - VALVES FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes: General Duty Valves for the following systems:

1. Fire Suppression standpipes, sprinklers and equipment.

B. Related Sections:

1. Section 09 90 00 - Painting: Product and execution requirements for painting specified by this section.
2. Section 21 05 03 - Pipes Tubes for Fire-Suppression Piping and Equipment: Product requirements for piping for placement by this section.
3. Section 21 05 05 - Hangers and Supports for Fire-Suppression Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
4. Section 21 05 48 - Noise and Vibration Controls for Fire Suppression Piping and Equipment: Product requirements for vibration isolation for placement by this section.
5. Section 21 12 00 - Fire Suppression Standpipes: Product requirements for fire standpipe piping for placement by this section.
6. Section 21 13 13 - Wet-Pipe Sprinkler Systems: Product requirements for wet sprinkler piping for placement by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers.

B. ASTM International.

C. American Water Works Association:

1. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
2. ASTM B 62 - Standard Specification for Composition Bronze or Ounce Metal Casting.
3. ASTM D 429 - Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.
4. ASTM B 763 - Standard Specification for Copper Alloy Sand Casting for Valve Application.
5. AWWA C 500 - Standard for Metal-Seated Gate Valves for Water Supply Service.

6. AWWA C 509 - Standard for Resilient-Seated Gate Valves for Water Supply Service.
7. AWWA C 515- Standard for Reduced Wall, Resilient- Seated Gate Valves for Water Supply Service.
8. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.

C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

D. Design Data: Indicate pipe sizes. Indicate pipe sizing methods. Indicate calculations used.

E. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.5 EPDQUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

C. Perform Work in accordance with NYCBC.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience approved by manufacturer.

C. Design pipe hangers and supports under direct supervision of a Professional Engineer licensed in the State of New York and experienced in design of this Work.

1.7 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions - Product Requirements: Environmental conditions affecting products on site.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Requirements for coordination.

PART 2 - PRODUCTS

2.1 GENERAL

A. All fire protection water control valves within the building shall be either wedge gate valves with painted iron wheel handles, shall have gland followers in stuffing boxes, and shall be constructed so that they may be repacked while open and under pressure; or slow-closing quarter-turn gear-operated butterfly valves.

B. All valves shall have the name of the manufacturer and working pressure cast or stamped on body.

C. All valves: to be U.L. listed and FM approved.

D. All valves shall be with threaded or flanged ends as required by the piping system in which they are installed.

E. Valves shall be selected for a minimum working pressure or 200 psig.

2.2 VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Milwaukee Valve Co.
2. Crane Valve Co.
3. Anvil International
4. Nibco, Inc.
5. Mueller Co.
6. Victaulic Co.
7. Or approved equal

B. Gate Valves:

1. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends.

2. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.
3. Post Indicator Type: Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

C. Globe or Angle Valves:

1. Up to and including 2 inches: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with back seating capacity packable under pressure.
2. Over 2 inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

D. Ball Valves:

1. Up to and including 2 inches: Bronze two-piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded ends with union.
2. Over 2 inches: Manufacturers: Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.

E. Butterfly Valves:

1. Up to and including 2 inches: Bronze Body, Stainless steel disc, resilient replaceable seat, grooved ends, extended neck, hand wheel and gear drive and integral indicating device, and built-in tamper proof switch rated 10 amp at 115 volt AC, open-type D.P.D.T.
2. 2-1/2” and Larger: Cast or Ductile Iron Body, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, grooved ends. With extended neck, hand wheel and gear drive and integral indicating device and external tamper switch rated 10 amp at 115 volt AC, open-type, D.P.D.T.

F. Check Valves:

1. Up to and including 2 inches: Bronze body and swing disc, rubber seat, threaded ends.
2. Over 2 inches: Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
3. 4 inches and Over: Iron body, bronze disc with stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

G. Drain Valves:

1. 2 inch and smaller: Straight or angle globe valve, bronze, 200 W.W.P. with hose thread nipple and cap.

2.3 PRESSURE RATINGS FOR CHECK AND GATE VALVES

A. Vertical Distance From Fire Pump:

Vertical Distance from Fire Pump	Class
0-165’	250
165’-400’	150

B. Max. Static Head from Roof Tank:

Max. Static Head from Roof Tank	Class
0-115’	150
115’-270’	250
270’-425’	350
425’-657’	500
657’-1122’	800
1122’-Larger	1000

2.4 SECTIONAL AND RISER CONTROL VALVES

A. Riser control valves, where practical, shall be located within a required stair enclosure serving the entrance floor. Provide a sign indicating the valve location, installed within the stair enclosure at the entrance floor.

B. Where riser control or section valves are located outside of a required stair enclosure, the valves shall be of such type and so installed so as to be remotely operated by an electronic motor. The remote control shall be from either the entrance floor or from the fire pump room. Operating devices shall be grouped, suitably housed, and kept locked with a Fire Department lock and key. The door of the housing shall be embossed to indicate the purpose of the device. Instructions for operating the remote valves by the control device shall be legible, detailed, and complete, and shall be permanently secured to the inner face of the door.

1. Electric Motor Operator for Butterfly Valve shall be similar to Kennedy Valve Electric Motor Operator, provided with an auxiliary handwheel operator for manual operation. Rated for 300 psi. 120 volts. Normally open. Slow Opening and closing time rated for Fire Protection usage

C. Each valve shall be so designed and installed as to permit its manual operation at the valve locations. When the valve is located higher than 7’-0”, provide a remote operator or chain wheel operator.

D. Each control valve shall be conspicuously marked with the number assigned to it on the riser diagram for the standpipe system. Each valve shall have a metal sign stating “Standpipe Control Valve” securely hung from the valve.

E. Metal tag with number identifying control valve shall be conspicuously marked with the number assigned to it on the riser diagram for the standpipe system. The marking shall be in white figures, 1½” high, on a 2” square engraved anodized aluminum tag with a red background. Tags

shall be as manufactured by Seton Nameplate Corp., Brimar Industries, Inc., Marking Services Inc. or by EMED Co. or approved equal.

2.5 FLOOR CONTROL VALVES

A. 2-1/2 inches and larger: Provide butterfly valve with grooved ends, including integral supervised open D.P.D.T. tamper switch.

B. Floor control valve assembly to include supervised butterfly valve, check valve, flow switch, inspector's test and drain assembly and drain.

2.6 TEST/DRAIN VALVES

A. Provide a brass construction combination inspector's test and drain valve.

2.7 PRESSURE RESTRICTING DEVICE (Standpipe Systems)

A. 2½" Hose stations: when the normal static pressure measured at a hose connection exceeds 100 psig, the valve shall be equipped with an adjustable type pressure restricting device (PRD) so that the static and residual pressures will not exceed 100 psi.

B. PRD shall be similar to Croker 2-1/2" model 5374.

2.8 LADDER

A. Provide permanent heavy steel ladders to provide access to valves in accordance with the code requirements. Ladders shall be of width and height required, shall be made of heavy steel bars and heavy rungs and shall be permanently fastened at location. Where the shut-off valve adjacent to the sprinkler alarm valve is located higher than 7' above the floor, ladder shall be provided where directed.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. All valves shall be installed only in the upright vertical or horizontal positions unless specifically otherwise required by the drawings.

B. All valves shall be installed in accessible locations to facilitate easy removal for repair or replacement.

END OF SECTION 21 05 04

SECTION 21 05 05 - HANGERS, SUPPORTS AND ANCHORS FOR FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Sleeves.
5. Mechanical sleeve seals.
6. Formed steel channel.
7. Firestopping relating to fire protection work.
8. Firestopping accessories.
9. Equipment bases and supports.

B. Related Sections:

1. Section 09 90 00 - Painting: Product and execution requirements for painting specified by this section.
2. Section 21 05 04 - Valves for Fire Suppression: Product requirements for valves for placement by this section.
3. Section 21 05 16 - Expansion Fittings and Loops for Fire-Suppression Piping: Product requirements for piping expansion compensation devices for placement by this section.
4. Section 21 13 13 - Wet-Pipe Sprinkler Systems: Product requirements for wet sprinkler piping for placement by this section.

1.3 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Manufacturer’s literature, catalog data and illustrations.

C. Shop Drawings indicating:

1. Dimensions.
2. Construction details of hangers, inserts, anchors and guides.
3. Materials.
4. Maximum Load.

5. Locations.
6. Recommended installation procedures.
7. Isolator loading and deflection.
8. Spring diameters, compressed spring heights at rated load; solid spring heights.
9. Equipment operating speeds.

1.4 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Codes and Authorities:

1. Federal Specification WW-H171b.
2. ASA Code for Pressure Piping.
3. ASTM A-575-73.
4. MSS SP-58-67.
5. MSS SP-69-66.
6. Underwriters Laboratories.
7. Factory Mutual.
8. National Fire Protection Association

C. Perform Work in accordance with NYCBC.

D. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   a. Floor Penetrations within Wall Cavities: T-Rating is not required.

E. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by manufacturer for penetrating items connecting maximum of two stories.

F. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

G. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

H. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

I. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience approved by manufacturer.

C. Design pipe hangers and supports under direct supervision of a Professional Engineer licensed in the State of New York and experienced in design of this Work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to General Conditions - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Refer to General Conditions - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Refer to General Conditions - Administrative Requirements: Requirements for coordination.

1.10 WARRANTY

A. Refer to General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 GENERAL

A. Details of support methods for typical conditions are described herein. Actual method(s) of restraint for all equipment shall be submitted by the manufacturer of each piece of equipment accompanied by a letter indicating compliance with the criteria established. The Contractor shall provide restraints as indicated on approved Shop Drawings.

2.2 REQUIRED SEISMIC APPLICATIONS

A. All equipment which is bolted directly to concrete housekeeping pads.

B. All floor mounted equipment mounted on vibration isolators.

C. All piping and equipment supported from overhead.

D. Wall hung equipment.

E. All floor-mounted pipes and ducts are not secured to seismic floor stands.

2.3 TYPES OF RESTRAINTS

A. Seismic Restraint, Type I:

1. Each corner or side seismic restraint shall incorporate minimum 5/8" thick pad limit stops. Restraints shall be made of plate, structural members or square metal tubing in a welded assembly, incorporating resilient pads. Angle bumpers are not acceptable. System to be field bolted to structure to resist seismic forces in accordance with the NYSBC.
2. Seismic spring mountings as described above are an acceptable alternative providing all seismic loading requirements are met.
3. Mason Industries Type Z-1011, Type Z-1225, or approved equal.

B. Seismic Restraint, Type II:

1. Metal cable type with approved end fastening devices to equipment and structure. System to be field bolted to structure or overhead structural members or structure with aircraft cable.

C. Spring Seismic Restraint, Type III:

1. Shall comply with general characteristics of spring isolators. Shall incorporate snubbing restraint in all directions. Shall be capable of supporting equipment at a fixed elevation

during equipment erection. Cast or aluminum housings are not acceptable. System to be field bolted to deck to resist seismic forces in accordance with the Building Code.

a. Mason Type SSLFH, or as approved equal.
b. VMCI Type SAWR
c. VEC Type BXL

D. Bolted Seismic Restraint, Type IV:

1. Non-isolated equipment shall be field bolted (powder shots not acceptable) to resist seismic forces unless under 100 pound shear force required.

2.4 HANGERS

A. All bracket, clamp and rod sizes indicated in this specification are minimum sizes only. All structural hanging materials shall have a built-in safety factor of 5.

B. Provide rolled-steel auxiliary pipe supports as required.

C. Anchor points shall be located and constructed to permit the piping system to take up its expansion and contraction freely in opposite directions from the anchored points.

D. Guide points shall be located and constructed wherever required or shown on drawings and at each side of an expansion joint or loop, to permit free axial movement only in a piping system.

E. All hangers shall be U.L. listed and FM approved.

F. C-clamps with locknut and retaining clip will be permitted.

G. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Carpenter & Paterson Inc.
2. Anvil (Formerly Grinnell)
3. I.R. Rauch's & Sons
4. Or approved equal

H. Pipe Hanger Schedule:

	Carpenter & Paterson 'Witch'	Grinnell	I.R. Rauch's & Sons
C-Clamp with Retaining Clip and locknut	47	86	47
(pipe sizes 2" & smaller)	with 22	with 89	with 22
Beam Clamp	293	228	82
Multi-J Hook	---	---	228
J Hook	---	---	221
Clevis Hanger	100	260	100

	Carpenter & Paterson 'Witch'	Grinnell	I.R. Rauch's & Sons
Clevis hanger w/Saddle	100SH	---	100SH
180° Shield	265P	168	265P
Single Rod Roll Hanger	140	181	140
Double Rod Roll Hanger	142	171	142
Trapeze	---	46	1600-1700
U-bolt Adjustable Pipe	283	137C	283
Stanchion Saddle	247	259	247
Welded Steel Bracket	84 or 139	199 or 195	84 or 139
Riser clamp	126	261	126
Welded Beam Attachment	113A	66	---
Welded Beam Attachment w/bold & nut	113B	66	113A
Concrete Insert	108	282	180 or 181
Phillips Inserts	513	Phillips Insert	1000

I. Hanger Rod Schedule:

Pipe Size	Rod Diameter
2" and smaller	3/8"
2-1/2" - 3-1/2"	1/2'
4" - 5"	5/8"
6"	3/4"
8" - 12"	7/8"

2.5 ANCHORING SYSTEM

A. Pipe hangers shall be connected to the building structure as follows:

1. All piping shall be supported directly from beams or by means of auxiliary steel furnished and installed by this Contractor attached to beams by means of isolation hangers, or to existing slab via adhesive anchors furnished and installed by this contractor.
2. Adhesive Anchors: Provide threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Submit all products to the Structural Engineer for final review and approval.
    a. Provide stainless steel anchors. Stainless steel anchors shall be AISI Type 316 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

b. Provide the following:
   1) Hilti HAS threaded rods, with HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit System for anchorage to concrete. ICC ESR-3187.
   2) Hilti HIT-Z anchor rods with HIT-HY 200 Safe Set System for anchorage to concrete. ICC ESR-3187.
   3) Hilti HAS threaded rods with HIT-HY 200 Injection Adhesive Anchoring System for anchorage to concrete, ICC ESR-3187.
   4) Hilti HAS threaded rods, with RE 500 SD Injection Adhesive Anchoring System for anchorage to concrete, ICC ESR-2322.
   5) Or approved equal.

3. Contractor shall be required to submit slab pull-out strength test to the structure engineer for approval prior to installation.

B. Examine the areas and conditions where specialty anchoring system is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

C. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

D. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction and the manufacturer's recommended installation procedures.

E. Install the following manufacturer's guidelines:

1. Drill hole using a roto-hammer or Hilt diamond coring machine.
2. Push the HIT-TZ in the hole to verify sufficient hole depth (only threads visible). For floor applications, pushing the rod compacts to the drill dust.
3. Inject adhesive staring from the bottom of the hole.
4. Fill hole 1/2 to 2/3 full. If the hole is full of water, it is suggested to start injecting from the bottom of the hole and fill entirely with adhesive.

F. Anchoring system shall be required to comply with the following:

1. Each anchor shall be able to hold 5x the load being placed or as required by the New York City Building Code or as required by the Project Manual, whichever is most restrictive.

G. Engineering Data:

1. Before any anchor system is installed, submit engineering data drawings to the Commissioner for review indicating how performance standards specified here shall be met. The Contractor is responsible for the structural design and supports for these systems and must show his proposed systems on these drawings.
2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members.

Calculations and drawings must be prepared by a Structural Engineer licensed in the State of New York and shall be signed and sealed by this Engineer.

H. Quality Assurance:

1. Use adequate numbers of skilled workmen who are thoroughly instructed and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
2. Manufacturers shall provide instructions for all workers to install system.

I. The Contractor shall provide on-site testing by an accredited testing laboratory, demonstrating compliance with specifications. Testing shall be performed to the loading requirements of the New York City Building Code or by requirements of the Project Manual or 5x the load being placed on the most heavily loaded anchor; whichever is most restrictive. Test a minimum of 3 anchors in each zone, of each floor, evenly distributed over the area where anchors will be installed. Tested anchors can be used in the final assemblies. Supply reports to the Commissioner.

2.6 PROTECTION OF INSULATED PIPE

A. Provide insulation protection shield at each hanger, 12 gage for piping 2-1/2 inches and smaller and 8 gage for larger piping.

B. Insert insulation identical to pipe insulation in void between saddle and pipe.

2.7 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.8 FOUNDATIONS

A. All equipment, piping, etc., shall be mounted on approved foundations, all as specified herein, or as shown on the drawings.

B. All floor-mounted equipment shall be erected on 12” high concrete pads, over the complete floor area of the equipment, unless specified to the contrary herein. Hereinafter, wherever vibration eliminating devices and/or concrete inertia blocks are specified, these items shall in turn be mounted upon aforementioned pads unless specified to the contrary herein.

C. All concrete foundations and supports (and required reinforcing thereof) will be furnished and installed under this Section of the Specification. Furnish templates for all concrete foundations and supports, and all required hanger bolts and other appurtenances necessary for the proper installation of equipment. Submit shop drawings showing the complete details of all foundation bases including necessary concrete and steel work, vibration isolation devices, etc.

2.9 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.10 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings and Potentially Wet Floors: Schedule 40 galvanized steel pipe.

C. Sleeves for pipes through Rated Construction: Galvanized steel, thickness as required to meet UL1479 requirements.

D. Sealant: Acrylic; refer to Division 07.

2.11 MECHANICAL SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Thunderline Link-Seal, Inc.
2. NMP Corporation
3. Fernco
4. Or approved equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.12 FORMED STEEL CHANNEL

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Unistrut Corp.
4. Or approved equal.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.13 FIRESTOPPING

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. 3M fire Protection Products
5. Specified Technology, Inc.
6. Or approved equal.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Firestopping system shall meet UL1479 requirements.

D. Color: As selected from manufacturer’s full range of colors.

2.14 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Mineral fiberboard.
2. Sheet metal.
3. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products.

2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to General Conditions - Administrative Requirements: Verification of existing conditions before starting work.

3.3 INSTALLATION

A. All piping shall be supported only from building structural steel or galvanized steel inserts imbedded in poured concrete. Where piping revisions are required after slabs are poured, pipes 3" and smaller may be supported at intermediate points by "Phillips" or other 3/4" expansion bolts and shields, provided main supports are not less than 20' on centers. All inserts, expansion bolts and shields in post-tensioned concrete slabs shall be submitted to Structural Engineer for approval prior to commencement of work. Intermediate supports for piping 4" and larger shall be attached to concrete beams or columns by means of 4" x 4" x 3/8" (horizontal) and supporting rod at 90° from anchor bolt. It is the intent that inserts are only permitted in poured concrete construction.

B. Hanger Locations for Horizontal Piping:

1. Steel Piping 1-1/4" and Smaller: Every 6'.
2. Steel Piping 1-1/2" and Larger: Every 10'.

C. Support Locations for Vertical Piping:

1. Threaded & Mechanical Joint Piping: At every floor, but in no case greater than 20-foot intervals.

D. Hangers shall be installed outside of piping insulation with a semi-cylindrical galvanized shield set between the hanger and insulation.

E. All beam attachments shall be installed on clean, smooth, and non-fireproofed sections of the beam.

F. All fire protection piping shall be hung individually from the structure.

G. All hangers, anchors, rods and supports shall be painted.

H. Supporting piping from other piping, conduit or ductwork is prohibited.

3.4 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.5 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide copper plated hangers and supports for copper piping.

K. Design hangers for pipe movement without disengagement of supported pipe.

L. All hangers and supports shall be capable of screw adjustment after piping is erected and provided with a locking nut (double nut) to prevent loss of adjustment.

M. Provide required anchors, sway bracing, blocking and steel to connect to structure to prevent pipe movement due to expansion, contraction or thrust where required and as directed by the Commissioner.

N. Provide pipe restraints to prevent movement by an upward thrust at armovers.

O. Horizontal piping with grooved mechanical couplings shall not be left unsupported between any two couplings nor shall any pipe be left unsupported wherever a change of line flow takes place.

P. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.6 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending a minimum of 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.7 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent and water pipes projecting 12 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.8 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.9 INSTALLATION - FIRESTOPPING

A. Install material at fire-rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping to meet UL1479 requirements.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

D. Place intumescent coating in sufficient coats to achieve rating required.

E. Remove dam material after firestopping material has cured.

F. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   c. Pack void with backing material.
   d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

G. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   c. Install type of firestopping material recommended by manufacturer.

2. Install escutcheons, floor plates or ceiling plates where piping, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

4. Interior partitions: Seal pipe penetrations at computer rooms, telecommunication rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit

3.10 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.11 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

END OF SECTION 21 05 05

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SECTION 21 05 13 - COMMON MOTOR REQUIREMENTS FOR FIRE-SUPPRESSION EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

1. Section includes: Single- and three-phase motors for application on equipment provided under other sections and for motors furnished loose to Project.

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.

1.3 REFERENCES

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.

C. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.

C. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

1.5 QUALITY ASSURANCE

A. Refer to DCAS General Conditions.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three (3) years documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Refer to General Conditions: Product storage and handling requirements.

B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.

D. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Cooper Industries Inc.
2. Eaton Corp.
3. General Electric Co
4. Or approved equal

B. Motors 3/4 hp and Larger: Three-phase motor as specified below.

C. Motors Smaller Than 3/4 hp: Single-phase motor as specified below, except motors less than 250 watts or 1/4 hp may be equipment manufacturer’s standard.

D. Three-Phase Motors: NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.

1. Service Factor: 1.15.
2. Enclosure: Meet conditions of installation.

3. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
4. Insulation System: NEMA Class F.
5. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
6. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
7. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
8. Sound Power Levels: Conform to NEMA MG 1.

E. Single Phase Motors:

1. Permanent split-capacitor type where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
2. Voltage: 115 volts, single phase, 60 Hz.

F. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.2 SOURCE QUALITY CONTROL

A. Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work..

3.2 INSTALLATION

A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

B. Install engraved plastic nameplates in accordance with Section 26 05 53.

C. Ground and bond motors in accordance with Section 26 05 26.

3.3 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.15.

END OF SECTION 21 05 13

SECTION 21 05 16 - EXPANSION FITTINGS AND LOOPS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Flexible pipe connectors.
2. Pipe alignment guides.
3. Swivel joints.
4. Pipe anchors.

B. Related Sections:

1. Division 1 - Section 01 35 20 - LEED Requirements.
2. Section 21 05 00 - Common Work Results for Fire Suppression: Product and installation requirements for piping used in fire protection systems.
3. Section 21 05 48 - Vibration and Seismic Controls for Fire-Suppression Piping and Equipment: Product and installation requirements for vibration isolators used in piping systems.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.
2. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

1.4 DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Expansion Compensation Design Criteria:

1. Installation Temperature: 50 degrees F.
2. Fire Protection System Temperature: 120 degrees F.
3. Safety Factor: 30 percent.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints. Submit shop drawings sealed by a Professional Engineer Licensed in the State of New York. Include shop drawing information for piping expansion compensation in shop drawings for piping system specified.

C. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

D. Design Data: Indicate criteria and show calculations. Submit calculations sealed by a Professional Engineer Licensed in the State of New York.

E. Manufacturer's Installation Instructions: Submit special procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

H. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

C. Operation and Maintenance Data: Submit adjustment instructions.

1.7 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

C. Furnish materials in accordance with the State of New York standard.

D. Maintain one (1) copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

C. Design expansion compensating system under direct supervision of Professional Engineer Licensed in the State of New York and experienced in design of this Work.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

B. Furnish five (5) year manufacturer warranty for leak free performance of packed expansion joints.

1.11 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Supply two (2) 12 ounce containers of packing lubricant and cartridge style grease gun.

PART 2 - PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Steel Piping:

1. Inner Hose: Stainless steel
2. Exterior Sleeve: Double braided stainless steel.
3. Pressure Rating: 200 psig at 250 degrees F.

4. Joint: Flanged or welded.

2.2 ACCESSORIES

A. Pipe Alignment Guides: Two-piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

B. Swivel Joints: Cast steel body, double ball bearing race, field lubricated, with (Buna-N) o-ring seals.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. Install Work in accordance with ASME B31.9.

B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Refer to Division 21. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

D. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

E. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 21 xx xx for pipe hanger installation requirements.

F. Provide grooved piping systems with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation. Grooved piping systems need not be anchored.

3.3 MANUFACTURER'S FIELD SERVICES

A. Refer to DCAS General Conditions: Manufacturers’ field services.

B. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION 21 05 16

SECTION 21 05 48 - NOISE AND VIBRATION CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Inertia bases.
2. Vibration isolators.

B. Contractor shall provide complete seismic and vibration isolation for the entire fire pump, standpipe and sprinkler systems. Design of seismic systems and installation supervision shall be provided by the contractor's registered Professional Engineer. The seismic engineer shall have a minimum of five years of experience in the design of such systems. The contractor's professional Engineer shall provide signed and sealed affidavit indicating complete compliance with State and Local codes for the design and installation of the seismic systems.

C. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 07 90 00 - Joint Protection: Product requirements for joint sealers specified for placement by this section.
3. Section 21 05 29 - Hangers and Supports for Fire Protection Piping and Equipment: Product requirements for pipe hangers and supports.
4. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC: Requirements for sound and vibration measurements performed independent of this section

1.3 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

B. American National Standards Institute:

1. ANSI S1.4 - Sound Level Meters.
2. ANSI S1.8 - Reference Quantities for Acoustical Levels.

3. ANSI S1.13 - Methods for the Measurement of Sound Pressure Levels in Air.
4. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.

C. Air-Conditioning and Refrigeration Institute:

1. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.

D. American Society of Heating, Refrigerating and:

1. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
2. ASHRAE Handbook - HVAC Applications.

E. Sheet Metal and Air Conditioning Contractors':

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.4 PERFORMANCE REQUIREMENTS

A. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping.

B. Consider upper floor locations critical unless otherwise indicated.

C. Use concrete inertia bases for base mounted pumps over 10 hp (7.5 kW).

D. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.

C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.

D. Design Data: Submit calculations indicating maximum room sound levels are not exceeded.

E. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions.

F. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate sound isolation installation is complete and in accordance with instructions.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of hangers including attachment points.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years 'experience.

C. Design application of seismic restraints and isolators under direct supervision of a Professional Engineer licensed in New York State of New York experienced in design of this Work.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for inertia bases.

PART 2 - PRODUCTS

2.1 INERTIA BASES

A. Vibration isolation systems shall be provided on all equipment.

B. Seismic restraints shall maintain equipment and piping in a captive position. Seismic restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise.

C. Details of support methods for typical conditions are described herein. Actual method(s) of restraint for all equipment shall be submitted by the manufacturer of each piece of equipment accompanied by a letter indicating compliance with the criteria established. The Contractor shall provide restraints as indicated on approved Shop Drawings.

D. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Kinetics Noise Control, Inc.
2. Vibration Mountings & Controls, Inc.
3. Vibro-Acoustics.
4. Or approved equal

E. Structural Bases:

1. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
2. Construction: Welded structural steel with gusset brackets, supporting equipment and motor with motor slide rails.

F. Concrete Inertia Bases:

1. Mass: Minimum of 1.5 times weight of isolated equipment.
2. Construction: Structured steel channel perimeter frame, with gusset brackets and anchor bolts, adequately reinforced, concrete filled.
3. Connecting Point: Reinforced to connect isolators and snubbers to base.
4. Concrete: Reinforced 3,000 psiconcrete.

2.2 VIBRATION ISOLATORS (For Fire Protection Equipment, No Piping)

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Mason Industries Inc.
2. Vibration Eliminator Co., Inc.
3. Vibration Mountings & Controls/Korfund
4. Or approved equal

B. Open Spring Isolators:

1. Spring Isolators:
   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

C. Code: Color code springs for load carrying capacity.

1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
2. Spring Mounts: Furnish with leveling devices, minimum 0.25 inchthick neoprene sound pads, and zinc chromate plated hardware.
3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.

D. Restrained Spring Isolators:

1. Spring Isolators:
   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

E. Code: Color code springs for load carrying capacity.

1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
2. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
4. Restraint: Furnish mounting frame and limit stops.

F. Closed Spring Isolators:

1. Spring Isolators:
   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

G. Code: Color code springs for load carrying capacity.

1. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.

H. Restrained Closed Spring Isolators:

1. Spring Isolators:
   a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.

I. Code: Color code springs for load carrying capacity.

1. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
3. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.

J. Neoprene Pad Isolators:

1. Rubber or neoprene-waffle pads.

a. 30 durometer.
b. Minimum 1/2 inch thick.
c. Maximum loading 40 psi.

K. Height of ribs: not to exceed 0.7 times width.

1. Configuration: Single layer.

L. Seismic Snubbers:

1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
2. Neoprene Elements: Replaceable, minimum of 0.75 inch thick.
3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

M. Seismic Restraint, Type I:

1. Each corner or side seismic restraint shall incorporate minimum 5/8" thick pad limit stops. Restraints shall be made of plate, structural members or square metal tubing in a welded assembly, incorporating resilient pads. Angle bumpers are not acceptable. System to be field bolted to structure to resist seismic forces in accordance with the NYCBC.
2. Seismic spring mountings as described above are an acceptable alternative providing all seismic loading requirements are met.
3. Mason Industries Type Z-1011, Type Z-1225, or approved equal.

N. Seismic Restraint, Type II:

1. Metal cable type with approved end fastening devices to equipment and structure. System to be field bolted to structure or overhead structural members or structure with aircraft cable.

O. Spring Seismic Restraint, Type III:

1. Shall comply with general characteristics of spring isolators. Shall incorporate snubbing restraint in all directions. Shall be capable of supporting equipment at a fixed elevation during equipment erection. Cast or aluminum housings are not acceptable. System to be field bolted to deck to resist seismic forces in accordance with the Building Code.
   a. Mason Type SSLFH
   b. VMCI Type SAWR
   c. VEC Type BXL
   d. Or approved equal

P. Bolted Seismic Restraint, Type IV:

1. Non-isolated equipment shall be field bolted (powder shots not acceptable) to resist seismic forces unless under 100 pound shear force required.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Coordination and project conditions.

B. Verify equipment and piping is installed before work in this section is started.

3.3 INSTALLATION

A. Install isolation for motor driven equipment.

B. Bases:

1. Set steel bases for 1 inch clearance between housekeeping pad and base.
2. Set concrete inertia bases for 2-inch clearance between housekeeping pad and base.

C. Adjust equipment level.

D. Install spring hangers without binding.

E. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

F. Provide resiliently mounted equipment with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05 inch maximum clearance. Provide other snubbers with clearance between 0.15 inch and 0.25 inch.

3.4 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Quality Requirements

B. Inspect isolated equipment after installation and submit report. Include static deflections.

C. Refer to Division 23 for sound measurements.

D. After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to mechanical equipment rooms, duct and pipe shafts, and other critical locations. Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements. Submit complete report of test results including sound curves.

E. Furnish services of testing agency to take noise measurement. Use meters meeting requirements of ANSI S1.4.

END OF SECTION 21 05 48

SECTION 21 12 00 - FIRE-SUPPRESSION STANDPIPES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes partial standpipe system including the following:

1. Angle Hose Valves
2. Fire Hose and Nozzles
3. Accessories for Valves and Hoses.
4. Painting and Identification of piping

B. Related Sections:

1. Section 09 90 00 - Painting: Product and execution requirements for painting specified by this section.
2. Section 21 05 00 - Common Work Results for Fire Suppression: Product and execution requirements for pipe, fittings, valves, hangers, supports, identification and painting for placement by this section.
3. Section 21 05 03 - Pipes Tubes for Fire-Suppression Piping and Equipment: Product requirements for piping for placement by this section.
4. Section 21 05 05 - Hangers and Supports for Fire-Suppression Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
5. Section 21 05 16 - Expansion Fittings and Loops for Fire-Suppression Piping: Product requirements for piping expansion compensation devices for placement by this section.
6. Section 21 13 13 - Wet-Pipe Sprinkler Systems: Product requirements for wet sprinkler piping for placement by this section.

1.3 REFERENCES

A. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved by Factory Mutual Research for Property Conservation.

B. National Fire Protection Association:

1. NFPA 14 - Standard for the Installation of Standpipe, Private Hydrants and Hose Systems.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate supports, components, accessories, and sizes.

C. Product Data: Submit manufacturer's catalog sheet for equipment indicating rough-in size, finish and accessories.

D. Field Test Reports: Indicate compliance with specified performance.

E. Manufacturer's Installation Instructions: Submit with product data.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit servicing requirements and test schedule.

1.6 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform Work in accordance with NYCBC.

C. Maintain one (1) copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver and store products in shipping packaging until installation.

1.9 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for standpipes and valves.

PART 2 - PRODUCTS

2.1 GENERAL

A. All threads are to conform to NYC Fire Department requirements.

2.2 PIPE ESCUTCHEONS

A. Pipe escutcheons shall have inside diameter closely fitting pipe outside diameter or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Escutcheons shall be cast or sheet brass, solid or split-hinged, with brass set screw. Provide chrome finish for occupied areas exposed to view.

2.3 PIPE SLEEVES

A. Provide pipe sleeves of one of the following. Pipe sleeve must be appropriate type and thickness for the UL firestopping assembly selected:

1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3" and smaller, 20 gage minimum; 4" to 6", 16 gage; over 6", 14 gage minimum.
2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.
4. Firestop penetration materials for sealing sleeves shall be listed by Underwriters Laboratories and if not listed have MEA or OTCR approval. The materials shall be as specified in Section 07 27 00. For pipes passing through fire-rated floor, cast-in place firestop device with Underwriters Laboratories listing, and if not listed have MEA or OTCR approval, is permitted as an acceptable sleeve alternative to a metallic sleeve with firestopping material. The cast-in place device is a one-step firestopping process that does not require additional firestop penetration materials for sealing the sleeves. The device shall be installed where required for sleeving purposes. The cast-in place firestop device shall not be used for wall applications.

B. Materials for sealing space between each pipe and sleeve through non-rated interior walls shall consist of mineral wool and sealant.

2.4 FIRE HOSE CABINETS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Potter Roemer
2. WSA Inc.
3. Croker
4. Or approved equal

B. Hose Connection Valve: Angle type; brass finish; 2-1/2 inch size with 2-1/2 inch by 1-1/2 inch reducer, thread to match fire department hardware, with threaded cap and chain of brass finish. Hose valve shall conform to FDNY standards. Valves shall be similar to Potter Roemer Fig. 4065, Croker Corp. Fig. 5015, or approved equal. Cap with chain shall be similar to Potter Roemer 4625, Croker Corp. Fig. 5713, or approved equal. Threads shall be to NYC Fire department specifications.

2.5 VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Croker.
2. Potter Roemer.
3. Victaulic.
4. Or approved equal.

B. Gate Valves: 300 psi WWP: 3/4" to 2", bronze body, OS&Y indicating type; double or wedge disc with threaded ends. 2½" and up: IBBM, OS&Y indicating type; double or wedge disc with end connections as required to suit the piping system.

C. Butterfly Valves: ductile iron body; double seal or encapsulated ductile iron disc design for bubble tight shut off; stainless steel stems, gear operated; valve operation: integral indicating device.

D. Check Valves: IBBM, single clapper swing check with metal to metal or rubber faced checks, suitable for horizontal and vertical installation; end connections as required to suit the piping system; 300 psi. Accepted manufacturers: Stockham, NIBCO or other approved equal.

2.6 PAINTING

A. Paints used on dedicated piping to combination sprinkler and standpipe shall not:

1. Exceed the VOC content limits established in the Green Seal Standard GS-11 Paints, first edition, May 20, 1993.
2. Exceed the VOC content limit of 250 g/L established in the Green Seal Standard GC-03, Anti-Corrosive paints, second edition, January 7, 1997.

B. Provide colors indicated in Paragraph 3.04

1. First (1st) coat – Alkyd Vinyl Acrylic – Latex Primer – 1.2 Mills DFT
2. Second (2nd) coat – Semi-Gloss Vinyl Acrylic Latex – Enamel – 1.3 Mills DFT

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work..

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Coordination and project conditions.

B. Verify blocking in place for cabinet installation.

3.3 INSTALLATION

A. Install in accordance with NFPA 14.

B. Install cabinets plumb and level. Secure to adjacent surfaces. Establish top of cabinet (inside horizontal) surface 66 inches above finished floor.

C. Install hose station valve in cabinet at 60 inches above floor.

D. Where static pressure exceeds 100 psi at any hose station, furnish pressure orifice disc in discharge of hose station valve to prevent pressure on hose exceeding 90 psi.

3.4 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Quality Requirements, and Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Test entire system in accordance with NFPA 14.

C. Require test be witnessed by Fire Marshall and the City of New York’s insurance underwriter.

3.5 TESTING

A. Hydrostatic Testing: After flushing system, test standpipe piping hydrostatically, for period of 2 hour, at not less than 300 psi or 50 psi in excess of the system working pressure, whichever is greater. Check system for leakage of joints. The test pressure shall be read from a gage located at the low point of each system or zone being tested.

1. Repair or replace piping system as required to eliminate leakage.
2. Test the entire fire protection installation, including fire alarm system, in accordance with the requirements of the NYC Fire Code and give at least 2 days’ advance notice in writing of tests and inspections to the Construction Inspection Division and the City of New York. Tests shall be conducted in the presence of the Commissioner, Fire Department. All tests shall be performed as part of this contract.

3.6 FIELD PAINTING

A. Protect sprinkler heads during painting with small paper bags. Painting of sprinkler/ fire standpipe piping, hangers, and all other items and accessories shall conform to the code requirements.

B. Paint standpipes in accordance with Specification Section 21 05 00.

3.7 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Final cleaning.

B. Flush entire system of foreign matter.

END OF SECTION 21 12 00

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Wet-pipe sprinkler system
2. System design
3. Installation and certification.

B. Related Sections:

1. 28 31 00 Fire Detection and Alarm System for electric connections to equipment specified by this section.
2. 26 05 19 Low-Voltage Electric Power Conductors and Cables for electric connections to equipment specified by this section.

1.3 REFERENCES

A. National Fire Protection Association:

1. NFPA 13 - Installation of Sprinkler Systems.
2. Factory Mutual Global.

1.4 SYSTEM DESCRIPTION

A. System to provide coverage for entire building areas noted in Drawing Schedule.

B. Provide hydraulically designed system to NFPA 13 light hazard and ordinary hazard, Group 1 occupancy requirements.

C. Interface system building fire and smoke alarm system.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls. Submit hydrant flow test, hydraulic calculations and shop drawings. Signed and sealed by a Professional Engineer licensed in the State of New York.

C. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support require- ments, and piping connections.

D. Samples: Submit two (2) of each style of sprinkler specified.

E. Design Data: Submit design calculations; signed and sealed by a Professional Engineer licensed in the State of New York.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.7 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform Work in accordance with NYCBC and NFPA 13 - 2007 as amended by Appendix Q.

C. Maintain one (1) copy of each document on site.

D. Install sprinkler/fire standpipe systems in accordance with local regulations of the NYC Fire Department.

E. Comply with local Fire Department regulations for sizes, threading and arrangement of connections for fire department equipment to Fire Department connections.

F. All gauges, instruments and test devices shall be provided with a certificate of calibration and calibration curve or letter indicating that a minimum of five (5) test points have been calibrated. The certificate and letter must show the date of last calibration. The calibration date must be within a year of the testing date.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

C. Design system under direct supervision of a Professional Engineer licensed in the State of New York and experienced in design of this Work.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Product storage and handling requirements.

B. Store products in shipping containers until installation.

C. Furnish piping with temporary inlet and outlet caps until installation.

1.10 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty.

1.11 SITE INVENTORY

A. Refer to General Conditions - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish extra sprinklers under provisions of NFPA 13.

C. Furnish suitable wrenches for each sprinkler type.

D. Furnish metal storage cabinet.

PART 2 - PRODUCTS

2.1 AUTOMATIC SPRINKLERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Viking Sprinkler Corp.
2. Reliable Automatic Sprinkler Corp.
3. TYCO.

4. Or approved equal.

B. Suspended and Gypsum Board Ceiling Type:

1. Type: Concealed pendant type with matching push on cover plate.
2. Finish: Enamel, color white.
3. Escutcheon Plate Finish: Enamel, color white.
4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

C. Exposed Area Type:

1. Type: Standard upright type with guard.
2. Finish: Brass.
3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

D. Sidewall Type:

1. Type: Semi-recessed horizontal side wall type with matching push on escutcheon plate and guard.
2. Finish: Enamel, color white.
3. Escutcheon Plate Finish: Enamel, color white.
4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

E. Guards: Finish to match sprinkler finish.

2.2 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water Alarm Check Valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.

1. Grooved or flanged ends.
2. 175 psig WWP.

C. Water-Flow Indicators:

1. Potter Electric Signal Co. Model VSR-F.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:

1. Potter Electric Signal Co. Model OSYSU-2:
   a. Fire-Lite Alarms, Inc.; a Honeywell company.
   b. Kennedy Valve; a division of McWane, Inc.
   c. System Sensor; a Honeywell company.
   d. Or approved equal.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Locate on each valve as designated on the drawings. Switches shall be mounted so not to interfere with the normal operation of the valve and shall be adjusted to operate within two revolutions of the valve control or when the stem has moved no more than one-fifth of the distance from its normal position. The switch mechanism shall be contained in a weatherproof die-cast aluminum housing which shall provide 3/4" tapped conduit entrance and incorporate the necessary facilities for attachment to the valve. Switch housings shall be finished in red baked enamel.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXECUTION REQUIREMENTS

A. Refer to General Conditions for the requirements governing execution.

3.3 GENERAL

A. Information included in this specification and of various agency requirements are given as a guide only. The contract documents do not relieve Contractor's responsibility to provide all work and equipment necessary to complete the installation in accordance with all requirements.

3.4 INSTALLATION

A. Install in accordance with NFPA 13.

B. No pipes or other apparatus shall be installed so as to interfere in any way with the full swing of the doors. The arrangement, positions and connections of pipes, drains, valves, etc., shown on the drawings, shall be taken as a close approximation and while they shall be followed as closely as possible, the right is reserved by the commissioner to change the locations to accommodate any conditions which may arise during the progress of the work without additional compensation to this contractor for such changes, provided that the changes are requested to the installation of this work.

C. All piping shall drain back to the risers or be provided with drain valves. Special precautions must be taken to avoid electrical work and ventilation ducts and no piping shall pass below lighting fixtures in luminous ceilings or under skylights.

D. All piping shall be unexposed except in no-ceiling areas. Where required, heads shall be located below ducts. Diffusers and lighting fixtures take preference in room layout.

E. In areas with restricted head room, heads and piping shall be tight to ceilings and provided with guards.

F. No heads shall be nearer than 6 inches to a ceiling support, and where 12" x 12", 24" x 24" or 24" x 48" ceiling panels are used, the heads shall be located in the center of the panel.

G. Install sprinkler heads in all areas on a true axis line in both directions with a maximum deviation from the axis of 1/2" plus or minus. In acoustical tile ceilings, sprinkler heads shall be located on center of tile. At the completion of the installation, remove and reinstall any heads found to exceed the above-mentioned tolerances.

H. Install guards on sprinklers as indicated on Drawings or as verified in field as requiring a guard.

I. Hydrostatically test entire system in accordance with NFPA 13.

J. Require test be witnessed by NYC Fire Department and the Commissioner.

K. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they will not be subject to freezing.

M. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.5 SPRINKLER COVERAGE

A. For determination of sprinkler systems, spacing and sizing, the following coverage ratings as listed in NFPA 13 and as listed by the insurance company for this project shall be followed. Also, comply with NYCBC requirements.

B. Provide sprinklers where shown on the drawings.

C. Hydraulically Calculated System: The system shall be hydraulically designed to provide a density based on NFPA requirements and the requirements of the insurance company and the _____.

Area	Hazard Classification	Density GPM/Sq.Ft.	Area of Application
General Public Areas, Offices	Light	0.10	1500
Storage rooms Mechanical spaces.	Ordinary	0.16	1500

D. Light Hazard Coverage: 225 square feet per sprinkler head.

E. Ordinary Hazard Coverage: 130 square feet per sprinkler head.

3.6 DRAINS AND TEST PIPES

A. Provide drains at base of riser, valved sections inside building, and other locations indicated or requiring same for complete drainage of systems. Siamese drains shall be equipped with automatic ball drips. Other drains shall be valves and/or plugs as indicated and/or required. Pipe drains to location as required.

B. Test pipes shall be valved and piped to discharge through proper orifice at approved locations.

C. Install buried shut-off valves in valve box.

D. Approved double check valve back-flow preventer assembly installed at sprinkler system water source connection by the Plumbing Contractor.

E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle. Install pipe bollards to protect from possible damage.

F. Place pipe runs to minimize obstruction to other work.

G. Install piping in concealed spaces above finished ceilings.

H. Hydrostatically test entire system in accordance with NFPA 13.

I. Require test be witnessed by the City of New York's insurance underwriter.

3.7 INTERFACE WITH OTHER PRODUCTS

A. Verify signal devices are installed and connected to fire alarm system.

3.8 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Final cleaning.

B. Flush entire piping system of foreign matter.

C. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Replace painted sprinklers with new.

3.9 PAINTING

A. Protect sprinkler heads during painting with small paper bags. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Painting of sprinkler/ fire standpipe piping, hangers, and all other items and accessories shall conform to the code requirements.

B. Paint sprinkler mains and combination standpipe/sprinkler mains in accordance with Specification Section 21 05 00

END OF SECTION 21 13 13

SECTION 21 30 00 – SPECIAL SERVICE PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Special service pump package and motor.
2. Controllers for electric special service pumps.
3. Electric jockey pump.
4. Controllers for pressure-maintenance pumps.
5. Special service -pump accessories and specialties
6. Flowmeter Systems.

B. Related Sections:

1. Section 21 05 00 - General Fire Suppression Requirements: Product requirements for Fire piping placement by this section.
2. Division 26 - Wiring Connections: Execution requirements for pumps specified by this section.

1.3 REFERENCES

A. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA MG 1 - Motors and Generators.

C. National Fire Protection Association:

1. NFPA 13 - Installation of Sprinkler Systems.
2. NFPA 14 - Installation of Standpipe and Hose Systems.
3. NFPA 20 - Standard for the Installation of Centrifugal Fire Pumps.

D. Underwriters Laboratories Inc.:

1. UL 448 - Pumps for Fire Protection Service.
2. UL 778 - Motor Operated Water Pumps.
3. UL 1478 - Fire Pump Relief Valves.
4. UL - Fire Protection Equipment Directory.

1.4 DESIGN REQUIREMENTS

A. Conform to NFPA 20.

B. Special Service Pump System: The special service pump system consists of an in-line fire pump, fire pump motor, automatic transfer switch, soft starting fire pump controller, jockey pump, jockey pump motor, jockey pump controller, associated valves, gauges, and test apparatus to supply water to the 25th floor and Penthouse sprinkler systems.

1. The jockey pump maintains a minimum pressure in the combined standpipe & sprinkler system.
2. The special service pump starts in the event of a drop in pressure below the minimum pressure maintained by the jockey pump.

C. Design Parameters

1. Size of selected pump is not to be changed from that shown on the Contract Drawings unless shown to be inadequate as per calculations to be provided for the sprinkler system.
2. Submittals in this section shall not be made until hydraulic calculations provided have been submitted and reviewed.
3. Special service pump and controller shall be delivered “broken down” for transport into the fire pump room, and field assembled.

1.5 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 20.

B. Pump Equipment, Accessory, and Specialty Pressure Rating: 300 psig minimum unless higher pressure rating is indicated.

1.6 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances and methods of assembly.

C. Product Data: Submit manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls, wiring diagrams and service connections. All Shop Drawings shall also be submitted to Electrical for approval.

D. Rigging: The contractor shall submit a rigging plan for bringing the special service pump and controller/transfer switch to the fire pump room prior to commencing with such work.

E. Test Reports

1. Factory performance test: certified test curve for each pump.
2. Field acceptance test: Indicate results of hydrostatic test and field acceptance tests.
3. Comply with Modified NYC Fire Code Chapter 9 Section BC 901 (901.5) (Acceptance Test).

F. Manufacturer's Installation Instructions: Submit support details, connection requirements, for fire pump system.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Contractor's written narrative identifying the specific method of performing the special service pump flow test, including safety measures for personnel and means for draining the water from the roof so as not to overload the roof or damage the building.

1.7 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of components and accessories.

C. Operation and Maintenance Data: Submit manufacturer's literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.

1.8 QUALITY ASSURANCE

A. Refer to DCAS General Conditions: Quality Requirements.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

D. Maintain one (1) copy of each document on site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience, and with service facilities within proximity of Project.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

C. Design special service pump system under direct supervision of a Professional Engineer licensed in the State of New York and experienced in design of this Work.

1.10 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product storage and handling requirements.

B. Accept special service pumps and components on site in factory packing. Inspect for damage. Comply with manufacturers rigging and installation instructions.

C. Protect special service pumps and components from physical damage including effects of weather, water and construction debris.

D. Furnish temporary, inlet and outlet caps and maintain in place until installation.

1.11 COORDINATION

A. Coordinate layout and installation of controllers with other construction including conduit, piping, special service -pump equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels. Ensure that controllers are within sight of special service -pump drivers.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.12 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.13 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

B. Furnish five -year manufacturer warranty for special service pumps.

1.14 MAINTENANCE SERVICE

A. Refer to DCAS General Conditions: Maintenance service.

B. Furnish service and maintenance of special service pump, driver, and controller for five (5) years from Date of Substantial Completion.

1.15 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Furnish one (1) set of gaskets, screens and seals for each pump type and model supplied.

C. Furnish for each controller packaged with protective covering for storage and identified with labels describing contents:

1. Indicating Lights: Two (2) of each type and color of lens installed; two (2) of each type and size of lamp installed.
2. Auxiliary Contacts: One (1) for each size and type of magnetic contactor installed.
3. Power Contacts: Three (3) for each size and type of magnetic contactor installed.
4. Contactor Coils: One (1) for each size and type of magnetic controller installed.

PART 2 - PRODUCTS

2.1 GENERAL

A. Description: Factory-tested special service -pump and driver unit.

B. Base: Fabricated and attached to special service -pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.

C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

D. Deliver the special service pump and controller “broken down” for transportation to the designated fire pump room.

2.2 SPECIAL SERVICE PUMPS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. ITT/A-C Pump Systems
2. Peerless Pump
3. Patterson
4. Aurora
5. Or approved equal

2.3 CENTRIFUGAL SPECIAL SERVICE PUMPS

A. Description, General: New York City MEA or BS&A approved, UL 448 Listed and FM Approved factory-assembled and -tested, electric-drive, centrifugal special service pumps capable of furnishing not less than 150 percent of rated capacity at not less than 65 percent of total rated head and with shutoff head limited to 140 percent of total rated head.

1. Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
2. Nameplate: Complete with capacities, characteristics, and other pertinent data.

B. Fabricate bases for special service pumps, pressure-maintenance pumps, and controllers (unless wall mounted) with reinforcement to resist movement of pumps and controllers when their bases are anchored to building structure.

C. Vertical, single stage, In-Line Special Service Pump with pump and driver mounted on same base and connected with coupling.
   1. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard. Do not use elastomeric (plastic) couplings.

D. Casing: Cast or ductile iron, with suction and discharge gage port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.

E. Impeller: Bronze construction, statically and dynamically balanced, and keyed to shaft.

F. Shaft: Solid alloy steel with bronze sleeve.

   1. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
   2. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

G. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.

H. Driver: UL-listed, NEMA MG 1, open-drip proof, squirrel-cage, induction motor complying with NFPA 20 and NFPA 70. Include wiring compatible with controller used.

   1. Manufacturers: Subject to compliance with requirement, provide products by one of the following:
      a. Emerson; U.S. Electrical Motors
      b. Lincoln Electric Company (The).
      c. Marathon Electric, Inc.
      d. WEG Electric Motors Corp.
      e. Or approved equal

I. Special service -Pump Performance Characteristics: Refer to schedules on Drawing SP-002 for additional model information.

   1. Rated Capacity: as listed on Design Drawings
   2. Inlet Flange: 300 lbs, ductile iron flange.
   3. Outlet Flange: 300 lbs, ductile iron flange.
   4. Motor Horsepower: as listed on Design Drawings

2.4 SPECIAL SERVICE PUMP CONTROLLER

A. Pump Controllers, General: UL 218 and NFPA 20; UL listed and FM approved for fire/special service pump service, suitable for use with the electric motor to be used; combined automatic and manual operation; factory tested for capacities and electrical characteristics required. Mark controller “Fire Pump Controller”.

B. Mounting: Floor-stand type for field electrical connections on the pump base.

C. Standards, Listings & Approvals:

1. The controller shall conform to all the requirements of the latest editions of: NFPA 70, National Electric Code.
2. The controller shall be listed by: Underwriters Laboratories, Inc., in accordance with UL508A, Standard for Industrial Controls.
3. The controller shall be approved by: Factory Mutual (IEC 62091).

D. Controller: UL listed, soft stop fire pump controller with automatic transfer switch, in NEMA 250 Types 2 and 12 enclosure, including the following:

1. Disconnect Switch: Externally operable, quick break type.
2. Circuit Breaker: Size to NFPA 20, minimum 65,000 amperes interrupting capacity.
3. Motor Starter: Energized automatically through pressure switch or manually by externally operable handle.
4. 0-300psi Pressure Switch, with adjustable settings: Set to cut in at160 psi.
5. Running Period: Fire Pump shall be arranged for manual stopping once it has started automatically.
6. Pilot Lamp: Indicates circuit breaker closed and power available.
7. Test Accessories: Ammeter test link and voltmeter test studs.
8. System pressure recorder, electric ac driven with spring backup.
9. Nameplate: Complete with capacity, characteristics, approvals and listings, and other pertinent data.
10. Alarm Relay for remote indication of "Pump Running", “Loss of Power" and "Phase Reversal"
11. Switch Relay: For remote start.
12. Manual Selector Station: On enclosure marked "Automatic" and "Non-Automatic."
13. Power Transfer Switch for utility normal power and generator set.

E. Enclosure

1. The controller components shall be housed in a NEMA Type 2 (IEC IP22) drip-proof, wall mounted enclosure.

F. Withstand Ratings (Short Circuit Current Ratings):

1. All controller components shall be front mounted, wired and front accessible for maintenance. The minimum withstand rating of the controllers shall not be less than 100,000 Amps RMS Symmetrical at 200-600 Volts*. If the available system fault current exceeds these ratings, the controllers shall be supplied with a withstand rating of 150,000 or 200,000 Amps RMS Symmetrical, as required.

G. Isolation Switch and Circuit Breaker

1. The controller shall include a motor-rated combination isolating disconnect switch/circuit breaker, mechanically interlocked and operated with a single, externally mounted handle. When moving the handle from “Off” to “On”, the interlocking mechanism shall sequence the isolating disconnect switch “On” first, and then the circuit breaker. When the handle is moved from “On” to “Off”, the interlocking mechanism shall sequence the circuit breaker “Off” first, and then the isolating disconnect switch.

2. The isolating disconnect switch/circuit breaker shall be mechanically interlocked so that the enclosure door cannot be opened with the handle in the “On” position except by a hidden tool operated bypass mechanism. The isolating disconnect switch/circuit breaker shall be capable of being padlocked in the “Off” position for installation and maintenance safety, and shall also be capable of being locked in the “On” position without affecting the tripping characteristics of the circuit breaker. The controller door shall have a locking type handle and three-point cam and roller vault type hardware. The circuit breaker trip curve adjustment shall be factory set, tested and sealed for the full load amps of the connected motor. The circuit breaker shall be capable of being field tested to verify actual pick up, locked rotor, and instantaneous trip points after field installation without disturbing incoming line and load conductors.

H. Operator Interface:

1. The fire pump controller shall feature an operator interface with user keypad. The interface shall monitor and display motor operating conditions, including all alarms, events, and pressure conditions. All alarms, events, and pressure conditions shall be displayed with a time and date stamp. The display shall be a 128x64 Backlit LCD capable of customized graphics. The display and interface shall be NEMA rated for Type 2, 3R, 4, 4X, and 12 protections and shall be fully accessible without opening the controller door. The display and user interface shall utilize multiple levels of password protection for system security. A minimum of 3 password levels shall be provided.

I. Ammeter/Voltmeter:

1. The special service pump controller operator interface shall be capable of displaying true RMS digital motor voltage and current measurements for all three phases simultaneously. Displays requiring push-button and selector switches to toggle between phases or current and voltage shall not be accepted.
2. Voltage and current shall be measured by True RMS technology to provide the most accurate measurement for all sine waves, including non-sinusoidal waveforms. Average responding meters will not be accepted.

J. Digital Status/Alarm Messages:

1. The digital display shall indicate text messages for the status and alarm conditions of:
   a. Motor on
   b. Local start / off delay time
   c. Fail to start
   d. Over voltage
   e. Emergency start
   f. Motor overload
   g. Disk near full
   h. Sequential start time
   i. System battery low
   j. Locked rotor trip
   k. Motor over 320%
   l. Disk error
   m. Pressure error
   n. Minimum run time

o. Remote start
p. Under voltage
q. Over frequency
r. Drive not installed
s. Printer error

2. The Sequential Start Timer, Minimum Run Timer/Off Delay Timer and Pump Restart Timer shall be displayed as numeric values reflecting the value of the remaining time.

K. LED Visual Indicators:

1. LED indicators, visible with the door closed, shall indicate:
   a. Power available
   b. Remote start
   c. Transfer switch emergency
   d. Phase reversal
   e. Motor overload
   f. Overvoltage
   g. Alarm
   h. Pump running
   i. Transfer switch normal
   j. Interlock on
   k. Emergency isolation switch off
   l. Undervoltage
   m. System pressure low
   n. Deluge open
   o. Phase failure
   p. Fail to start
   q. Automatic shutdown disabled

L. Data Logging:

1. The digital display shall monitor the system and log the following data:
   a. Motor calls/starts
   b. Total controller power on time
   c. Min/max system pressure
   d. Last locked rotor trip
   e. Max starting currents
   f. Min/max voltage per phase while idle (not running)
   g. Min/max voltage per phase during run
   h. Last locked rotor current
   i. Max run currents
   j. Pump last run time
   k. Last pump start
   l. Last phase fail/reversal
   m. Min/max frequency

n. Min voltage per phase during start.

M. Event Recording:

1. Memory: The controller shall record all operational and alarm events to system memory. All events shall be time and date stamped and includes an index number. The system memory shall have the capability of storing 3000 events and allow the user access to the event log via the user interface. The user shall have the ability to scroll through the stored messages in groups of 1 or 10.

N. USB Host Controller:

1. The controller shall have a built-in USB Host Controller. A USB port capable of accepting a USB Flash Memory Disk shall be provided. The controller shall save all operational and alarm events to the flash memory on a daily basis. Each saved event shall be time and date stamped. The total amount of historical data saved shall solely depend on the size of the flash disk utilized. The controller shall have the capability to save settings and values to the flash disk on demand via the user interface.

O. Serial Communications:

1. The controller shall feature a RS485 serial communications port for use with 2 or 4 wire Modbus RTU communications.

P. Solid Stat Pressure Transducer:

1. The controller shall be supplied with a solid stat pressure transducer with a range of 0- 300 psi +/-1 psi. The solid state pressure switch shall be used for both display of the system pressure and control of the pump controller. Systems using analog pressure devices or mercury switches for operational control will not be accepted. The Start, Stop and System Pressure shall be digitally displayed and adjusted through the user interface. The pressure transducer shall be mounted inside the controller to prevent accidental damage. The pressure transducer shall be directly pipe mounted to a bulkhead pipe coupling without any other supporting members. Field connections shall be made externally at the controller coupling to prevent distortion of the pressure switch element and mechanism.

Q. Power Transfer Switch:

1. The automatic transfer switch shall be capable of automatic power transfer from normal to alternate generator emergency power source in case of normal supply failure and automatically re-transfer after restoration of normal power conditions. Automatic emergency power transfer switch factory mounted and interwired with the pump controller. All wiring between the pump controller and the transfer switch shall be done at the factory and the entire unit assembly factory tested. The automatic transfer switch shall be reviewed and approved by the Electrical Engineer.
2. The contractor shall provide the controller and transfer switch as separate units if necessary for delivery to the fire pump room. Coordinate with the manufacturer for final wiring connections between the two sections to maintain all warranties. Verify final dimensions against field conditions.

3. Model as indicated on the drawings.

2.5 SPECIAL SERVICE PUMP ACCESSORIES

A. Eccentric suction reducer and OS&Y gate on suction side of pump.

B. Concentric increaser and check valve in pump discharge and OS&Y gate or butterfly valve on system side of check valve.

C. Special service pump bypass fitted with OS&Y gate or butterfly valves and check valve.

D. Main relief-valve, UL 1478, and enclosed type waste cone. The pressure relief valve shall be supplied by the pump manufacturer.

1. Bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.

E. Suction pressure gage, 4-1/2”diameter dial with snubber, valve cock and lever handle.

F. Discharge pressure gage mounted on board attached to pump, with snubber, valve cock and lever handle. 4-½" diameter dial.

G. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.

H. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.

I. Hose Valve Manifold Assembly:

1. Standard: Comply with requirements in NFPA 20.
2. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
4. Automatic Drain Valve: UL 1726.
5. Manifold: Similar to Croker Model 6807 or Potter Roemer model 5864.
   a. Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
   b. Body: exposed type, brass or ductile iron, - number of outlets as shown on drawing.
   c. Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
   d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
   e. Escutcheon Plate: Brass or bronze; rectangular.
   f. Exposed Parts Finish: Polished brass.
   g. Escutcheon Plate Marking: Equivalent to "Fire Pump Test."

2.6 SPECIAL SERVICE PUMP TESTING EQUIPMENT

A. The following equipment shall be stored in the pump room, in accordance with NYC Building Code requirements

1. Nozzles: Three (3) 2-1/2 x 1-1/8".
2. Spanner Wrenches: Three (3) galvanized malleable iron with holders.
3. Washers: 12.

B. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.

C. Pressure Rating: 175 psig minimum.

D. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter and fittings.

E. Permanently Mounted Flowmeter: Similar to Gerand Venturi Package Model-K, sized for the pump capacity and pipe size. Compatible with flow sensor; with dial not less than 4-1/2 inches in diameter. Include bracket or device for wall mounting.

1. Tubing Package: NPS 1/8 or NPS 1/4 soft copper tubing with copper or brass fittings and valves.

2.7 PRESSURE BOOSTER (JOCKEY) PUMP

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Grundfos
2. A-C Fire Pump Systems; a business of ITT Industries.
3. PACO Pumps; Grundfos Pumps Corporation U.S.A.
4. TACO Incorporated.
5. Or approved equal

B. Description: Factory-assembled and -tested, multistage, barrel-type vertical pump as defined in HI 2.1-2.2 and HI 2.3; designed for surface installation with pump and motor direct coupled and mounted vertically.

1. Pump Construction:
   a. Barrel: Stainless steel.
   b. Suction and Discharge Chamber: Cast iron with flanged inlet and outlet.
   c. Pump Head/Motor Mount: Cast iron.
   d. Impellers: Stainless steel, balanced, and keyed to shaft.
   e. Pump Shaft: Stainless steel.
   f. Seal: Mechanical type with carbon rotating face and silicon-carbide stationary seat.
   g. Intermediate Chamber Bearings: Aluminum-oxide ceramic or bronze.
   h. Chamber-Base Bearing: Tungsten carbide.

i. O-Rings: EPDM or NBR.

C. Motor: Single speed with permanently lubricated ball bearings and rigidly mounted to pump head. Comply with requirements of Section 21 05 13 "Common Motor Requirements for Fire Suppression Equipment."

1. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet long.

D. Nameplate: Permanently attached to pump and indicating capacity and characteristics.

E. Capacities and Characteristics:

1. Rated Capacity: as listed on Design Drawings.
2. Working Pressure: 175-psig minimum.
3. Inlet and Outlet Size: NPS 1-1/4.
4. Discharge and Suction Flanges: Class 300.
5. Motor Horsepower: as listed on Design Drawings.
6. Motor Speed: 3500 RPM
7. Electrical Characteristics: As indicated on Design Drawings

F. Jockey Pump Controller:

1. The auxiliary jockey pump controller, shall be factory assembled, wired, and tested and specifically designed for this type of service. This controller shall be of the same manufacturer as the main fire pump controller.
2. Control by automatic jockey pump controller with full voltage starter and minimum run timer shall start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump starts automatically on further pressure drop or on jockey pump failure
3. Construction:
   a. The jockey pump controller shall be full voltage starting, rated for wye-connected power systems above 240V. The controller shall incorporate a horsepower rated manual circuit protector and starting contactor, control circuit transformer with 24VAC secondary and 200-600V multi-tap primary, main disconnect switch, Hand-Off-Automatic selector switch and a 0-300 psi (0-20.7 bar) stainless steel solid state pressure transducer.

4. Operator Interface:
   a. The pump controller shall feature an operator interface with user keypad. The interface shall monitor and display motor operating conditions, including all alarms, events, and pressure conditions. All alarms, events, and pressure conditions shall be displayed with a time and date stamp. The display shall be a 128x64 Backlit LCD capable of customized graphics. The display and interface shall be NEMA rated for Type 12 protection and shall be fully accessible without opening the controller door. The display and user interface shall utilize multiple levels of password protection for system security. A minimum of 3 password levels shall be provided

5. Digital Status/Alarm Messages:

a. The digital display shall indicate text messages for the status and alarm conditions of:
   1) Pump running
   2) Low system pressure
   3) Automatic start
   4) Main switch position
   5) Sequential start time
   6) Pump restart timer
   7) System overpressure
   8) Minimum run time
   9) Fail to start
   10) Stop pressure setting
   11) Start pressure settting

b. The Sequential Start Timer, Minimum Run Timer/Off Delay Timer and Pump Restart Timer shall be displayed as numeric values reflecting the value of the remaining time.

6. LED Visual Indicators:
   a. LED indicators, visible with the door closed, shall indicate:
      12) Power On
      13) Alarm
      14) Pump running

7. Event Recording:
   a. Memory: The controller shall record all operational and alarm events to system memory. All events shall be time and date stamped and include an index number. The system memory shall have the capability of storing 3000 events and allow the user access to the event log via the user interface. The user shall have the ability to scroll through the stored messages in groups of 1 or 10.

8. Serial Communications:
   a. The controller shall feature a RS485 serial communications port for use with 2 or 4 wire Modbus RTU communications.

9. Solid State Pressure Transducer:
   a. The controller shall be supplied with a solid stat pressure transducer with a range of 0-300 psi +/- 1 psi. The solid state pressure switch shall be used for both display of the system pressure and control of the pump controller. Systems using analog pressure devices or mercury switches for operational control will not be accepted. The Start, Stop and System Pressure shall be digitally displayed and adjusted through the user interface. The pressure transducer shall be mounted inside the controller to prevent accidental damage. The pressure transducer shall be directly pipe mounted to a bulkhead pipe coupling without any other supporting members. Field connections shall be made externally at the controller coupling to prevent distortion of the pressure switch element and mechanism.

10. Controller Operation:
    a. A digitally set On Delay (Sequential Start) timer shall be provided as standard. Upon a call to start, the user interface shall display a message indicating the remaining time value of the On Delay timer.

b. The controller shall include a Minimum Run Timer to allow the motor to run for a set period of timer after starting. The timer shall be programmable through the user interface.
c. A pump restart delay timer shall be provided to allow the residual voltage of the motor to decay prior to restarting the motor and to prevent severe short cycling of the motor. The timer shall be programmable through the user interface.
d. A Lamp Test feature shall be included. The user interface shall also have the ability to display the status of the system inputs and outputs.
e. An Audible Test feature shall be included to test the operation of the audible alarm device (if supplied).
f. The disconnect switch shall be mechanically interlocked so that the enclosure door cannot be opened with the handle in the “On” position except by a hidden tool operated defeater mechanism. The disconnect switch shall be capable of being padlocked in the “Off” position for installation and maintenance safety.

2.8 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Motors: In accordance with Section 21 05 13.

B. Disconnect Switch: Factory mount in control panel.

2.9 GROUT

A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements and for conditions affecting performance of special service pumps.

B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before special service -pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Field assemble the broken down fire pump and controller units in accordance with manufacturer's guidelines.

B. Install and align special service pump, pressure-maintenance pump, and controller according to NFPA 20.

C. Install pumps and controllers to provide access for periodic maintenance including removal of motors, impellers, couplings and accessories.

D. Floor-Mounting Controllers: Install controllers on concrete bases, using floor stands high enough so that the bottom of enclosure cabinet is not less than 12 inches above finished floor. Comply with requirements for concrete bases specified in Division 03.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

E. Install special service -pump suction and discharge piping equal to or larger than sizes required by NFPA 20.

F. Support piping and pumps separately so weight of piping does not rest on pumps.

G. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Section 21 13 13 "Wet-Pipe Sprinkler Systems".

H. Install pressure gages on special service -pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Section 21 13 13 "Wet- Pipe Sprinkler Systems".

I. Install piping hangers and supports, anchors, valves, gages and equipment supports according to NFPA 20.

J. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.

K. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to Electrical Installer.

L. Wiring Method: Conceal conductors and cables in accessible ceilings, walls and floors where possible.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Section 21 13 13 “Wet-Pipe Sprinkler Systems”. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Connect relief-valve discharge the suction side of the pump, as indicated on the schematic drawing.

D. Connect flowmeter-system meters, sensors, and valves to tubing.

E. Connect special service pumps to their controllers.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

A. Test each special service pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in “Controllers for Fire-Pump Drivers."

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections and to assist in testing.

D. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Verify and Test Each Electric-Driver Controller:
   a. Verify that voltages at controller locations are within plus 10 or minus 1 percent of motor nameplate rated voltages, with motors off. If outside this range for any motor, notify Construction Manager before starting the motor(s).
   b. Test each motor for proper phase rotation.

E. Components, assemblies and equipment will be considered defective if they do not pass tests and inspections.

F. Furnish fire hoses in number, size and length required to reach storm drain or other acceptable location to dispose of special service -pump test water. Hoses are for tests only and do not convey to the City of New York.

3.7 FIELD ACCEPTANCE TEST

A. A field acceptance performance test shall be conducted upon the pump system installation completion. The test shall be conducted as recommended in NFPA 20 and shall demonstrate the peak (150%) and the rated (100%) pump capacity in the presence of the Commissioner. The method shall follow the Contractor's written narrative. A field performance standard curve shall be produced and compared for verification with the factory performance curve.

B. The field performance test for the pump system shall also comply with the requirements of The Modified New York City Fire Code Appendix Q Chapter 9 Section BC 901 (901.5).

C. The Contractor shall perform necessary Interdisciplinary Tests and Functional Performance Tests according to manufacturer's procedures.

D. Special service pump installation shall be arranged to allow the test of the pump at its rated conditions. The fire protection system must have outlets available to test the pump and suction supply piping.

E. Pump Phase Reversal Test: For electric motors, a test shall be performed to ensure that there is not a phase reversal condition in either the normal power supply configuration or from alternate power supply.

F. Controller Acceptance Test: Pump controllers shall be tested in accordance with the manufacturer's recommended test procedure. As a minimum, no less than six automatic and six manual operations shall be performed during the acceptance test. A pump driver shall be operated for a period of at least 5 minutes at full speed during each of the operations. The automatic operation sequence of the controller shall start the pump from all provided starting features. This sequence shall include pressure switches and remote starting signals. The selection, size, and setting of all overcurrent protective devices, including pump controller circuit breaker shall be confirmed to be in accordance with NFPA 20 requirements. The pump shall be started once from each power source and run for a minimum of 5 minutes. Manual emergency operation shall be accomplished by a manual actuation of the emergency handle to the fully latched position in a continuous motion. The handle shall be latched for the duration of this test run.

G. Emergency Power Supply: On installations with an emergency source of power and an automatic transfer switch, loss of primary source shall be simulated and transfer shall occur while the pump is operating at peak load. Transfer from normal to alternate source and retransfer from alternate to normal source shall not cause opening of overcurrent protection devices in either line. At least half of the manual and automatic operations of the controller acceptance tests shall be performed with the pump connected to the alternate source.

H. Test Duration: The pump shall be in operation for not less than 1 hour total time during all of the foregoing tests.

I. The Contractor must communicate in writing to the Commissioner the testing method to be used. The Contractor's written narrative shall indicate the means and method for carrying out all the steps identified in the testing procedures at grade level (150%) and at the roof. Particular emphasis shall be placed on safety, draining and the structural integrity of the roof to support the live load from the water that will be used for the test.

3.8 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Starting procedure for pumps is as follows:
   a. Prime pump by opening suction valve and closing drains and prepare pump for operation.
   b. Open sealing-liquid supply valves if pump is so fitted.
   c. Start motor.
   d. Open discharge valve slowly.
   e. Observe leakage from stuffing box and adjust sealing-liquid valve for proper flow to ensure lubrication of packing. Do no tighten gland immediately but let packing run in before leakage through stuffing boxes.
   f. Check general mechanical operation of pump and motor.

3.9 DEMONSTRATION AND INSTRUCTING

A. Demonstrate automatic operation of system including verification of pressure switch set points.

3.10 STARTUP AND WARRANTY

A. The pump manufacturer's representative shall have single source responsibility for the pumps and complete control system. Start-Up services, including adjustment and field calibration of the controls, operator instruction and system warranty, shall be included in the price for the system. The warranty shall be 12 months from the date of start-up, not to exceed 18 months from the time of shipment.

3.11 SERVICE CONTRACT

A. The manufacturer's authorized service representative shall provide a one (1) year service contract. The service contract period shall commence after the acceptance of the equipment. The service contract shall include a complete system inspection twice a year, including; check of proper pump sequencing and alarm activation with adjustments as requires; and review of instruction for operating personnel, if requested. Any required service work to be noted in a formal inspection report along with a detailed proposal for the repairs. The service representative shall provide 24 hour emergency service.

END OF SECTION 21 30 00

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SECTION 22 05 00 - GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Contractor shall provide all labor and materials required to install, test and place into operation the plumbing systems as called for in the Contract Documents in accordance with NYCBC. The contractor shall be responsible for all work associated with the design and installation of plumbing systems for this project. This shall include, but not be limited to; code review, design and layout of plumbing systems, coordination with all trades and building structure, detailed piping layouts prepared in accordance with the City of New York.
2. Contractor shall provide submission of all required shop drawing submittals for review by Commissioner, complete installation of the plumbing systems, all valves, piping, supports, fixtures, all testing and system corrections, accurate as-built drawings submitted as CAD drawings to Commissioner and all required certificates.
3. Contractor shall furnish and install all labor, materials, apparatus and appliances essential to the complete functioning of the systems described and/or indicated herein, or which may be reasonably implied as essential whether mentioned in the Contract Drawings and Specifications or not.
4. Sizes indicated on contract documents are minimum sizes and shall not be reduced.

B. Related Sections:

1. Section 03 30 00 – Cast in place Concrete: Execution requirements for inserts and sleeves specified by this section.
2. Section 09 91 00 - Painting: Execution requirements for piping painting specified by this section.
3. Division 23 05 00 - General Mechanical Requirements.
4. Divisions 22 and 23 sections as noted herein.

1.3 DIVISION OF RESPONSIBILITY

A. The requirements under Section 22 05 00 are intended for the party or parties who have been duly awarded the applicable portion of work to be performed under the indexed sections of Division 22 also known as the Plumbing Work.

1.4 REFERENCE STANDARDS

A. New York City Building Code 2022.

B. New York City Plumbing Code 2022.

C. American Society of Mechanical Engineers:

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
5. ASME B16.25 - Butt Welding Ends.
6. ASME B16.3 - Malleable Iron Threaded Fittings.
7. ASME B16.4 - Gray Iron Threaded Fittings.
8. ASME B16.5 - Pipe Flanges and Flanged Fittings.
9. ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.

D. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
3. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
4. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
7. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

F. American Water Works Association:

1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

G. Compliance with the following codes and standards shall be required as applicable:
1. CISPI Cast Iron Soil Pipe Institute

2.	NEMA	National Electrical Manufacturers Association
3.	FM	Factory Mutual
4.	NFPA	National Fire Protection Association
5.	UL	Underwriters' Laboratories, Inc.
6.	NEC	National Electrical Code
7.	ANSI	American National Standards Institute
8.	OSHA	Occupational Safety and Health Act
9.	AWWA	American Water Works Association
10.	MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
11.	ARI	Air Conditioning and Refrigeration Institute
12.	ISEA	Industry Safety Equipment Association
13.	NSF	National Sanitation Foundation
14.	PDI	Plumbing Drainage Institute
15.	FS	Federal Specification
16.	IAMPO	International Association of Plumbing and Mechanical Officials
17.	ASSE	American Society of Sanitary Engineering
18.	DOE	United States Department of Energy
19.	EPA	United States Environmental Protection Agency
20.	NYCFC	New York City Fire Code
21.	NYCMC	New York City Mechanical Code
22.	NYSEC	Energy Conservation Construction Code of New York State (New York State Energy Code)

H. Conform to materials and equipment rating standards, listings or classifications of the above organizations as well as ratings, listings or classifications accepted under local codes and laws.

1.5 ABBREVIATIONS

A. In addition to those listed below, meanings of common abbreviations used in text of Division 22 of the Project Specifications are tabulated in ASHRAE Handbook, "Fundamentals", latest edition.

B. Project Abbreviations:

1.	DCAS	Department of Citywide Administrative Services
2.	MER	Mechanical Equipment Room
3.	HVAC	Heating, Ventilating and Air Conditioning
4.	BMS	Building Management System
5.	AC	Air Conditioning
6.	H & V	Heating and Ventilating
7.	AWG	American Wire Gauge
8.	BWG	Birmingham Wire Gauge
9.	USS	United States Standard
10.	B & S	Brown & Sharpe
11.	OS & Y	Outside Screw and Yoke
12.	IBBM	Iron Body Brass Mounted
13.	WSP	Working Steam Pressure
14.	PSIG	Pounds per Square Inch Gauge
15.	PRV	Pressure Reducing Valve

16. GPM Gallons per Minute
17. MBH Thousand BTU per hour
18. BTU British Thermal Units
19. F Degrees Fahrenheit
20. WG Water Gage
21. GPM Gallons Per Minute
22. # Number
23. SP Static Pressure
24. CFM Cubic Feet per Minute
25. LB Pound (Also shown as: #)

C. See Drawings for additional abbreviations.

1.6 DEFINITIONS

A. "Provide" means to "Furnish" and "install".

B. "Install" means to erect, join, units, fasten, link, attach, set up, connect, test and turn over to the City of New York, complete and ready for regular operation, the particular work referred to.

C. "Furnish" means to purchase and supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application for the particular work referred to.

D. "As Directed" means as directed by the Commissioner.

E. "Concealed" means embedded in masonry or other construction, installed behind wall furring or within double partitions, installed within hung ceilings, pipe shafts and pipe spaces.

F. "Submit' means submit to the Commissioner for review. Refer to Architectural, General and Special Conditions for proper procedures.

1.7 REVIEW OF CONTRACT DOCUMENTS AND SITE

A. With the submission of his Bid, Contractor shall give written notice to the Commissioner of any materials or apparatus believed in-adequate or unsuitable, in violation of laws, ordinances, rules or regulations of the City of New York, and any necessary items of work omitted. In the absence of such written notice it is mutually agreed that the Contractor has included the cost of all required items in his Proposal for a complete project.

B. Contractor shall acknowledge that he has examined the Plans, Specifications and Site, and that from his own investigations he has satisfied himself as to the nature and location of the work; the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials; availability of labor, water, electric power, roads and uncertainties of weather; the conformation and condition of the ground; the character, quality and quantity of surface and subsurface materials to be encountered; the character of equipment and facilities needed preliminary to and during the execution of the work; all federal, state, county, township and municipal laws, ordinances and regulations particularly those relating to construction methods; and all other matters which can in any way affect the work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with the available

information concerning these conditions will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work.

C. The City of New York assumes no responsibility for any understanding or representation made during or prior to the negotiation and execution of this Contract unless such understanding or representations are expressly stated in the Contract, and the Contract expressly provides that the responsibility, therefore, is assumed by the City of New York.

1.8 MEASUREMENTS

A. Contractor shall base all his measurements, both horizontal and vertical from established benchmarks. All work shall agree with these established lines and levels. He shall verify all measurements at site; and check the correctness of same as related to the work.

1.9 BID DOCUMENTS

A. The drawings show the general layout of the various items of equipment; however, layout of equipment, accessories, specialties, and piping systems are diagrammatic unless specifically dimensioned, and do not necessarily indicate every required fitting, support or similar items required for a complete installation. Consult the architectural drawings and details for exact locations of fixtures and equipment located in finished construction and/or surfaces. Where same is not definitively located, obtain the information from the Commissioner before proceeding by submitting a dimensioned submittal for review. Any reasonable changes in locations indicated shall be made by this Contractor without additional cost to the City of New York.

B. The Contractor shall follow the drawings in laying out the work and check drawings of all trades to verify spaces in which work shall be installed. Maintain maximum headroom and where space conditions appear inadequate, the Commissioner shall be notified before proceeding with the installation.

C. In general, specifications describe quality and type of material and equipment.

D. The drawings show the various systems schematically. No added compensation shall be granted for variations due to field conditions or resulting from coordination with subcontractors working under other divisions of the specifications and/or design documents.

E. Work that is reasonably inferable scope of work not shown on the drawings but called for in the specifications, or vice versa, shall be provided by the Contractor without additional expense to the City of New York.

F. Where variance occurs between the drawings and specifications, or within either document itself, the Contractor shall request clarification in writing from the Commissioner as to which item and manner in the work shall be installed.

G. The commercially standard items of equipment and the specified names mentioned herein are intended to identify standards of quality and performance necessary for the proper functioning of the work.

H. Equipment shown on the drawings with particular manufactures identified has been coordinated for structural penetrations, electrical connection, operating and service (maintenance) requirements, and physical size with regard to the space where the equipment is shown. If they comply with the project specifications, these and the other specified manufacturers of this equipment shall be acceptable, contingent on the Contractor providing a complete installation and maintaining full responsibility to provide, at no additional cost, any modifications to the structure or electrical service that are required to properly install, operate and service the equipment being used. These modifications shall not include additional area for equipment unless approved by the Commissioner.

1. The Contractor shall note these changes on the equipment submittal and shall show all differences in equipment being supplied from that shown on the drawings. Failure of the Contractor to provide this information with the submittal shall indicate the submitted equipment meets or exceeds in performance the equipment shown on the drawings and is physically no larger than the equipment specified.

I. Failure of the Contractor to comply with the above and any discrepancy found shall result in the Contractor providing equipment equal to that specified at the Contractor's expense.

1.10 SPACE LIMITATIONS

A. The equipment selections used in the preparation of the Contract Documents shall fit into the physical spaces provided and indicated, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearance in accordance with Code requirements, the requirements of the equipment manufacturer's recommendations.

B. In the preparation of drawings, a reasonable effort to accommodate acceptable equipment manufacturer's space requirements has been made; however, since space requirements and equipment arrangement vary according to each manufacturer, the responsibility for initial access, maintenance access, Code-required access and proper fit rests with the Contractor.

C. Physical dimensions and arrangements of equipment to be installed shall be subject to the Commissioner's review.

D. Coordinate the installation of equipment, ductwork, conduit, bus duct, piping, cable, cable trays, etc., installation with lighting fixtures, special ceiling construction, air distribution equipment and the structure. Provide additional rises, drops and offsets as required. If, after installed, new ductwork, conduit, bus duct, piping or cable is found to be in conflict with the architecture, structure or other work which is either existing or shown on the Contract Documents, the ductwork, conduit, bus duct, piping or cable shall be relocated without additional cost to the City of New York.

E. The Contractor shall follow the drawings in laying out the work and check drawings of all trades to verify spaces in which work shall be installed. Maintain maximum headroom and, where space conditions appear inadequate, the Commissioner shall be notified before proceeding with the installation.

1.11 LABOR AND MATERIALS

A. All materials and apparatus required for the work shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces.

B. Contractor shall remove all materials delivered, or work erected, which does not comply with Contract Drawings and Specifications, and replace with proper materials, or correct such work as directed, at no additional cost to the City of New York.

1.12 COVERING OF WORK

A. No pipe, fitting, or other work of any kind shall be covered up or hidden from view before it has been examined or approved by the Commissioner over same. Any unacceptable work, or unauthorized or disapproved materials discovered shall be removed and corrected immediately after being condemned.

B. Any type of equipment shown or specified to be installed outdoors, on grade or on roof, shall have appropriate protection against outdoor weather. Equipment such as motors, panels, etc. shall have rain hood or appropriate protection as provided under Division 22. Insulated pipes shall have aluminum covers or as specified. Insulated ducts shall be provided with aluminum jacket with overlapping, sealed joints. Uninsulated ducts shall be soldered joints and seams or as specified. Where no protection is feasible, such as in exposed vibration springs, hangers, pipe or steel members, such items shall be hot dipped galvanized or as approved by the Commissioner.

1.13 PROTECTION

A. Contractor shall protect the work and material of all trades from damage by his work or workmen and shall replace all damaged material with new.

B. Contractor shall be responsible for work and equipment until his work is finally inspected, tested, and accepted; he shall protect his work against theft, injury or damage; and carefully store material and equipment received on site which is not immediately installed; close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.

C. Contractor shall be responsible for the preservation of all public and private property, along and adjacent to the work, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits and other underground structures or utilities, and shall carefully protect from disturbance or damage all property marks until the Commissioner has witnessed or otherwise referenced their location and shall not remove them until directed.

D. All mechanical and electrical equipment delivered to the site shall have appropriate wrapping to protect them from rain, flood, wind, construction debris and all types of water damage normally encountered at the construction sites. Protection of equipment such as fans, coils, valves and similar equipment shall be the responsibility of the Contractor receiving such equipment at the jobsite for installation under Division 22 Contract.

1.14 CUTTING AND PATCHING

A. Provide all cutting, rough and finish patching required for systems and equipment included in these specifications.

B. Furnish and locate all sleeves and inserts required before the floors and walls are built; Contractor shall pay the cost of cutting and patching required for pipes where sleeves and inserts were not installed in time, or where incorrectly located. Provide all drilling required for the installation of hangers.

C. All holes cut through concrete slabs or arches shall be punched or drilled from the underside. No structural members shall be cut without the approval of the Commissioner and all such cutting shall be done in a manner directed by him.

D. Contractor shall not do any cutting that may impair strength of building construction. No holes, except for small screws, may be drilled in beams or other structural members without obtaining prior approval. All work shall be done in a neat manner by mechanics skilled in their trades and as approved.

E. Provide sleeves and fire stopping at piping and ductwork floor, wall and roof penetrations in accordance with recognized standards.

1.15 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Procedure:

1. Prepare a schedule of specific submissions at the outset of the Project for the Commissioner's review and approval; make submissions listed below and in the other Sections of Division 22.
   a. If submissions listed in other Sections of Division 22 are more specific than those listed below, comply with the more specific requirements.
   b. Failure of the Contractor to submit Shop Drawings in ample time for checking shall not entitle him to an extension of Contract time, and no claim for extension by reason of such default will be allowed.
   c. Piecemeal submittals are unacceptable and will not be reviewed. No submittal shall be considered for review, the review of which is contingent upon acceptance of other features for which submittals have not been submitted.
   d. Submittals from Vendor without Contractor's review and approval stamp will not be reviewed.
   e. Submittals shall not be used by the Contractor as a means to secure approval of a substitution. Contractor must indicate all deviations, omissions and substitutions in his submittal; if there are none of these 3 exceptions, he shall then state on the submittal: "No Exception Taken". Any submittal without stated exceptions, or without statement that no exception is taken will not be reviewed and will be rejected and returned to Contractor for rectification.
   f. All products of a similar nature (i.e., valves, pipe, fixtures) shall be provided by one manufacturer.

C. Shop Drawings:

1. Manufacturer's Drawings:
   a. Submit equipment listed in all applicable Sections - include material specifications, operating characteristics and finishes, specified agency listings or approvals.
   b. Cuts, brochures or other literature submitted for expeditious approval but incomplete or missing items of hardware or software (performance data) shall be re-submitted until all system or equipment components have been reviewed and approved. Any item not included in the original or first submission shall be considered outstanding work until such item of equipment or work has been sub- mitted or installed in place exactly conforming to the intent of the contract documents.
   c. Contractor shall provide preliminary layout drawings of all major pieces of equipment (i.e., water heaters, pumps, backflow preventers), confirming that the submitted product physically fits within the architectural enclosures. This drawing is required along with the manufacturer's product data.
   d. Contractors shall be responsible for all costs related to substitutions as they affect other contractors.

2. Installation Drawings:
   a. Furnish coordinated drawings of equipment installation, including interconnecting piping and ductwork. Minimum scale for these drawings shall be 1/4 inch equals one foot for piping and 3/8 inch equals one foot for ductwork.
   b. Coordinate space requirements for electrical, HVAC and other trades in the vicinity of work.
   c. Include connections, anchorages and fastenings for piping, conduit and ductwork.
   d. Make allowance for clearances for access to and maintenance of equipment.
   e. Do not install any piping or equipment, in any area, prior to obtaining approval of its layout by means of submitting shop drawings.
   f. Any missing items of equipment, material or labor, during initial submission of shop drawings, are to be completed and re-submitted for final approval. Shop drawing should not be used as a vehicle for obtaining variances, deviation or omission from the scope of contract documents. Approval of a submittal shall pertain to the portions that conform to the intent of the contract documents.
   g. Submission of any missing, incomplete or otherwise deviant layout is subject to re-submission until all contract requirements have been properly included or shown on the same layout.
   h. Submit drawings indicated on equipment and piping loads to the Commissioner for review.

D. Required Samples:

1. Color samples, for prefinished items.
2. Natural finish metals, for quality of finish.

E. Reports:

1. Compliance with listings and approvals for equipment and for fire ratings.
2. Acceptance certificates from inspecting agencies.
3. Complete printed and illustrated operating instructions where required in report format.

4. Manufacturer's pressure tests on vessels.
5. Manufacturer's performance tests on operating equipment.
6. Field pipe testing reports.
7. Welder's certificates and field test reports.
8. Field operating test results for operating equipment.
9. Performance report on the balancing of water systems.
10. Performance reports for vibration isolation equipment.
11. Manufacturer's reports on motorized equipment alignment and installation.
12. Additional reports as noted in other sections.

F. Specific references to any article, device, product or material, fixture or item of equipment by name, make or catalog number shall be interpreted as establishing a basis of cost and a standard quality. All devices shall be of the make and type listed by Special Agencies, such as the Underwriters' Laboratories, and where required, approved by DCAS.

G. Contractor shall be responsible for any deviations in equipment size, motor horsepower and access requirement, from specified products, including coordination with and costs associated with the related work of other Trades.

1.16 COMPLETE PERFORMANCE OF WORK

A. Contractor, under this section of the specifications, shall provide all labor, materials, supervision, supplies, tools, scaffolding, machinery, equipment, appliances and services (including transportation, rigging, storage utilities, etc.) and all required permits and licenses necessary to complete the work under this Contract. All systems and equipment shall be complete in every respect and all items of material, equipment and labor shall be furnished, installed, tested and commissioned for a fully operational system.

B. Contractor shall coordinate his work with the work of the other trades so as to resolve conflicts without impeding job progress or the project construction schedule. Provide notice with the bid proposal of any concrete work required by this section that is not indicated on the structural or architectural drawings or drawings of other trades.

C. Contractor shall examine all Contract Documents for all sections of the specifications in order to determine the extent of work required to be completed under this section. Failure to examine all Contract Documents for this project shall not relieve Contractor of the responsibility to perform all the work required for a complete, fully operational and satisfactory installation.

D. Work shall be executed in strict accordance with the best practice of the trades in a thorough, workmanlike manner by competent, skilled technicians and trade personnel.

E. Contractor shall provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. All labor, materials, apparatus and appliances essential to the complete and proper functioning of the systems described and/or indicated herein, or which may be reasonably implied as essential, whether mentioned in the Contract Drawings and specifications or not, shall be furnished and installed by the Contractor. The entire installation shall be ready in every respect for the satisfactory and efficient operation when completed.

G. In cases of doubt as to the work intended, or in the event of need for explanation thereof, request supplementary written instructions in the form of a Request For Information (RFI) from the Commissioner.

H. Prior to commencing with the fabrication and/or installation, shop drawings must be prepared and approved, and the work specified herein and shown on the Contract Drawings must be coordinated with all other trades.

I. Contractor shall be responsible for material and workmanship until completion and final acceptance. Replace any of same which may be damaged, lost or stolen, without additional cost to the City of New York. Guard the building and its contents against damage by this Contractor, his employees or Subcontractors, and make good any damage free of charge.

J. Where, due to union regulations or trade agreements, any of the work shown on the drawings or specified herein is not considered this trade's work, subcontract the work in question, but assume full responsibility for the complete installation. Except for such changes as may be specifically approved by the Commissioner, in accordance with alternates or options stated hereinafter, all work must be in full accordance with the intent of the plans and specifications, complete in every way and ready for satisfactory and efficient operation when delivered to the City of New York.

K. Provide signs required by the City of New York.

L. Provide all rigging required for complete installation and furnish drawings showing necessary points of support, reactions and supplementary bracing. This shall be submitted for approval by Commissioner. Should any shoring be required, provide same after Commissioner's approval. Rigging plan shall be provided to the Commissioner for review prior to scheduling rigging. Rigging plan must be stamped by a Professional Engineer licensed in the State of New York.

M. Become thoroughly acquainted with the work involved and obtain and verify at the building all measurements necessary for the proper installation of work. Furnish to subcontractors any information relating to work of this division necessary for the proper installation of their Contracts. Confer with subcontractors for finish adjacent to work of this division and arrange to have visible portions of the work (such as access doors, grilles, escutcheons, etc.) fit in with the finish in a manner satisfactory to the Commissioner.

N. Certain materials may be furnished, installed or furnished and installed under other sections of the specifications. Examine the Contract Documents to ascertain these requirements.

O. Carefully check space requirements with other trades to ensure that all material can be installed in the spaces allotted thereto. Finished suspended ceiling elevations are indicated on the General Construction Drawings.

P. Transmit to other trades all information required for work to be provided under their respective divisions (such as water connections, foundations, electric wiring, access doors and the like) in ample time for installation.

Q. Wherever the Contractor's work interconnects with work of subcontractors, Contractor shall coordinate his work with the subcontractors to ensure that all information is necessary so that they may properly install all the necessary connections and equipment. Identify all work items

(valves, dampers, pull boxes, etc.) in an approved manner in order that the other trades may know where to install such items such as access doors, panel, etc.

R. Where disagreements occur between the plans and the specifications or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the Base Bid.

S. Provide required supports and hangers for piping, ductwork, conduit and equipment, so that loading shall not exceed allowable loadings of structure. Submittal of a bid shall be deemed a representation that the Contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

T. Set all inserts in ample time to allow the work of the other trades to be performed on scheduled time.

U. Furnish and set all sleeves for passage of pipes through structural masonry and concrete walls and floors and elsewhere as required for proper protection of each pipe passing through building surfaces. Coordinate this work with the Commissioner in order to expedite and properly perform this work

V. Field drilling, cutting and/or reinforcing of holes in structural metal deck required for work under this division shall be coordinated and approved by the Commissioner. All such drilling, cutting and reinforcing costs shall be borne by the Contractor.

W. Should the Contractor neglect to perform preliminary work and should cutting be required in order to install equipment, the expense of this cutting and restoring of surfaces to their original condition shall be borne by the Contractor.

X. Architectural drawings shall be checked for ceiling height requirements.

Y. Due to the type of installation, a fixed sequence of operation is required to properly install the complete systems. It shall be the responsibility of the Contractor to coordinate, protect and schedule his work with other trades in accordance with the construction sequence.

1.17 COORDINATION

A. Contractor shall prepare preliminary shop drawings suitable for use in coordinating his work with the work of other trades. The HVAC Section shall prepare and furnish background with ductwork at 3/8" = 1'-0" scale for all trades to indicate piping, cable tray and conduit in relation to all structural elements of the construction, including floor elevations; steel locations, size and elevations; partitions locations; door locations and direction of swing; and all other information required to assure coordination of the electrical, sheetmetal and piping trades and fire protection in relation to the Architectural function of the project. Coordination meetings shall be held under the supervision of the Commissioner. Each trade shall have proper representation at all coordination meetings for the purpose of detailing, on the drawings mentioned above, the exact location and routing of their work. After the conclusion of the coordination at the working meetings, each trade shall sign the coordinated originals, copies of which shall be distributed by the Commissioner. Final shop drawings of all trades shall be in accordance with the coordinated drawing, after which final shop drawings shall be submitted for final approval.

B. If the contractor installs work so as to cause interference with work of other trades, he shall make necessary changes in work to correct the condition immediately without delaying project and without extra charge.

C. Dimensional layout plans of equipment rooms shall be made showing all bases, pads and inertia blocks required for mechanical equipment. Include dimensions of bases, bolt layouts, details, etc.

D. Contractor shall furnish all necessary templates, patterns, etc., for installing work and for purpose of making adjoining work conform, furnish setting plans and shop details to other trades as required.

1.18 CONCRETE AND GROUTING

A. Provide concrete pads for all floor-mounted equipment.

B. Contractor shall make coordinated layouts showing concrete work required for housekeeping pads, which are cast in place.

C. Concrete housekeeping pads: 4" minimum thickness, sized to cover the full area of each piece of equipment and access area provided under Concrete Work.

D. Concrete bases: Dimension and height to suit the equipment.

1.19 ACOUSTICAL PERFORMANCE OF EQUIPMENT AND SYSTEMS

A. Noise levels from operation of motor driven equipment, whether airborne or structure-borne, and noise levels created by or within plumbing equipment are not to exceed sound pressure levels determined by the noise criteria curves in the ASHRAE Guide.

B. Acoustical Tests:

1. The City of New York may require contractor to conduct sound tests for those areas or equipment he deems too noisy.
2. If NC level in any space exceeds that in the schedule or the specification due to improper installation or operation of mechanical systems, the Contractor is required to make remedial changes or repairs.
3. Contractor is required to retest until specified criteria has been met.

1.20 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Instructions and Demonstration for the City of New York's Personnel:

1. After all equipment is functioning properly, each system is to be automatically operated for five (5) working shifts, and not to be adjusted during this period, 40 hours scheduled at the convenience of the City of New York. Any adjustments will void the test and start the time period all over again.
2. During this period, instruct the City of New York's personnel in the use, operation and maintenance of all equipment of each system. Lessons will include a lecture-type

instruction given in a non-machine room environment. During the lesson, normal operation of the system installed and operating will be explained, along with troubleshooting procedures. This will be followed by a field inspection and demonstration of equipment.

3. The above instruction is exclusive of that required of specified equipment manufacturers. If more stringent or longer instruction is indicated for specific equipment or systems, these shall supersede the above requirements.

B. Operating and Maintenance Data:

1. Provide four (4) complete sets of manufacturer's catalogues, instructions, maintenance and repair information and parts lists for operating equipment and devices.
   a. Include performance curves for fans and pumps, factory furnished wiring diagrams and control diagrams, and applicable flow diagrams.
   b. Submit seven sets of instructions for distribution.

2. Data for the equipment installed is to be submitted.
3. The data is to be carefully checked for accuracy by comparison with the installed equipment nameplates.
4. Provide a recommended list of spare parts for equipment and list of special, non-standard tools to service equipment.
5. Index and assemble the instructions in durable loose-leaf binders.
6. The completed binders are to be available at the time the equipment installation begins.
7. In addition, follow all requirements of General Conditions Section 01 77 00 - Execution and Closeout Requirement.

1.21 RECORD DRAWINGS

A. Provide and maintain a currently up-to-date record set of reproducible prints showing all changes, additions or omissions made during construction. Contractor shall, at his own expense, produce the Record Drawings.

B. Deliver four (4) sets of all as-built drawings and one (1) set of reproducible drawings of the record drawings to the City of New York before submitting requisition for final payment.

C. Shop Drawings shall be cross-referenced on the mylar copies for this requirement where applicable.

D. Submit AutoCAD compatible as-built drawing files.

1.22 WARRANTY

A. The following supplements the General Conditions for Plumbing Work:

1. Non-durable, expendable items such as replaceable (not cleanable) water filter media are not subject to replacement after the date of acceptance.
2. Warranty time limits for equipment exceeding those indicated in General Conditions are specified in the applicable Sections of Division 22.

B. In addition, follow all requirements of General Conditions Section 01 77 00 - Execution and Closeout Requirement.

1.23 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and tag numbering.

1.24 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform Work in accordance with NYCBC.

C. Comply with current governing codes, ordinances and regulations, as well as with requirements of EPA, NFPA, U.L. and all other applicable codes.

D. Comply with the requirements of New York City over any part of the work and secure all necessary permits.

E. Where codes or standards are listed herein, the applicable portions apply.

F. Plans, specifications, codes and standards are minimum requirements. Where requirements differ, apply the more stringent.

G. Should any change in plans or specifications be required to comply with governing regulations, notify the Commissioner.

H. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workmanlike manner by competent workmen. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

1.25 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within proximity of Project.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.26 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Product storage and handling requirements.

B. Deliver and store valves in shipping containers, with labeling in place.

C. Furnish cast iron and steel valves with temporary protective coating.

D. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. If products and materials are specified or indicated on the drawings for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of the Commissioner.

B. Provide products and materials that are new, clean, free of defects and free of damage and corrosion.

C. All products and materials used in this project will not contain asbestos, P.C.B.'s or any other material which is considered hazardous by the Department of Environmental Protection.

D. Replace materials of less than specified quality as designated by the Commissioner and relocate work incorrectly installed as determined by the Commissioner.

E. Provide name/data plates on major components of equipment with manufacturer's name, model number, serial number, capacity data and electrical characteristics attached in a conspicuous place.

F. Install materials and equipment with qualified trades people.

G. Maintain uniformity of manufacture for equipment used in similar applications and sizes.

H. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards, and as approved by DCAS.

I. Fully lubricate equipment when installed.

J. Do not operate water systems until piping has been cleaned and tested and all required equipment is in place.

K. Locate all floor-mounted equipment on a concrete pad.

L. Provide steel channel support system for all wall or floor-mounted panels, devices, etc.

M. Secure equipment with bolts, washers and locknuts of ample size to support equipment. Embedded anchor bolts to have bottom plate and pipe sleeves. Grout machinery set in con- crete under the entire bearing surface. After grout has set, remove wedges, shims and jack bolts and fill space with grout.

N. Locate valves, access doors, etc. to be easily accessible, either in mechanical spaces or through access panels specified herein. Obtain Commissioner's approval of access panel locations.

O. Follow manufacturers' instructions for installing, connecting and adjusting equipment. Provide one copy of such instructions to the Commissioner before installing any equipment. Provide a copy of such instructions and attach to the equipment for reference during work on the equipment.

P. Pressure vessel and relief valves shall be selected, built and labeled in accordance with ASME. Obtain a certificate from the Building Inspector showing such acceptance and mount this certificate in a black frame under glass or laminated plastic adjacent to each pressure vessel and relief valve.

Q. Where factory testing of equipment is required to ascertain performance and attendance by the Commissioner is required to witness such tests, associated travel costs and subsistence shall be borne by the Contractor.

R. Equipment capacities, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be de-rated with the method of de-rating identified on shop drawings.

2.2 EQUIPMENT AND SYSTEMS CRITERIA

A. The criteria of design and performance to produce the required operation is based on equipment shown or scheduled, and as specified.

B. Equipment of other manufacturers will be considered, subject to its acceptability and the following:

1. The equipment must conform to the structural design provisions for loads applied to the structure; to the dimensions established by drawings for spaces and other (service, etc.) clearances; and for inlet and outlet locations and relationships to associated equipment and piping.
2. Changes to the building arrangement or structure, which are required to suit equipment offered must be by the Contractor at no extra expense to the City of New York.
3. Changes to the electrical requirements such as circuit breaker or starter size, conduit or wire size shall be coordinated by the Contractor and the expense borne by him with no additional cost to the City of New York.
4. Changes to other Contractor's scope of work shall be the responsibility of this Contractor, at no extra expense to the City of New York.

C. Operating equipment, operating systems and other products are specified by names and models and by performance criteria standards:

1. Where both specifying media are employed, the names and models establish a standard for manufacturing quality, while the performance criteria govern the capacity, rating or output.
2. In any question regarding intent, the capacity, rating or output which is compatible with the other systems, is intended to be of prime concern and is to be provided.

3. Contractor shall follow the City of New York's Standards for Turn-Over Acceptance, Commissioning and Testing. Where there is a conflict between these requirements and Building Department's requirements, the more stringent requirements shall apply.

D. The descriptions of equipment and systems cover basic equipment and operation, but not all the details of design and construction.

1. The use of singular in descriptions does not limit the quantities to be furnished to produce the complete system, together with the results specified.
2. Furnish equipment required to provide specified performance under installed conditions.
3. Factory wiring and piping is to conform to specifications for field work, unless otherwise specified.
4. Provide trim, enclosures, transition pieces and accessories required to make complete installation in each instance.

E. All Drawings of Division 22 are schematic and diagrammatic.

1. Symbols and diagrams are used to indicate the various items of work and the complete systems, but they do not necessarily have dimensional significance, neither do they necessarily include all related and subsidiary parts and equipment. Contractor shall provide all parts, elements, transition pieces, etc. as required for a complete and operational system.
2. The work is to be installed complete and ready for operation in conformity with the intent expressed on the Drawings and in the Specifications.
3. Coordinate work with the requirements of the Architectural and Structural drawings for dimensions, locations and clearances.
4. Locations of mechanical and electrical items which are exposed to view shall be taken from the Architectural Drawings where available or are to be located as directed by the Commissioner.
5. Contractor shall provide all transition pieces and rises/drops for piping.
6. Minimum height of piping, valves, etc. in mechanical rooms excluding drops to equipment, shall be 7'-0" unless otherwise noted

2.3 IDENTIFICATION MARKINGS

A. Every valve, control, and apparatus installed under this Contract shall be tagged, labeled or stenciled as follows: Tags and labels securely fastened by brass chains, screws or mastic as applicable. Equipment controls numbered according to equipment schedules on Plans. Tags numbered to conform to a directory listing number, location and use. Directories to be mounted under glass in aluminum self-closing frames, 8-1/2" x 11" in size.

1. Apply identification after testing, insulation and field painting are completed.

B. Valve Identification:

1. Provide an identification tag for each valve, including control valves.
2. Differentiate between the different classes of service in the numbering systems.
3. Use 2" brass tags stamped with designation numbers 1" high, filled in with black enamel.
4. Attach tags securely to handles or spindles of valves with heavy brass "S" hooks or brass chains.

5. Provide six copies of valve charts with one of each framed under glass and mounted where directed.

C. Piping Identification:

1. Provide on bare and covered pipes for all services.
2. Use a system of marking and colors conforming to ANSI A-13.1.
3. Install to provide permanent adhesion.
4. Install in readily visible location.
5. Apply legend and flow markers as required for maintenance purposes, with at least one marker in every 50'-0" of each line and at every change of direction.
6. Color Coding of Piping: After exposed and visible piping has been finish painted, the installer of the piping shall identify the type of service lines with applied color bands. The direction of flow shall be indicated with stenciled arrows. Color bands shall be 1-inch wide, finished in gloss enamel; lettering and arrows shall be same color as the bands. Indicators shall be applied at connections to other equipment; at entrances to spaces; adjacent to valves; near access doors to pipe spaces; and at maximum intervals of 50 feet on long pipe runs. Letters shall be positioned to be easily read from a normal standing position. If there is no standard for color code and designation, the following colors and letter designations shall be used:

Plumbing Piping		
Service	Color	Designation
Cold water	Green	Cold Water
Hot water	Yellow	Domestic hot water
Hot water return	Yellow	Domestic hot water return
Sanitary	Green	Sanitary sewer
Vent	Yellow	Vent
Rain water	Green	Storm
Pump discharge	Green	Pump discharge

D. Equipment Identification:

1. Provide stencil lettering on operating equipment and units:
   a. Use black oil base paint, except where equipment finish is dark, use white paint.
   b. Make all characters distinguishable from the floor, but not less than 2" high.

2. For each motor starter, controller and similar accessory provide a lamicore nameplate attached with screws or rivets to a fixed part of the equipment in a visible location.
   a. Make plates not less than 2" x 1" x 1/8" thick with 1/4" high characters.
3. Equipment such as tanks, access doors to equipment such as filters, neatly stenciled with letters not less than 1 inch high. Any equipment too small to receive such stenciling shall be provided with brass name tags 2" x 1” in size.
4. In areas where removable ceilings occur, install appropriate color-coded tile markers to indicate location of valves and other equipment or fittings that may require maintenance service.

E. Refer to Division 22 for additional requirements.

2.4 ALTERNATIVE MATERIALS AND EQUIPMENT

A. Contract Documents are based on materials specified and on equipment manufacturers indicated on the Drawings. Approval by the Commissioner of equipment manufacturers other than indicated on the Drawings or materials other than specified, does not relieve Contractor of any responsibility to provide equipment and materials which will meet the performance as stated or implied by the Contract Documents.

B. Only the equipment manufacturers listed in individual sections are acceptable for this project, subject to requirements of contract documents.

C. Submit proposals to supply alternative materials or equipment, in writing, to the Commissioner with sufficient lead time for review by the Commissioner prior to the date equipment must be ordered to maintain project schedule. Contractor submitting alternative will reimburse the City of New York for all costs associated with the review of the proposed alternative whether alternative is accepted or rejected.

D. Include all revisions required to adapt alternatives in such proposals, including revisions by other trades. Acceptance of an alternative will only be considered if there is no increase in the contract price.

E. Wherever operating results such as quantity delivered or pressure obtained are scheduled, or when the make and size of apparatus, for which such quantities are readily determinable, is specified, the substitution being proposed must conform substantially to the quantities specified or implied. The substitution must fit into available space conditions and must function properly in coordination with the rest of the system.

F. Proposed changes and substitutions of systems, apparatus, equipment and manufacturers will be considered, subject to the approval of the Commissioner. Include the following information with the proposal.

1. A description of the difference between the existing contract requirements and that proposed, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on subcontractors and acknowledge the inclusion of implementation costs.
2. Schematic drawings and details to supplement the description.
3. A list of the contract requirements that must be revised if the change is accepted, including any suggested specification revisions.
4. Complete list of materials and equipment proposed for use in the change.
5. Include a description and estimate of costs the City of New York may incur in implementing the change, such as test, evaluation, operating and support costs.
6. A projection of any effects the proposed change would have on collateral costs to the City of New York.
7. A statement of the time by which a contract modification accepting the change must be issued, noting any effect on the contract completion time or the delivery schedule.
8. A statement indicating the reduction to the contract price if the City of New York accepts the change. Be responsible for appropriate modifications to all trades.

2.5 PROTECTION OF ELECTRICAL EQUIPMENT

A. Keep piping 6'-0" outside the vertical line of unprotected electrical equipment or provide non-corrosive metal (soldered 20 gauge copper or welded stainless steel), watertight support, pans piped to an indirect drain line to a proper receptor.

1. Construct and support pans to hold minimum depth of 3 inches of water.

2.6 ACCESS DOORS

A. General:

1. Steel, flush four-sided frame and door assembly, chemically cleaned after fabrication and painted with rust inhibitive primer.
2. Provide hardware and locking devices.
3. Provide access doors required for access to mechanical work through finished wall construction and non-removable ceiling construction.
4. Deliver doors and location information to appropriate trade for installation.

B. Provide flush type access door or panel no smaller than 18" x 18" and no larger than 30" x 30" for all valves, cleanouts, or apparatus located in chases, walls, non-accessible hung ceilings or floors; finish shall be prime coat, except floor panels which shall be polished brass or chrome plate. Doors and trim 14 gauge steel, frame 16 gauge steel, with flush concealed and standard flush locks, screwdriver operated cams, of Milcor manufacturer, Karp Associates, Nystrom or approved equal.

1. All panels and their exact location subject to approval of the Commissioner.
2. Where space conditions prevent door swinging open, provide removable door on lift-up hinges. This will only be accepted on a case-by-case basis. This condition must be submitted to the City of New York and Commissioner for approval prior to installation.
3. Furnish a complete list locating all access doors required in finished walls, ceilings, partitions, shafts and other inaccessible locations.

2.7 PRIME PAINTING

A. All piping, supports, auxiliary steel and miscellaneous iron within all MER's shall be prime painted as specified herein.

B. All exposed uninsulated piping, fittings, equipment stands, supports, platforms, cradles, and hangers; except chrome finished materials, shall be painted. All ungalvanized surfaces shall be painted with zinc chromate, or approved equal, and all galvanized surfaces shall be prime coated with a phosphate pretreatment coating, dry film thickness of 0.35 with a 0.50 mil. one coat Glid-Guard galvanized steel primer Y5229 or approved equal.

C. Upon completion of the prime coat of all mechanical equipment specified above, all insulated and exposed piping shall be painted with finish coating, as specified under Division 09 90 00 and/or other Sections. This Section shall complete stenciling and color identification, specified under Division 22, following the finish painting.

D. Except where otherwise specified, steel piping in concrete and buried steel piping and steel tanks:

1. Provide heavy coat of bituminous solution primer.
2. In accordance with NFPA and other applicable codes.

E. Provide factory finishes, except as noted, to match Commissioner's color samples, for items appearing in exposed finished work, and including:

1. Equipment
2. Enclosures on equipment

F. All damaged factory-painted surfaces shall be repaired to match original surface. If, in opinion of the Commissioner, such repairs are unsatisfactory, item in question shall be completely refinished or replaced with new.

2.8 EQUIPMENT INSTALLATION

A. Locate and set equipment anchor bolts, dowels and aligning devices for equipment requiring them.

1. Level and shim the equipment; coordinate and oversee the grouting work.
2. After one week of continuous operation, the technician will return to check and realign all shafts, bearings, seals, couplings and belt drives as needed. Provide report indicating completion of this work.

B. Field assembly, installation and alignment of equipment is to be done under field supervision provided by the manufacturer or with inspection, adjustments and approval by the manufacturer, as a part of the Contract.

C. Alignment and Lubrication Certification for Motor Driven Apparatus:

1. After permanent installation has been made and connections have been completed, but before the equipment is continuously operated, a qualified representative of the manufacturer is to inspect the installation and shall report in writing on the manufacturer's letterhead as follows:
   a. That shafts, bearings, seals, couplings, and belt drives are perfectly aligned and doweled so the equipment will remain perfectly aligned in the normal service intended by the Documents and that no strain or distortion will occur in normal service. All dowels shall be aligned after equipment is running.
   b. That all parts of the apparatus are properly lubricated for operation.
   c. That the installation is in accordance with manufacturer's instructions.
   d. That suitable maintenance and operating instructions have been provided for the City of New York's use.

D. Equipment Startup:

1. Each equipment manufacturer is to provide qualified personnel to inspect and approve equipment and installation and to supervise the startup of the equipment and to supervise the operating tests of the equipment.

2. If a minimum number of hours for startup and instruction are not stated with the equipment specifications, these shall be 2 full 8-hour working days as a minimum.
3. Advise the City of New York of startup at least 72 hours in advance.

E. Equipment Turn-Over:

1. Contractor shall follow the City of New York's Standards for Turn-Over Acceptance, Commissioning and Testing. Where there is a conflict between these requirements and the regulations by the Commissioner, the more stringent requirements shall apply.

2.9 WELDING

A. General:

1. All welding procedures, welders, and welding operators shall be qualified in accordance with the requirements of ASME/ANSI B31.9 and Section IX of the ASME Code, latest editions.
2. Welding procedures shall be reported on ASME Section IX Forms "QW," or its equivalent. Joint preparation sketches (to be included with the welding procedures) shall show all dimensions including tolerances, for bevel angle, land size, offset and root gap.
3. Contractor shall be responsible for the welding performed by personnel of his organization and shall conduct the required qualification tests and submit results to the Commissioner for his review and approval.
4. All welding procedures shall meet requirements of New York Fire Department Certified Requirements. The filing of MSDS form shall be held in the field office.
5. A copy of the welders and fire watch certificate shall be held in the field office.

B. Processes:

1. Employ the Manual Shielded Metal-Arc (SMAW) welding process.
2. Double butt welding shall be permitted on all joints accessible from both sides. Where double butt-welding is employed, the first root pass shall be back-chipped.
3. Welding of pressure parts shall be performed with low hydrogen type electrodes. Electrodes of Classifications E6012, E6013, E7014 and E7024 shall not be used.
4. Brazing and Soldering:
   a. The Contractor shall prepare applicable "Brazing and Soldering Procedures" forms for approval of the City of New York.
   b. Brazing shall conform to ASME Section IX.
   c. Soldering shall conform to the relevant procedures in the manuals of the Copper Development Association.
   d. The City of New York may reject any brazed or soldered joint for lack of penetration or for other applicable grounds. These defective joints shall be redone until satisfactory.

C. Quality of Workmanship - In addition to conformance with the procedural and quality requirements set forth in the applicable Code or material specification, all welding shall meet the following requirements.

1. Butt welds shall have full penetrations and shall be slightly convex with uniform height.
2. Each weld shall be uniform in width and size throughout its full length.

3. Each layer of welding shall be smooth, free of slag, cracks, pinholes, undercut in excess of 1/32" and completely fused to adjacent weld beads and base metal.
4. Cover passes shall be free of coarse ripples, irregular surface, non-uniform bead patterns, high crown, and deep ridges or valleys between heads. The surface smooth- ness of the finished weld shall be suitable for the proper interpretation of non-destructive examination of the weld.
5. Surfaces of parts to be joined by welding shall be cleaned of all oil, grease, paint, scale and rust with solvent and/or wire brushing.
6. Fillet weld size shall be in accordance with the applicable code or as specified on the drawings with full throat and legs of equal length.
7. Welding filler metal and welding flux shall be properly stored in such a manner as to ensure that no damage to the coating or corrosion of weld rod will occur. Low hydrogen type electrodes shall be stored in enclosures which provide a regulated temperature as prescribed by the electrode manufacturer. All electrodes shall be properly identified.
8. Socket welds shall have a gap of approximately 1/16" between the bottom of the socket and the end of the pipe prior to welding. Socket welds shall have a minimum of two weld layers.

D. Repair and Weld Defects:

1. A weld is defective and shall be repaired if it does not meet the acceptance standard of each applicable non-destructive examination as defined ASME/ANSI B31.9, latest edition.
2. Repairs shall be made in accordance with ASME/ANSI B31.9, latest edition.

E. Welding Identification and Weld Marking:

1. All welds must be identified with the welder's identifying symbol. Welds, where more than one welder performs the work, shall be stamped by each welder.
2. Marking shall be done by a permanent method that will not result in sharp discontinuities.
3. Where stamping or marking on the base materials is not practical or feasible, permanently affixed metal bands of the same material may be applied. Stamping or any method of permanent marking on the bands is acceptable.

2.10 CLEANING AND ADJUSTING

A. Notification:

1. Inform the City of New York and Commissioner of all cleaning, blowing out and fill-up schedules one week prior to starting.
2. Notify the City of New York and Commissioner again, 48-hours prior to each event. If neither attends the procedures, notify in writing, the specific task performed 24-hours after each event.
3. Leaks appearing during the various pressure tests shall be corrected by replacing all defective materials or welds and subsequent tests shall not be made until the piping is found in perfect condition. Caulking of screwed joints or peaning of welds is prohibited. Wherever it is necessary to cut out a weld and the ends of the pipe cannot be conveniently brought together, then a short piece shall be fitted in and welded.
4. Damage to the building and equipment resulting from tests shall be repaired at no additional cost to the City of New York.

5. Tests claimed to have been performed without following above procedures shall be deemed as not performed.

B. Cleaning:

1. Blow out, clean and flush each piping system and equipment, to clean thoroughly. MSDS forms for clean agent and procedure shall be presented to the field office. After cleaning, the systems shall be tested by an independent organization, approved by the Commissioner prior to testing.
2. Clean all materials and equipment; leave in condition ready to operate and ready to receive succeeding finishes where required.
3. Clean the operating equipment and systems to be dust free inside and out.
4. Clean concealed and unoccupied areas such as plenums and pipe spaces and equipment rooms to be free of rubbish and dust.
5. After completion of all pressure tests, properly clean every piece of apparatus furnished and remove caps and other provisions made for testing purposes only.
6. Cutting oil, excess pipe joint compound, finely divided solids and other similar foreign material shall be removed from all circulating water systems before they go into operation. Before chemical cleaning of water systems flush with clean water. Each system shall be cleaned chemically with circulating solution. Fill, vent and circulate the system with this solution at maximum operating temperature for required duration. During cleaning procedure, circulation shall be stopped periodically followed by blow off at all low points. Immediately following chemical cleaning, system to be drained and then refilled with clean water to which treatment shall then be added. After systems have been drained, flushed and refilled, a chemical test shall be made to determine that the cleaning solution remaining in the system does not impart alkalinity to the water in excess of 300 ppm.
7. After the water piping system has been properly cleaned as indicated above, each water system shall be operated for a minimum of 3 days with 1/2” surgical felt, bonded to baskets on each pump strainer. Felt filters shall be run for as long a time as necessary to thoroughly clean all piping until approved by the Commissioner. During the cleaning period, heat exchangers and coil valves shall be kept closed for the entire cleaning period. Provide one (1) inch manual bypass at equipment to permit flushing of branch piping. For flushing and blow-off for main risers, provide drain valves at the bottom in the horizontal runout to the riser. Also provide an additional valve in the cyclo-clean separator piping for pumps with mechanical seals so that separator discharge water may be wasted during the cleaning procedure.
8. All pipe strainers shall be removed and cleaned upon completion of blowdown period.
9. After this period of operation, all systems shall be drained and refilled with fresh water as specified.
10. All equipment installed shall be thoroughly cleaned in preparation of the finished painting.
11. All dowels shall be aligned after system is running.

C. Adjusting:

1. Adjust and align equipment interconnected with couplings or belts. After one week of continuous operation, the technician will return to check and realign all shafts, bearings, seals, couplings and belt drives as needed. Provide report indicating completion of this work.
2. Adjust valves of all types and calibrate equipment of all types to provide proper operation.

3. Clean all strainers after system cleaning and flushing and again before final system startup.
4. Motors, fans, pumps, compressors, etc. shall be properly oiled and left ready for operation.
5. Verify that each fixture is in proper operating condition. All fixtures shall be cleaned, adjusted and inspected.
6. Submission of certified tests shall, in no way, relieve the Contractor of fulfillment of guarantee.
7. Gauges, instruments, thermometers and meters shall be checked and tested to specified accuracy.
8. Alarms shall be tested to fulfill satisfactory operating conditions.
9. Allow sufficient time to perform all tests, adjustments, etc., necessary to place the various systems in final operating condition, verify performance requirements and check all safety devices. Labor, instruments, etc., required for various tests shall be furnished by the Contractor. The Contractor shall see that all his subcontractors, manufacturer's representatives or Field Engineers necessary to check and adjust various systems are present, with sufficient forms, and that all test results are recorded properly and turned over to the City of New York for approval.
10. The Commissioner will make final check for all systems only after Contractor has completed and returned to the City of New York all recorded test data together with letter that his work is 100% complete. Additional tests may be required to meet the requirements of the City of New York's documents for demonstration of various systems, whether or not specified, to verify performance, workmanship or for adjustments.
11. Unless otherwise specified, equipment shall be installed and adjusted in accordance with manufacturer's recommendations to function properly with capacities required or specified.

D. Running Test of Piping Systems:

1. Any section of the work, after it has been completed and otherwise satisfactorily tested, shall be put in actual operation by Contractor and operated by him for a period of 2 days of 24 hours each, during which time any defects which may appear shall be remedied and any necessary adjustments shall be made. Test shall be performed in the presence of the Commissioner and serve as part of the Instructions Program.
2. During the time of the tests, repack all valves, make all adjustments and otherwise put the apparatus in perfect condition for operation, and shall instruct the Commissioner in the use of management of the apparatus. All joints shall be made absolutely tight under tests. Caulking of pipe joints or makeshift methods of repairing leaks shall not be allowed. Piping which is not tight under tests shall be taken down and reassembled.
3. All gauges, thermometers, alarms, instruments, etc. shall be tested to demonstrate that they are functioning properly and within the range of these devices, and to show their degree of accuracy.
4. If during the first test run, the system cannot be completely vented within 24 hours, install additional air vents at high points of system to facilitate quick venting of all water systems.

E. Permanent Equipment Operating During Construction:

1. Use only in same service as the permanent applications, provided that written approval is granted by the Commissioner.

2. Use disposable filters during temporary operation.
3. Expendable media, including belts used for temporary operation and similar materials are to be replaced just prior to acceptance.
4. Packings in equipment operated during construction must be repacked just prior to system acceptance, using materials and methods specified by the supplying manufacturer.

F. Retouch or repaint equipment furnished with factory finish as required to provide same appearance as new.

G. Tools:

1. Provide one set of specialized or non-standard maintenance tools and devices required for servicing the installed equipment.

H. Pump Characteristic Charts:

1. Pump Characteristic Charts: Furnish 4 characteristic charts for each pump. Charts shall be not less than 8-1/2" x 11" showing head developed, efficiency and power required for varying capacities at the operating speed of the equipment.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to General Conditions for the requirements governing execution.

3.2 GENERAL

A. Temporary Protection:

1. Provide and maintain protection for the work whether completed or in progress.
2. Provide suitable coverings and enclosures.

B. Scaffolding, Rigging and Hoisting:

1. Provide all scaffolding, rigging and hoisting services necessary for erection, and/or delivery into the premises, of any equipment and apparatus furnished. Remove from the premises when no longer required.

C. Waterproofing:

1. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Commissioner before work is done. This Contractor shall provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

3.3 COORDINATION OF WORK

A. The drawings show the general arrangement of equipment, piping and appurtenances. Follow these drawings as closely as the actual construction and as the work of other trades will permit. Provide offsets, fittings and accessories that may be required but not shown on the drawings. Investigate the site, structural and finish ground conditions affecting the work, and arrange the work accordingly. Provide such work and accessories as may be required to meet such conditions.

B. Carefully check space requirements with other trades to ensure that material can be installed in the spaces allotted thereto including finished suspended ceilings.

C. Wherever work interconnects with work of other trades, coordinate with other trades, ensure that they have the information to properly install the necessary connections and equipment. Identify items (valves, etc.) requiring access in order that the Ceiling Trade will know where to install access doors and panels.

D. Consult with other trades regarding equipment so that, wherever possible, motors, motor controls, pumps and valves are of the same manufacture.

E. Furnish and set sleeves for passage of pipes through structural masonry and concrete walls and floors and elsewhere as will be required for the proper protection of each pipe passing through building surfaces.

F. Properly provide firestopping around all pipes, sleeves, etc., which pass through rated walls, partitions and floors.

G. Provide detailed information on openings and holes required in precast members for fire protection work. Cast holes 4 inches and larger in diameter. Field-cut holes smaller than 4 inches. Obtain structural engineer's approval before cutting any openings or holes.

H. Provide required supports and hangers for piping and equipment, designed so as not to exceed allowable loading of structures.

I. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades and report any discrepancies between them to the Commissioner and obtain from him written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.

J. Wherever the work is of sufficient complexity, prepare additional detail drawings, to scale similar to that of the design drawings, prepared on tracing medium of the same size as contract drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the drawings as to the area to which it applies. Submit these drawings to the Commissioner for review. At completion include a set of such drawings with each set of as-built drawings.

K. Before commencing work, examine adjoining work on which this work is in any way dependent for perfect workmanship and report conditions which prevent performance of first-class work.

Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

L. Adjust location of pipes, panels, equipment, etc., to accommodate the work and to prevent interferences, both anticipated and encountered. Determine the exact route and location of each pipe prior to fabrication.

1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. For example: condensate, steam and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way lines whose elevations can be changed.
2. Make offsets, transitions and changes in direction in pipes, as required to maintain proper head room and pitch on sloping lines. Furnish and install traps, air vents, drains, etc., as required to effect these offsets, transitions and changes in direction.

M. Install plumbing work to permit removal (without damage to other parts) of coils, heat exchanger plates and tube bundles, filters, belt guards, sheaves and drives, and other parts requiring periodic replacement or maintenance. Arrange pipes and equipment to permit access to valves, cocks, traps, starters, motors and control components, and to clear the openings of swinging doors and access panels.

N. Provide access panels in equipment, etc., as required for inspection and maintenance of internal equipment.

O. In case of doubt as to the work intended, or in the event of need for explanation thereof, request supplementary instructions from the Commissioner.

P. Immediately upon the award of this Contract, but prior to commencing any work, confer together with designated major subcontractors, and with the Commissioner concerning the work under this Contract.

3.4 CUTTING AND PATCHING

A. Lay out the work carefully in advance. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of piping or other equipment, do the work carefully. Repair any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc., using skilled mechanics of the trades involved at no additional cost to the City of New York.

B. Do no cutting, channeling, chasing or drilling of unfinished masonry, tile, etc., unless permission from the Commissioner is first obtained. If permission is granted, perform this work in a manner approved by the Commissioner.

C. Where piping or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.

D. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required to install piping. Be responsible to properly locate such openings and for any cutting and patching caused by the neglect to do so.

3.5 RESPONSIBILITY FOR EVALUATION

A. The Commissioner makes no representations, regarding the character or extent of the sub- soils, water levels, existing structural, plumbing, fire protection, mechanical and electrical installations, above or below ground, or other subsurface conditions which may be encountered during the work. The Contractor must make his own evaluation of existing conditions which may affect methods or cost of performing the work, based on his own examination of the facility or other information. Failure to examine the drawings or other information does not relieve the Contractor of his responsibility for satisfactory accomplishment of the work.

3.6 EQUIPMENT BASES, PLATFORMS AND SUPPORTS

A. Provide supporting platforms, steel supports, anchor bolts, inserts, etc., for all equipment and apparatus requiring access for service and maintenance.

B. Obtain prior approval for installation method of structural steel required to frame into building structural members for the proper support of equipment, conduit, etc. Welding will be permitted only when approved by the Commissioner.

C. Submit shop drawings of supports for approval to the Commissioner before fabricating or constructing.

D. Provide leveling channels, anchor bolts, complete with nuts and washers, for all apparatus and equipment secured to concrete pads and further supply exact information and dimensions for the location of these leveling channels, anchor bolts, inserts, concrete bases and pads.

E. Where supports are on concrete construction, care shall be taken not to weaken concrete or penetrate waterproofing.

3.7 ACCESSIBILITY

A. The installation of valves, dampers and other items shall be conveniently and accessibly located with reference to the finished building floors, walls, roof and penthouses as applicable.

B. In-line pumps shall not be installed higher than 7 ft. above floor and shall be fully accessible for servicing its motor, valves, controls and instruments.

C. Equipment removal, tube-pull access door swing spaces shall be identified on shop drawings and maintained during installation.

3.8 EXISTING CONDITIONS

A. The existing building will remain occupied and operational throughout the duration of the renovation. Contractors shall familiarize themselves with and protect the existing systems that are to remain operational. Contractors shall take all precautions to minimize dust, debris, vibration and noise in order to limit any impact on the existing facility.

3.9 DEMOLITION WORK RELATED TO EXISTING WORK

A. Contractor shall disconnect and remove all abandoned, unused or discarded equipment (piping, conduits, wires, ductwork, tubing, supports, etc.) from the areas of work as indicated on Drawings.

B. Provide Fire Watch for all periods when existing fire suppression system is taken off-line.

C. Provide firestopping at all conduit/pipe penetrations at rated construction, where ducts, piping/conduit, etc. have been removed.

D. Whenever existing equipment is disconnected from its services, remove all pipe, conduit or duct branches or runnouts to the point of connection to the existing pipe riser or electrical panel or duct shaft as the case may be. Cap off pipes or ducts near the risers, valved outlets or at mains. Remove all ductwork as indicated on plans and provide sheet metal cap (minimum 24 gage) at all connections to existing ductwork that is to remain. Provide temporary ducts with dampers and valved pipes as required to keep system in operation and occupancy of building.

E. Remove all piping as indicated on plans and provide capped outlets at the point of connection to the existing risers or as indicated on plans. For steel piping to be removed, provide Steel Schedule 40 welded cap. For brass and copper piping, provide 95/5 (tin-antimony) soldered copper Type 'L' Cap. All waste and vent lines shall be capped with a no hub coupling.

F. All welding and soldering shall conform to the following:

1. General:
   a. All welding procedures, welders, and welding operators shall be qualified in accordance with the requirements of ASME/ANSI B31.9 and Section IX of the ASME Code, latest editions.
   b. Welding procedures shall be reported on ASME Section IX Forms "QW," or its equivalent. Joint preparation sketches (to be included with the welding procedures) shall show all dimensions including tolerances, for bevel angle, land size, offset and root gap.
   c. Contractor shall be responsible for the welding performed by personnel of his organization and shall conduct the required qualification tests and submit results to the Commissioner for his review and approval.

2. Processes:
   a. Employ the Manual Shielded Metal-Arc (SMAW) welding process.
   b. Use backing rings for welds above 6" diameter pipe.
   c. Double butt welding shall be permitted on all joints accessible from both sides. Where double butt-welding is employed, the first root pass shall be back-chipped.
   d. Welding of pressure parts shall be performed with low hydrogen type electrodes. Electrodes of Classifications E6012, E6013, E7014 and E7024 shall not be used.
   e. Provide ventilation and exhaust.

3. Brazing and Soldering:
   a. The Contractor shall prepare applicable "Brazing and Soldering Procedures" forms for approval of the City of New York.
   b. Brazing shall conform to ASME Section IX.

c. Soldering shall conform to the relevant procedures in the manuals of the Copper Development Association.
d. The City of New York may reject any brazed or soldered joint for lack of penetration or for other applicable grounds. These defective joints shall be redone until satisfactory.

4. Quality of Workmanship - In addition to conformance with the procedural and quality requirements set forth in the applicable Code or material specification, all welding shall meet the following requirements.
   a. Butt welds shall have full penetrations and shall be slightly convex with uniform height.
   b. Each weld shall be uniform in width and size throughout its full length.
   c. Each layer of welding shall be smooth, free of slag, cracks, pinholes, undercut in excess of 1/32" and completely fused to adjacent weld beads and base metal.
   d. Cover passes shall be free of coarse ripples, irregular surface, non-uniform bead patterns, high crown, and deep ridges or valleys between heads. The surface smoothness of the finished weld shall be suitable for the proper interpretation of non-destructive examination of the weld.
   e. Surfaces of parts to be joined by welding shall be cleaned of all oil, grease, paint, scale and rust with solvent and/or wire brushing.
   f. Fillet weld size shall be in accordance with the applicable code or as specified on the drawings with full throat and legs of equal length.
   g. Welding filler metal and welding flux shall be properly stored in such a manner as to ensure that no damage to the coating or corrosion of weld rod will occur. Low hydrogen type electrodes shall be stored in enclosures which provide a regulated temperature as prescribed by the electrode manufacturer. All electrodes shall be properly identified.
   h. Socket welds shall have a gap of approximately 1/16" between the bottom of the socket and the end of the pipe prior to welding. Socket welds shall have a minimum of two weld layers.

5. Repair and Weld Defects:
   a. A weld is defective and shall be repaired if it does not meet the acceptance standard of each applicable non-destructive examination as defined ASME/ANSI B31.9, latest edition.
   b. Repairs shall be made in accordance with ASME/ANSI B31.9, latest edition.

G. Cutting shall be done carefully in order not to disturb systems or services in areas where demolition is not required.

H. Fully charged fire extinguisher and/or active hoses are to be on sight for fire watch during all burning conditions that require Oxygen/Accel gas for cutting or welding, soldering and the creation of dust, that may activate the fire alarm system, requires that the system be put on bypass for the affected zones. Coordinate shutdown with the City of New York.

I. Equipment specified or indicated to be demolished shall be removed from the project site. All ballasts shall be tested for PCBs and mercury before removal. Test results shall be submitted to the City of New York and ballasts shall be disposed of properly.

J. Provide additional support for all existing conditions, cabling and devices to remain which are affected by demolition of existing ceilings and partitions.

K. Protect existing systems, pipes, conduits and communications wiring to remain with flame retardant plywood.

L. Drawings are general in nature and do not indicate full extent of removal required, including all hangers, supports, ancillary devices, etc.

3.10 MODIFICATIONS TO EXISTING WORK

A. Contractor shall perform all work as shown or as specified, within the existing site and structures as part of this Contract without detriment to the existing systems or equipment to be kept in operation or maintained in their places.

B. For full extent of modifications to be done to existing systems, Contractor shall inspect existing systems and site conditions to familiarize himself with the complexity of his work related to removals and relocations required, and the existing finishes to be preserved without any damage resulting from possible careless installation procedures. Upon written request by the bidders, the City of New York shall make the existing schematic plans available for inspection without any responsibility for their completeness or accuracy.

C. As-Built drawings are not available on the existing installations.

D. All cutting shall be done only by mechanics skilled in the particular trade which is affected. No cutting shall be done without proper protections against damage, dirt and dust resulting therefrom or without proper safeguards to workmen, the public, and occupants of buildings.

E. Before cutting is started in any location, Contractor shall carefully investigate conditions influencing human and structural safety. Existing piping, wiring and items concealed in walls and slabs, wherever these walls and slabs are removed, shall be properly relocated, rerouted or removed as the case may require.

F. General Construction trades shall perform all finish masonry, repairing, restoring and finishing of all cut openings, closing up of existing openings, and removing and restoring the affected sections of the suspended ceilings.

G. If, during partial occupancy of the building, circumstances necessitate temporary shutdown of any facilities or otherwise interfere with access to building, the City of New York shall be given a minimum of 48 hours' notice before doing such work.

H. In all areas where interface, relocation or alternation work is to be done, Contractor shall disconnect and remove from the premises all existing piping, etc., that will not be required to remain in service after the alterations are completed. All such equipment (except as requested as salvage by the City of New York) shall become the property of the Contractor, and he shall remove same from the premises immediately upon disconnection. Existing piping, etc., being removed shall not be reused.

I. Contractor shall move or relocate any existing mechanical equipment, piping, etc., which may temporarily interfere with the construction, (to a temporary location) if the existing equipment is

to be kept in operation during construction. He shall also install temporary piping that might be required (during demolition or excavation and during the construction of tunnels, retaining walls, footings or columns) for offsetting all piping around the construction area in order to maintain services to the existing systems. Provide temporary piers, supports and hangers as required for excavation.

J. The trade in charge of concrete and superstructure shall provide all cuts and openings through structural slabs and walls, except for core drillings for passage of piping. Contractor shall coordinate his work with concrete contractor and provide necessary dimensions for all openings.

K. Upon completion, remove all temporary piping and equipment, shoring, scaffolds, etc., and leave all areas clean and free from material and debris resulting from work performed under this Section. Provide rough patching in areas shown.

L. Test all piping to be retained or shown to be re-used together with the new extensions connected to them. Install isolation valves as required.

3.11 USE OF EQUIPMENT

A. The use of any equipment, or any part thereof, for purposes other than testing even with the City of New York consent, shall not be construed to be an acceptance of the work on the part of the City of New York, nor shall it be construed to obligate the City of New York in any way to accept improper work or defective materials.

B. Use of permanent equipment for temporary services must be approved in writing by the City of New York.

3.12 CODES, RULES, PERMITS & FEES

A. The Contractor shall give all necessary notices, obtain all permits and filings including, but not limited to, New York City DEP, New York State DEC, New York City and State Building Code requirements, and pay all government sales taxes, fees, and other costs, in connection with his work. However, all utility connections, extensions, and tap fees for water, storm, sewer, gas, telephone, and electricity shall be paid directly to utility companies and/or agencies by the City of New York, unless otherwise indicated. The Contractor shall file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments; obtain all required certificates of inspection for his work and deliver same to the Commissioner before request for acceptance and final payment for the work.

B. The complete design and construction shall conform to the requirements of the NYCBC, NYCPC, NFPA, NEC, FM, UL and any other local or state code which may govern.

3.13 CODE COMPLIANCE

A. Special (controlled) inspection procedures shall, in general, ensure the following:

1. The adherence of the standards of material and workmanship required by the New York City Building Code.

2. The checking of building processes and the evaluation of materials to ensure conformity with the New York City Building Code.
3. The elimination of unspecified, non-conforming substitutions.
4. The discovery of discrepancies between the New York City Building Code requirements and the final Drawings or Specifications and their early correction.
5. The prevention of error which may result in unnecessary and costly maintenance or upkeep costs.
6. The determination of necessary tests and laboratory work.

B. Furnish to the Commissioner weekly progress reports. These reports will state the following:

1. The progress of inspections and filing for the previous week.
2. Although discrepancies will be reported to the Commissioner immediately upon discovery, they will be included in the reports, as will the resolution of these discrepancies.
3. Tests witnessed during the week and code items whose installation has been completed during the same period.

3.14 FINAL INSPECTION

A. Contractor shall arrange and schedule final inspection of work and shall notify the Commissioner in writing that the Contractor has thoroughly checked his work and, in the opinion of the Contractor, is ready for final inspection.

B. During the entire period schedule for these inspections, the Contractor and representatives of each manufacturer of equipment involved shall be present. All of these organizations shall have sufficient and competent personnel present so that adjustments can be made to all systems without delay.

3.15 ACCEPTANCE

A. The operation or the temporary use of the equipment and the mechanical and electrical installation, by the City of New York does not constitute an acceptance of the work. The final acceptance is to be made after the Contractor has adjusted his equipment, demonstrated that it fulfills the requirements of the Contract Documents, and has furnished all the required Certificates. Warranties and guaranties are effective after the acceptance.

3.16 ADDITIONAL REQUIREMENTS

A. The contractor will be responsible for maintaining the rest rooms at the end of each shift and ensuring that they are cleaned and restocked.

B. Oxygen/Accel tanks that are not in use are to be chained to carry truck. Tanks are to be securely chained to columns. Storage of tanks inside/outside of building shall follow FDNY requirements.

C. All gas hoses are to be in good condition. Hoses with multiple repairs are not to be used and will be confiscated.

D. Gas regulators will be checked for leakage.

E. Electric welding lines are to be in good condition or job will be stopped.

F. Fully charged fire extinguisher and/or active hoses are to be on sight for fire watch during all burnings.

G. During all stages of demolition of existing equipment (while in an occupied space/building), if it is deemed necessary to use cutting torches; proper ventilation is to be maintained. The exhaust fumes shall be purged from the space undergoing demolition to the exterior of the building using an "in-line" blower/exhaust minimum of 1500 cfm ¼ hp. Fumes from the demolition shall be drawn from the space through a flexible duct and evacuated through a flexible duct. Pedestal type fans may be used to control dust. Demolition areas shall be isolated from regular operational spaces for their full height and length of walls by using wood or sheet rock enclosures. Where a doorway exists, several layers of plastic not less than 1.8 mils shall cover it. Demolition in a space adjacent to an occupied space will be held at a negative air pressure to the surrounding area while demolition is underway. The contractor shall make every effort to locate and seal all openings that allow fumes to escape into occupied area. Contractor will provide cost options to the City of New York including those involving strictly evening or weekend work that completes the job in the same time frame.

END OF SECTION 22 05 00

SECTION 22 05 03 - PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:

1. Domestic water piping, above grade.
2. Sanitary sewer piping, above grade.
3. Equipment drains and overflows.
4. Unions and flanges.

B. Related Sections:

1. Section 07 84 13 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
3. Section 09 90 00 - Painting: Product and execution requirements for painting specified by this section.
4. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
5. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
6. Section 22 07 00 - Plumbing Insulation: Product requirements for piping insulation for placement by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.3 - Malleable Iron Threaded Fittings.
3. ASME B16.4 - Gray Iron Threaded Fittings.
4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
5. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
6. ASME B31.9 - Building Services Piping.
7. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.

8. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A536 - Standard Specification for Ductile Iron Castings.
6. ASTM B32 - Standard Specification for Solder Metal.
7. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
8. ASTM B75 - Standard Specification for Seamless Copper Tube.
9. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
10. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:

1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

E. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary, Waste, and Vent Piping Applications.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions and sizes.

C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

D. Design Data: Indicate pipe sizes. Indicate pipe sizing methods. Indicate calculations used. Submit sizing methods and calculations sealed by registered professional engineer.

E. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.5 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

C. Perform Work in accordance with NYCBC.

D. Maintain one (1) copy of each document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience approved by manufacturer.

C. Design pipe hangers and supports under direct supervision of a Professional Engineer licensed in the State of New York and experienced in design of this Work.

1.7 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions - Product Requirements: Environmental conditions affecting products on site.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Requirements for coordination.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, ABOVE GRADE

A. Ductile Iron Pipe: AWWA C151

1. Fittings: AWWA C110, ductile iron, standard thickness.
2. Joints: AWWA C111, rubber gasket with rods.

B. Copper Tubing: ASTM B88, Type L drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free.
3. Mechanical press type fittings are not acceptable.

2.2 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
3. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tubing: ASTM B88, Type L drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder. Mechanical press type fittings are not acceptable.

2.4 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 250, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with [soldered] or [brazed joints]

3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Gaskets: 1/16 inch thick preformed neoprene gaskets.
3. Flanges shall be of same weight as the fittings and valves in each service category. Welding neck flanges shall be used with flanged valves and equipment on welded lines. Galvanized screwed flanges shall be used on galvanized screwed lines. Flanges shall be drilled in conformance with 150 lbs. or 300 lbs. standard and shall be faced and spot- faced. Threaded and loose flanges on brass piping shall be brass. Laps shall be machined on front, back and edge. Threaded flanges shall have faces perpendicular to adjoining pipe.

2.5 PIPE FITTINGS

A. Each pipe fitting shall have cast, stamped, or indelibly marked on it the marker's name or mark, weight, and quality of the product when such marking is required by the approved standard.

B. Welding fittings shall be of same material and schedule as pipe to which they are welded. Welding fittings including laterals shall be approved factory reinforced to develop full working pressure of connecting piping main. Welding elbows shall be long radius pattern. Welding fittings shall be used exclusively, except as otherwise specified. Weldolets may be used for branches only where branch is two (2) or more nominal pipe sizes smaller than main or riser. All welding "lateral" fittings shall have pressure ratings equal to the pipe with which they are to be used. Welding fittings shall be of Tube-Turn, Walworth manufacture, or approved equal, to conform to ASTM-A-234 specifications.

C. Nipples shall be extra heavy shoulder type of same material as pipe, close nipples are not acceptable.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Verification of conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 22 05 29.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 21 05 16.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Establish invert elevations, slopes for drainage to 1/4 or 1/8 inch per foot minimum as required by NYCBC. Maintain gradients.

J. Slope piping and arrange systems to drain at low points.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

L. Install piping penetrating roofed areas to maintain integrity of roof assembly.

M. Install valves in accordance with Section 22 05 23.

N. Install piping specialties in accordance with Section 23 21 16.

O. Insulate piping. Refer to Section 22 07 00.

P. Install pipe identification in accordance with Section 22 05 53.

Q. Mechanical press type fittings are not acceptable for copper piping systems.

3.5 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping system in accordance with ASME B31.9.

B. Install Work in accordance with NYCBC.

3.6 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

A. Install sanitary waste and vent piping systems in accordance with NYCPC.

B. Install bell and spigot pipe with bell end upstream.

C. Support cast iron drainage piping at every joint.

3.7 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test domestic water piping system in accordance with applicable code. Hydrostatic pressure test shall be a minimum of 80 psig for 4 hours with no leaks.

C. Test sanitary waste and vent piping system in accordance applicable code

3.8 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean and disinfect domestic water distribution system in accordance with Section 22 11 00.

END OF SECTION 22 05 03

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SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Flexible pipe connectors.
2. Expansion joints.
3. Expansion compensators.
4. Pipe alignment guides.
5. Swivel joints.
6. Pipe anchors.

B. Related Sections:

1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for piping hangers and supports.
2. Section 22 11 00 - Facility Water Distribution: Product and installation requirements for piping used in domestic water systems.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.
2. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

1.4 DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Expansion Compensation Design Criteria:

1. Installation Temperature: 60 degrees F.

2. Domestic Hot Water: 140 degrees F.
3. Safety Factor: 30 percent.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints. Include shop drawing information for piping expansion compensation in shop drawings for piping system specified in Section 22 05 00.

C. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

D. Design Data: Indicate criteria and show calculations.

E. Manufacturer's Installation Instructions: Submit special procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

H. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

C. Operation and Maintenance Data: Submit adjustment instructions.

1.7 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

C. Perform Work in accordance with NYCBC.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

C. Design pipe hangers and supports under direct supervision of a Professional Engineer licensed in the State of New York and experienced in design of this Work.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for leak free performance of packed expansion joints.

PART 2 - PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Flexicraft Industries
2. Unaflex Incorporated
3. DME Industries
4. Or approved equal.

B. Steel Piping:

1. Inner Hose: Carbon Steel.
2. Exterior Sleeve: Double braided.
3. Pressure Rating: 125 psig WSP and 450 degrees F.
4. Joint: Flanged. As specified for pipe joints.
5. Size: Use pipe-sized units.
6. Maximum offset: 3/4 inch on each side of installed center line.

C. Copper Piping:

1. Inner Hose: Bronze.
2. Exterior Sleeve: Braided bronze.
3. Pressure Rating: 125 psig WSP and 450 degrees F.
4. Joint: Flanged. As specified for pipe joints.
5. Size: Use pipe sized units.
6. Maximum offset: 3/4 inch on each side of installed center line.

2.2 EXPANSION JOINTS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Flexicraft Industries
2. Unaflex Incorporated
3. DME Industries
4. Or approved equal

B. Stainless Steel Bellows Type:

1. Pressure Rating: 125 psig WSP and 400 degrees F.
2. Maximum Compression: 1-3/4 inch.
3. Maximum Extension: 1/4 inch.
4. Joint: As specified for pipe joints.
5. Size: Use pipe sized units.
6. Application: Steel piping 3 inches and smaller.

C. External Ring Controlled Stainless Steel Bellows Type:

1. Pressure Rating: 125 psig WSP and 400 degrees F.
2. Maximum Compression: 15/16 inch.
3. Maximum Extension: 5/16 inch.
4. Maximum Offset: 5/16 inch.
5. Joint: Flanged.
6. Size: Use pipe sized units.
7. Accessories: Internal flow liner.
8. Application: Steel piping 3 inches and larger.

D. Two-ply Bronze Bellows Type:

1. Construction: Bronze with anti-torque device, limit stops, internal guides.
2. Pressure Rating: 125 psig WSP and 400 degrees F.
3. Maximum Compression: 3 inches.
4. Maximum Extension: 1/4 inch.
5. Joint: As specified for pipe joints.
6. Size: Use pipe sized units.
7. Application: Copper piping.

E. Low Pressure Compensators with two-ply Bronze Bellows:

1. Working Pressure: 75 psig.
2. Maximum Temperatures: 250 degrees F.
3. Maximum Compression: 1/2 inch.
4. Maximum Extension: 5/32 inch.
5. Joint: Soldered.
6. Size: Use pipe sized units.
7. Application: Copper or steel piping 2 inches and smaller.

F. Copper with Packed Sliding Sleeve:

1. Maximum Temperature: 250 degrees F.
2. Joint: As specified for pipe joints.
3. Size: Use pipe sized units.
4. Copper or steel piping 2 inches and larger.
5. Application: Copper or steel piping 2 inches and larger.

2.3 ACCESSORIES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Flexicraft Industries
2. Unaflex Incorporated
3. DME Industries
4. Or approved equal.

B. Pipe Alignment Guides: Two-piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1-inch thick insulation, minimum 3-inch travel.

C. Swivel Joints: Bronze, Ductile Iron body, double ball bearing race, field lubricated, with Buna-N O-ring seals.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. Install Work in accordance with ASME B31.9.

B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

D. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

E. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 22 05 29 for pipe hanger installation requirements.

F. Provide grooved piping systems with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation. Grooved piping systems need not be anchored.

G. Provide expansion loops/joints as indicated on Drawings.

3.3 MANUFACTURER'S FIELD SERVICES

A. Refer to General Conditions - Quality Requirements: Manufacturers' field services.

B. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION 22 05 16

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Gate valves.
2. Ball valves.
3. Check valves.

B. Related Sections:

1. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for pipe hangers and supports.
3. Section 22 07 00 - Plumbing Insulation: Product and installation requirements for insulation for valves.
4. Section 22 11 00 - Facility Water Distribution: Product and installation requirements for piping, piping specialties and equipment used in domestic water systems.
5. Section 22 13 00 - Facility Sanitary Sewerage: Product and installation requirements for piping, piping specialties and equipment used in sanitary waste and vent systems.
6. Section 22 14 00 - Facility Storm Drainage: Product and installation requirements for piping specialties and equipment used in storm drainage systems.

1.3 REFERENCES

A. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
3. MSS SP 80 - Bronze Gate and Check Valves.
4. MSS SP 110 - Ball Valves Threaded, Socket-Welding and Solder Joint.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves.

C. Operation and Maintenance Data: Submit installation instructions and exploded assembly views.

1.6 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. For drinking water service, provide valves complying with NSF 61.

C. Perform Work in accordance with NYCBC.

D. Maintain one (1) copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions - Product Requirements: Environmental conditions affecting products on site.

1.10 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish 5-year manufacturer warranty for valves excluding packing.

PART 2 - PRODUCTS

2.1 GATE VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc.
5. Stockham Valves & Fittings.
6. Or approved equal

B. Furnish materials in accordance NYCBC.

C. 2 inches and Smaller: MSS SP 80, Class 150, bronze body, bronze trim, threaded or union bonnet, non-rising stem, hand-wheel, inside screw, solid or split wedge disc, alloy seat rings, solder or threaded ends.

D. 2-1/2 inches and Larger: MSS SP 70, Class 125 cast iron body, bronze trim, bolted bonnet, non-rising stem, hand-wheel, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.2 BALL VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc.
5. Stockham Valves & Fittings.
6. Or approved equal

B. Furnish materials in accordance with NYCBC.

C. 2 inches and Smaller: MSS SP 110, 600 psi WOG two-piece bronze body, chrome plated brass ball, full port, teflon seats, blow-out proof stem, solder or threaded ends lever handle with balancing stops.

2.3 CHECK VALVES

A. Horizontal Swing Check Valves:

1. Manufacturers: Subject to compliance with requirement, provide products by one of the following:
   a. Crane Valve, North America.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO, Inc.
   e. Stockham Valves & Fittings.
   f. Or approved equal

2. Furnish materials in accordance with NYCBC.
3. 2 inches and Smaller: MSS SP 80, Class 150 bronze body and cap, bronze seat, Buna-disc, solder or threaded ends.
4. 2-1/2 inches and Larger: MSS SP 71, Class 125 cast iron body, bolted cap, bronze or cast iron disc flanged ends.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.

3.3 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

F. Refer to Section 22 05 03 for piping materials applying to various system types.

G. Refer to Section 22 05 29 for pipe hangers.

H. Refer to Section 22 07 00 for insulation requirements for valves.

I. Install Work in accordance with NYCBC.

3.4 VALVE APPLICATIONS

A. All shut-off valves 2” and smaller shall be ball valves.

B. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

C. Install ball or gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install ball valves for throttling, bypass, or manual flow control services (pump service).

E. Install ball valves in domestic water systems for shut-off service (pump service).

F. Install ball valves in domestic water systems for throttling service.

G. Install gate valves in sanitary systems for shut-off service.

END OF SECTION 22 05 23

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SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to plumbing and fire protection work.
9. Firestopping accessories.
10. Equipment bases and supports.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
2. Section 07 84 13 - Firestopping: Product requirements for firestopping for placement by this section.
3. Section 07 92 00 - Joint Protection: Product requirements for sealant materials for placement by this section.
4. Section 07 62 00 - Installation requirements for roof flashing installation.
5. Section 09 91 00 - Painting: Product and execution requirements for painting specified by this section.
6. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.
7. Section 22 11 00 - Facility Water Distribution: Execution requirements for placement of hangers and supports specified by this section.
8. Section 22 13 00 - Facility Sanitary Sewerage: Execution requirements for placement of hangers and supports specified by this section.
9. Section 22 14 00 - Facility Storm Drainage: Execution requirements for placement of hangers and supports specified by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.4 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat and hot gases through fire rated construction.

1.5 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E814 or UL 1479, to achieve fire ratings in accordance with FM, UL and WH Design Numbers.

B. Firestop interruptions to fire rated assemblies, materials and components.

1.6 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to NSPC, FM, UL and WH for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from DCAS indicating approval of materials used.

1.7 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe and riser support hangers.

F. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by a Professional Engineer licensed in the State of New York, suitable for presentation to _____for acceptance as meeting code fire protection requirements.

1.8 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

C. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Non-combustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by _____for penetrating items connecting maximum of two stories.

D. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

E. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

F. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

G. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.

H. Perform Work in accordance with NYCBC.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.10 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical and damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

1.12 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.13 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish 5-year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. General

1. All bracket, clamp and rod sizes indicated in this specification are minimum sizes only. All structural hanging materials shall have a built-in safety factor of 5.
2. Provide pipe roll support where longitudinal movement due to expansion and contraction may occur.
3. A pipe clamp is secured to pipe and the clamp is secured to the ceiling in order to prevent movement and act as an anchor.
4. Guide points shall be located and constructed wherever required or shown on drawings and at each side of an expansion joint or loop, to permit free axial movement only in a piping system.
5. Anchor points shall be located and constructed to permit the piping system to take up its expansion and contraction freely in opposite directions from the anchored points.
6. All hangers shall be U.L. listed.

B. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Carpenter & Paterson Inc.
2. Anvil (Formerly Grinnell)
3. Witch

4. Or approved equal.

C. Pipe Hanger Schedule:

	Carpenter & Paterson 'Witch'	Grinnell	I.R. Rauch's & Sons
C-Clamp with Retaining Clip and Locknut (pipe sizes 2 inches and smaller)	47 with 22	86 with 89	47 with 22
Beam Clamp	293	228	82
Multi-J Hook	---	---	228
J Hook	---	---	221
Clevis Hanger	100	260	100
Clevis Hanger w/Saddle	100SH	---	100SH
180° shield	265P	168	265P
Single Rod Roll Hanger	140	181	140
Double Rod Roll Hanger	142	171	142
Trapeze	---	46	1600-1700
U-bolt Adjustable Pipe	283	137C	283
Stanchion Saddle	247	259	247
Welded Steel Bracket	84 or 139	199 or 195	84 or 139
Riser Clamp	126	261	126
Welded Beam Attachment	113A	66	---
Welded Beam Attachment w/bolt & nut	113B	66	113A
Concrete Insert	108	282	180 or 181
Phillips Inserts	513	Phillips Insert	1000

D. Hangers

1. Steel Pipe:
   a. Horizontal Piping:
      1) 1-1/2 inches and smaller - Clevis hangers 8 feet on centers.
      2) 1-1/4 inches and larger - Clevis hangers 12 feet on centers.
   b. Vertical Piping:
      1) Riser clamps at each slab penetration.
      2) Stand-offs at 10-foot intervals.

2. Copper Tubing:
   a. Horizontal Piping:
      1) 1-1/4 inches and smaller clevis hanger 8 feet on center.
      2) 1-1/2 inches and larger clevis hanger 10 feet on center.
      3) Hangers to be of adequate size to permit insulation to be continuous through hangers.

b. Vertical Piping:
   1) Copper plated riser clamps at each slab penetration.
   2) Copper plated stand-offs at 10-foot intervals.
   3) To control expansion, anchor piping to construction using one copper plated riser clamp above and one below floor slab.

E. Hanger Rods

1. Hanger rods shall be hot rolled steel, threaded and shall be of the following minimum sizes:

Pipe Size	Rod Diameter
3 inches and smaller	1/2"
4 and 5 inches	5/8"
6 inches	3/4"
8, 10 and 12 inches	7/8"

2.2 PROTECTION OF INSULATED PIPE

A. Provide insulation protection shield at each hanger, 12 gage for piping 2-1/2 inches and smaller and 8 gage for larger piping.

2.3 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.4 ANCHORING SYSTEM

A. Pipe hangers shall be connected to the building structure as follows:

1. All piping shall be supported directly from beams or by means of auxiliary steel furnished and installed by this Contractor attached to beams by means of isolation hangers, or to existing slab via adhesive anchors furnished and installed by this contractor.
2. Adhesive Anchors: Provide threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Submit all products to the Structural Engineer for final review and approval.
   a. Provide stainless steel anchors. Stainless steel anchors shall be AISI Type 316 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
   b. Provide the following:
      1) Hilti HAS threaded rods, with HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit System for anchorage to concrete. ICC ESR-3187.
      2) Hilti HIT-Z anchor rods with HIT-HY 200 Safe Set System for anchorage to concrete. ICC ESR-3187.

3) Hilti HAS threaded rods with HIT-HY 200 Injection Adhesive Anchoring System for anchorage to concrete, ICC ESR-3187.
4) Hilti HAS threaded rods, with RE 500 SD Injection Adhesive Anchoring System for anchorage to concrete, ICC ESR-2322.
5) Or approved equal.

3. Contractor shall be required to submit slab pull-out strength test to the structure engineer for approval prior to installation.

B. Examine the areas and conditions where specialty anchoring system is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

C. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

D. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of DCAS and the manufacturer's recommended installation procedures.

E. Install the following manufacturer's guidelines:

1. Drill hole using a roto-hammer or Hilt diamond coring machine.
2. Push the HIT-TZ in the hole to verify sufficient hole depth (only threads visible). For floor applications, pushing the rod compacts to the drill dust.
3. Inject adhesive staring from the bottom of the hole.
4. Fill hole 1/2 to 2/3 full. If the hole is full of water, it is suggested to start injecting from the bottom of the hole and fill entirely with adhesive.

F. Anchoring system shall be required to comply with the following:

1. Each anchor shall be able to hold 5x the load being placed or as required by the New York City Building Code or as required by the Project Manual, whichever is most restrictive.

G. Engineering Data:

1. Before any anchor system is installed, submit engineering data drawings to the Commissioner for review indicating how performance standards specified here shall be met. The Contractor is responsible for the structural design and supports for these systems and must show his proposed systems on these drawings.
2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of New York and shall be signed and sealed by this Engineer.

H. Quality Assurance:
1. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

2. Manufacturers shall provide instructions for all workers to install system.

I. Contractor to provide on-site testing by an accredited testing laboratory, demonstrating compliance with specifications. Testing shall be performed to the loading requirements of the New York City Building Code or by requirements of the Project Manual or 5x the load being placed on the most heavily loaded anchor; whichever is most restrictive. Test a minimum of 3 anchors in each zone, of each floor, evenly distributed over the area where anchors will be installed. Tested anchors can be used in the final assemblies. Supply reports to the Commissioner.

2.5 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.6 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe.

C. Sleeves for fire rated construction shall meet UL1479 requirements and shall be constructed of steel pipe.

D. Sealant: Acrylic; refer to Division 07.

2.7 MECHANICAL SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Thunderline Link-Seal, Inc.
2. NMP Corporation
3. Fernco
4. Or approved equal

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and

pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.8 FORMED STEEL CHANNEL

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Unistrut Corp.
4. Or approved equal

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.9 FIRESTOPPING

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. 3M fire Protection Products
5. Specified Technology, Inc.
6. Or approved equal

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application. Provide sleeves at all rated construction.

1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer’s full range of colors.

2.10 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.3 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing or damming materials to arrest liquid material leakage.

D. Obtain permission from the Commissioner before using powder-actuated anchors.

E. Do not drill or cut structural members.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide copper plated hangers and supports for copper piping.

K. Design hangers for pipe movement without disengagement of supported pipe.

L. All hangers and supports shall be capable of screw adjustment after piping is erected and provided with a locking nut (double nut) to prevent loss of adjustment.

M. Provide required anchors, sway bracing, blocking and steel to connect to structure to prevent pipe movement due to expansion, contraction or thrust where required and as directed by the Commissioner.

N. Provide bracing in addition to required pipe hangers to maintain pipe alignment.

O. Provide anchors on pump discharge piping as required to assure piping alignment and stability from pump operation.

P. Where required, provide supplemental channels and steel to support work of this section. Cut ends of steel shall be ground smooth free from burs and sprayed with a galvanized coating.

Q. Where several pipes rest on a common trapeze, increase hanger rod diameter and decrease spacing in accordance with maximum and minimum pipe sizes respectively.

R. Provide pipe restraints to prevent movement by an upward thrust in the pipe risers.

S. Hanger system shall not penetrate waterproofing.

T. Pipe and equipment support system shall be installed not to weaken the building structural system.

U. Horizontal piping with grooved mechanical couplings shall not be left unsupported between any two couplings nor shall any pipe be left unsupported wherever a change of line flow takes place.

V. Do not hang pipes from metal roof decks; suspend from steel beams.

W. Riser clamps supporting or anchoring vertical piping shall have equal arm resting on the slab. Recess arms in slab two inches in exposed areas. Provide supplemental steel when piping occurs in open shafts.

X. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

Y. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

Z. All rooftop piping supports shall be anchored to the structure and shall be able to withstand 120 MPH wind loading.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending a minimum of 6 inches beyond supported equipment. Refer to Division 03.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 12 inches minimum above finished roof surface. Coordinate roof flashing with roofing contractor. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor, shower and mop sink drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.

D. Place intumescent coating in sufficient coats to achieve rating required.

E. Remove dam material after firestopping material has cured.

F. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   c. Pack void with backing material.
   d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

G. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   c. Install type of firestopping material recommended by manufacturer.

2. Install escutcheons, floor plates or ceiling plates where piping, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations at computer rooms, telecommunication rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.9 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Quality Requirements, and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.10 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.11 PROTECTION OF FINISHED WORK

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 22 05 29

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SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.

B. Related Sections:

1. Section 09 90 00 - Painting: Execution requirements for painting specified by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures and installation.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Or approved equal.

B. Furnish materials in accordance with NYCBC.

C. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Plastic Tags:

1. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

a. Craftmark Identification Systems.
b. Safety Sign Co.
c. Seton Identification Products.
d. Or approved equal.

2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:

1. Manufacturers: Subject to compliance with requirement, provide products by one of the following:
a. Craftmark Identification Systems.
b. Safety Sign Co.
c. Seton Identification Products.
d. Or approved equal.

2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. Manufacturers: Subject to compliance with requirement, provide products by one of the following:
a. Craftmark Identification Systems.
b. Safety Sign Co.
c. Seton Identification Products.
d. Or approved equal.

2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.3 STENCILS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Or approved equal.

B. Stencils: With clean cut symbols and letters of following size:

1. Equipment: 1-3/4 inches high letters.

C. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers: Subject to compliance with requirement, provide products by one of the following:
   a. Craftmark Identification Systems.
   b. Safety Sign Co.
   c. Seton Identification Products.
   d. Or approved equal.

2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

1. Manufacturers: Subject to compliance with requirement, provide products by one of the following:
   a. Craftmark Identification Systems.
   b. Safety Sign Co.
   c. Seton Identification Products.
   d. Or approved equal.

2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.5 LABELS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Or approved equal.

B. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.3 INSTALLATION

A. Apply stencil painting in accordance with Section 09 90 00.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Identify water heaters, pumps, tanks, and water treatment devices with stencil painting. Identify in-line pumps and other small devices with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 22 05 53

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SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Plumbing piping insulation, jackets and accessories.
2. Plumbing equipment insulation, jackets and accessories.

B. Related Sections:

1. Section 07 84 13 - Firestops and Smokeseals: Product requirements for firestopping for placement by this section.
2. Section 09 91 00 – Painting and Finishing: Execution requirements for painting insulation jackets and covering specified by this section.

1.3 REFERENCES

A. ASTM International:

1. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
2. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
3. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
5. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

C. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

D. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

E. Perform Work in accordance with NYCBC.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three (3) years documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish 5-year manufacturer warranty for man-made fiber.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Glass Fiber and Mineral Fiber Insulation Products:
   a. CertainTeed.
   b. Knauf.
   c. Johns Manville.
   d. Owens-Corning.
   e. Or approved equal.

2.2 PIPE INSULATION

A. ASTM C547, molded glass fiber pipe insulation. Conform to ASTM C795.

1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Operating Temperature Range: 0 to 850 degrees F.
3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

2.3 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:

1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

B. PVC Plastic Pipe Jacket:

1. Product Description: ASTM D1785, One piece molded type fitting covers and sheet material, off-white color.
2. Thickness: 15 mil.
3. Connections: Brush on welding adhesive and Pressure sensitive color matching vinyl tape.

C. Aluminum Pipe Jacket:

1. ASTM B209.
2. Thickness: 0.016 inch thick sheet.

3. Finish: Smooth.
4. Joining: Longitudinal slip joints and 2-inch laps.
5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 3/8 inch thick aluminum.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

G. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Coordination and project conditions.

B. Verify piping has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.3 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.

C. Piping Systems Conveying Fluids Below Ambient Temperature:

1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
3. Insulate fittings, joints and valves with molded insulation of like material and thickness as adjacent pipe. Finish with vapor retarder and PVC fitting covers.

D. Hot Piping Systems less than 140 degrees F:

1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with PVC fitting covers.
3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

E. Inserts and Shields:

1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
   a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
   b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

F. Insulation Terminating Points:

1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
2. Condensate Piping: Insulate entire piping system and components to prevent condensation.

G. Pipe Exposed in Mechanical Equipment Rooms, corridors, and laboratories: Finish with PVC jacket and fitting covers.

H. Prepare pipe insulation for finish painting. Refer to Section 09 90 00 - Painting.

3.4 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

3.5 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	PIPE SIZE	INSULATION THICKNESS inches
Domestic Hot Water Supply and Recirculation (both potable and non-potable)	1-1/4 inches and smaller 1-1/2 inches and larger	1.0 1.5
Domestic Cold Water (both potable and non-potable)	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0

END OF SECTION 22 07 00

SECTION 22 08 00 – COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including contract conditions and the scope of work document, and other Division 01 specification sections, apply to this section.

B. Owner's Project Requirements and Basis-of-Design documentation, if included, are for reference information only.

C. The following specification sections contain information related to the design, installation, testing, and acceptance of the plumbing equipment:

1. Specification Section 01 91 13 – General Commissioning Requirements

1.02 EQUIPMENT SUMMARY

A. This section lists the plumbing equipment items that will be commissioned as a part of the project scope:

1. Commissioning of the plumbing related items include:

a. Plumbing Systems

1) Domestic Hot Water system

2. The detailed list of plumbing equipment to be commissioned is specified as part of the commissioning plan issued by the commissioning agent.

1.03 DEFINITIONS

A. B.A.S. – “Building Automation System”

B. CM – “Construction Manager”

C. CxA – “Commissioning Authority”

D. DOR – “Designer of Record”

E. DDC – “Direct Digital Control”

F. FPT – “Functional Performance Test”

G. HVAC&R – “Heating, Ventilation, Air Conditioning, and Refrigeration”

H. "Systems," "Subsystems," "Equipment," and "Components" – Where these terms are

used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

I. PFC – ”Pre-functional (construction) checklist”

J. T.A.B. – “Testing, Adjusting, and Balancing”

1.04 COMPENSATION

A. Should Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.

1. Failure to provide timely notice of commissioning activities schedule changes.

2. Failure to meet acceptance criteria for test demonstrations.

1.05 DOCUMENTATION

A. MEP Design Review

1. The CxA will perform a commissioning focused design review of the MEP Drawings and specifications for the project at ~100% CDs and issue comments to the DOR.

2. The DOR is responsible for formally addressing each comment issued by the CxA.

3. The CxA will confirm that the DOR addressed the initial design review comments in the ~100% CD issuance.

B. Informational Equipment Submittal

1. Equipment submittals will be submitted for approval by the CM to the Owner, DOR, and CxA to be reviewed concurrently.

2. Each equipment submittal is required to contain (at a minimum) the following information:

a. Manufacturer Name
b. Model Number
c. Quantity
d. Installed Options
e. Unit Dimensions
f. Maximum Heating / Cooling Load
g. Electrical Criteria
h. Installation Requirements
i. Wiring Diagrams
j. Performance / Efficiency Ratings
k. Parts Listing
l. Warranty Information

3. Submittal Review Process

   a. The submittal review process begins once the CM submits the equipment submittals to the Owner, DOR, and CxA for review and approval.
   b. The CxA will review each submittal within seven (7) days of receipt and provide comments directly to the DOR.
   c. The DOR will be responsible for deciding whether or not to include the CxA's submittal review comments in their official response to the CM.

C. Pre-Functional (Construction) Checklists

1. PFCs are documents that will be developed and completed by the CxA to confirm that the equipment has been installed per the manufacturer's instruction and in accordance with the approved equipment submittal and relevant specification section.

2. Completed PFCs will be utilized as confirmation that the installed equipment is ready to be scheduled for functional testing. Any deviations in installation from the contract documents, manufacturer's recommendations, or design specifications will be noted as a deficiency and recorded on the Commissioning Issues Log.

3. Checklist criteria should include (but is not limited to) the following:

   a. Manufacturer Name
   b. Model Number
   c. Serial Number
   d. Electrical Criteria
   e. Location (i.e. floor, room name / number, etc.)
   f. Filter presence (if applicable)
   g. Exterior disposition (e.g. cracked, dented, damaged)
   h. Deficiencies found during installation

4. Start-up reports issued by the equipment manufacturer are sufficient forms of PFCs that may be submitted to the CxA in lieu of CM or subcontractor developed forms.

D. Pipe Leakage and cleaning

1. All piping systems shall be hydrostatically tested. Pneumatic testing is not acceptable.

Hydrostatic pressure tests for water and steam piping systems shall include the respective equipment (including valves, strainers, etc.) unless the test pressure exceeds the manufacturer's maximum allowable test pressure as obtained by the Mechanical Contractor.

All required leak testing shall be completed prior to the application of insulation.

E. FUNCTIONAL PERFORMANCE TESTS

1. Functional performance tests are documents developed by the CxA and executed by the plumbing contractor.

2. The CxA requires the approved equipment submittal, sequence of operations, control submittal and completed PFC, and TAB report prior to scheduling functional testing.

3. The purpose of the FPTs is to test the operation of the equipment in its various modes of operation. Some modes that may be tested as a part of the equipment's sequence of operations are:

   a. Un-Occupied Mode
   b. Occupied Mode
   c. Hand-OFF-Auto
   d. Emergency Power Mode (if applicable)
   e. Alarms

4. Any deviation in operation from the approved sequence of operations will be recorded as a deficiency and included on the commissioning Deficiency Log which will be issued in its entirety at the culmination of functional testing.

F. ISSUES LOG

1. The commissioning issues log is a spreadsheet constructed by the CxA that details all of the installation and operational deficiencies found during the pre-functional and functional testing stages for each equipment item.

2. A deficiency is defined as follows:

   a. Any deviation in the equipment's installation in comparison to the approved equipment submittal, contract drawings, or relevant design specification.
   b. Any deviation in an equipment's operation in comparison to the approved sequence of operations, or relevant design specification.

3. Once a deficiency is identified by the CxA, it will be added to the deficiency list and marked "OPEN". The list is distributed to the project team where it becomes the CM's responsibility to rectify the issue. Once the issue is addressed, the CxA will confirm that the CM has corrected the deficiency and mark the deficiency as "CLOSED" on the deficiency list.

4. The Owner will serve as the arbiter in the event that CM and the CxA disagree on a perceived deficiency.

G. Systems Manual

1. Provide operating instructions and maintenance data books for all equipment and materials furnished under this division to the CxA.

2. Submit one (1) copy of operation and maintenance manuals in searchable electronic format (PDF) for review at least ten (10) weeks before Final Review of the

project.

3. Operation and maintenance manuals shall include complete periodic maintenance schedules, lubrication, cleaning and servicing data compiled in clearly and easily understandable form. Data shall show serial numbers and model numbers of each piece of equipment, complete lists of replacement parts (including part numbers), motor ratings and actual loads.

4. Include the following information where applicable:

1. Name, location and phone number of nearest service agency and phone number for 24-hour manufacturer service hotline.

2. Narrative describing system operation.

3. Identifying name and mark number.

4. Locations of major equipment (where several similar items are used, provide a list).

5. Complete nameplate data.

6. “Final Reviewed” submittals.

7. Parts lists.

8. Performance curves and data.

9. Wiring diagrams.

10. Lubrication charts.

11. Manufacturers’ recommended operation and maintenance instructions with all non-applicable information deleted.

12. List of spare parts recommended for normal service requirements.

13. Assembly and disassembly instructions with exploded view drawings where available.

14. Troubleshooting diagnostic instructions where available.

15. Description of alarm and trouble codes for software-based systems.

16. Manufacturer recommended and actual set points.

H. FINAL COMMISSIONING REPORT

1. The final commissioning report is developed by the CxA and is a cumulative review of the commissioning process for the project.

2. The results of the functional testing, deficiency resolution, final equipment disposition, and recommendations for on-going systems monitoring and

maintenance are included in the report.

3. A list of appendices contained in the Final Commissioning Report include:

   a. Final Commissioning Plan
   b. Completed and Blank Pre-Functional Checklists
   c. Completed and Blank Functional Performance Tests
   d. Completed Deficiency Log
   e. Field Observation Reports
   f. Start-up Reports
   g. TAB Report
   h. MEP Static Test Results
   i. Training Sign-In Sheets
   j. As Built drawings

1.06 QUALITY ASSURANCE

A. Testing Equipment, Instrumentation Quality, and Calibration

1. All test equipment used during the commissioning phase of the project will possess the following:

   a. Certificate of calibration certified with the date the test equipment was last calibrated.
   b. Manufacturer, model number, and serial number.

2. All test equipment will be capable of meeting the following criteria:

   a. Capable of testing and measuring performance within the specified acceptance criteria.
   b. Calibrated at the manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument.
   c. Maintained in good repair and operating condition throughout the duration of us on the project.
   d. Recalibrated or repaired if damaged in any way while being used on the project.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 GENERAL EXECUTION REQUIREMENTS

A. Schedule and coordinate commissioning with the construction schedule.

B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.

C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies.

D. Include in the Commissioning Plan a detailed list of the test demonstrations.

E. Report test data and commissioning issue resolutions.

F. Schedule personnel to participate in and perform Commissioning-Process Work.

G. Installing contractors' commissioning responsibilities include, but are not limited to, the following:

1. Operating the equipment and systems they install during tests.

2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

3.02 PLUMBING TESTING REQUIREMENTS

A. The commissioning testing schedule will be determined by the CM upon submission of the requisite documentation and completion of equipment installation.

1. The CxA must be notified three (3) business days in advance of the proposed testing date.

2. The CxA will make the functional test forms available to the CM in advance of testing.

3. The CM (and plumbing contractor) will be responsible for providing the appropriate test equipment to complete functional testing.

B. The following requirements are the sole responsibility of the CM and plumbing subcontractors to complete prior to functional testing by the CxA:

1. Certify in writing that all plumbing systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the contract documents, approved shop drawings, and submittals.

2. Certify in writing that TAB procedures have been completed and that TAB reports have been submitted to the EOR and CxA for review, discrepancies corrected, and corrective work approved.

3. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (e.g. normal, hand, off, auto, occupied, etc.)

4. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions to verify compliance with acceptance criteria.

5. Provide personnel capable of accessing, operating, and making changes (if

necessary) to the unit.

6. Perform functional performance tests written by CxA.

7. Resolve commissioning deficiencies in a timely fashion and notify the CxA once corrective action is completed.

C. Testing should be performed using design conditions whenever possible, however, simulated conditions may be used (e.g. BAS temperature manipulation, shorting sensors, etc.) to test specific modes if deemed necessary by the CxA.

D. The sampling method of testing is used when functional testing of large quantities of equipment is required.

1. The sampling method is used on only contractually agreed upon equipment items.

2. In the event that 10% of the sample size fails functional testing, the remainder of the sample size will be considered to have failed as well. It will be incumbent upon the CM to resolve the issue and contact the CxA for retesting.

E. Retesting of commissioned equipment will be required if:

1. 10% of a sample size of equipment fails functional testing.

2. Equipment is not ready to be commissioned at the designated testing date.

+ + END OF SECTION + +

SECTION 22 11 00 - FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Unions and flanges.
2. Hose bibs.
3. Trap Primers.
4. Backflow preventers.
5. Water hammer arrestors.
6. Thermostatic mixing valves.

B. Related Sections:

1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
3. Section 09 90 00 - Painting: Product and execution requirements for painting specified by this section.
4. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
5. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
6. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
7. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
8. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
9. Section 26 05 00 - General Electrical Requirements: Execution requirements for electric connections to equipment specified by this section.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B31.9 - Building Services Piping.

C. American Society of Sanitary Engineering:

1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
2. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
4. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
5. ASSE 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
6. ASSE 5015 - Performance Requirements for Testing Double Check Backflow Prevention Assemblies (DC) and Double Check Fire Protection Backflow Prevention Assemblies (RPDF).

D. ASTM International:

1. ASTM E1 - Standard Specification for ASTM Thermometers.
2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C651 - Disinfecting Water Mains.

G. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

H. Plumbing and Drainage Institute:

1. PDI WH201 - Water Hammer Arrester Standard.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.

2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes and finishes.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit exploded assembly views and recommended maintenance intervals.

1.6 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. For drinking water service, provide valves complying with NSF 61.

C. Perform Work in accordance with NYCBC.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience and with service facilities within proximity of Project.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Product storage and handling requirements.

B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

F. Comply with pump manufacturer's written rigging instructions for handling.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions - Product Requirements.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for domestic water piping.

PART 2 - PRODUCTS

2.1 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with soldered joints.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges.
3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.2 HOSE BIBS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Wilkins
2. Woodford
3. Stern-Williams
4. Or approved equal

B. Interior: Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with hand wheel lock shield and removable key, integral vacuum breaker in conformance with ASSE 1011.

2.3 TRAP PRIMERS (ELECTRIC)

A. Electronic Trap Priming Assembly, Surface mounted. 12x12 metal cabinet with cover, NEMA-1, circuit breaker, manual override switch,/test button, timer, solenoid valve. Backflow prevention: anti-siphon atmospheric vacuum breaker.

B. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. PPP Inc. Model PTS with distribution manifold.
2. Smith, Jay R. Mfg. Co.; Smith Industries, Inc.
3. Watts Industries, Inc.; Water Products Div.
4. Or approved equal

C. Standard: ASSE 1018.

D. Pressure Rating: 125 psig minimum.

E. Body: Bronze.

F. Inlet and Outlet Connections: NPS 3/4 threaded, union, or solder joint, with isolation valve.

G. Refer to drawings for quantity of drains connected and manifold model number.

2.4 WATER HAMMER ARRESTORS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Jay R. Smith
2. Zurn
3. Sioux Chief
4. Or approved equal.

B. ASSE 1010; copper construction, piston type sized in accordance with PDI WH-201.

2.5 THERMOSTATIC MIXING VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Leonard Valve
2. Bradley
3. Lawler
4. Or approved equal

B. Valve: Bronze or cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment. Conform to ASSE 1070 to temper water to maximum 110 degrees F.

C. Capacity: Listed on Drawings.

D. Accessories:

1. Check valve on inlets.
2. Volume control shut-off valve on outlet.
3. Stem thermometer on outlet.
4. Strainer stop checks on inlets.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Coordination and project conditions.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange systems to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment. Refer to Section 22 05 16.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

H. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.

K. Install domestic water piping in accordance with ASME B31.9.

L. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.

M. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 22 05 29.

N. Install unions downstream of valves and at equipment or apparatus connections.

O. Install valves with stems upright or horizontal, not inverted.

P. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

Q. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

R. Install ball valves for throttling, bypass, or manual flow control services.

S. Provide flow controls in water circulating systems as indicated on Drawings.

T. Install potable water protection devices on plumbing lines where contamination of domestic water may occur.

U. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

V. Test backflow preventers in accordance with ASSE 5013 and 5015.

W. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping.

3.5 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test domestic water piping system in accordance with NYCBC, NSPC and DCAS.

3.6 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for cleaning.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

D. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION 22 11 00

SECTION 22 13 00 - FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Floor drains.
2. Cleanouts.

B. Related Sections:

1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
2. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
3. Section 09 90 00 - Painting: Product and execution requirements for painting specified by this section.
4. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
5. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
6. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A112.21.1 - Floor Drains.
2. ASME B31.9 - Building Services Piping.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings and accessories. Submit manufacturers catalog information.

2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes and finishes.

C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

1.6 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform Work in accordance with NYCBC.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience, and with sewage ejector service facilities within proximity of Project.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions - Product Requirements.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for sewage ejectors.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Jay R. Smith
2. Zurn
3. Josam
4. Or approved equal

B. Refer to Schedule on Drawings.

C. Floor Drain: ASME A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.2 CLEANOUTS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Jay R. Smith
2. Zurn
3. Josam
4. Or approved equal

B. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid cover.

C. Interior Finished Floor Areas: Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.

D. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.

E. Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Coordination and project conditions.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.4 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Field inspecting, testing, adjusting and balancing.

B. Test sanitary waste and vent piping system in accordance with NYCBC, NSPC.

END OF SECTION 22 13 00

SECTION 22 14 00 - FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:
   1. Roof drains.
   2. Cleanouts.

B. Related Sections:
   1. Section 09 90 00 - Painting: Execution requirements for painting material specified by this section.
   2. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
   3. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
   4. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
   5. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.

1.3 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B31.9 - Building Services Piping.

1.4 SUBMITTAL PROCEDURES

A. Refer to DDC General Conditions Section 01 33 00 “Submittal Procedures”.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sump-pumps, catch basins and manholes.

C. Product Data:
   1. Piping: Submit data on pipe materials, fittings and accessories. Submit manufacturers catalog information.
   2. Hangers and Supports: Submit manufacturers catalog information including load capacity.

3. Storm Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

D. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and clean-outs.

B. Operation and Maintenance Data: Submit exploded assembly views for pumps and equipment.

1.6 QUALITY ASSURANCE

A. Refer to DDC General Conditions Section 01 40 00 “Quality Requirements”.

B. Perform Work in accordance with NYCBC.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products with minimum three (3) years documented experience, and facilities within proximity of Project.

B. Installer: Company specializing in performing work of this Division with minimum three (3) years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 ROOF DRAINS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Jay R. Smith
2. Zurn
3. Josam
4. Or approved equal

B. Roof Drain:
1. Assembly: ASME A112.21.2M.
2. Body: Lacquered cast iron with sump.
3. Strainer: Removable cast iron dome with vandal proof screws.
4. Accessories: Coordinate with roofing type:
   a. Membrane flange and membrane clamp with integral gravel stop.
   b. Adjustable under deck clamp.
   c. Roof sump receiver.
   d. Waterproofing flange.
   e. Leveling frame.
   f. Adjustable extension sleeve for roof insulation.

2.2 CLEANOUTS

A. Interior Finished Floor Areas: Lacquered cast iron body with anchor flange, reversible clamping collar, adjustable threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.

B. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.

C. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DDC General Conditions for execution requirements.

3.2 EXAMINATION

A. Verify excavations are to be required grade, dry and not over-excavated.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.4 FIELD QUALITY CONTROL

A. Test storm drainage piping system in accordance with NYCBC.

END OF SECTION 22 14 00

SECTION 22 40 00 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Water Closets.
2. Lavatories.
3. Sinks.
4. Mop Basin.
5. Drinking fountains.

B. Related Sections:

1. Section 07 90 00 - Joint Protection: Product requirements for calking between fixtures and building components for placement by this section.
2. Section 22 11 00 - Facility Water Distribution: Supply connections to plumbing fixtures.
3. Section 22 13 00 - Facility Sanitary Sewerage: Waste connections to plumbing fixtures.
4. Section 26 05 00 - General electrical Requirements: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.

B. American Society of Mechanical Engineers:

1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
2. ASME A112.18.1 - Plumbing Fixture Fittings.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim and finishes.

C. Manufacturer's Installation Instructions: Submit installation methods and procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.6 QUALITY ASSURANCE

A. Refer to DCAS General Conditions - Quality Requirements.

B. Perform Work in accordance with NYCBC.

C. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.

D. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience, and with service facilities within proximity of Project.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Product storage and handling requirements.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.9 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for plumbing fixtures.

1.10 EXTRA MATERIALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two (2) sets of faucet washers and sink supply fittings.

PART 2 - PRODUCTS

2.1 GENERAL

A. Fixtures shall be of the first quality as fabricated by a manufacturer of established reputation.

B. Trim which includes faucets, strainers, escutcheons, lavatory supplies, traps, etc., shall be made of brass and shall be polished chromium-plated. Material specified as chromium-plated shall be thoroughly and evenly applied and guaranteed not to strip or peel. Chromium-plating on plumbing fixture trim shall be in accordance with Federal Specification WW-P-541b for grade "R" plating. Manufacturer shall submit certification that all chrome-plating on finished trim meets aforementioned Federal Specification. Plated work shall be highly buffed. Plastic, zinc or white metal will not be approved.

C. Supply to fixtures shall be separately controlled by its own stops.

D. Provide set screw CP cast brass escutcheons for piping and tubing

2.2 WATER CLOSETS - WALL HUNG, FLUSH VALVE TYPE

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following – match existing water closet manufacturer where possible:

1. American Standard
   a. Kohler
   b. Toto
   c. Or approved equal.

2. Bowl:
   a. Manufacturer: Kohler Kingston model K-4325
   b. Or approved equal.

3. ASME A112.19.2; wall hung, siphon jet vitreous china closet bowl with ceramic glaze, with elongated rim, 1-1/2 inch top spud, china bolt caps.

4. Exposed Flush Valve:
   a. Standard Toilet Rooms:
      1) Manufacturer: Sloan Royal Flushometer 111-1.28 HE, 1.28 gpf
   b. Manual flushometer
   c. Or approved equal.

5. Dual-Flush:
   a. Manufacturer: Sloan Ecos model 8111-1.6/1.1 HW.
   b. Battery powered, dual-flush with full flush (1.6 gpf) and reduced flush button (1.1 gpf), smart sensing technology, and manual override buttons.
   c. Or approved equal.

6. ASME A112.18.1; exposed, chrome plated.
7. Seat:
   a. Manufacturer: Church 9500C
   b. Or approved equal.

8. Other manufacturers offering equivalent products:
   a. Beneke
   b. Olsonite
   c. Or approved equal.

9. Solid white plastic, open front, extended back, brass bolts, without cover.

B. Wall Mounted Carrier: ASME A112.6.1; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers. Anchor Foot.

2.3 WALL HUNG LAVATORIES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. American Standard
2. Kohler
3. Toto
4. Or approved equal.

B. Vitreous China Wall Hung Basin: ASME A112.19.2M; vitreous china wall hung lavatory 22 x 21 inch minimum, with 4 inch high back, drillings on 4 inch centers, rectangular basin with splash lip, and front overflow.

1. Faucet:
   a. Chicago Faucet model 116.868.AB.4, dual supply, sensor activated lavatory faucet, 6 Volt lithium CRP2 batter (included), low-flow 0.35 gpm spray outlet, vandal resistant. 4” deck plate and grid strainer assembly. ADA compliant.
   b. Or approved equal.

2. Concealed mechanical mixing valve for tempered water supply.

C. Waste Fittings: ASME A112.18.2 or ASTM F 409.

D. Accessories:

1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
2. Offset waste with perforated plug and strainer.
3. Screwdriver stops.

4. Rigid supplies.
5. Wall Mounted Carrier:
6. Manufacturer: Jay R. Smith, Josam, Zurn.
7. ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger.

2.4 SINKS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Elkay
2. Just
3. Kohler
4. Or approved equal

B. Single Compartment Bowl: ASME A112.19.3: ____" x ?" x 6 inch outside dimensions, 18 gage thick, Type 304 stainless steel. Self-rimming and undercoated, with 1-1/2 inch chromed brass drain 3-1/2 inch crumb cup and tailpiece, ledge back drilled for trim.

C. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Chicago Faucets
2. Moen
3. Kohler
4. Or approved equal

D. ASME A112.18.1; Steel finish on brass 9" supply spout, deck mounted on single penetration, water economy aerator, optional 2.2 gpm flow regulator, and single lever handle. ADA Compliant.

1. Accessories:
   a. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
   b. Drain fitting suitable for 3-1/2" waste connection.
   c. Wheel handle stops.
   d. Flexible supplies.

2.5 DRINKING FOUNTAINS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Elkay
2. Oasis
3. Halsey Taylor
4. Or approved equal

B. Drinking Fountain with Bottle Filler

1. Bi-level bubbler wall-mounted drinking fountain with bottle filling station shall be designed to meet the clearances required by ANSI A117.1 and ADA. Fountain shall be made from type 300 stainless steel with a satin finish. All seams shall be welded and ground smooth. Unit shall have stainless steel basin with anti-splash ridge and removable drain strainer. All waterways shall be constructed of copper. Unit shall be furnished with a bottom plate secured with vandal resistant screws. Furnish a screwdriver for removing bottom plate screws. Bubbler shall be chrome plated with non-removable anti-squirt feature and integral hood. Automatic stream height regulator shall be located inside unit to prevent tampering. Includes self-closing, light touch front and side pushbar actuation. Unit shall include filter certified to NSF/ANSI for lead reduction with visual monitor to indicate when replacement is necessary.
2. Bottle Filler shall be sensor-actuated with auto shut-off timer and bottle counter, shall provide 1.1 to 1.5 GPM with laminar flow for minimal splash and shall include anti- microbial protected plastic components. Unit shall be lead-free design which meets Safe Drinking Water Act and is certified to NSF/ANSI 61. Unit shall be Elkay EZSTLG8WSLK, Halsey Taylor HTHB-HALDBLSS-NF or Oasis PGF2EBQSL. All bubblers shall meet the requirements of the federally mandated “Reduction of Lead in Drinking Water Act”. Regardless of model numbers indicated herein, provide equivalent models that meet the requirements of the act.

C. General:

1. Carrier: Provide Josam Co., J. R. Smith Figure 824-M31, Wade 420-M36 floor mounted chair carrier, or Approved Equal. Floor mounted hanger plate carrier using rectangular high-strength steel uprights welded to base plates
2. Drinking fountain trap shall meet New York City Building Code requirements, shall be chrome plated cast brass: 1¼” inlet by 1½” outlet.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.3 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.4 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and/or wall carriers and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 xx xx, color to match fixture.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.6 ADJUSTING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise or overflow.

3.7 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Final cleaning.

B. Clean and adjust plumbing fixtures and equipment.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

END OF SECTION 22 40 00

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SECTION 22 50 00 - PLUMBING TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Every new plumbing system shall be inspected and tested. Inspections and tests shall comply with the requirements of this Section.
2. Defects disclosed by tests shall be repaired, or, if required by the City of New York, defective work shall be replaced with new work. Tests shall be repeated after defects have been repaired or replaced and shall be repeated as often as necessary until all work passes the required tests.

1.3 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4

B. Certification of Tests.

C. Domestic Water Sterilization Plan as per Article 3.4.

D. Notices (72 hours) prior to all tests

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide all materials, equipment and other items required for tests, retests, repairs and replacements that are required to complete the work of this section.

B. All gauges, instruments and test devices shall be provided with a certificate of calibration and calibration curve or letter indicating that a minimum of five (5) test points have been calibrated. The certificate and letter must show the date of last calibration. The calibration date must be within a year of the testing date.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 PIPING SYSTEM TESTS - GENERAL

A. All new piping and equipment shall be tested prior to application of insulation, painting, concealing or placing of backfill. Testing as stipulated herein shall be considered minimum, and where tests stipulated by DCAS exceed these requirements, such more stringent tests shall be performed.

B. The work of the Contractor shall include the furnishing of all labor, testing instruments, gauges, pumps, smoke machines, and other equipment required or necessary for tests, required by law, rules and regulations and as specified.

C. Provide all other tests required by the City of New York.

D. All appurtenances shall be operated after installation to determine whether or not they meet the requirements of the Specifications.

E. Where controls and accessories are not designed to withstand pipe test pressures, they shall be removed or otherwise properly protected against damage during such test. After approval of such tests, controls and accessories shall be installed and tested with operating medium to operating pressures.

F. If in any test leaks are observed, the defective work or material shall be replaced. No caulking of screwed joints or holes will be acceptable. Peening of welds is prohibited. Repetition of the entire test will be required as many times as leaks can be observed from the tests, until no leak results in successful completion of the test.

G. All tests shall be made in the presence and to the satisfaction of the Commissioner over the work to be tested, and as may be directed; and at least 72 hours' notice shall be given to the Commissioner in advance of all tests.

H. All piping which is to be enclosed in partitions or hung ceilings shall be tested and made tight when directed by the Commissioner and in adequate time to permit the installation of partitions and ceilings. When necessary, the Contractor shall drain the piping and/or take such precautions as required to prevent damage by freezing.

3.3 DOMESTIC WATER SYSTEM STERILIZATION

A. The potable water system shall be disinfected, and water samples shall be collected and analyzed by the Contractor. The requirements of this Section include disinfection of all parts of new potable water systems including, but not limited to, new service connections as specified.

B. The Contractor shall ensure that all pipes, fittings, fixtures, and related appurtenances are all shipped, handled, delivered and stored in an acceptable, sanitary manner. Disinfection of interior parts of the potable water system shall not begin until all fixtures are installed and

functioning properly and authorization to begin disinfection to verify is issued by DCAS. An IEH representative may, at their discretion, perform a site inspection to verify that all fixtures are installed and operating properly prior to providing authorization to begin disinfection.

C. All work shall be performed in accordance with the requirements of §141.11 of the New York City Health Code, the New York State Department of Health State Sanitary Code, and Section PC 610 of the New York City Plumbing Code. "Potable water" as used in this Section shall have the meaning defined in Article 141 of the New York City Health Code, as set forth in Title 24 of the Rules of the City of New York. As used in this Section, the potable water system includes, but is not necessarily limited to, the hot and cold water distribution system piping, fittings, fixtures, related appurtenances and service main connections.

D. Chemicals, additives, treatment devices and equipment that may come in contact with potable water shall be in compliance with the requirements of Subpart 5-1 of the State Sanitary Code, the American Water Works Association (AWWA), National Sanitation Foundation (NSF)/American National Standards Institute (ANSI) 60 Drinking Water Treatment Chemicals – Health Effects and NSF/ANSI 61 Drinking Water System Components – Health Effects.

E. The Contractor shall prepare Disinfection and Water Quality Testing Plans (DWQTPs) for review by the City of New York's Industrial and Environmental Hygiene (IEH) Division. Approval of the DWQTPs by the City of New York's IEH Division shall be required prior to implementation. Submittal of separate DWQTPs is required for the interior parts of the potable water system and the exterior service main connections. Prior to submittal of the DWQTP(s) the Contractor (specifically the individual responsible for preparing the DWQTP(s)) shall visit the site to inspect all parts of the potable water system to be disinfected and to determine site- specific conditions to be addressed in the DWQTP(s).

F. Each DWQTP shall include, at a minimum, the following, as applicable to disinfection of interior parts of potable water system and exterior service main connections:

1. Description of pre-disinfection flushing procedures. Flushing shall be performed in the presence of the IEH representative using clean potable water and will be performed until the effluent is clear.
2. Concentration and form of chlorine to be used for disinfection (chlorine gas is not acceptable and shall not be used).
3. Description of testing procedures to verify pH is within acceptable range during disinfection procedures. DWQTP shall include a statement that pH range will not result in damage to the potable water system and provides for optimal disinfection conditions.
4. Point(s) of treatment for the potable water distribution system. The Contractor shall provide the operational procedure that will ensure chlorinated water is drawn into all areas, fixtures, and components of the potable water system at the concentration appropriate to achieve disinfection. The procedure shall describe the means for preventing backflow of chlorine into portions of the distribution system not subject to disinfection, if any, and for preventing backflow into the water supply service connection. The concentration range appropriate to achieve disinfection is equal to or greater than 50 ppm for a contact time of 24 hours, or equal to or greater than 200 ppm for a contact time of 3 hours. All potable water fixtures shall be tested (using field test strips or portable chlorine meter) to verify that chlorinated water is present throughout the system.
5. Contact Time: The Contractor shall identify and describe testing equipment, means and methods, and points of testing throughout the potable water system, which will be used to ascertain that there is sufficient concentration of chlorine remaining throughout the water

system to ensure disinfection after the contact time has been reached. The contact times specified in Section PC 610 of the New York City Plumbing Code are minimum required contact times. The Contractor shall place signs on each fixture/outlet indicating "Disinfection in Progress. Do Not Drink or Use Water."

6. Steps to achieve disinfection should the chlorine concentration remaining in the potable water system at the end of the contact time be below the acceptable level.
7. Flushing procedures (methods and duration). All potable water fixtures must be tested for residual chlorine concentration after disinfection and thorough flushing. Following flushing with clean potable water, residual chlorine concentrations shall be equal to or less than the residual chlorine concentration measured at point where potable water enters the portion of the system being disinfected. Discharge of effluent shall be in accordance with federal, state, and local regulations.
8. Sampling points and number of samples for bacteriological examination. Samples shall be collected from a minimum of 10% of potable water fixtures per floor or two outlets per floor, whichever is greater. One (1) sample is also required from immediately downstream of the backflow prevention device located where the service connection enters the building. If the building has more than one connection to the municipal water supply, then at least one (1) sample shall be collected immediately downstream of each backflow prevention device. Samples shall be collected a minimum of 24 hours after flushing.
9. Bacteriological analyses to be performed and applicable regulatory standards. Analysis of water samples for Total Coliform, E.Coli bacteria, and Heterotrophic Plate Count (HPC) is required. The Contractor shall certify in the DWQTP that sample analyses will be performed in accordance with the latest edition of the Standard Methods for the Examination of Water and Wastewater, published jointly by the American Public Health Association (APHA), American Water Works Association (AWWA), and the Water Environment Federation (WEF).
10. Sample collection techniques and handling procedures.
11. Sample containers, preservation, holding times, and chain-of-custody procedures shall be in compliance with New York State Department of Health (NYSDOH) requirements and the requirements of the analytical method.
12. Certified laboratory must be used (with copies of current certifications provided). Laboratory analysis shall be performed by a laboratory certified for bacteriological analyses by the NYSDOH under the Environmental Laboratory Approval Program (ELAP).
13. Standard laboratory reporting format.
14. Name and qualifications of specialty Contractor performing the disinfection and testing. Minimum contractor qualifications are: successful completion of at least three projects similar in scope and execution and at least three years' experience in performing water disinfection and sampling. In addition, demonstrate compliance with minimum qualification requirements in paragraphs (b)(1)or b(2), and (c) of §141.11 of the New York City Health Code.
15. Copies of the permits obtained in accordance with the requirements of Article 141 of the New York City Health Code, and copies of all applications and submittals made to obtain the permits as well as copies of any and all other regulatory agency submittals and approvals in connection with the disinfection work. Copies of permits shall be submitted to the EOR at least 30 calendar days prior to start of disinfection. Additionally, submit a certification stating the work will be performed in accordance with the requirements of paragraphs (d) (Product Standards), (e) (Cross Connection Control), (f) (Design, Installation and Maintenance), (h) (Water Quality), (j) (Chemical Storage) and (k) (Termination of Treatment) of §141.11 of the New York City Health Code. Identify any

proposed exceptions to the requirements of paragraphs (d), (e), (f), (h), (j), and (k) of §141.11. Exceptions to §141.11 shall not be permitted without the explicit approval of the IEH Division of the City of New York.

16. Documentation that all personnel to be involved in the addition of chemicals to the drinking water supply have successfully completed the appropriate course approved by the State under Subpart 5-4 of the State Sanitary Code.
17. Statement that the potable water system has been carefully evaluated, that the disinfection procedures to be performed are compatible with all components of the potable water system and compatible with any water treatment chemicals that have been or will be added by the Contractor to the potable water system, and that the disinfection procedures will in no way result in any damage to the potable water system.
18. Explicitly identify each and every component, if any, of the building potable water system which the Contractor would propose to exclude from the disinfection procedures. Describe how each component would be excluded. Provide a justification for any such proposed exclusion, including citations to supporting regulations and/or guidance. There shall be no such exclusions without the express written approval of the IEH Division of the City of New York.

G. All chain of custody forms and sample analysis results shall be submitted to the Commissioner and to the IEH Division of the City of New York within 72 hours of the time that samples are delivered to the laboratory. Approval of all sample analysis results by the IEH Division of the City of New York must be obtained by the Contractor. All disinfection procedures and bacteriological results shall be reviewed and a determination made by the City of New York's IEH Division as to the suitability of the water for drinking purposes. This determination will be made upon verification that results are "negative/absent" for E. Coli and Total Coli form and are less than 500 Colony forming units/milliliter (Cfu/ml) for HPC and that all work has been conducted in full compliance with the requirements of this Section and the approved DWQTPs. If the disinfection and/or sampling are deemed unacceptable by the City of New York, the pipe system flushing (in accordance with Article 3.4 and Section PC 610 of the New York City Plumbing Code), disinfection and sampling procedures shall be repeated until an acceptable water quality is demonstrated. The City of New York may require submittal of a revised disinfection procedure to the IEH Division for approval prior to additional disinfection. Potable water system shall not be put into service until successful completion of the disinfection plan and acceptance by the IEH Division.

3.4 DRAINAGE AND VENT PIPING INSIDE BUILDING

A. Rough Plumbing: The piping of plumbing drainage and venting system shall be verified as to material and shall be tested upon completion of the rough piping installation and proven to be watertight. The Commissioner may require the removal of any cleanout plugs to ascertain that the prescribed pressure has been reached in all parts of the system.

1. Water Test:
   a. A water test shall be applied to the drainage system which includes soil, waste, leader and vent piping either in its entirety or in sections after rough piping has been installed. If applied to the entire system, all openings in the piping, except the highest opening, shall be tightly closed and the system filled with water to the point of overflow. If the system is tested in section, each opening, except the highest opening of the sections under test, shall be tightly plugged and each section filled with water. No section shall be tested with less than a 10 ft., head of water. In testing successive sections, at least the upper 10 ft., of the following

section shall be tested, so that no joint or pipe in the building (except the uppermost 10 ft., of the system) shall have been submitted to a test of less than 10 ft., head of water. The water shall be kept in the system or in the portion under the test for at least 15 minutes before inspection starts; the system shall then be tight at all points.

B. Finished Plumbing: After the plumbing fixtures have been set and their traps filled with water the entire drainage system shall be verified as to materials and shall be tested and proven gas tight by smoke test.

1. Smoke Test:
   a. The smoke test shall be made by filling all traps with water and then introducing into the entire system a pungent thick smoke produced by one or more smoke machines. When the smoke appears at stack openings of the roof, these openings shall be closed and a pressure equivalent to a 1" water column shall be maintained for the period of inspection.

3.5 POTABLE WATER SUPPLY TEST

A. When the water supply fixtures roughed in are in place, the Contractor shall close all openings and test entire system under a pressure of 150 pounds per square inch for at least one hour as shown upon an approved test gage.

3.6 FIXTURE TEST

A. Fixtures shall be tested for soundness, stability of support, and satisfactory operation of all parts. All water-closet floor flanges must be tested.

3.7 FINAL OPERATING TEST

A. After completion of the entire work, the Contractor shall operate the entire installation of plumbing and drainage in the presence of the Commissioner and the representatives of the manufacturers of the different apparatus and appliances installed.

3.8 FUEL, MATERIAL AND LABOR FOR TESTS, ETC.

A. The Contractor shall furnish all fuel, apparatus, material and labor required for preliminary and final operations, cleaning, testing and adjusting, including the necessary oil, electric current and the services of competent mechanics.

3.9 FINAL TEST OF FIXTURES

A. After all fixtures are set and connected, the Contractor shall turn water on at all fixtures, traps, etc., and the proper working of all shall be demonstrated by him to the satisfaction of the Commissioner.

END OF SECTION 22 50 00

SECTION 23 05 00 GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. The requirements under Section 23 05 00 are intended for the party or parties who have been duly awarded the applicable portion of work to be performed under the indexed sections of Division 23 also known as the Heating, Ventilating and Air Conditioning Work.

1.3 REFERENCE STANDARDS

A. Compliance with the following codes and standards shall be required as applicable:

1.	ADC	Air Diffusion Council
2.	AGA	American Gas Association
3.	AMCA	Air Movement and Control Association
4.	ANSI	American National Standards Institute
5.	ARI	American Refrigeration Institute
6.	ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
7.	ASME	American Society of Mechanical Engineers
8.	ASTM	American Society for Testing Materials
9.	AWWA	American Water Works Association
10.	DOE	United States Department of Energy
11.	EPA	United States Environmental Protection Agency
12.	FM	Factory Mutual
13.	MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
14.	NACE	National Association of Corrosion Engineers
15.	NEC	National Electrical Code
16.	NEMA	National Electrical Manufacturers Association
17.	NYCBC	New York City Building Code
18.	NYCFC	New York City Fire Code
19.	NYCMC	New York City Mechanical Code
20.	NYECC	New York City Energy Conservation Code
21.	OSHA	Occupational Safety and Health Act
22.	OTCR	Office of Technical Certification and Research (BSA & MEA)
23.	SMACNA	Sheet Metal and Air Conditioning Contractor's National Association

24.	TEMA	Tubular Exchanger Manufacturers Association
25.	UL	Underwriters' Laboratories, Inc.
26.	USAS	USA Standards Institute (Formerly ASA)
27.	USGBC	United States Green Building Council

B. Conform to materials and equipment rating standards, listings or classifications of the above organizations as well as ratings, listings or classifications accepted under local codes and laws.

1.4 ABBREVIATIONS

A. In addition to those listed below, meanings of common abbreviations used in text of Division 23 of the Project Specifications are tabulated in ASHRAE Handbook, "Fundamentals", latest edition.

B. Project Abbreviations:

1.	AC	Air Conditioning
2.	ATC	Automatic Temperature Control
3.	AWG	American Wire Gauge
4.	BMS	Building Management System
5.	BTU	British Thermal Units
6.	C	Degrees Celsius
7.	CFM	Cubic Feet per Minute
8.	F	Degrees Fahrenheit
9.	GPM	Gallons per Minute
10.	H & V	Heating and Ventilating
11.	HVAC	Heating, Ventilating and Air Conditioning
12.	IBBM	Iron Body Brass Mounted
13.	LB	Pound (Also shown as: #)
14.	MBH	Thousand BTU per hour
15.	MER	Mechanical Equipment Room
16.	mm	Millimeter
17.	#	Number
18.	OS & Y	Outside Screw and Yoke
19.	PRV	Pressure Reducing Valve
20.	PSIG	Pounds per Square Inch Gauge
21.	SP	Static Pressure
22.	USS	United States Standard
23.	WG	Water Gage

C. See Drawings for additional abbreviations.

1.5 DEFINITIONS

A. "Provide" means furnish and install, complete, the specified material, equipment or other item and perform all required labor to make a finished installation.

B. "Furnish and install" has the same meaning as given above for "Provide."

C. “Furnish” means supply the specified material, equipment or other items.

D. “Install” means provide all labor required to make a finished and complete installation.

E. Refer to General Conditions for other definitions.

1.6 REVIEW OF CONTRACT DOCUMENTS AND SITE

A. With the submission of his Bid, Contractor shall give written notice to the Commissioner of any materials or apparatus believed in-adequate or unsuitable, in violation of laws, ordinances, applicable codes and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that the Contractor has included the cost of all required items in his Proposal for a complete project.

B. Contractor shall acknowledge that he has examined the Plans, Specifications and Site, and that from his own investigations he has satisfied himself as to the nature and location of the work; the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials; availability of labor, water, electric power, roads and uncertainties of weather; the conformation and condition of the ground; the character, quality and quantity of surface and subsurface materials to be encountered; the character of equipment and facilities needed preliminary to and during the execution of the work; all federal, state, city county, township and municipal laws, ordinances and regulations particularly those relating to employment of labor and construction methods; and all other matters which can in any way affect the work or the cost thereof under the Contract. Any failure by the Contractor to acquaint himself with the available information concerning these conditions will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work.

C. The City of New York assumes no responsibility for any understanding or representation made during or prior to the negotiation and execution of this Contract unless such understanding or representations are expressly stated in the Contract, and the Contract expressly provides that the responsibility, therefore, is assumed by the City of New York.

1.7 BID DOCUMENTS

A. The drawings show the general layout of the various items of equipment; however, layout of equipment, accessories, specialties, ducts, plenums and piping systems are diagrammatic unless specifically dimensioned, and do not necessarily indicate every required fitting, support or similar items required for a complete installation. Consult the architectural drawings and details for exact locations of fixtures and equipment located in finished construction and/or surfaces. Where same is not definitively located, obtain the information from the Commissioner before proceeding by submitting a dimensioned submittal for review. Any reasonable changes in locations indicated shall be made by the Contractor without additional cost to the City of New York.

B. The Contractor shall follow the drawings in laying out the work and check drawings of all trades to verify spaces in which work shall be installed. Maintain maximum headroom and where space conditions appear inadequate, the Commissioner shall be notified before proceeding with the installation.

C. In general, specifications describe quality and type of material and equipment.

D. The drawings show the various systems schematically. No added compensation shall be granted for variations due to field conditions or resulting from coordination with other trade Contractors working under other divisions of the specifications and/or design documents.

E. Work that is reasonably inferable scope of work not shown on the drawings but called for in the specifications, or vice versa, shall be provided by the Contractor without additional expense to the City of New York.

F. Where variance occurs between the drawings and specifications, or within either document itself, the Contractor shall request clarification in writing from the Commissioner as to which item and manner in the work shall be installed.

G. The commercially standard items of equipment and the specified names mentioned herein are intended to identify standards of quality and performance necessary for the proper functioning of the work.

H. Equipment shown on the drawings with particular manufactures identified has been coordinated for structural penetrations, electrical connection, operating and service (maintenance) requirements, and physical size with regard to the space where the equipment is shown. If they comply with the project specifications, these and the other specified manufacturers of this equipment shall be acceptable, contingent on the Contractor providing a complete installation and maintaining full responsibility to provide, at no additional cost, any modifications to the structure or electrical service that are required to properly install, operate and service the equipment being used. These modifications shall not include additional area for equipment unless approved by the Commissioner.

1. The Contractor shall note these changes on the equipment submittal and shall show all differences in equipment being supplied from that shown on the drawings. Failure of the Contractor to provide this information with the submittal shall indicate the submitted equipment meets or exceeds in performance the equipment shown on the drawings and is physically no larger than the equipment specified.

I. Failure of the Contractor to comply with the above and any discrepancy found shall result in the Contractor providing equipment equal to that specified at the Contractor's expense.

1.8 MEASUREMENTS

A. Contractor shall base all his measurements, both horizontal and vertical from established benchmarks. All work shall agree with these established lines and levels. He shall verify all measurements at site; and check the correctness of same as related to the work.

1.9 SPACE LIMITATIONS

A. The equipment selections used in the preparation of the Contract Documents shall fit into the physical spaces provided and indicated, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearance in accordance with Code requirements, the requirements of the specifications and the equipment manufacturer's recommendations.

B. In the preparation of drawings, a reasonable effort to accommodate acceptable equipment manufacturer's space requirements has been made; however, since space requirements and equipment arrangement vary according to each manufacturer, the responsibility for initial access, maintenance access, Code-required access and proper fit rests with the Contractor.

C. Physical dimensions and arrangements of equipment to be installed shall be subject to the Commissioner's review.

D. Coordinate the installation of equipment, ductwork, conduit, bus duct, piping, cable, cable trays, etc., installation with lighting fixtures, special ceiling construction, air distribution equipment and the structure. Provide additional rises, drops and offsets as required. If, after installed, new ductwork, conduit, bus duct, piping or cable is found to be in conflict with the architecture, structure or other trade work which is either existing or shown on the Contract Documents, the ductwork, conduit, bus duct, piping or cable shall be relocated without additional cost to the City of New York.

E. Contractor shall follow the drawings in laying out the work and check drawings of all trades to verify spaces in which work shall be installed. Maintain maximum headroom and, where space conditions appear inadequate, the Commissioner shall be notified before proceeding with the installation.

1.10 LABOR AND MATERIALS

A. All materials and apparatus required for the work shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces.

B. Contractor shall remove all materials delivered, or work erected, which does not comply with Contract Drawings and Specifications, and replace with proper materials, or correct such work as directed, at no additional cost to the City of New York.

1.11 COVERING OF WORK

A. No pipe, fitting or other work of any kind shall be covered up or hidden from view before it has been examined or approved by the Commissioner over same. Any unacceptable work, or unauthorized or disapproved materials discovered shall be removed and corrected immediately.

B. Any type of equipment shown or specified to be installed outdoors, on grade, on roof or similar areas shall have appropriate protection against outdoor weather. Equipment such as motors, panels, etc. shall have rain hood or appropriate protection as provided under Division 23. Insulated pipes shall have aluminum covers or as specified. Insulated ducts shall be provided with aluminum jacket with overlapping, sealed joints. Uninsulated ducts shall be soldered joints and seams or as specified. Where no protection is feasible, such as in exposed vibration springs, hangers, pipe or steel members, such items shall be rated by the manufacturer for outdoor use or as approved by the Commissioner.

1.12 PROTECTION

A. Contractor shall protect the work and material of all trades from damage by his work or workmen, and shall replace all damaged material with new.

B. Contractor shall be responsible for work and equipment until his work is finally inspected, tested, and accepted; he shall protect his work against theft, injury or damage; and carefully store material and equipment received on site which is not immediately installed; close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.

C. Contractor shall be responsible for the preservation of all public and private property, along and adjacent to the work, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits and other underground structures or utilities, and shall carefully protect from disturbance or damage all property marks until an authorized agent has witnessed or otherwise referenced their location, and shall not remove them until directed.

D. All mechanical and electrical equipment delivered to the site shall have appropriate wrapping to protect them from rain, flood, wind, construction debris and all types of water damage normally encountered at the construction sites. Protection of equipment such as fans, coils, valves and similar equipment shall be the responsibility of the Contractor receiving such equipment at the jobsite for installation under Division 23 Contract.

1.13 COMPLETE PERFORMANCE OF WORK

A. Contractor, under this section of the specifications, shall provide all labor, materials, supervision, supplies, tools, scaffolding, machinery, equipment, appliances and services (including transportation, rigging, storage utilities, etc.) and all required permits and licenses necessary to complete the work under the Contract. All systems and equipment shall be complete in every respect and all items of material, equipment and labor shall be furnished, installed, tested and commissioned for a fully operational system.

B. Contractor shall coordinate his work with the work of the other trades so as to resolve conflicts without impeding job progress or the project construction schedule. Provide notice with the bid proposal of any concrete work required by this section that is not indicated on the structural or architectural drawings or drawings of other trades.

C. Contractor shall examine all Contract Documents for all sections of the specifications in order to determine the extent of work required to be completed under this section. Failure to examine all the Contract Documents for this project shall not relieve Contractor of the responsibility to perform all the work required for a complete, fully operational and satisfactory installation.

D. Work shall be executed in strict accordance with the best practice of the trades in a thorough, workmanlike manner by competent, skilled technicians and trade personnel.

E. Contractor shall provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. All labor, materials, apparatus and appliances essential to the complete and proper functioning of the systems described and/or indicated herein, or which may be reasonably implied as essential, whether mentioned in the Contract Drawings and specifications or not, shall be furnished and installed by the Contractor. The entire installation shall be ready in every respect for the satisfactory and efficient operation when completed.

G. In cases of doubt as to the work intended, or in the event of need for explanation thereof, request supplementary written instructions in the form of a Request For Information (RFI) from the Commissioner.

H. Prior to commencing with the fabrication and/or installation, shop drawings must be prepared and approved, and the work specified herein and shown on the Contract Drawings must be coordinated with all other trades.

I. Contractor shall be responsible for material and workmanship until completion and final acceptance. Replace any of same which may be damaged, lost or stolen, without additional cost to City of New York. Guard the building and its contents against damage by the Contractor, his employees or subcontractors, and make good any damage free of charge.

J. Where, due to union regulations or trade agreements, any of the work shown on the drawings or specified herein is not considered this trade's work, subcontract the work in question, but assume full responsibility for the complete installation. Except for such changes as may be specifically approved by the Commissioner, in accordance with alternates or options stated hereinafter, all work must be in full accordance with the intent of the plans and specifications, complete in every way and ready for satisfactory and efficient operation when delivered to the City of New York.

K. Provide signs required by the City of New York.

L. Provide all rigging required for complete installation and furnish drawings showing necessary points of support, reactions and supplementary bracing. This shall be submitted for approval by City of New York. Should any shoring be required, provide same after City of New York's approval. Rigging plan shall be provided to the City of New York for review prior to scheduling rigging. Rigging plan must be stamped by a Professional Engineer licensed in the State of New York.

M. Become thoroughly acquainted with the work involved and obtain and verify at the building all measurements necessary for the proper installation of work. Furnish to subcontractors any information relating to work of this division necessary for the proper installation of their Contracts. Confer with subcontractors for finish adjacent to work of this division and arrange to have visible portions of the work (such as access doors, grilles, escutcheons, etc.) fit in with the finish in a manner satisfactory to the City of New York.

N. Certain materials may be furnished, installed or furnished and installed under other sections of the specifications. Examine the Contract Documents to ascertain these requirements.

O. Carefully check space requirements with other trades to ensure that all material can be installed in the spaces allotted thereto. Finished suspended ceiling elevations are indicated on the Contract Drawings.

P. Transmit to trades doing work of other divisions all information required for work to be provided under their respective divisions (such as water connections, foundations, electric wiring, access doors and the like) in ample time for installation.

Q. Wherever Contractor's work interconnects with work of subcontractors, the Contractor shall coordinate his work with these Contractors to ensure that all Contractors have the information

necessary so that they may properly install all the necessary connections and equipment. Identify all work items (valves, dampers, pull boxes, etc.) in an approved manner in order that the other trades may know where to install such items such as access doors, panel, etc.

R. Where disagreements occur between the plans and the specifications or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the Base Bid.

S. Provide required supports and hangers for piping, ductwork, conduit and equipment, so that loading shall not exceed allowable loadings of structure. Submittal of a bid shall be deemed a representation that the Contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

T. Set all inserts in ample time to allow the work of the other trades to be performed on scheduled time.

U. Furnish and set all sleeves for passage of pipes through structural masonry and concrete walls and floors and elsewhere as required for proper protection of each pipe passing through building surfaces. Coordinate this work with the Commissioner in order to expedite and properly perform this work.

V. Field drilling, cutting and/or reinforcing of holes in structural metal deck required for work under this division shall be coordinated through the Commissioner and approved by the Structural Engineer. All such drilling, cutting and reinforcing costs shall be borne by the Contractor.

W. Should the Contractor neglect to perform preliminary work, and should cutting be required in order to install equipment, the expense of this cutting and restoring of surfaces to their original condition shall be borne by the Contractor.

X. Architectural drawings shall be checked for ceiling height requirements.

Y. Due to the type of installation, a fixed sequence of operation is required to properly install the complete systems. It shall be the responsibility of the Contractor to coordinate, protect and schedule his work with other trades in accordance with the construction sequence.

1.14 CUTTING AND PATCHING

A. Provide all cutting and rough patching required for systems and equipment included in these specifications. All finish patching will be done under General Construction work.

B. Provide all sleeves and inserts required before the floors and walls are built; Contractor shall pay the cost of cutting and patching required for pipes where sleeves and inserts were not installed in time, or where incorrectly located. Provide all drilling required for the installation of hangers.

C. All holes cut through concrete slabs or arches shall be punched or drilled from the underside. No structural members shall be cut without the written approval of the Commissioner and all such cutting shall be done in a manner directed by him.

D. Contractor shall not do any cutting that may impair strength of building construction. No holes, except for small screws, may be drilled in beams or other structural members without obtaining prior approval. All work shall be done in a neat manner by mechanics skilled in their trades and as approved.

E. All penetrations through the terra cotta floor shall be coordinated with the Structural Engineer.

F. Provide sleeves and fire stopping at piping and ductwork floor, wall and roof penetrations in accordance with recognized standards.

1.15 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Procedure:

1. Prepare a schedule of specific submissions at the outset of the Project for the City of New York's review and approval; make submissions listed below and in the other Sections of Division 23 of the Project Specifications.
   a. If submissions listed in other Sections of Division 23 are more specific than those listed below, comply with the more specific requirements.
   b. Failure of the Contractor to submit Shop Drawings in ample time for checking shall not entitle him to an extension of Contract time, and no claim for extension by reason of such default will be allowed.
   c. Piecemeal submittals are unacceptable and will not be reviewed. No submittal shall be considered for review, the review of which is contingent upon acceptance of other features for which submittals have not been submitted.
   d. Submittals from Vendor without Contractor's review and approval stamp will not be reviewed.
   e. Submittals shall not be used by the Contractor as a means to secure approval of a substitution. Contractor must indicate all deviations, omissions and substitutions in his submittal; if there are none of these 3 exceptions, he shall then state on the submittal: "No Exception Taken" and it will be assumed to fully comply with the contract documents. Any submittal without stated exceptions, or without statement that no exception is taken will not be reviewed and will be rejected and returned to Contractor for rectification.
   f. All products of a similar nature (i.e., diffusers, air handling units or variable speed drives) shall be provided by a single manufacturer.

C. Shop Drawings:

1. Manufacturer's Drawings:
   a. Submit equipment listed in all applicable Sections - include material specifications, operating characteristics and finishes, specified agency listings or approvals.
   b. Cuts, brochures or other literature submitted for expeditious approval but incomplete or missing items of hardware or software (performance data) shall be re-submitted until all system or equipment components have been reviewed and approved. Any item not included in the original or first submission shall be considered outstanding work until such item of equipment or work has been sub-

mitted or installed in place exactly conforming to the intent of the contract documents.

c. Contractor shall provide preliminary layout drawings of all major pieces of equipment (i.e., boilers, chillers, cooling towers, air handling units), confirming that the submitted product physically fits within the architectural enclosures. This drawing is required along with the manufacturer's product data.

d. Contractors shall be responsible for all costs related to substitutions as they affect subcontractors.

2. Installation Drawings:

a. Furnish coordinated drawings of equipment installation, including interconnecting piping and ductwork. Minimum scale for these drawings shall be 3/8 inch equals one foot.

b. Coordinate space requirements for electrical, plumbing and other trades in the vicinity of work.

c. Include connections, anchorages and fastenings for piping, conduit and ductwork.

d. Make allowance for clearances for access to and maintenance of equipment.

e. Do not install any piping conduits or ductwork, in any area, prior to obtaining approval of its layout by means of submitting shop drawings.

f. Any missing items of equipment, material or labor, during initial submission of shop drawings, are to be completed and re-submitted for final approval. Shop drawing should not be used as a vehicle for obtaining variances, deviation or omission from the scope of contract documents. Approval of a submittal shall pertain to the portions that conform to the intent of the contract documents.

g. Submission of any missing, incomplete or otherwise deviant layout is subject to re-submission until all contract requirements have been properly included or shown on the same layout.

h. Submit drawings indicated on equipment, piping and ductwork loads to structural engineer for review.

D. Reports:

1. Compliance with listings and approvals for equipment and for fire ratings.
2. Acceptance certificates from inspecting agencies.
3. Complete printed and illustrated operating instructions where required in report format.
4. Manufacturer's pressure tests on vessels.
5. Manufacturer's performance tests on operating equipment.
6. Field pipe testing reports.
7. Welder's certificates and field test reports.
8. Field operating test results for operating equipment.
9. Performance report on the balancing of air and water systems.
10. Performance reports for vibration isolation equipment.
11. Manufacturer's reports on motorized equipment alignment and installation.
12. Additional reports as noted in other sections.

E. Specific references to any article, device, product or material, fixture or item of equipment by name, make or catalog number shall be interpreted as establishing a basis of cost and a standard quality. All devices shall be of the make and type listed by Special Agencies, such as the Underwriters' Laboratories, and where required, approved by the Commissioner.

F. Contractor shall be responsible for any deviations in equipment size, motor horsepower and access requirement, from specified products, including coordination with and costs associated with the related work of other Trades.

1.16 COORDINATION

A. Contractor shall prepare preliminary shop drawings suitable for use in coordinating his work with the work of other trades. The HVAC Section shall prepare and furnish background with ductwork at 3/8" = 1'-0" scale for all trades to indicate piping, cable tray and conduit in relation to all structural elements of the construction, including floor elevations; steel locations, size and elevations; partitions locations; door locations and direction of swing; and all other information required to assure coordination of the electrical, sheetmetal and piping trades and fire protection in relation to the Architectural function of the project. Coordination meetings shall be held under the supervision of the Commissioner or the Contractor. Each trade shall have proper representation at all coordination meetings for the purpose of detailing, on the drawings mentioned above, the exact location and routing of their work. After the conclusion of the coordination at the working meetings, each trade shall sign the coordinated originals, copies of which shall be distributed by the Commissioner or Contractor to all parties concerned including the City of New York. Final shop drawings of all trades shall be in accordance with the coordinated drawing, after which final shop drawings shall be submitted for final approval.

B. If the trade contractor installs work so as to cause interference with work of other trades, he shall make necessary changes in work to correct the condition immediately without delaying project and without extra charge.

C. Dimensional layout plans of equipment rooms shall be made showing all bases, pads and inertia blocks required for mechanical equipment. Include dimensions of bases, bolt layouts, details, etc.

D. Contractor shall furnish all necessary templates, patterns, etc., for installing work and for purpose of making adjoining work conform, furnish setting plans and shop details to other trades as required.

1.17 CONCRETE AND GROUTING

A. Requirements for concrete and grouting are specified in other Sections.

1. Concrete shall be 3,000 psi stone concrete with water reducing admixture, except where otherwise specified.
2. Concrete shall have air entraining admixture where exposed to weather.

B. Contractor shall make coordinated layouts showing concrete work required for housekeeping pads, roof curbs, thrust blocks, etc. which are cast in place.

C. Concrete housekeeping pads: 4" minimum thickness, sized to cover the full area of each piece of equipment and access area provided under Concrete Work.

D. Concrete bases: Dimension and height to suit the equipment.

E. Concrete inertia blocks for vibration isolation. Dimensions designed by the vibration isolation equipment manufacturer and inertia block provided by Division 23, under Mechanical work.

1.18 ACOUSTICAL PERFORMANCE OF EQUIPMENT AND SYSTEMS

A. Noise levels from operation of motor driven equipment, whether airborne or structure-borne, and noise levels created by or within air handling equipment and air distribution and control media, are not to exceed sound pressure levels determined by the noise criteria curves in the ASHRAE Guide and as noted under Section 23 05 48.

B. Acoustical Tests:

1. The City of New York may require contractor to conduct sound tests for those areas or equipment he deems too noisy.
2. If NC level in any space exceeds that in the schedule or the specification due to improper installation or operation of mechanical systems, the respective Trade Contractor is required to make remedial changes or repairs.
3. Respective Trade Contractor is required to retest until specified criteria has been met.

1.19 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Instructions and Demonstration for the City of New York's Personnel:

1. After all equipment is functioning properly, each system is to be automatically operated for ten (10) working shifts, and not to be adjusted during this period, 80 hours in heating and 80 hours in cooling seasons, and 80 hours during “shoulder” or “swing” seasons scheduled at the convenience of the City of New York. Any adjustments will void the test and start the time period all over again.
2. The hours of operation are to include the City of New York's designated personnel in each shift, for each season.
3. During this period, instruct the City of New York's personnel in the use, operation and maintenance of all equipment of each system. Training will include a lecture-type instruction given in a non-machine room environment. During the lesson, normal operation of the system installed and operating will be explained, along with troubleshooting procedures. This will be followed by a field inspection and demonstration of equipment.
4. The above instruction is exclusive of that required of specified equipment manufacturers. If more stringent or longer instruction is indicated for specific equipment or systems, these shall supersede the above requirements.

B. Operating and Maintenance Data:

1. Provide four (4) complete sets of manufacturer's catalogues, instructions, maintenance and repair information and parts lists for operating equipment and devices. Include one (1) CD with a PDF file with all required documentation.
   a. Include performance curves for fans and pumps, factory furnished wiring diagrams and control diagrams, and applicable flow diagrams.
   b. Submit seven sets of instructions for distribution.

2. Data for the equipment actually installed is to be submitted.

3. The data is to be carefully checked for accuracy by comparison with the installed equipment nameplates.
4. Provide a recommended list of spare parts for equipment and list of special, non-standard tools to service equipment.
5. Index and assemble the instructions in durable loose-leaf binders.
6. The completed binders are to be available at the time the equipment installation begins.
7. In addition, follow all requirements of DDC General Conditions.

1.20 RECORD DRAWINGS

A. Provide and maintain a currently up-to-date record set of reproducible prints showing all changes, additions or omissions made during construction. Contractor shall, at his own expense, produce the Record Drawings.

B. Deliver four (4) sets of all as-built drawings and one (1) set of reproducibles of the record drawings to the City of New York before submitting requisition for final payment.

C. Shop Drawings shall be cross-referenced on the mylar copies for this requirement where applicable.

D. Submit AutoCAD, or other as required by City of New York, compatible as-built drawing files.

1.21 WARRANTY

A. The following supplements the General Conditions for Mechanical Work:

1. Non-durable, expendable items such as replaceable (not cleanable) air filter media are not subject to replacement after the date of acceptance.
2. Warranty time limits for equipment exceeding those indicated in DDC General Conditions are specified in the applicable Sections of Division 23.
3. In addition, follow all requirements of DDC General Conditions.

1.22 INDEMNIFICATION

A. This Contractor covenants and agrees:
1. That the Contractors, their Subcontractors and their agents, servants and employees shall provide and maintain a safe place of work, and that they shall comply with all laws and regulations of New York City Building Code.
2. To indemnify, defend and hold harmless the City of New York, City of New York's agents and Commissioner from and against any liability, loss, damage or expense, including attorney's fees arising from a failure or alleged failure on the part of the Contractors, their Subcontractors and their agents, servants and employees to provide and maintain a safe place to work or to comply with all laws and regulations of New York City Building Code.
3. That the Contractors, their Subcontractors and their agents, servants and employees shall indemnify, defend and hold harmless the City of New York, City of New York's agents and Commissioner from and against any liability, loss, damage or expense, including attorneys' fees, arising from a failure or alleged failure on the part of the Contractors, their Subcontractors and their agents, servants and employees to discharge the obligations assumed by them in the performance of the work, including any act or

omission allegedly resulting in death, personal injury, property damage or improper construction, construction techniques, or the use of improper or inappropriate material or tools.

4. That any controversy or dispute to which the Contractor, the City of New York and the Commissioner are parties shall be submitted to the American Arbitration Association for decision in accordance with the rules of such association for construction industry disputes. All Contractors, including Subcontractors assigned to this Contractor, likewise agreed to submit to such arbitration any dispute between or among them, the Contractor, the City of New York and the Commissioner, and the Contractor agrees to make available to the Commissioner, on demand, signed copies of the Contract between the Owner and the Contractor and between the Contractor and his Subcontractors. The Contractor and each Subcontractor agree that by submitting a bid which is accepted, this paragraph shall be deemed a written agreement to submit any controversy thereafter arising to arbitration.

PART 2 - PRODUCTS

2.1 IDENTIFICATION MARKINGS

A. Every equipment valve, damper, control, and apparatus installed under this Contract shall be tagged, labeled or stenciled as follows: Tags and labels securely fastened by brass chains, screws or mastic as applicable. Equipment controls numbered according to equipment schedules on Plans. Tags numbered to conform to a directory listing number, location and use. Directories to be mounted under glass in aluminum self-closing frames, 8-1/2" x 11" in size.

1. Apply identification after testing, insulation and field painting are completed.

B. Valve Identification:

1. Provide an identification tag for each valve, including control valves.
2. Differentiate between the different classes of service in the numbering systems; as an example: “CHW-II”, “HW-II” or “CW-II”.
3. Use 2" brass tags stamped with designation numbers 1" high, filled in with black enamel.
4. Attach tags securely to handles or spindles of valves with heavy brass "S" hooks or brass chains.
5. Provide six (6) copies of valve charts with one of each framed under glass and mounted where directed.

C. Piping Identification:

1. Provide on bare and covered pipes for all services.
2. Use a system of marking and colors conforming to ANSI A-13.1.
3. Install to provide permanent adhesion.
4. Install in readily visible location.
5. Apply legend and flow markers as required for maintenance purposes, with at least one marker in every 50'-0" of each line and at every change of direction.
6. Color Coding of Piping: After piping has been finish painted, the installer of the piping shall identify the type of service lines with applied color bands and stenciled letters. The

direction of flow shall be indicated with stenciled arrows. Color bands shall be 1-inch wide, finished in gloss enamel; lettering and arrows shall be same color as the bands. Specify that indicators be applied at connections to pumps, chillers, and other equipment; at entrances to spaces; adjacent to valves; near access doors to pipe spaces; and at maximum intervals of 50 feet on long pipe runs and at each change of direction. Specify that letters be positioned to be easily read from a normal standing position. If there is no City of New York's standard for color code and designation, the following colors and letter designations shall be used:

HVAC PIPING

Service	Color	Designation
Pumped Condensate	Yellow	PR
Condenser Water Supply	Green	CWS
Condenser Water Return	Green	CWR
Hot Water Supply	Brown with Red Bands	HWS
Hot Water Return	Brown with Orange Bands	HWR
Steam	Orange	HPS, LPS
Other	As directed	As directed

D. Equipment Identification:

1. Provide stencil lettering on operating equipment and units:
   a. Use black oil base paint, except where equipment finish is dark, use white paint.
   b. Make all characters distinguishable from the floor, but not less than 2" high.

2. For each motor starter, controller and similar accessory provide a lamicore nameplate attached with screws or rivets to a fixed part of the equipment in a visible location.
   a. Make plates not less than 2" x 1" x 1/8" thick with 1/4" high characters.
   b. Designations for equipment tags shall match contract schedules.
3. Equipment such as fans, tanks, ducts, access doors to equipment such as filters, coils, fans, neatly stenciled with letters not less than 1 inch high. Any equipment too small to receive such stenciling shall be provided with brass name tags 2" x 1" in size.
   a. Label ducts by function (supply air, return air, exhaust air and transfer).
4. In areas where removable ceilings occur, install appropriate color coded tile markers to indicate location of valves and other equipment or fittings that may require maintenance service.

E. Refer to Section 23 05 53 for additional requirements.

2.2 PROTECTION OF ELECTRICAL EQUIPMENT

A. Keep piping 2'-0" outside the vertical line of unprotected electrical equipment or provide non-corrosive metal (soldered 20 gauge copper or welded stainless steel), watertight support, pans piped to an open drain.

1. Construct and support pans to hold minimum depth of 3 inches of water.

2.3 ACCESS DOORS

A. General:

1. Steel, flush four-sided frame and door assembly, chemically cleaned after fabrication and painted with rust inhibitive primer.
2. Provide hardware and locking devices.
3. Provide access doors required for access to mechanical work through finished wall construction and non-removable ceiling construction.
4. Deliver doors and location information to appropriate trade for installation.

B. Furnish for installation by the appropriate trade, flush type access door or panel no smaller than 18" x 18" and no larger than 30" x 30" for all dampers, valves, cleanouts, or apparatus located in chases, walls, non-accessible hung ceilings or floors; finish shall be prime coat, except floor panels which shall be polished brass or chrome plate. Doors and trim 14 gauge steel, frame 16 gauge steel, with flush concealed and standard flush locks, screwdriver operated cams, of Milcor manufacturer or approved equal.

1. All panels and their exact location subject to approval of the Commissioner.
2. Where space conditions prevent door swinging open, provide removable door on lift-up hinges. This will only be accepted on a case-by-case basis. This condition must be submitted to the City of New York and Commissioner for approval prior to installation.
3. Furnish a complete list locating all access doors required in finished walls, ceilings, partitions, shafts and other inaccessible locations.

2.4 PRIME PAINTING

A. All piping, supports, auxiliary steel and miscellaneous iron within all MER's shall be prime painted as specified herein.

B. All exposed uninsulated piping, fittings, equipment stands, supports, platforms, cradles, and hangers; except chrome finished materials, shall be painted. All ungalvanized surfaces shall be painted with zinc chromate, or approved equal, and all galvanized surfaces shall be prime coated with a phosphate pretreatment coating, dry film thickness of 0.35 with a 0.50 mil. one coat Glid-Guard galvanized steel primer Y5229, or approved equal.

C. Upon completion of the prime coat of all mechanical equipment specified above, all insulated and exposed piping shall be painted with finish coating, as specified under Division 9 and/or other Sections. This Section shall complete stenciling and color identification, specified under Division 23, following the finish painting.

D. Except where otherwise specified, steel piping in concrete and buried steel piping and steel tanks:

1. Provide factory-applied anti-corrosive polyurethane coating, minimum 15 mils thickness which complies with UL 1746, Parts I and IV.
2. In accordance with NFPA and other applicable codes.

E. Provide factory finishes, except as noted, to match Commissioner’s color samples, for items appearing in exposed finished work, and including:

1. Equipment
2. Registers and grilles
3. Diffusers
4. Enclosures on equipment
5. Thermostat Covers
6. Sprinkler Heads.

F. All damaged factory painted surfaces shall be repaired to match original surface. If, in opinion of the Commissioner, such repairs are unsatisfactory, item in question shall be completely refinished or replaced with new.

2.5 WELDING

A. General:

1. All welding procedures, welders, and welding operators shall be qualified in accordance with the requirements of ASME/ANSI B31.9 and Section IX of the ASME Code, latest editions.
2. Welding procedures shall be reported on ASME Section IX Forms "QW," or its equivalent. Joint preparation sketches (to be included with the welding procedures) shall show all dimensions including tolerances, for bevel angle, land size, offset and root gap.
3. Contractor shall be responsible for the welding performed by personnel of his organization and shall conduct the required qualification tests and submit results to the Commissioner for his review and approval.
4. All welding procedures shall meet requirements of New York City Fire Department Certified Requirements. The filing of MSDS form shall be held in the field office.
5. A copy of the welders and fire watch certificate shall be held in the field office of the sight.

B. Processes:

1. Employ the Manual Shielded Metal-Arc (SMAW) welding process.
2. Double butt welding shall be permitted on all joints accessible from both sides. Where double butt-welding is employed, the first root pass shall be back-chipped.
3. Welding of pressure parts shall be performed with low hydrogen type electrodes. Electrodes of Classifications E6012, E6013, E7014 and E7024 shall not be used.
4. Brazing and Soldering:
   a. The Contractor shall prepare applicable "Brazing and Soldering Procedures" forms for approval of the City of New York.
   b. Brazing shall conform to ASME Section IX.
   c. Soldering shall conform to the relevant procedures in the manuals of the Copper Development Association.
   d. For all refrigeration piping, the mechanics shall be skilled and specially trained in this type of pipe joining.
   e. The City of New York may reject any brazed or soldered joint for lack of penetration or for other applicable grounds. These defective joints shall be redone until satisfactory.

C. Quality of Workmanship - In addition to conformance with the procedural and quality requirements set forth in the applicable Code or material specification, all welding shall meet the following requirements.

1. Butt welds shall have full penetrations and shall be slightly convex with uniform height.
2. Each weld shall be uniform in width and size throughout its full length.
3. Each layer of welding shall be smooth, free of slag, cracks, pinholes, undercut in excess of 1/32" and completely fused to adjacent weld beads and base metal.
4. Cover passes shall be free of coarse ripples, irregular surface, non-uniform bead patterns, high crown, and deep ridges or valleys between heads. The surface smooth- ness of the finished weld shall be suitable for the proper interpretation of non-destructive examination of the weld.
5. Surfaces of parts to be joined by welding shall be cleaned of all oil, grease, paint, scale and rust with solvent and/or wire brushing.
6. Fillet weld size shall be in accordance with the applicable code or as specified on the drawings with full throat and legs of equal length.
7. Welding filler metal and welding flux shall be properly stored in such a manner as to ensure that no damage to the coating or corrosion of weld rod will occur. Low hydrogen type electrodes shall be stored in enclosures which provide a regulated temperature as prescribed by the electrode manufacturer. All electrodes shall be properly identified.
8. Socket welds shall have a gap of approximately 1/16" between the bottom of the socket and the end of the pipe prior to welding. Socket welds shall have a minimum of two weld layers.
9. Welds for steam piping shall be X-rayed in accordance with NYCBC requirements. Submit results of X-ray analysis for approval.

D. Repair and Weld Defects:

1. A weld is defective and shall be repaired if it does not meet the acceptance standard of each applicable non-destructive examination as defined ASME/ANSI B31.9, latest edition.
2. Repairs shall be made in accordance with ASME/ANSI B31.9, latest edition.

E. Welding Identification and Weld Marking:

1. All welds must be identified with the welder's identifying symbol. Welds, where more than one welder performs the work, shall be stamped by each welder.
2. Marking shall be done by a permanent method that will not result in sharp discontinuities.
3. Where stamping or marking on the base materials is not practical or feasible, permanently affixed metal bands of the same material may be applied. Stamping or any method of permanent marking on the bands is acceptable.

2.6 EQUIPMENT AND SYSTEMS CRITERIA

A. The criteria of design and performance to produce the required operation is based on equipment shown or scheduled, and as specified.

B. Equipment of other manufacturers will be considered, subject to its acceptability and the following:

1. The equipment must conform to the structural design provisions for loads applied to the structure; to the dimensions established by drawings for spaces and other (service, etc.) clearances; and for inlet and outlet locations and relationships to associated equipment, piping and ducts.
2. Changes to the building arrangement or structure, which are required to suit equipment offered must be by the Contractor at no extra expense to the City of New York.
3. Changes to the electrical requirements such as circuit breaker or starter size, conduit or wire size shall be coordinated by the Contractor and the expense borne by him with no additional cost to the City of New York.
4. Changes to other Contractor's scope of work shall be the responsibility of the Contractor, at no extra expense to the City of New York.

C. Operating equipment, operating systems and other products are specified by names and models and also by performance criteria standards:

1. Where both specifying media are employed, the names and models establish a standard for manufacturing quality, while the performance criteria governs the capacity, rating or output.
2. In any question regarding intent, the capacity, rating or output which is compatible with the other systems, is intended to be of prime concern and is to be provided.
3. Contractor shall follow the City of New York's Standards for Turn-Over Acceptance, Commissioning and Testing. Where there is a conflict between these requirements and Building Department's requirements, the more stringent requirements shall apply.

D. The descriptions of equipment and systems cover basic equipment and operation, but not all the details of design and construction.

1. The use of singular in descriptions does not limit the quantities to be furnished to produce the complete system, together with the results specified.
2. Furnish equipment required to provide specified performance under installed conditions.
3. Factory wiring and piping is to conform to specifications for field work, unless otherwise specified.
4. Provide trim, enclosures, transition pieces and accessories required to make complete installation in each instance.
5. Provide all seismic provisions as required to meet NYCBC requirements.

E. All Mechanical Drawings of Division 23 are schematic and diagrammatic.

1. Symbols and diagrams are used to indicate the various items of work and the complete systems, but they do not necessarily have dimensional significance, neither do they necessarily include all related and subsidiary parts and equipment. Contractor shall provide all parts, elements, transition pieces, etc. as required for a complete and operational system.
2. The work is to be installed complete and ready for operation in conformity with the intent expressed on the Drawings and in the Specifications.
3. Coordinate work with the requirements of the Architectural and Structural drawings for dimensions, locations and clearances.
4. Locations of mechanical and electrical items which are exposed to view shall be taken from the Architectural Drawings where available, or are to be located as directed by the Commissioner.

5. Contractor shall provide all transition pieces and rises/drops for piping and ductwork.
6. Minimum height of piping, ductwork, valves, etc. in mechanical rooms excluding drops to equipment, shall be 7'-0" unless otherwise noted.

2.7 EQUIPMENT INSTALLATION

A. Locate and set equipment anchor bolts, dowels and aligning devices for equipment requiring them.

1. Level and shim the equipment; coordinate and oversee the grouting work.
2. After one week of continuous operation, the technician will return to check and realign all shafts, bearings, seals, couplings and belt drives as needed. Provide report indicating completion of this work.

B. Field assembly, installation and alignment of equipment is to be done under field supervision provided by the manufacturer or with inspection, adjustments and approval by the manufacturer, as a part of the Contract.

C. Alignment and Lubrication Certification for Motor Driven Apparatus:

1. After permanent installation has been made and connections have been completed, but before the equipment is continuously operated, a qualified representative of the manufacturer is to inspect the installation and shall report in writing on the manufacturer's letterhead as follows:
   a. That shafts, bearings, seals, couplings, and belt drives are perfectly aligned and doweled so the equipment will remain perfectly aligned in the normal service intended by the Documents and that no strain or distortion will occur in normal service. All dowels shall be aligned after equipment is running.
   b. That all parts of the apparatus are properly lubricated for operation.
   c. That the installation is in accordance with manufacturer's instructions.
   d. That suitable maintenance and operating instructions have been provided for the City of New York's use.

D. Belt Drives:

1. V-belt drives shall include a driving and driven sheave grooved for belts of trapezoidal cross-section. Belts shall be constructed of fabric and rubber so designed as not to touch the bottom of the grooves, the power being transmitted by the contact between the belts and V-shape groove sides. Drives shall be designed for a minimum of 150 percent of motor horsepower. Drive sheaves shall be of the companion type.
2. All motors shall be provided with fixed sheaves, once the correct speed is determined during testing/balancing period.
3. All fans shall be installed with fixed pitch sheaves on their drive motors. Sheaves shall be selected to provide air quantities under specified conditions. Air systems shall be put into operation, and Contractor shall determine actual size of sheaves required to produce specified air quantities on installed systems via the use of adjustable sheaves. Adjustable pitch sheaves shall then be replaced with the proper size fixed sheave. Adjustable pitch sheaves shall be property of Contractor and removed from premises.

E. Machinery Guards:

1. Motor drives shall be protected by belt guards furnished by the equipment manufacturer or in accordance with the Sheet Metal and Air Conditioning Contractors National Association's Duct Manual. In all cases, guards of all types must be as approved as acceptable under OSHA Standards.

F. Equipment Startup:

1. Each equipment manufacturer is to provide qualified personnel to inspect and approve equipment and installation and to supervise the startup of the equipment and to supervise the operating tests of the equipment.
2. If a minimum number of hours for startup and instruction are not stated with the equipment specifications, these shall be 2 full 8-hour working days as a minimum.
3. Advise the City of New York of startup at least 72 hours in advance.

G. Equipment Turn-Over:

1. Contractor shall follow the City of New York's Standards for Turn-Over Acceptance, Commissioning and Testing. Where there is a conflict between these requirements and the regulations by commissioning agent, the more stringent requirements shall apply.

2.8 CLEANING AND ADJUSTING

A. Notification:

1. Inform the City of New York and field representatives of all cleaning, blowing out and fill-up schedules one week prior to starting.
2. Notify the City of New York and Commissioner again, 48-hours prior to each event. If neither attends the procedures, notify in writing, the specific task performed 24-hours after each event.
3. Leaks appearing during the various pressure tests shall be corrected by replacing all defective materials or welds and subsequent tests shall not be made until the piping is found in perfect condition. Caulking of screwed joints or peaning of welds is prohibited. Wherever it is necessary to cut out a weld and the ends of the pipe cannot be conveniently brought together, then a short piece shall be fitted in and welded.
4. Damage to the building and equipment resulting from tests shall be repaired at no additional cost to the City of New York.
5. Tests claimed to have been performed without following above procedures shall be deemed as not performed.

B. Cleaning:

1. Blow out, clean and flush each piping system and equipment, to clean thoroughly. MSDS forms for clean agent and procedure shall be presented to the field office. After cleaning, the systems shall be tested by an independent organization, approved by the Commissioner prior to testing.
2. Clean all materials and equipment; leave in condition ready to operate and ready to receive succeeding finishes where required.
3. Clean the operating equipment and systems to be dust free inside and out.
4. Clean concealed and unoccupied areas such as plenums, pipe and duct spaces and equipment rooms to be free of rubbish and dust.

5. After completion of all pressure tests, properly clean every piece of apparatus furnished and remove caps and other provisions made for testing purposes only.
6. Cutting oil, excess pipe joint compound, finely divided solids and other similar foreign material shall be removed from all circulating water systems before they go into operation. Before chemical cleaning of water systems flush with clean water. Each system shall be cleaned chemically with circulating solution as specified in section 23 25 00. Fill, vent and circulate the system with this solution at maximum operating temperature for required duration. During cleaning procedure, circulation shall be stopped periodically followed by blow off at all low points. Immediately following chemical cleaning, system to be drained and then refilled with clean water to which treatment shall then be added. After systems have been drained, flushed and refilled, a chemical test shall be made to determine that the cleaning solution remaining in the system does not impart alkalinity to the water in excess of 300 ppm.
7. After the water piping system has been properly cleaned as indicated above, each water system shall be operated for a minimum of 3 days with 1/2" surgical felt, bonded to baskets on each pump strainer. Felt filters shall be run for as long a time as necessary to thoroughly clean all piping until approved by The Commissioner. During the cleaning period, heat exchangers and coil valves shall be kept closed for the entire cleaning period. Provide one (1) inch manual bypass at equipment to permit flushing of branch piping. For flushing and blow-off for main risers, provide drain valves at the bottom in the horizontal runout to the riser. Also provide an additional valve in the cyclo-clean separator piping for pumps with mechanical seals so that separator discharge water may be wasted during the cleaning procedure.
8. All pipe strainers shall be removed and cleaned upon completion of blowdown period.
9. After this period of operation, all systems shall be drained and refilled with fresh water and new chemicals as specified.
10. All equipment installed shall be thoroughly cleaned in preparation of the finished painting.
11. All dowels shall be aligned after system is running.

C. Adjusting:

1. Adjust and align equipment interconnected with couplings or belts. After one week of continuous operation, the technician will return to check and realign all shafts, bearings, seals, couplings and belt drives as needed. Provide report indicating completion of this work.
2. Adjust valves of all types and calibrate equipment of all types to provide proper operation.
3. Clean all strainers after system cleaning and flushing and again before final system startup.
4. Motors, fans, pumps, compressors, etc. shall be properly oiled and left ready for operation.
5. Verify that each and every supply and return and exhaust fan, each fan coil unit fan, motor and automatic control valve is in running condition. All equipment shall be cleaned, including coils, motors, housing, pans, etc. and inspected by the Commissioner.
6. Submission of certified tests shall, in no way, relieve the Contractor of fulfillment of guarantee.
7. Gauges, instruments, thermometers and meters shall be checked and tested to specified accuracy.
8. Alarms shall be tested to fulfill satisfactory operating conditions.
9. Allow sufficient time to perform all tests, adjustments, etc., necessary to place the various systems in final operating condition, verify performance requirements and check

all safety devices. Labor, instruments, etc., required for various tests shall be furnished by Contractor. The Contractor shall see that all his subcontractors, manufacturer's representatives or Field Engineers necessary to check and adjust various systems are present, with sufficient forms, and that all test results are recorded properly and turned over to the City of New York for approval.

10. The Commissioner will make final check for all systems only after Contractor has completed and returned to the City of New York all recorded test data together with letter that his work is 100% complete. Additional tests may be required to meet the requirements of City of New York's documents for demonstration of various systems, whether or not specified, to verify performance, workmanship or for adjustments.
11. Unless otherwise specified, equipment shall be installed and adjusted in accordance with manufacturer's recommendations to function properly with capacities required or specified.
12. Provide adjustments during summer, winter and shoulder/swing seasons.

D. Running Test of Piping Systems:

1. Any section of the work, after it has been completed and otherwise satisfactorily tested, shall be put in actual operation by Contractor and operated by him for a period of 2 days of 24 hours each, during which time any defects which may appear shall be remedied and any necessary adjustments shall be made. Test shall be performed in the presence of the City of New York or the Commissioner, and serve as part of the Instructions Program.
2. During the time of the tests, repack all valves, make all adjustments and otherwise put the apparatus in perfect condition for operation, and shall instruct the City of New York's personnel in the use of management of the apparatus. All joints shall be made absolutely tight under tests. Caulking of pipe joints or makeshift methods of repairing leaks shall not be allowed. Piping which is not tight under tests shall be taken down and reassembled.
3. All gauges, thermometers, alarms, instruments, etc. shall be tested to demonstrate that they are functioning properly and within the range of these devices, and to show their degree of accuracy.
4. If during the first test run, the system cannot be completely vented within 24 hours, install additional air vents at high points of system to facilitate quick venting of all water systems.

E. Permanent Equipment Operating During Construction:

1. Use only in same service as the permanent applications, provided that written approval is granted by the Commissioner.
2. Use disposable filters during temporary operation.
3. Expendable media, including belts used for temporary operation and similar materials are to be replaced just prior to acceptance.
4. Packings in equipment operated during construction must be repacked just prior to system acceptance, using materials and methods specified by the supplying manufacturer.

F. Retouch or repaint equipment furnished with factory finish as required to provide same appearance as new.

G. Tools:

1. Provide one set of specialized or non-standard maintenance tools and devices required for servicing the installed equipment.

H. Fan and Pump Characteristic Charts:

1. Fan Characteristic Charts: Furnish 4 characteristics curve charts for each fan, including those embodied in factory assembled units. Characteristic curve charts shall not be less than 8-1/2" x 11" and shall show the static pressure, capacity, horsepower and overall efficiency for operating conditions from no load to 130% specified load.
2. Pump Characteristic Charts: Furnish 4 characteristic charts for each pump. Charts shall be not less than 8-1/2" x 11" showing head developed, efficiency and power required for varying capacities at the operating speed of the equipment.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 GENERAL

A. Temporary Protection:

1. Provide and maintain protection for the work whether completed or in progress.
2. Provide suitable coverings and enclosures.

B. Scaffolding, Rigging and Hoisting:

1. Provide all scaffolding, rigging and hoisting services necessary for erection, and/or delivery into the premises, of any equipment and apparatus furnished. Remove from the premises when no longer required.

C. Waterproofing:

1. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Commissioner before work is done. Contractor shall provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

3.3 EQUIPMENT BASES, PLATFORMS AND SUPPORTS

A. Provide supporting platforms, steel supports, anchor bolts, inserts, etc., for all equipment and apparatus requiring access for service and maintenance.

B. Obtain prior approval for installation method of structural steel required to frame into building structural members for the proper support of equipment, conduit, etc. Welding will be permitted only when approved by the Commissioner.

C. Submit shop drawings of supports for approval to the Commissioner before fabricating or constructing.

D. Provide leveling channels, anchor bolts, complete with nuts and washers, for all apparatus and equipment secured to concrete pads and further supply exact information and dimensions for the location of these leveling channels, anchor bolts, inserts, concrete bases and pads.

E. Where supports are on concrete construction, care shall be taken not to weaken concrete or penetrate waterproofing.

3.4 ACCESSIBILITY

A. The installation of valves, dampers and other items shall be conveniently and accessibly located with reference to the finished building floors, walls, roof and penthouses as applicable.

B. In-line pumps shall not be installed higher than 7 ft. above floor and shall be fully accessible for servicing its motor, valves, controls and instruments.

C. Equipment removal, tube-pull access door swing spaces shall be identified on shop drawings and maintained during installation.

3.5 MODIFICATIONS TO EXISTING WORK

A. Contractor shall perform all work as shown or as specified, within the existing site and structures as part of this Contract without detriment to the existing systems or equipment to be kept in operation or maintained in their places.

B. For full extent of modifications to be done to existing systems, Contractor shall inspect existing systems and site conditions to familiarize himself with the complexity of his work related to removals and relocations required, and the existing finishes to be preserved without any damage resulting from possible careless installation procedures. Upon written request by the

C. s, City of New York shall make the existing schematic plans available for inspection without any responsibility for their completeness or accuracy.

D. As-Built drawings are not available on the existing installations. Any drawings that may be available to the Contractor are for information only. All field criteria must be field verified by Contractor.

E. All cutting shall be done only by mechanics skilled in the particular trade which is affected. No cutting shall be done without proper protections against damage, dirt and dust resulting therefrom or without proper safeguards to workmen, the public, and occupants of buildings.

F. Before cutting is started in any location, Contractor shall carefully investigate conditions influencing human and structural safety. Existing piping, wiring and items concealed in walls and slabs, wherever these walls and slabs are removed, shall be properly relocated, rerouted or removed as the case may require.

G. Perform all finish masonry, repairing, restoring and finishing of all cut openings, closing up of existing openings, and removing and restoring the affected sections of the suspended ceilings.

H. If, during partial occupancy of the building, circumstances necessitate temporary shutdown of any facilities or otherwise interfere with access to building, the City of New York shall be given a minimum of 48 hours' notice before doing such work.

I. In all areas where interface, relocation or alternation work is to be done, Contractor shall disconnect and remove from the premises all existing ductwork, piping, etc., that will not be required to remain in service after the alterations are completed. All such equipment (except as requested as salvage by the City of New York) shall become the property of the Contractor, and he shall remove same from the premises immediately upon disconnection. Existing ductwork, piping, etc., being removed shall not be reused.

J. Contractor shall move or relocate any existing mechanical equipment, piping, ductwork, etc., which may temporarily interfere with the construction, (to a temporary location) if the existing equipment is to be kept in operation during construction. He shall also install temporary piping, ductwork or equipment that might be required (during demolition or excavation and during the construction of tunnels, retaining walls, footings or columns) for offsetting all piping around the construction area in order to maintain services to the existing systems. Provide temporary piers, supports and hangers as required for excavation.

K. Concrete Contractor shall provide all cuts and openings through structural slabs and walls, except for core drillings for passage of piping. Contractor shall coordinate his work with concrete contractor and provide necessary dimensions for all openings.

L. Upon completion, remove all temporary piping and equipment, shoring, scaffolds, etc., and leave all areas clean and free from material and debris resulting from work performed under this Section. Provide rough patching in areas shown.

M. Test all piping to be retained or shown to be re-used together with the new extensions connected to them. Install isolation valves as required.

N. Where a fan or any of its connected ductwork is to be modified, relocated or ductwork extended to a new discharge location, test fan prior to starting work and submit test data to the Commissioner for record purposes. Test same fan following completion of work to verify its final capacity in terms of CFM, Static Pressure and Amperes drawn while in operation, showing compliance to data previously established.

3.6 USE OF EQUIPMENT

A. The use of any equipment, or any part thereof, for purposes other than testing even with the City of New York's consent, shall not be construed to be an acceptance of the work on the part of the City of New York, nor shall it be construed to obligate the City of New York in any way to accept improper work or defective materials.

B. Use of permanent equipment for temporary services must be approved in writing by the City of New York.

3.7 CODES, RULES, PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits and filings including, but not limited to, New York City Department of Buildings, New York State DEC, New York City and

State Building Code requirements, and pay all government sales taxes, fees, and other costs, in connection with his work. Coordinate all utility connections, extensions, and tap fees for water, storm, sewer, gas, telephone and electricity with the Commissioner. The Contractor shall file all necessary plans, prepare all documents and obtain all necessary approvals of Department of Buildings; obtain all required certificates of inspection for his work and deliver same to the Commissioner before request for acceptance and final payment for the work.

B. The complete design and construction shall conform to the requirements of the NYCBC, NYCMC, NYCFC, NYSEC, NFPA, NEC, FM, UL and any other local or state code which may govern.

C. Provide all New York City and New York State permits for equipment, systems, etc. as required.

3.8 CODE COMPLIANCE

A. As part of this work, each Contractor is required to provide assistance to an independent agency for purposes of enforcing code compliance, including special inspections, as follows:

1. For the entire duration of this work, provide material and labor required by an independent organization headed by a Professional Engineer licensed in the State of New York for purposes of monitoring compliance with all applicable codes in general and providing special inspection on all items as required by the New York City Building Code, including but not limited to:
   a. Construction of ducts and its accessories including hanger installation.
   b. Air intakes and outlets.
   c. Electrical wiring and equipment pertaining to mechanical equipment.
   d. Air cooling and heating equipment.
   e. Fire and smoke dampers.
   f. Controls.
   g. Heating equipment.
   h. Monitoring of New York City (OTCR) approvals required for HVAC and Fire Protection equipment.
   i. Structural Concrete poured under this Contract.
   j. Fire stopping at penetrations.
   k. Energy Code Progress Inspections.

B. The independent organization shall be responsible for compiling, issuing and submitting to the Commissioner all code required reports and forms.

C. Within his bid, the contractor shall submit the cost related to assisting of special inspection as specified. The submission shall also include the methods and forms proposed to be used to perform his work.

D. Special inspection procedures shall, in general, ensure the following:

1. The adherence of the standards of material and workmanship required by the New York City Building Code.
2. The checking of building processes and the evaluation of materials to ensure conformity with the New York City Building Code.

3. The elimination of unspecified, non-conforming substitutions.
4. The discovery of discrepancies between the New York City Building Code requirements and the final Drawings or Specifications and their early correction.
5. The prevention of error which may result in unnecessary and costly maintenance or upkeep costs.
6. The determination of necessary tests and laboratory work.

E. Regular Inspection Services: Provide a part-time field inspection supervisor qualified to monitor the project for code compliance and having five to ten years previous field experience in supervising similar Mechanical system installations.

F. The following forms will be prepared and filed with the New York City Building Department in order to secure their approvals and permits:

1. Forms PW-1, PW-1B and PW-C: Plan/Work Approval Application
2. Form TR-1: Technical Report Statement of Responsibility
3. Form PW-4: Application for Equipment Use Permit
4. Form TR-8: Energy Code Progress Inspections

G. Also furnish to the Commissioner weekly progress reports. These reports will state the following:

1. The progress of inspections and filing for the previous week.
2. Although discrepancies will be reported to the Commissioner immediately upon discovery, they will be included in the reports, as will the resolution of these discrepancies.
3. Tests witnessed during the week and code items whose installation has been completed during the same period.

3.9 FINAL INSPECTION

A. Contractor shall arrange and schedule final inspection of work and shall notify the Commissioner in writing that the Contractor has thoroughly checked his work and, in the opinion of the Contractor, is ready for final inspection.

B. During the entire period schedule for these inspections, the Contractor and representatives of each manufacturer of equipment involved shall be present. All of these organizations shall have sufficient and competent personnel present so that adjustments can be made to all systems without delay.

C. Contractor shall recheck equipment after seasonal use to ensure proper operation for summer, winter and shoulder/swing seasons.

3.10 ACCEPTANCE

A. The operation or the temporary use of the equipment and the mechanical and electrical installation, by the City of New York does not constitute an acceptance of the work. The final acceptance is to be made after the Contractor has adjusted his equipment, demonstrated that it

fulfills the requirements of the Contract Documents, and has furnished all the required Certificates. Warranties and guaranties are effective after the final acceptance.

3.11 GUARANTEE

A. Submit a single guarantee stating that all portions of the work are in accordance with Contract requirements. Guarantee all work against faulty and improper material and workmanship for a period of one year from date of final acceptance by the City of New York, except that where guarantees or warranties for longer terms are specified herein, such longer term shall apply. At no additional cost to City of New York, within 72 hours after notification, correct any deficiencies which occur during the guarantee period, all to the satisfaction of the City of New York and Commissioner.

B. Guarantee that the materials and workmanship supplied under this division will be of the best quality currently available, that the equipment will be erected in a practical manner and in accordance with best practices, that it will be complete in operation, nothing being omitted in the way of labor and material required to make this so, although not specifically shown or mentioned herein and that it will be delivered in proper working order, complete and perfect in every respect without additional cost – whether or not shown in detail on the drawings or described in detail in this specification.

C. Be responsible for all damage to or caused by the work performed under this division for a period of one year from date of acceptance of work under this Contract. Repair at no cost to the City of New York all such damage which occurs within 24 hours' notice thereof by the City of New York. Damage which occurs prior to the completion of this work shall be repaired at once. Be responsible for any damage and repair thereof and reimburse the City of New York of all expense incurred thereby.

END OF SECTION 23 05 00

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SECTION 23 05 01 SCOPE OF HVAC WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. This Specification and the accompanying Contract Drawings are intended to include the furnishing and installation, in a workman-like and approved manner, of all labor, materials, equipment and appliances necessary and required to completely install the HVAC Systems as specified and shown on the Drawings.
2. General scope of work shall be as listed below, however, omission of specific items shall not be construed as being omitted from the Contract if the item is mentioned elsewhere or implied.
3. The list is not intended to be complete, but it is to serve as a guide to the character and extent of the work, and in general, shall consist of the following:
   a. Cleaning of all piping and duct systems prior to operation.
   b. All electrical interlock wiring, except as noted otherwise.
   c. Complete DDC control and BAS system.
   d. All control and interlock wiring (in conduit) for the BAS loop system and all components.
   e. All miscellaneous appurtenances, accessories and specialties required for a complete installation placed into satisfactory operating condition.
   f. Signs, charts, labels, etc., conforming to the requirements of the specifications, codes.
   g. Steam/hot water heat exchanger and controls.
   h. Hot water piping system, circulating pumps, valves, expansion tanks accessories and air separator.
   i. Supply, return, exhaust ventilation systems and air conditioning systems, including fans, air-handling units, ductwork, motors, dampers, filters, air distribution devices, dampers, and all accessories.
   j. Dedicated Outside Air Systems.
   k. Variable Refrigerant Flow – Heat Recovery Systems.
   l. Condenser water system.
   m. All drains and drainage systems from HVAC coils, protective drain pans and plenum duct drains.
   n. Radiators.
   o. Piping, valves, fittings, accessories.
   p. Motor starters, motor control centers and variable frequency drives (VFD) for the fans, pumps and hot water pumps for all other mechanical equipment as specified and/or scheduled.

q. Insulation of piping, ductwork, equipment, etc.
r. Prime painting of equipment and piping, shop finishes, piping identification, stenciling and color coding.
s. Instructions and guarantees.
t. Water treatment systems for all closed water systems.
u. Supports, hangers and accessories.
v. Auxiliary steel required for supporting HVAC equipment, ductwork and piping other than those available in the building structure.
w. Directing the location of access doors and panels required in acoustical tile hung ceilings and furnishing of all access doors and panels required in plaster or dry wall ceilings and partitions.
x. Providing template to the General Construction Contractor for housekeeping pads required under for all floor mounted equipment.
y. Vibration and inertia bases for fans, pumps, etc., and vibration isolators for all equipment and piping.
z. Counter flashing around roof penetrations or waterproofed floor penetrations of HVAC ducts and piping. Caulking around sleeves and fire-stopping at all floor and wall penetration of piping and ductwork.
aa. Sound control and acoustical treatment.
bb. Furnishing and setting of sleeves, required for piping or ductwork in walls and/or slabs.
cc. Duct cleaning.
dd. Testing, Adjusting, Balancing and Commissioning.
ee. Refrigerant leak detection systems.
ff. Install duct smoke detectors furnished by Electrical Contractor.
gg. Protection during construction.

1.3 WORK OF OTHER SECTIONS AND/OR TRADES

A. Following work shall be performed under other Sections:

1. All concrete and foundation work, including pads and curbs for equipment installation, unless otherwise noted.
2. Undercutting of doors or louvers in doors.
3. Weatherproof louvers in outside walls for air intakes and exhaust.
4. Setting of access doors in walls and ceilings.
5. Supplemental steel (grilleage) by mechanical contractor.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 23 05 01

SECTION 23 05 03 PIPES AND TUBES FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:

1. Heating water piping.
2. Condenser water piping.
3. Equipment drains and overflows.
4. Low pressure steam piping.
5. Low pressure steam condensate piping.
6. Unions and flanges.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 08 31 13 - Access Doors and Frames: Product requirements for access doors for placement by this section.
2. Section 09 90 00 - Painting and Coating: Product and execution requirements for painting specified by this section.
3. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping Expansion Compensation: Product requirements for piping expansion compensation devices for placement by this section.
4. Section 23 05 23 - General-Duty Valves for HVAC Piping: Product requirements for valves for placement by this section.
5. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
6. Section 23 05 48 - Noise and Vibration Controls for HVAC Piping and Equipment: Product requirements for Noise and Vibration Isolation for placement by this section.
7. Section 23 07 00 - HVAC Insulation: Product requirements for piping insulation for placement by this section.
8. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.
9. Section 23 22 16 - Steam and Condensate Piping Specialties: Product requirements for steam and condensate piping specialties for placement by this section.
10. Section 23 23 00 - Refrigerant Piping: Product requirements for refrigerant piping for placement by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.4 - Gray Iron Threaded Fittings.
3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
5. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
6. ASME B31.1 - Power Piping.
7. ASME B31.9 - Building Services Piping.
8. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
9. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM B32 - Standard Specification for Solder Metal.
4. ASTM B68 - Standard Specification for Seamless Copper Tube, Bright Annealed.
5. ASTM B75 - Standard Specification for Seamless Copper Tube.
6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
7. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
8. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

1.3 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Refer to DCAS General Conditions - Submittal Procedures: Submittal procedures.

1.4 SUBMITTALS

A. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes for approval, prior to fabrication or installation.

B. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

C. Welder certifications and welding procedures.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. Perform Work in accordance with NYCBC requirements.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum ten (10) years documented experience.

1.7 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions - Product Requirements: Environmental conditions affecting products on site.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of buried piping with trenching.

C. Reference Section 23 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 HEATING WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53, Schedule 40, seamless, black.

1. Fittings: ASTM A234, forged steel welding type.
2. Joints: Welded for pipe 2-1/2 inches and larger.

B. Copper Tubing: ASTM B88, Type L hard drawn for sizes 3 inches and smaller.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Brazed.

2.2 CONDENSER WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53, Schedule 40, seamless, black.

1. Fittings: ASME B16.3, malleable iron or ASTM A234, forged steel welding type.
2. Joints: Threaded for pipe 2 inches and smaller; welded for pipe 2-1/2 inches and larger.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, 95-5 tin-antimony, or tin and silver.

2.4 LOW PRESSURE STEAM PIPING (15 PSIG MAXIMUM)

A. Steel Pipe: ASTM A53/A53M, Schedule 40 seamless, black.
1. Fittings: ASME B16.3 malleable iron Class 125, or ASTM A234/A234M forged steel Class 125.
2. Joints: Threaded for pipe 2 inches and smaller; welded for pipe 2-1/2 inches and larger.

2.5 LOW PRESSURE STEAM CONDENSATE PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 80 seamless, black.
1. Fittings: ASME B16.3 malleable iron Class 125, or ASTM A234/A234M forged steel Class 125.
2. Joints: Threaded for pipe 2 inches and smaller; welded for pipe 2-1/2 inches and larger.

2.6 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 250, malleable iron, threaded.

2. Copper Piping: Class 150, bronze unions with brazed joints.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges.
3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. Flanges shall be of same weight as the fittings and valves in each service category. Welding neck flanges shall be used with flanged valves, equipment, etc., on welded lines. Galvanized screwed flanges shall be used on galvanized screwed lines. Flanges shall be drilled in conformance with 150 lbs. or 300 lbs. standard and shall be faced and spot-faced. Screwed and loose flanges on brass piping shall be brass. Laps shall be machined on front, back and edge. Screwed flanges shall have faces perpendicular to adjoining pipe.

2.7 PIPE FITTINGS

A. Each pipe fitting shall have cast, stamped, or indelibly marked on it the marker's name or mark, weight, and quality of the product when such marking is required by the approved standard.

B. Welding fittings shall be of same material and schedule as pipe to which they are welded. Welding fittings including laterals shall be approved factory reinforced to develop full working pressure of connecting piping main. Welding elbows shall be long radius pattern. Welding fittings shall be used exclusively, except as otherwise specified. Weldolets may be used for branches only where branch is two (2) or more nominal pipe sizes smaller than main or riser. All welding "lateral" fittings shall have pressure ratings equal to the pipe with which they are to be used. Welding fittings shall be of Tube-Turn or Walworth manufacture or approved equal, to conform to ASTM-A-234 specifications.

C. Nipples shall be extra heavy shoulder type of same material as pipe, close nipples are not acceptable.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Verification of existing conditions before starting work.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.4 CONNECTIONS

A. Copper with solder or brazing joints shall be cleaned bright and properly fluxed. Flux shall be non-corrosive as approved.

B. Threaded Joints:

1. Make up screw pipe with clean sharp threads and pipe joint cement used on male thread only.
2. Ream ends of pipe and clean out the pipe after cutting.
3. Use graphite paste on threads of cleanout plugs.
4. Provide sufficient number of flanges or unions to disassemble piping without breaking screwed fittings.

C. Teflon paste shall be used on screwed joints and shall be applied to the male thread only.

D. In connection to equipment, the manufacturer's recommendation as to pipe size and arrangement shall be followed. Connection to equipment shall be made to permit ready disconnection of equipment with minimum disturbance to adjoining pipe. Screwed or flanged unions shall be used at all equipment at inlet and outlet ends. Piping shall be flanged, or fitted with unions for all sections immediately adjacent to connection of equipment which may require pipe removal to aid in all large tube pulling, coil removal, cleaning etc.

E. Assembly of the mechanical joint pipe and fittings shall be complete with a torque wrench. Torque to be applied to each bolt shall be between 60 pounds and 90 pounds. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation will not be permitted.

F. Flange joints shall be faced true, packed and made up perfectly square and tight. Each flange joint shall be provided with suitable grade steel bolts for the specific service and with hexagon nuts. Bolts and nuts shall be dipped in a mixture of graphite and oil, just before installation.

G. Gaskets shall have proper thickness and suitable for specific service. All gaskets shall be asbestos free. Gaskets in steam service shall meet the requirement of the utility company.

H. Where piping is to be installed under related work by other Sections, in connection with work and equipment installed by this Trade, the piping will be installed by other Sections, this Trade shall make the final connections.

I. Provide di-electric fittings for all connections between ferrous and non-ferrous metals.

3.5 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 00.

G. Provide access door where valves and fittings are concealed in inaccessible spaces. Coordinate size and location of access doors with Section 08 31 13.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals. Insulate pipe joints or valves between dissimilar metals, to prevent dielectric action; use isolating flanges. Dielectric couplings are unacceptable

I. Cap pipe and equipment outlets during construction; keep lines and inside of equipment free of foreign materials.

1. Provide for expansion without warping lines, or dislocating or straining connected equipment beyond allowable stress limits.
2. Install piping to clear building construction and to avoid interference with other work.
3. Conceal piping.

J. Pipe base drains from pumps to open drains; use plugged tees at 90 degree turns.

K. Provide drain with gate valve for equipment containing water. Pipe to an open drain where such drain is within 50 feet of equipment.

L. Water Lines:

1. At each low point, provide drain nipple and a 3/4" hose bibb drain or a 3/4" drain valve piped to an open drain.
2. Provide air vents at high points in all closed loop piping systems.
3. Pitch piping upward in direction of flow or install piping with top of pipes at same level, using eccentric reducers.

M. Place valves and specialties so as to permit easy operation and access; pack all valves at the completion of the work before final inspection.

N. Water coils: Provide air venting at top of coil and drainage at bottom of coil with 1/2" gate valves.

O. Provide cold-water make-up piping between the outlets provided under the Plumbing Work and point of equipment under HVAC Work requiring same. Each connection to be provided with a globe valve, check valve and vacuum breaker. An anti-siphon check valve, similar to that made by Bidoro Company, may be substituted for the check valve and vacuum breaker.

P. Provide a cold water makeup tank, pump and piping for each expansion tank, fill stations and other equipment requiring same. Each connection shall be provided with a gate valve, check valve and a backflow preventer.

Q. Vents for water systems shall be appropriately valved, 3/4” minimum, and piped over to indirect drains or to locations accessible for draining.

R. Provide a capped hose bibb and valve at the base of all water risers to accept a hose for drainage.

S. Miscellaneous drains and overflow from tanks, equipment, piping, relief valves, pumps, etc., shall be run to the nearest indirect drain and terminate in an elbow over the drain. Provide drain valves wherever required for complete drainage of piping, including the system side of all pump check valves. Drain lines shall pitch not less than 1" in 40' in direction of flow.

1. Screwed couplings and shoulder nipples not exceeding 6" in length shall be of same material as pipe but of dimensions conforming to Schedule 80. Close nipples are prohibited.

T. Vertical sections of main risers in shafts shall be constructed of pipe lengths welded together; do not use mechanical couplings or screwed fittings.

U. Drawings indicate generally the sizes and locations of pipe lines, but the Construction Manager reserves the right to direct changes in run and details of pipe work as necessitated by site conditions. Piping to be of sizes indicated on the Drawings; size any pipe diameter not shown on the Drawings to be in proportion to the load carried at the same resistance as similar piping, or of sizes as directed by Construction Manager.

V. Cut piping accurately to measurements established at the Construction Site and work into place without springing or forcing, properly clearing all openings, structural members and other equipment. Overhead piping to run as high as possible under structural members.

W. Establish invert elevations, slopes for drainage to 1/4 inch minimum. Maintain gradients.

X. Slope piping and arrange systems to drain at low points.

Y. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

Z. Install piping penetrating roofed areas to maintain integrity of roof assembly.

AA. Install valves in accordance with Sections 23 05 23 and 23 23 00.

BB. Install piping specialties in accordance with Sections 23 21 16 and 23 23 00.

CC. Insulate piping. Refer to Section 23 07 00.

DD. Install pipe identification in accordance with Section 23 05 53.

3.6 ROUTES AND GRADES

A. Piping shown on the drawings shall be considered as diagrammatic for clearness and may or may not, in all parts, be shown in its true position. This fact does not, in any way, relieve the Contractor from full responsibility for the proper erection of a system of piping in every aspect suitable for the work intended.

B. Drawings indicate generally sizes and locations of pipelines, but the right is reserved to direct changes in details of pipe work as necessitated by actual conditions. Piping shall be of sizes indicated on drawings. Any pipe size not shown shall be in proportion to the load carried at the same resistance as similar piping, or of size as directed.

C. Piping shall be accurately cut to measurement established at the construction site and shall be worked into place without springing or forcing, properly clearing openings, structural members and other equipment. Overhead piping shall be run as high as possible under structural members.

D. Exposed piping shall be run perpendicular and/or parallel to floors, walls, etc. Piping and valves shall be grouped neatly and shall be run so as to avoid reducing headroom or passage clearance.

E. Piping shall be concealed. Piping shall be installed so that same can be drained of all water.

F. Water mains shall pitch upward in direction of flow.

G. Fittings of the eccentric reducing type shall be used where change of size occurs in horizontal piping for proper drainage or venting.

H. Steel pipe bends shall be made of open hearth, low carbon steel, leaving a smooth uniform exterior and interior finish. Pipe bends shall be made with seamless steel pipe, having a minimum radius of not less than 5 pipe diameters.

I. Long-turn fittings shall be used wherever conditions permit.

J. Piping above grade shall be installed so as to be readily accessible for operation, maintenance, repair or replacement.

K. Extra heavy nipples for short shoulder type only. Close nipples are prohibited.

L. Under all conditions, and unless otherwise shown or directed, branches from any steam main shall be taken from the top of the pipe, and all valve stems shall stand upright or at an angle above the center line of the pipe and not handle down.

M. No piping or work of any kind shall be concealed or covered until all required tests have been satisfactorily completed and the work has been approved by the Commissioner.

3.7 INSTALLATION - HEATING AND COOLING PIPING SYSTEMS

A. Install hydronic piping in accordance with ASME B31.9.

3.8 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Test hydronic piping systems in accordance with ASME B31.9.

3.9 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for cleaning.

B. After completion, fill, clean and treat hydronic piping system. Refer to Section 23 25 00.

3.10 PRESSURE TESTING OF PIPING SYSTEMS

A. Pay fees for tests and inspections; furnish labor, materials, equipment and any instruments required for the tests.

B. Perform tests and comply with requirements of the inspecting agency to obtain approval for the City of New York's use of systems and equipment, as a part of the Contract Work.

C. Replace or repair equipment damaged during testing.

D. Give advance notice of tests to the City of New York.

E. Replace any materials which fail under testing and replace or satisfactorily repair any other materials or work damaged by the testing or failures.

F. Do not conceal or insulate any section of piping until testing on that section has been satisfactorily completed and approved.

G. The Contractor shall provide all temporary valves, blanks and accessories for all piping tests, as part of the Work.

H. Test Criteria: Make all piping systems tight under the following test conditions:

1. Perform hydrostatic test as specified in "Examination, Inspection and Testing" of ANSI B31.9 code, except that duration of test shall be two hours without pressure drop and that no system shall be tested at less than indicated in Item 3 below.
2. If outside temperature is expected to be at or below freezing temperature, the City of New York has the option to require that the Contractor test piping by the use of non-corrosive glycol/water mixture.
3. Unless otherwise noted or specified, screwed piping shall be tested under a hydrostatic pressure of 200 psig for a period of 2 hours without fall in pressure gauge reading. Welded and brazed piping shall be subjected to 150 psig air pressure test and welds inspected by applying soap suds. During the air pressure tests, pinholes shall be rewelded at the direction of the Commissioner. Following the air pressure test, piping shall be subjected to hydrostatic test for a period of 2 hours without fall in the pressure gauge reading.

I. Hydrostatic test at 1-1/2 times operating pressure. Operating pressure of water systems, unless noted otherwise, shall be determined by adding pump shutoff head to building static height, with consistent units.

J. Miscellaneous Drain Piping:

1. Perform same tests as specified for water piping above, except that minimum test pressure shall be 50 psig and test duration shall be a minimum of 10 minutes (unless directed by the City of New York to be of longer duration).

K. Heat exchangers, valves, strainers and piping accessories shall be treated as part of the piping system for testing purposes, except for the following items:

1. Pressure gauges or other sensitive instruments which might be damaged during testing - remove during test and replace after test.

3.11 SYSTEM REQUIREMENTS

A. All piping systems and components shall be rated for a minimum design working pressure of 150 psig, unless otherwise noted.

END OF SECTION 23 05 03

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SECTION 23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:
   1. Single- and three-phase motors for application on equipment provided under other sections and for motors furnished loose to Project.

B. Related Sections (list below may not include all sections but is intended as a guide):

   1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   2. Section 26 05 53 - Identification for Electrical Systems.

1.3 REFERENCES

A. American Bearing Manufacturers Association:

   1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. National Electrical Manufacturers Association:

   1. NEMA MG 1 - Motors and Generators.

C. International Electrical Testing Association:

   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. New York City Electrical Code.

E. Underwriter’s Laboratory.

F. New York State Energy Research and Development Authority (NYSERDA).

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit catalog data for each motor furnished. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.

C. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

D. The motor nameplate and connection diagram shall be stainless steel and contain the following information:

1. Manufacturers' name
2. Rated volts and full load current
3. Rated frequency and number of phases
4. Rated full load speed
5. Rated temperature rise and rated ambient temperature
6. Time rating
7. Rated horsepower
8. Locked rotor code letter
9. Motors starting on wye connection and running on delta, shall be marked with the code letter corresponding to the wye connection.
10. Dual voltage motors which have a different locked rotor KVA on the two voltages, shall be marked with the code letter for the voltage giving the highest locked rotor KVA.
11. NEMA design letter
12. Service factor
13. Efficiency

E. In general, motors shall be furnished integrally mounted on all items of mechanical equipment.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. All motors shall be UL approved and listed.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product storage and handling requirements.

B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.

D. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR MOTORS

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Cooper Industries Inc.
2. Baldor Electric Co.
3. General Electric Co.
4. Emerson Electrical
5. Or Approved Equal

B. Motors 1/2 hp and Larger: Three-phase motor as specified below.

C. Motors Smaller Than 1/2 hp: Single-phase motor as specified below, except motors less than 250 watts or 1/4 hp may be equipment manufacturer's standard.

D. Three-Phase Motors: NEMA MG 1, Design B, premium-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.

1. Voltage: 200Volts, three phase, 60 Hz or as indicated on Drawings.
2. Service Factor: 1.15 unless indicated otherwise on Drawings.
3. Enclosure: Meet conditions of installation unless specific enclosure is indicated on Drawings or specified. Enclosure for pump motors or motors exposed to weather shall be totally enclosed fan-cooled type.
4. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
5. Insulation System: NEMA Class F.
6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
7. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
8. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
9. Sound Power Levels: Conform to NEMA MG 1.
10. Efficiency: Premium efficiency motors conforming to NEMA. Motor efficiencies shall meet the requirements for financial rebates from NYSERDA.
11. Inverter Duty Rated for motors controlled by VFD. Fan motors controlled by VFD shall be equipped with shaft grounding rings.
12. Motor weight exceeding 25 pounds shall have lifting eyes.
13. Motor efficiencies shall meet minimum requirement for local utility company rebates.

E. Single Phase Motors:

1. Permanent split-capacitor type where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
2. Voltage: 115 volts, single phase, 60 Hz.

F. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.2 SOURCE QUALITY CONTROL

A. Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXISTING WORK

A. Disconnect and remove abandoned motors

B. Maintain access to existing motors and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing motors to remain or are to be reinstalled.

3.3 INSTALLATION

A. Install motor in alignment with shaft of the drive. Alignment test must be done prior to operating the equipment.

B. Install engraved plastic nameplates in accordance with Section 26 05 53.

C. Ground and bond motors in accordance with Section 26 05 26.

D. Coordinate two-speed motor installation with Division 26.

E. Provide motor shaft grounding ring (SGR) for motors controlled by Variable Frequency Drive.

3.4 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.15.

END OF SECTION 23 05 13

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SECTION 23 05 14 MOTOR CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Motor controls.

B. Related Requirements (list below may not include all sections but is intended as a guide):

1. All work shall be subject to the General Conditions and shall comply with applicable requirements of the contract.
2. Requirements of Section 23 05 00 shall also govern work specified herein, together with all applicable paragraphs of other Mechanical sections.

1.3 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
3. NEMA ICS 2.3 - Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers.
4. NEMA ICS 3 - Industrial Control and Systems: Factory Built Assemblies.
5. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
6. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.
7. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.
8. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. Underwriters Laboratories Inc.:

1. UL 198E - Class R Fuses.

2. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
3. UL 508 - Industrial Control Panels.
4. UL 845 - Motor Control Centers.

D. Material and Installation shall comply with latest editions of NYCBC Code.

E. Examine the Contract Documents of Division 26 for coordinating work specified under this section.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Submit shop drawings and product data in accordance with general conditions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install all motors, and furnish all variable speed drives, combination motor starters/disconnect switches, disconnect switches and starters that are required for controlling the HVAC equipment and motors.

B. Coordinate with Division 26 work for installation of and for proper integration of electrical power wiring with the motors, and equipment that are provided under Division 23.

2.2 VARIABLE FREQUENCY DRIVES

A. Description

1. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use with a standard NEMA Design B induction motor.
2. The drive manufacturer shall supply the drive and all necessary options as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. VFD's that are manufactured by a third party and "brand labeled" shall not be acceptable. All VFDs installed on this project shall be from the same manufacture.

B. Quality Assurance

1. Referenced Standards:

C. Institute of Electrical and Electronic Engineers (IEEE)

1. Standard 519-1992, IEEE Guide for Harmonic Content and Control.

D. Underwriters laboratories

1. UL508C.

E. National Electrical Manufacturer's Association (NEMA)

1. ICS 7.0, AC Adjustable Speed Drives.

F. IEC 16800 Parts 1 and 2.

G. National Electric Code (NEC)

1. NEC 430.120, Adjustable-Speed Drive Systems.

H. International Building Code (IBC)

1. IBC 2006 Seismic – referencing ASC 7-05 and ICC AC-156.
2. Qualifications:

I. VFDs and options shall be UL listed as a complete assembly. VFD's that require the customer to supply external fuses for the VFD to be UL listed are not acceptable. VFDs with red label UL stickers, requiring additional branch circuit protection are not acceptable. The base VFD shall be UL listed for 100 KAIC without the need for input fuses.

J. CE Mark – The VFD shall conform to the European Union ElectroMagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level.

K. The entire VFD enclosure, including the bypass shall be seismically certified and labeled as such in accordance with the 2006 International Building Code (IBC):

1. VFD manufacturer shall provide Seismic Certification and Installation requirements at time of submittal.
2. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake test data as defined by ICC AC-156.
3. Seismic ratings based upon calculations alone are not acceptable. Certification of Seismic rating must be based on testing done in all three axis of motion.

L. Acceptable Manufactures

1. ABB ACH Series
2. Or approved equal

M. The VFD manufacturer shall have available a comprehensive, HVAC Drive Computer Based Training (CBT) product. The CBT product shall include detailed, interactive sections covering VFD unpacking, proper mechanical and electrical installation, and programming. The CBT product shall allow the user to provide just-in-time training to new personnel or refresher training for maintenance and repair personnel on the user's site. The CBT product shall be repeatable, precise and shall include record keeping capability. The CBT product shall record answers to simulations and tests by student ID number. The CBT product must be professionally produced and have interactive sections, student tests, and include video clips of proper wiring and installation.

N. Submittals

1. Submittals shall include the following information:

O. Outline dimensions, conduit entry locations and weight.

P. Customer connection and power wiring diagrams.

Q. Complete technical product description include a complete list of options provided. Any portions of this specification not met must be clearly indicated or the supplier and contractor shall be liable to provide all additional components required to meet this specification.

R. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).

1. The VFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519. All VFD's shall include a minimum of 5% impedance reactors, no exceptions.

S. The VFD package as specified herein shall be enclosed in a UL Listed Type enclosure, exceeding NEMA enclosure design criteria (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and - 35% nominal voltage as a minimum.

1. Environmental operating conditions: VFDs shall be capable of continuous operation at 0 to 50°C (32 to 122°F) ambient temperature as per VFD manufacturers documented / submittal data or VFD must be oversized to meet these temperature requirements. Not acceptable are VFD's that can only operate at 40°C intermittently (average during a 24 hour period) and therefore must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing. All circuit boards shall have conformal coating.
2. Enclosure shall be rated UL Type 1 and shall be UL listed as a plenum rated VFD. VFD's without these ratings are not acceptable. NEMA only type 1 enclosures are not acceptable (must be UL Type 1).

T. All VFDs shall have the following standard features:

1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
2. The VFD shall have code-required disconnecting means.
3. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
4. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. Capacitor

back-up is not acceptable. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output Form-C relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.

5. The VFD's shall utilize pre-programmed application macro's specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.
6. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required. To extend the fan and bearing operating life, the VFD shall cycle the cooling fans on and off as required.
7. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).
8. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
9. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.
10. The VFD shall have internal 5% impedance reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor shall add an AC line reactor.
11. The input current rating of the VFD shall be no more than 3% greater than the output current rating. VFD's with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.120. Input and output current ratings must be shown on the VFD nameplate.
12. The VFD shall include a coordinated AC transient surge protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.
13. The VFD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over the serial communications bus. The loss-of-load condition sensing algorithm shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.
14. The VFD shall have user programmable underload and overload curve functions to allow user defined indications of broken belt or mechanical failure / jam condition causing motor overload
15. The VFD shall include multiple "two zone" PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4-20mA, 0-10V, and / or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for "two zone" control.

16. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C relay output and / or over the serial communication bus.
17. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

U. All VFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.
2. Two (2) PID Set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.
3. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (i.e., valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.
4. Two (2) programmable analog inputs shall accept current or voltage signals.
5. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data.
6. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC or 24VAC.
7. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.
8. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety input status shall also be transmitted over the serial communications bus.

9. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates. The time delay shall be field programmable from 0 – 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications), and when switching from drive to bypass.
10. Seven (7) programmable preset speeds.
11. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
12. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.
13. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.
14. The VFD shall include password protection against parameter changes.

V. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words. The keypad shall include a minimum of 14 assistants including:

1. Start-up assistant
2. Parameter assistants
   a. PID assistant
   b. Reference assistant
   c. I/O assistant
   d. Serial communications assistant
   e. Option module assistant
   f. Panel display assistant
   g. Low noise set-up assistant
3. Maintenance assistant
4. Troubleshooting assistant
5. Drive optimizer assistants

W. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

1. Output Frequency
2. Motor Speed (RPM, %, or Engineering units)
3. Motor Current
4. Motor Torque
5. Motor Power (kW)
6. DC Bus Voltage
7. Output Voltage

X. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from -500Hz (reverse) to 500Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.

Y. Serial Communications:

1. The VFD shall have an EIA-485 port as standard. The protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, BACnet, LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.
2. The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
   a. Data Sharing – Read Property – B.
   b. Data Sharing – Write Property – B.
   c. Device Management – Dynamic Device Binding (Who-Is; I-Am).
   d. Device Management – Dynamic Object Binding (Who-Has; I-Have).
   e. Device Management – Communication Control – B.
3. If additional hardware is required to obtain the BACnet interface, the VFD manufacturer shall supply one BACnet gateway per drive. Multiple VFDs sharing one gateway shall not be acceptable.
4. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.
5. Serial communication in bypass shall include, but not be limited to; bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible.

6. The VFD / bypass shall allow the DDC to control the drive and bypass digital and analog outputs via the serial interface. This control shall be independent of any VFD function. The analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive and bypass' digital (Form-C relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive and bypass' digital inputs shall be capable of being monitored by the DDC system. This allows for remote monitoring of which (of up to 4) safeties are open.
7. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO & AO commands in memory in the event the serial communications connection is lost and continue controlling the process.

Z. EMI / RFI filters. All VFD's shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level with up to 100 feet of motor cable. No Exceptions. Certified test reports shall be provided with the submittals confirming compliance to EN 61800-3, First Environment.

AA. All VFD's through 75HP at 480 V shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not sustain damage from this power mis-wiring condition.

BB. Features – Features to be furnished and mounted by the drive manufacturer. All features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

1. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor per section 2.01K below.
2. Fieldbus adapters - Protocols such as LonWorks, DeviceNet, Ethernet IP (ControlNet over Ethernet & ModBus TCP), BACnet IP, and Profibus shall be provided. Coordinate with appropriate communications protocol with BMS vendor.

CC. Bypass Controller

1. A complete factory wired and tested bypass system consisting of a door interlocked, padlockable circuit breaker, output contactor, bypass contactor, and fast acting VFD input fuses are required. UL Listed motor overload protection shall be provided in both drive and bypass modes.
2. The bypass enclosure door and VFD enclosure must be mechanically interlocked such that the disconnecting device must be in the "Off" position before either enclosure may be accessed. Provide bypass interlock for use by qualified personnel. Bypass contactor shall be NEMA rated and shall be equipped with solid-state electronic overloads.
3. The VFD and bypass package shall have a UL listed short circuit current rating (SCCR) of 100,000 amps and this rating shall be indicated on the UL data label.
4. The drive and bypass package shall be seismic certified and labeled to the IBC:

DD. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake table test data as defined by ICC AC-156.

1. Drive Isolation Fuses - To ensure maximum possible bypass operation, fast acting fuses, exclusive to the VFD, shall be provided to allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection. This maintains bypass operation capability in the event of a VFD failure. Bypass designs which have no such fuses, or that incorporate fuses common to both the VFD and the bypass, will not be accepted.
2. The system (VFD and Bypass) tolerated voltage window shall allow the system to operate from a line of +30%, -35% nominal voltage range. The system shall incorporate circuitry that will allow the drive or bypass contactor to remain "sealed in" over this voltage tolerance at a minimum.
3. The bypass shall maintain positive contactor control through the voltage tolerance window of nominal voltage +30%, -35%. This feature is designed to avoid contactor coil failure during brown out / low line conditions and allow for input single phase operation when in the VFD mode. Designs that will not allow input single phase operation in the VFD mode are not acceptable.
4. Motor protection from single phase power conditions - the bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in bypass mode are not acceptable.
5. The bypass system shall NOT depend on the VFD for bypass operation. The bypass system shall be designed for standalone operation and shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the system for repair / replacement. Serial communications shall remain functional even with the VFD removed.
6. Serial communications – the bypass shall be capable of being monitored and / or controlled via serial communications. On-board communications protocols shall include ModBus; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet.
7. Serial communication capabilities shall include, but not be limited to; bypass run-stop control; the ability to force the unit to bypass; and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus and / or via a Form-C relay output – keypad "Hand" or "Auto" selected, bypass selected, and broken belt indication. The DDC system shall also be able to monitor if the motor is running in the VFD mode or bypass mode over serial communications. A minimum of 50 field serial communications points shall be capable of being monitored in the bypass mode.
8. The bypass serial communications shall allow control of the bypass' digital outputs via the serial interface. This control shall be independent of any bypass function or operating state. The bypass' digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the bypass' digital inputs shall be capable of being monitored by the DDC system.
9. There shall be an adjustable motor current sensing circuit for the bypass and VFD modes to provide proof of flow (broken belt) indication. The condition shall be indicated on the keypad display, transmitted over the building automation protocol and/or via a Form-C relay output contact closure. The broken belt indication shall be programmable to be a

system (drive and bypass) indication. The broken belt condition sensing algorithm shall be programmable to cause only a warning or a fault and / or system shutdown.

10. The digital inputs for the system shall accept 24VAC or 24VDC. The bypass shall incorporate an internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 ma of 24 VDC for use by others to power external devices.
11. There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad command, time-clock control, digital input, or serial communications) the bypass shall provide a dry contact closure that will signal the damper to open (motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a bypass system input and allows motor operation. Up to four separate safety interlock inputs shall be provided. When any safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. This feature will also operate in Fireman's override / smoke control mode.
12. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor condition shall be indicated on the bypass LCD display, programmed to fire a Form-C relay output, and / or over the serial communications protocol.
13. The bypass control shall include a programmable time delay for bypass start and keypad indication that this time delay is in process. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 – 120 seconds.
14. There shall be a keypad adjustment to select manual or automatic transfer bypass. The user shall be able to select via keypad programming which drive faults will result in an automatic transfer to the bypass mode and which faults require a manual transfer to bypass. The user may select whether the system shall automatically transfer from drive to bypass mode on the following drive fault conditions:
    a. Over current
    b. Over voltage
    c. Under voltage
    d. Loss of analog input
15. The following operators shall be provided:
    a. Bypass Hand-Off-Auto
    b. Drive mode selector
    c. Bypass mode selector
    d. Bypass fault reset
16. The bypass shall include a two line, 20 character LCD display. The display shall allow the user to access and view:
    a. Energy savings – in US dollars
    b. Bypass motor amps
    c. Bypass input voltage– average and individual phase voltage
    d. Bypass power (kW)
    e. Bypass faults and fault logs
    f. Bypass warnings
    g. Bypass operating time (resettable)
    h. Bypass energy (kilowatt hours – resettable)

i. I/O status
j. Parameter settings / programming
k. Printed circuit board temperature

17. The following indicating lights (LED type) or keypad display indications shall be provided. A test mode or push to test feature shall be provided.
    a. Power-on (Ready)
    b. Run enable
    c. Drive mode selected
    d. Bypass mode selected
    e. Drive running
    f. Bypass running
    g. Drive fault
    h. Bypass fault
    i. Bypass H-O-A mode
    j. Automatic transfer to bypass selected
    k. Safety open
    l. Damper opening
    m. Damper end-switch made

18. The Bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs. This I/O allows for a total System (VFD and Bypass) I/O count of 24 points as standard. The bypass I/O shall be available to the BAS / DDC system even with the VFD removed.
19. The on-board Form-C relay outputs in the bypass shall programmable for any of the following indications.
    a. System started
    b. System running
    c. Bypass override enabled
    d. Drive fault
    e. Bypass fault
    f. Bypass H-O-A position
    g. Motor proof-of-flow (broken belt)
    h. Overload
    i. Bypass selected
    j. Bypass run
    k. System started (damper opening)
    l. Bypass alarm
    m. Over temperature

20. The bypass shall provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.
21. The bypass shall include a supervisory control mode. In this bypass mode, the bypass shall monitor the value of the VFD's analog input (feedback). This feedback value is used to control the bypass contactor on and off state. The supervisory mode shall allow

the user to maintain hysteresis control over applications such as cooling towers and booster pumps even with the VFD out of service.

22. The user shall be able to select the text to be displayed on the keypad when an external safety opens. Example text display indications include “FireStat”, “FreezStat”, “Over pressure” and “Low suction”. The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.
23. Smoke Control Override Mode (Override 1) – The bypass shall include a dedicated digital input that will transfer the motor from VFD mode to Bypass mode upon receipt of a dry contact closure from the Fire / Smoke Control System. The Smoke Control Override Mode action is not programmable and will always function as described in the bypass User’s Manual documentation. In this mode, the system will ignore low priority safeties and acknowledge high priority safeties as required by UL 864/UUKL. All keypad control, serial communications control, and normal customer start / stop control inputs will be disregarded. This Smoke Control Mode shall be designed to meet the intent of UL864/UUKL.
24. Fireman’s Override Mode (Override 2) – the bypass shall include a second, programmable override input which will allow the user to configure the unit to acknowledge some digital inputs, all digital inputs, ignore digital inputs or any combination of the above. This programmability allows the user to program the bypass unit to react in whatever manner the City of New York requires. The Override 2 action may be programmed for “Run-to-Destruction”. The user may also force the unit into Override 2 via the serial communications link.
25. Class 10, 20, or 30 (programmable) electronic motor overload protection shall be included.
26. The VFD Product Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. A toll free 24/365 technical support line shall be available.
27. For stair pressurization fans, provide engraved, permanently attached red-faced label, minimum 6” x 6” with the following language “Caution: This VFD Is Part of The Life Safety Smoke Control System. Notify the City of New York’s Staff Prior To Any Change or Maintenance Activity to This Drive.”

2.3 SOLID-STATE REDUCED-VOLTAGE MOTOR STARTERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Allen-Bradley
2. Eaton/Cutler-Hammer
3. General Electric
4. Schneider Electric/Square D
5. Siemens
6. Or approved equal

B. Reduced Voltage Motor Starters

1. The solid-state reduced-voltage starters shall be UL and CSA listed. The solid-state reduced-voltage starter shall be an integrated unit with power SCRs, logic board, paralleling bypass contactor, and electronic overload relay enclosed in a single housing.
2. The SCR-based power section shall consist of six (6) back-to-back SCRs and shall be rated for a minimum peak inverse voltage rating of 1500 volts PIV.

3. Units using triacs or SCR/diode combinations shall not be acceptable.
4. Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dv/dt effects.
5. The logic board shall be mounted for ease of testing, service and replacement. It shall have quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs and SCR gate firing output circuits.
6. The logic board shall be identical for all ampere ratings and voltage classes and shall be conformally coated to protect environmental concerns.
7. The paralleling run bypass contactor shall energize when the motor reaches 90 of full speed and close/open under one (1) times motor current.
8. The paralleling run bypass contactor shall utilize an intelligent coil controller to limit contact bounce and optimize coil voltage during varying system conditions.
9. The coil shall have a lifetime warranty.
10. Starter shall be provided with solid-state electronic overload protection as standard and shall be based on inverse time-current algorithm. Overload protection shall be capable of being disabled during ramp start for long acceleration loads via a DIP switch setting on the device keypad.
11. Overload protection shall be adjusted via the device keypad and shall have a motor full load ampere adjustment from 30 to 100% of the maximum continuous ampere rating of the starter.
12. Starter shall have selectable solid-state electronic overload class setting of 5, 10, 20 or 30 via a DIP switch setting on the device keypad.
13. Starter shall be capable of either an electronic or mechanical reset after a fault.
14. Units using bimetal overload relays are not acceptable.
15. Over temperature protection (on heat sink) shall be standard.
16. Starters shall provide protection against improper line-side phase rotation as standard. Starter will shut down if a line-side phase rotation other than A-B-C exists. This feature can be disabled via a DIP switch on the device keypad.
17. Starters shall provide protection against a phase loss or unbalance condition as standard. Starter will shut down if a 50% current differential between any two phases is encountered. This feature can be disabled via a DIP switch on the device keypad.
18. Start shall provide protection against a motor stall condition as standard. This feature can be disabled via a DIP switch on the device keypad.
19. Starter shall provide protection against a motor jam condition as standard. This feature can be disabled via a DIP switch on the device keypad.
20. Starter shall be provided with a form C normally open (NO), normally closed (NC) contact that shall change state when a fault condition exists. Contacts shall be rated 60 VA (resistive load) and 20 VA (inductive load). In addition, an LED display on the device keypad shall indicate type of fault (Overtemp, Phase Loss, Jam, Stall, Phase Reversal, and Overload).
21. The following control function adjustments on the device keypad are required:
    a. Selectable Torque Ramp Start or Current Limit Start
    b. Adjustable Kick Start Time, 0-2 seconds
    c. Adjustable Kick Start torque, 0-85%
    d. Adjustable Ramp Start Time; 0.5-180 seconds
    e. Adjustable Initial Starting Ramp Torque; 0-85%
    f. Adjustable Smooth Stop Ramp Time; 0-60 seconds.
22. Maximum continuous operation shall be at 115% of continuous ampere rating.

C. Enclosures:

1. The enclosures shall be wall mountable NEMA 1 for indoor and NEMA 3R for outdoor installation.
2. Starters shall have a heavy-duty fusible type disconnect switch with UL Class R or Class J fuses.

D. Options:

1. Each starter shall be equipped with HOA selector switch, start-stop pushbuttons, red "run" pilot light, green "stop" pilot light and two (2) NO/2 NC auxiliary contacts, as indicated on the drawings.

E. Factory Testing:

1. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.
2. The manufacturer shall provide three (3) certified copies of factory test reports.

F. Field Quality Control:

1. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and start-up of the equipment specified under this section. The manufacturer's representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained herein.
2. The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer's service representative.

G. Inspection and final adjustments.

H. Operational and functional checks of controllers/starters and spare parts.

1. The Contractor shall provide three (3) copies of the manufacturer's field start-up report.

I. Manufacturer's Certification:

1. A qualified factory-instructed manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.
2. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

J. Instructing:

1. The Contractor shall provide a instructing session for up to five (5) Commissioners for 2 normal workdays at a jobsite location determined by the City of New York.
2. The instructing representative shall be conducted by a manufacturer's qualified representative.
3. The instructing program shall consist of the following:
   a. Instructions on the proper maintenance and operation of the equipment.

2.4 MOTOR STARTERS AND CONTROLS

A. All motor controllers and starters integral shall be in accordance with the following:

1. All individually mounted motor controllers and starters shall be of the following type:
   a. Combination fused switch and magnetic controller with solid-state overload protection and low voltage protection.

B. Manual toggle switch operation 2 pole or single pole starter with overload protection in approved NEMA enclosure. Where motors are installed remote from starters, provide pilot light.

1. Provide UL Class RK-1 time-delay, current limiting fuses for all combination starters. Fuses shall be selected based on the fuse manufacturer's motor sizing tables and shall be coordinated with the upstream fuse or circuit breaker.
2. Starters shall be NEMA rated contactors with solid-state electronic motor overload protection.
3. All starters shall be provided with thermal overload protection in all phase legs. Starters for 3-phase motors shall be equipped solid-state electronic overload units, which shall also provide single phase protection. Single phase manual starters shall be equipped with melting alloy overload relays.
4. Provide all starters with an external overload reset button, mounted in the starter cover.
5. Provide three-position, maintained contact rotary selector switch (H-O-A) in starter covers for all automatically controlled motors. Pushbuttons are not required where H-O-A switches are used.
6. Provide 120V control power transformers in all controllers. Control power transformers shall be provided with two primary and one secondary fuse. Fuses shall be UL Class CC time delay type.
7. Provide all necessary auxiliary contacts in starters as required. Provide time delay relays for all interlocked motors.
8. All pilot lights shall be LED type with red or green jewel as indicated. Provide pilot lights where required as follows:
   a. Starters with start-stop pushbutton: 1 pilot light to indicate "Motor On".
   b. Starters with H-O-A switches: 1 pilot light to indicate "Motor On".
9. Each controller, mounted in NEMA type enclosure. Enclosures shall be as follows:
   a. Exterior: NEMA 4X stainless steel.
   b. Interior, dry locations: NEMA 1.
   c. Boiler rooms: NEMA 12.
10. Enclosure sizes and wiring terminals shall be suitable for the use of copper power and control conductors.
11. Starters shall be subject to the approval, as to limit of inrush current, as set up by the Utility Company. In general, magnetic starters shall be located close to the equipment controlled.

2.5 REMOTE DEVICES

A. Remote "Hand-off-auto" selector switch, pilot light, and similar devices, shall be of same manufacture as the associated starter and shall be oiltight.

B. Remote pilot light shall be LED type.

C. Remote contact making devices shall be pilot duty rated.

2.6 FACTORY FURNISHED CONTROL PANELS

A. The packaged control panel furnished with duplex pumps and compressors shall be provided with a circuit breaker and a magnetic starter with solid-state electronic overloads for each motor. The incoming line lugs shall be arranged to accept a separate branch circuit to each circuit breaker. A control power transformer shall be provided and served via a transfer relay with power taken from the load side of each incoming line circuit breaker. If the two (2) electric services are from different power sources, one being an emergency generator, a transfer switch shall be provided in lieu of the transfer relay.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 GENERAL

A. Motors installed, not in strict compliance with the above, shall be replaced at no cost to the City of New York.

3.3 ELECTRICAL WIRING

A. Provide all necessary wiring diagrams indicating wire size and connections as required for the proper operation of the equipment.

B. Contractor shall be responsible for replacing all fuses in the electrical systems during construction which blow due to tests or malfunction of his motorized or non-motorized electrical equipment.

3.4 INSTALLATION

A. Assembly:

1. Assemble shipping sections and set motor control centers in place level, plumb and in alignment; with channel sills level over their full length on surface of housekeeping pads.
2. Make required mechanical and electrical connections including those indicated on approved shop drawings.
3. Touch-up paint all marred factory finishes.

B. Overload Elements:

1. Provide in accordance with motor nameplate current, service factor and ambient temperature.

2. With clamp-on ammeter verify loading of motors. Adjust solid-starter overload setting per the manufacturer's instructions.

C. Tighten and torque electrical connections in accordance with manufacturer's instruction and UL 486.

3.5 TESTING

A. Coordinate testing of starter with testing of the motor and the system associated with the motor.

1. VFD Installation

B. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the VFD installation manual.

C. Power wiring shall be completed by the electrical contractor, to NEC Code 430.122 wiring requirements based on the VFD input current. Caution: VFDs supplied without internal reactors have substantially higher input current ratings, which may require larger input power wiring and branch circuit protection. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

END OF SECTION 23 05 14

SECTION 23 05 16 EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Externally pressurized metal expansion joint
2. Expansion joints.
3. Expansion compensators.
4. Pipe alignment guides.
5. Pipe anchors.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product and installation requirements for piping hangers and supports.
2. Section 23 05 48 - Noise and Vibration Controls for HVAC Piping and Equipment: Product and installation requirements for vibration isolators used in piping systems.
3. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Product and installation requirements for piping used in hydronic heating and cooling systems.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.
4. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
5. NYCMC

B. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

1.4 DESIGN REQUIREMENTS

A. Provide structural work and supplemental steel required for expansion and contraction of piping. Provide anchors, guides, and expansion joints and adequately support system. Supplemental steel shall be designed with a safety factor of 5.0.

B. Provide anchor loadings to Structural Engineer for approval prior to installation.

C. Expansion Compensation Design Criteria:

1. Installation Temperature: 40 degrees F.
2. Low Temperature Hot Water Heating System Temperature: 230 degrees F.
3. Chilled Water System Temperature: 85 degrees F.
4. Safety Factor: per ASME code.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate piping fitting on the layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints. Submit shop drawings sealed by a registered engineer. Include shop drawing information for piping expansion compensation in shop drawings for piping systems specified in Section 230503 and elsewhere through this division.

C. Product Data:

1. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

D. Design Data: Indicate criteria and stress analysis. Submit calculations sealed by a registered engineer.

E. Manufacturer's Installation Instructions: Submit special procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

H. Manufacturer's Field Reports: Indicate results of inspection by manufacturer's representative.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

C. Operation and Maintenance Data: Submit adjustment instructions.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. Perform Work in accordance with NYCBC.

C. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

C. Design expansion compensating system under direct supervision of a Professional Engineer licensed in the State of New York and experienced in design of this Work.

1.9 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.10 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection and packaging in place until installation.

1.11 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for leak free performance of packed expansion joints.

1.12 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Supply two (2) 12-ounce containers of packing lubricant and cartridge style grease gun.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Flexicraft
2. Adsco
3. U.S. Bellows, Inc.
4. Metraflex
5. Or approved equal

B. Furnish materials in accordance with NYCBC.

2.2 EXTERNALLY PRESSURIZED EXPANSION JOINTS (bellow type)

A. General: Externally pressurized metal expansion joints shall consist of a stainless metal bellows in a heavy metal casing with integral guides, a drain plug and flanged end fittings. Flanges shall be carbon steel, ANSI B16.5 150# type. The bellows shall be of 304 stainless steel and the casing shall be carbon steel. Joints shall be designed to meet the design pressures and temperatures for the system and shall be capable of accommodating the axial compressive movements of the piping system.

B. The manufacturer shall submit a computerized stress analysis for sizing of all expansion joints.

C. Bellows shall be 304 stainless steel.

D. Minimum working pressure rating shall be 150 PSI, test pressure shall be minimum 225 PSI.

E. Maximum working temperature shall be 850 degrees F.

F. Ends shall be flanged.

2.3 ACCESSORIES

A. Pipe Alignment Guides: Two-piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3-inch travel. Refer to section 23 05 48 for additional information.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. Install Work in accordance with ASME B31.9.

B. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

C. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 22 05 29 for pipe hanger installation requirements.

D. Provision for expansion shall be made in all piping by means of loops, bends, or offsets. Where pipe lines join or where branches occur, provisions shall be made for the expansion of both lines.

E. Guides shall be located and constructed wherever required, or shown on drawings, to permit free axial movement only. A minimum of two (2) guides shall be installed on each end of joint plus at least one (1) guide between two (2) joints. Vertical pipe guides shall be in accordance with Section 23 05 48 - Noise and Vibration Controls for HVAC Piping and Equipment.

F. Piping shall be anchored to control expansion and prevent undue strain on the fittings and apparatus. Anchors shall be attached to pipe and fastened to structure. The detail and loading force of steel connections to the structure must be approved by the Structural Engineer prior to fabrication.

3.3 MANUFACTURER'S FIELD SERVICES

A. Refer to DCAS General Conditions: Manufacturers’ field services.

B. Furnish inspection services by expansion joint manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION 23 05 16

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SECTION 23 05 23 GENERAL DUTY VALVES FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Gate valves.
2. Globe valves.
3. Ball valves.
4. Plug valves.
5. High Performance Butterfly valves.
6. Check valves.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product and installation requirements for pipe hangers and supports.
3. Section 23 07 00 - HVAC Insulation: Product and installation requirements for insulation for valves.
4. Section 23 21 16 - Hydronic Piping Specialties: Product and installation requirements for piping specialties used in hydronic piping systems.
5. Section 23 23 00 - Refrigerant Piping: Product and installation requirements for valves and piping specialties used in refrigeration systems.

1.3 REFERENCES

A. ASTM International:

1. ASTM A216/A216M - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.

B. Products Standardization Society of the Valve and Fittings Industry:

1. MSS SP 68 - High Performance Butterfly Valves.
2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.

6. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
7. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

C. Underwriters Laboratories Inc.:

1. UL 842 - Valves for Flammable Fluids.

D. Code Compliance:

1. Furnish materials in accordance with NYCBC and NYCMC.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves.

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

D. Valve charts and tags.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NYCBC.

B. All valves shall have a rating exceeding system operating pressure at system temperature and not less than a minimum working pressure of 125 psig or 150 psig.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions: Environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet or frozen.

1.11 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Requirements for extra materials.

B. Furnish two (2) packing kits for each size valve.

PART 2 - PRODUCTS

2.1 GATE VALVES

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Crane Valve, North America.
2. Milwaukee Valve Company.
3. NIBCO, Inc.
4. Stockham Valves & Fittings.
5. Or approved equal

B. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, non-rising stem, hand-wheel, inside screw with back-seating stem, solid wedge disc, alloy seat rings, threaded ends.

C. 2-1/2 inches and Larger: MSS SP 70, Class 125, cast iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.2 GLOBE VALVES

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Crane Valve, North America.
2. Milwaukee Valve Company.
3. NIBCO, Inc.
4. Stockham Valves & Fittings.
5. Or approved equal

B. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, threaded bonnet, hand wheel, teflon composition disc, threaded ends.

C. 2-1/2 inches and Larger: MSS SP 85, Class 125, cast iron body, bronze trim, hand wheel, outside screw and yoke, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.3 BALL VALVES

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Crane Valve, North America.
2. Milwaukee Valve Company.
3. NIBCO, Inc.
4. Stockham Valves & Fittings.
5. Or approved equal

B. 2 inches and Smaller: MSS SP 110, 400 psi WOG, one piece bronze body, chrome plated brass ball, full port, teflon seats, blow-out proof stem, solder or threaded ends, lever handle with balancing stops.

C. 1/4 inch to 1 inch: MSS SP 110, Class 125, two-piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port.

D. 1-1/4 inch to 3 inches: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, conventional port.

2.4 PLUG VALVES

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. DeZURIK, Unit of SPX Corp.
2. Flow Control Equipment, Inc.
3. Homestead Valve.
4. Or approved equal

B. 2 inches and Smaller: MSS SP 78, Class 150, semi-steel construction, rectangular port, full pipe area, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 150, semi-steel construction, rectangular port, full pipe area, pressure lubricated, teflon packing, flanged ends. Furnish worm gear-operated.

2.5 HIGH PERFORMANCE BUTTERFLY VALVES

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Crane Valve, North America
2. Fisher
3. Belimo
4. Or approved equal

B. 2-1/2 inches and Larger: MSS SP 68, Class 150.

1. Body: Carbon steel ASTM A105, lug ends, stainless steel stem, extended neck.
2. Disc: 316L stainless steel.
3. Seat: Resilient replaceable PTFE.
4. Handle and Operator: Infinite position lever handle with memory stop for 2-1/2" to 6". Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

C. Valves shall be high performance bubble-tight, dead-end service and bi-directional type.

2.6 CHECK VALVES

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Crane Valve, North America.
2. Milwaukee
3. Jamesbury.
4. Stockham Valves & Fittings.
5. Or approved equal

B. Horizontal Swing Check Valve:

1. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, solder or threaded ends.
2. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.
3. 2 inches and Smaller: MSS SP 80, Class 200, bronze body and cap, Y-pattern, bronze regrinding disc, solder or threaded ends.
4. 2-1/2 inches and Larger: MSS SP 71, Class 250, cast iron body, bolted cap, bronze or cast iron disc, flanged ends.
5. Provide valves capable of being refitted while the valve remains in the line.

C. Wafer Check Valves:

1. Class 250, cast-iron body; with replaceable bronze seat, and non-slam design lapped and balanced twin bronze flappers and stainless steel trim and torsion spring.
2. Provide valves designed to open and close at approximately one foot differential pressure.

D. Lift Check Valves, 2 inches and Smaller:

1. Class 125; cast-bronze body and cap conforming to ASTM B 62; horizontal or angle pattern, lift-type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends.
2. Provide valves capable of being refitted and ground while the valve remains in the line.

2.7 VALVES FOR REFRIGERANT SYSTEMS

A. Refer to section 23 23 00 - Refrigerant Piping

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to DCAS General Conditions: Verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.

C. Examine valve interior through the end ports for cleanliness, freedom from foreign matter and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.

D. Actuate valve through an open-close and close-open cycle. Examine functionally significant features such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.

E. Examine threads on both valve and the mating pipe for form (i.e., out-of-round or local indentation) and cleanliness.

F. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length and material. Check gasket material for proper size, material composition suitable for service and freedom from defects and damage.

G. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials and proper alignment.

H. Replace defective valves with new valves.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters at both ends of the valves in copper piping system.

C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08 31 13.

F. Valves shall be installed so they shall be readily accessible. For operation of valves not accessible for direct operation, furnish and install chain wheel, guide and sufficient length of chain to operate from floor level. Provide hooks for fastening chains out of the way. No valve shall be installed with the handle pointing downward. If, in the opinion of the Commissioner, valves have been installed so as to create a hazardous and unsafe condition, Contractor shall make corrections as directed, without additional charge.

G. Valves in Mechanical or Fan Rooms more than 8'-0" above the floor shall be chain operated, with either double end chain wrenches or chain wheels.

H. Valves 8" and larger shall be provided with a 1" bypass valve of same pressure rating.

I. Systems shall be supplied with valves in all branch mains, risers, drains, at all pumps, equipment, cooling coils, at all automatic valves and at all apparatus using steam or chilled water so located and arranged to give complete isolation and regulating control of the water.

J. The entire system shall be supplied with valves so located, arranged and operated as to give a complete regulating control to all fixtures and apparatus. Shut-off valves shall be provided on all risers, branch lines, branch lines from mains, mains and at each piece of equipment or fixture. Every section of branch supply and return piping and all risers of all services shall be controlled by a valve at the main. Every item of equipment shall be independently isolated by means of valves.

K. Valves, except as noted, shall be properly supported, independent of the piping.

L. Valves in copper tubing shall have soldered or brazed ends.

M. Valves, where exposed and used in connection with finished piping, shall be same finish as the pipe.

N. Valve manufacturer's representative shall instruct building operating personnel in proper maintenance of plug valves. Furnish equipment and lubricant for one (1) year service.

O. Furnish and connect to all valves, brass tags, polished or lacquered with stamp lettering or numbers filled in with black paint. Also furnish a schedule of all valve tags, framed in a polished hardwood frame and covered with plate glass.

3.3 VALVE APPLICATIONS

A. Valves 2” size and smaller used for water shutoff shall be ball valve type.

B. Valves 2-1/2” size and larger used for hot or cold water shutoff shall be high performance butterfly valve.

C. Valves 4” size and smaller used for hydronic bypass or for flow control shall be ball valve type.

D. Valves 5” size and larger used for hydronic bypass or flow control shall be globe valve type.

E. Valves 3” size and larger used for controlling water flow at pumps and at equipment shall be lubricated plug type.

F. Check valves used for water piping, 2" and smaller, shall be all bronze swing check valves with finished bronze trimmings and brazed or threaded ends.

G. Check valves used for water piping, 2-1/2" and larger, shall be cast iron body, bronze trimmings, swing check valves with flanged ends.

H. Check valves at discharge of water pumps shall be horizontal or vertical "silent" swing type, 200 psig design.

I. Gate valves shall be of the solid wedge type and shall be provided with gland and packing boxes and have top seat for packing under pressure when wide open.

END OF SECTION 23 05 23

SECTION 23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Adhesive anchoring system
4. Flashing.
5. Equipment curbs.
6. Sleeves.
7. Mechanical sleeve seals.
8. Formed steel channel.
9. Firestopping relating to HVAC work.
10. Firestopping accessories.
11. Equipment bases and supports.

B. Related Sections (list below may not include all sections but is intended as a guide):
1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
2. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.
3. Section 23 05 48 - Noise and Vibration Controls for HVAC Piping and Equipment: Product and execution requirements for vibration isolators.
4. Section 23 23 00 - Refrigerant Piping: Execution requirements for placement of hangers and supports specified by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
4. MSS SP 77 - Guidelines for Supports – Contractual Relationship
5. MSS SP-127 - Bracing for Piping Systems

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger, guide, anchor and support locations and detail of trapeze hangers. Include the following:

1. Manufacturer’s technical literature showing hanger type (per MSS SP-69 Standard) material of construction, loading capacity and installation data.
2. Hanger assembly details, including multiple supports and riser supports.
3. Pipe attachment details for insulated lines including seismic restraints.
4. Details of anchors, guides and restraints.

5. Contractor shall submit pull-out strength for all inserts to the structural engineer for review.
6. Calculated load force on each support point.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit calculations sealed by a Professional Engineer registered in the State of New York.

F. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by Professional Engineer registered in the State of New York suitable for presentation to Commissioner for acceptance as meeting code fire protection requirements.

I. Piping Layout Drawings:

1. Provide piping layouts for all HVAC piping systems at same scale as ductwork shop drawings; where such piping is shown on the coordination drawings, separate piping shop drawings for the same area shall also be submitted. Piping shop drawings shall show all hangers and supports, fittings, valves, strainers and accessories. They shall show all sections necessary to establish pipe elevations, shall identify hanger types and loads, and show all tie-ins to structure.

J. Engineering Data:

1. Before any anchor or support system is installed, submit engineering data drawings to the Commissioner for review indicating how performance standards specified here shall be met. The Contractor is responsible for the structural design and supports for these systems and must show his proposed systems on these drawings.
2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members. Calculations and drawings must be prepared by a Professional Engineer licensed in the State of New York and shall be signed and sealed by this Engineer.

K. Sleeve Layout Drawings: Indicating sleeves in foundation walls, slabs and roofs, grade beams, footings, sound isolation partitions and ceilings.

L. Concrete Pull-out Tests:

1. Contractor shall provide on-site testing by an accredited testing laboratory, demonstrating compliance with specifications. Testing shall be performed to the loading requirements of the New York City Building Code or by requirements of the Project Manual or 5x the load being placed on the most heavily loaded anchor/support; whichever is most restrictive. Test a minimum of 3 anchors/supports in each zone, of each floor, evenly distributed over the area where anchors/supports will be installed. Tested anchors/supports can be used in the final assemblies. Submit reports to the Commissioner.

1.5 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

B. Floor Penetrations Within Wall Cavities: T-Rating is not required.

C. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by the Commissioner for penetrating items connecting maximum of two stories.

D. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

E. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

F. Surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

G. Perform Work in accordance with the City of New York for welding hanger and support attachments to building structure.

H. Perform Work in accordance with NYCBC.

1.6 PERFORMANCE CRITERIA

A. Anchoring/support systems shall be required to comply with the following:

1. Each anchor/support shall be able to hold 5x the load being placed or as required by the New York City Building Code or as required by the Project Manual; whichever is most restrictive.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical and damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Anvil (formerly Grinnell).
3. Witch.
4. Or approved equal

B. Pipe hangers and supports shall comply with the recommendation of Standards SP-58 and SP-69 of the Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, except where otherwise noted in the Specifications or on the Drawings.

C. The Contractor shall comply with the contractural relationships recommended for the Pipe Hanger Engineer and the Mechanical Contractor, as stated in Standard MSS SP-77 unless otherwise noted in the Contract Documents.

D. Pipe hangers shall be of the clevis, pipe-roll and pipe-clamp types.

1. Piping subject to lateral or vertical movements shall be provided with supports of the spring hanger type. Refer to Section 23 05 48 "Noise and Vibration Control for HVAC Piping and Equipment" for Spring Hanger Requirements. No exceptions to this will be granted.

E. Pipe hangers shall be connected to the building structure as follows:

1. All water piping 8" and over shall be supported directly from beams or by means of auxiliary steel furnished and installed by this Contractor attached to beams by means of isolation hangers.
2. All other piping may be supported by inserts with sufficient holding capacity to support twice the calculated dead load. No expansion bolts shall be permitted without written permission from the Commissioner.

F. Hangers supported from miscellaneous floor steel shall have approved I-beam clamps. I-beam clamps for hangers supporting piping two (2) inches and smaller shall be adjustable side beam clamp. Piping shall be 2-1/2 inches and larger. I-beam clamps shall be Universal forged steel beam clamps with nut right-hand thread.

G. Water piping of six (6) inches and over in banks shall be supported on trapeze hangers constructed of two (2) 4" channels with 1" threaded rods at each end. Top of each rod shall tie in auxiliary steel as specified hereinafter.

H. Provide all auxiliary steel necessary to transmit loads for piping and equipment installed to building beams.

I. Hydronic Piping:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis. Provide cast iron roller for pipes with straight run large than 150 feet.
4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis cast iron roller.
5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Cold Pipe Sizes 3 inches and Smaller: Cast iron hooks.
9. Wall Support for Cold Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe, any size: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 2 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 2-1/2 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, carbon steel ring.

J. Refrigerant Piping:

1. Conform to ASME B31.5, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inches: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated carbon-steel ring.

K. Trapeze and Clevis Hangers:

1. Where two or more lines run parallel and adjacent to each other, trapeze hangers may be used.
2. Secure pipes supported by trapeze hangers and not mounted on pipe rolls to trapeze with hold down pipe clamps or "J" bolts.
3. Support vertical piping passing through slabs with pipe clamps installed above slab, unless they are subject to expansion or contraction.

L. Roller Hangers:

1. Support hot lines (hot water) 2 inches and larger on roller hangers.

M. Saddles and Shields:

1. Provide protective galvanized shield for supporting insulated lines 1-1/2 inches and smaller.
2. Provide galvanized saddles and roller hangers for supporting hot insulated lines 2" and larger and hard insulation for supporting cold insulated lines 2" and larger.
3. Insert insulation identical to pipe insulation in void between saddle and pipe.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 ANCHORING SYSTEM

A. Provide system by Hilti as listed below or approved equal.

1. Anchor: HIT-TZ, fabricated of carbon steel ASTM A510 with chemical composition of AISI 1038.
2. Adhesive “Fast cure adhesive” with maximum cure time of 30 minutes at 68 degrees F equal to HIT HY 150 max.

B. Examine the areas and conditions where specialty anchoring system is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

C. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

D. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction and the manufacturer’s recommended installation procedures.

E. Install the following manufacturer’s guidelines:

1. Drill hole using a roto-hammer or Hilt diamond coring machine.
2. Push the HIT-TZ in the hole to verify sufficient hole depth (only threads visible). For floor applications, pushing the rod compacts to the drill dust.
3. Inject adhesive staring from the bottom of the hole.
4. Fill hole 1/2 to 2/3 full. If the hole is full of water, it is suggested to start injecting from the bottom of the hole and fill entirely with adhesive.

F. Anchoring system shall be required to comply with the following:

1. Each anchor shall be able to hold 5x the load being placed or as required by the New York City Building Code or as required by the Project Manual, whichever is most restrictive.

G. Engineering Data:

1. Before any anchor system is installed, submit engineering data drawings to the Commissioner for review indicating how performance standards specified here shall be met. The Contractor is responsible for the structural design and supports for these systems and must show his proposed systems on these drawings.
2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of New York and shall be signed and sealed by this Engineer.

H. Quality Assurance:

1. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance f the work of this Section.
2. Manufacturers shall provide training for all workers to install system.
3. Contractor to provide on-site testing by an accredited testing laboratory, demonstrating compliance with specifications. Testing shall be performed to the loading requirements of the New York City Building Code or by requirements of the Project Manual or 5x the load being placed on the most heavily loaded anchor; whichever is most restrictive. Test a minimum of 3 anchors in each zone, of each floor, evenly distributed over the area where anchors will be installed. Tested anchors can be used in the final assemblies. See Volume 3 Structural drawings Key Plan for locations of the zones (Outer Portion, Corridor and Core). Supply reports to the Commissioner.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 EQUIPMENT CURBS

A. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3-inch cant, variable step to match roof insulation, 1-1/2 inch thick insulation, factory installed wood nailer.

2.6 ROOF-MOUNTED PIPING

A. Support on minimum 1-1/2" x 1/1-2" x 1/2" angle iron framing with roof-mounted concrete anchor, appropriately flashed and counter flashed to roofing system. Horizontal support angle shall be a minimum of 18" above finished roof.

2.7 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Schedule 40 Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel.

E. Sealant: Acrylic type.

2.8 MECHANICAL SLEEVE SEALS

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Thunderline Link-Seal, Inc.
2. NMP Corporation.
3. _____
4. Or approved equal

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.9 FORMED STEEL CHANNEL

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Allied Tube & Conduit Corp.
2. B-Line Systems.
3. _____
4. Or approved equal

B. Product Description: Galvanized 12 gage) thick steel. With holes 1-1/2 inches on center for use indoors, stainless steel for use outdoors.

2.10 FIRESTOPPING

A. Definitions:

1. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

B. System Description:

1. Firestopping Materials: UL 1479 to achieve fire ratings as noted on Architectural Drawings for adjacent construction, but not less than 1 hour fire rating.

C. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.

1. Surface Burning: ASTM E84 with maximum flame spread / smoke developed rating of 25/50.
2. Firestop interruptions to fire rated assemblies, materials, and components.

D. Performance Requirements:

1. Firestopping: Conform to applicable code for fire resistance ratings and surface burning characteristics.
2. Firestopping: Provide certificate of compliance from Special Inspector indicating approval of materials used.

E. Products: Subject to compliance with requirement, provide products by one of the following:

1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. International Protective Coating Corp.
5. 3M fire Protection Products
6. Specified Technology, Inc.
7. Or approved equal

F. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.

6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

G. Color: Full range of colors shall be available to be selected by the Commissioner.

2.11 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL listed products or products tested by independent testing laboratory.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to DCAS General Conditions: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Obtain permission from the Commissioner before using powder-actuated anchors.

D. Do not drill or cut structural members.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASTM F708, MSS SP 58, MSS SP 69, MSS SP 89 and NYCMC.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support vertical piping at every floor.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat steel hangers and supports. Underground hangers shall be painted with two (2) coats of black asphlatum.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 23 07 00.

M. Provide all necessary hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations. In all cases where hangers, brackets, etc., are supported from concrete construction, care shall be taken not to weaken concrete or penetrate waterproofing. All hangers and supports shall be capable of screw adjustment after piping is erected with a locking nut provided to prevent loss of adjustment due to pipe vibration. Hangers supporting piping expansion loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. All such hangers shall be finally adjusted, both in the vertical and horizontal direction, when the supported piping is hot. All supports and components shall be rated for a minimum of two times the calculated dead load.

3.4 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

C. Provide curbs for roof installations 24 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.

D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating to uniform density and texture.

D. Place intumescent coating in sufficient coats to achieve rating required.

E. Fire-Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.

F. Pack void with backing material.

G. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

1. Where conduit and wireway penetrate fire rated surface, install firestopping product in accordance with manufacturer's instructions.

H. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.

I. Install type of firestopping material recommended by manufacturer.

1. Install escutcheons floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
2. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
3. Interior partitions: Seal all pipe penetrations. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.9 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.10 CLEANING

A. Refer to DCAS General Conditions: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.11 PROTECTION OF FINISHED WORK

A. Refer to DCAS General Conditions: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.12 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches
Up to 1-1/2	6	6	1/2	3/8
2	8	8	1/2	1/2
2-1/2	10	10	5/8	5/8
3	10	10	5/8	5/8
4	-	10	-	3/4
5	-	10	-	3/4
6	-	10	-	3/4
8	-	10	-	7/8
10	-	10	-	1
12	-	10	-	1
1420	-	12	-	1-1/4

B. When several pipes rest on a common hanger, increase rod diameter accordingly, and spacing noted above must remain.

END OF SECTION 23 05 29

SECTION 23 05 48 NOISE AND VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Inertia bases.
2. Vibration isolators.
3. Duct silencers.
4. Acoustical performance requirements for spaces and equipment.
5. Acoustic housings.
6. Ductwork sound proofing/lagging.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping: Product requirements for anchors and piping expansion compensation.
2. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports.
3. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Requirements for sound and vibration measurements performed independent of this section.
4. Section 23 33 00 - Air Duct Accessories: Product requirements for both solid and flexible duct connectors for duct silencers specified for placement by this section.

1.3 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

B. American National Standards Institute:

1. ANSI S1.4 - Sound Level Meters.
2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
3. ANSI S1.13 - Methods for the Measurement of Sound Pressure Levels in Air.
4. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.

C. Air-Conditioning and Refrigeration Institute:

1. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.

D. American Society of Heating, Refrigerating and:

1. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
2. ASHRAE Handbook - HVAC Applications.

E. ASTM International:

1. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
2. ASTM E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
3. ASTM E596 - Standard Test Method for Laboratory Measurement of the Noise Reduction of Sound-Isolating Enclosures.

F. Sheet Metal and Air Conditioning Contractors':

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.4 PERFORMANCE REQUIREMENTS

A. Provide vibration isolation on motor driven equipment over 0.5 hp, which is connected piping and ductwork.

B. Provide minimum static deflection of isolators for equipment as follows or code minimum, unless specified otherwise. Actual static deflection shall not be less than 10% of specified deflection:

Equipment Type	Isolator Type	Static Deflection (inches)
Fans (including AHU, ERU, RTU)	Spring & Neoprene	2
Fan Coil Units/Heat Pumps	Spring & Neoprene	1
Dry coolers, Water-cooled Condenser, Chillers	Spring & Neoprene	2
Mechanical and Domestic Pumps greater than 5hp*	Spring & Neoprene	2
Mechanical and Domestic Pumps less than 5hp	Double-deflection Neoprene	0.3
Condensate Pumps	Neoprene Waffle Pad	0.1
Heat Exchangers**	Spring & Neoprene	1
Hot Water Generators, Boilers (Skid-mounted)	Spring & Neoprene	1
Generators	Spring & Neoprene	2

Equipment Type	Isolator Type	Static Deflection (inches)
Transformer less than 150 kVA	Double-deflection Neoprene	0.3
Transformers greater than 150 kVA	Spring & Neoprene	1

C. Consider upper floor locations critical unless otherwise indicated.

D. Use concrete inertia bases on base mounted pumps over 3 hp.

E. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.

F. Maintain rooms at following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE Handbook., HVAC Applications:

1. Offices:
   a. Conference rooms (interior): 30
   b. Conference rooms (perimeter): 42*
   c. Private (interior): 30
   d. Private (perimeter): 42*
   e. Open-plan areas (interior): 40
   f. Open-plan areas (perimeter): 42*
   g. Corridors (interior): 40
   h. Corridors (perimeter): 42*

   *Due to perimeter fan coil units.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4

B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, operational weights, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project. Calculate static deflection at each loading point.

C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.

D. Design Data: Submit calculations indicating maximum room sound levels are not exceeded.

E. Test Reports: Indicate dynamic insertion loss and noise generation values of silencers. Acoustic housings meet or exceed specified sound transmission loss values.

F. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.

G. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.

H. Manufacturer's Field Reports: Indicate sound isolation installation is complete and in accordance with instructions.

I. Submit shop drawings for the items listed below. The shop drawings must be complete when submitted and must be presented in a clear, easily understood form. Incomplete or unclear presentation of shop drawings may be reason for rejection.

1. A complete description of products to be supplied, including product data, dimensions, specifications and installation instructions.
2. Detailed selection data for each vibration isolator supporting equipment, including:
   a. The equipment identification mark
   b. The isolator type
   c. The actual load based on operational weight at each mounting point.
   d. The static deflection expected under the actual load
   e. The specified minimum static deflection
3. Steel rails, steel base frames and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method and location of equipment attachment bolts.
4. Details required to convey complete understanding of work.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of acoustic housings and ductwork lagging. Record actual locations of hangers including attachment points.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with AMCA 300, ANSI S1.13, ARI 575, ANSI S12.36 standards and recommendations of ASHRAE 68.

B. All vibration isolation systems including mountings, and hangers, shall be furnished by the same manufacturer.

C. The vibration isolation systems shall be designed to achieve at least 90% isolation efficiency or as specified, whichever is greater, at the lowest rotational speed of the equipment regardless of the condition of the mounting floor.

D. The flexible isolators shall be properly adjusted and installed in accordance with the weight distribution of the equipment to provide a stable mounting decoupled system. Each flexible isolator shall be designed and installed so that the equipment support base remains level during deflection. The natural frequency for each support point, based upon the load per isolator and its stiffness, shall not differ by more than plus or minus 10%.

E. The isolation system shall not cause the equipment to generate any mechanical problem, mechanical failure or misalignment of the couplings and bearings.

F. Furnish information as may be required to verify that all vibration control equipment will meet static deflections and percentage of isolation reduction specified for various uses.

1. Should operation of any system cause noise or vibration which is, in the opinion of the Commissioner, "objectionable," Contractor shall, at his own expense, make such changes in piping, equipment, etc., as may be necessary to eliminate the objectionable noise or vibration.
2. Should the installation of any equipment or piping transmit the noise to any portion of the structure which is, in the opinion of the Commissioner, "objectionable," Contractor shall, at his own expense, install such isolation and make such changes or additions as may be necessary to prevent the transmission of the noise or vibration.

G. Particular attention is directed to the problem of preventing noise and vibration transmission from Mechanical Equipment Rooms and Fan Rooms to adjacent areas. It is of paramount importance that no noise or vibration emanating from equipment in these rooms be perceptible in adjacent areas. Contractor shall incorporate in his installation all devices and accessories to accomplish this result. Such devices shall include vibration eliminator bases and sound absorber pads, muffler at air compressor air intakes, acoustical lining or sound traps at fresh air intake louvers, and other sound insulation, all as may be required.

H. All electrical connections, drain connections, piping connections, etc., made to equipment which rests on vibration isolators shall be sufficiently flexible to permit the equipment to be properly installed.

I. When concrete pads are called for to be under isolation, they shall be extended to span at least 2 of the supporting beams and they shall be reinforced with rods or mesh so that the concrete can act as a beam reinforcing the floor and providing a better support for the isolation. The vibration control equipment manufacturer shall submit templates and weight at each support point to the Concrete Section to achieve this.

J. Where supplementary steel is required to support piping this steel shall be designed to provide a maximum deflection of 0.08 inches at the midspan under the supported load. Piping shall be rigidly supported from the supplementary steel and the supplementary steel isolated from the building structure by means of isolators.

K. Acoustical Performance Specifications: It is the intent that noise levels due to air conditioning and/or ventilating equipment, ducts, grilles, registers, diffusers and air system pressure reducing devices will permit attaining sound pressure levels in occupied spaces conforming to NC curves as explained in the latest issue of the ASHRAE Guide and Data Book. Refer to Section 1.3 for background noise performance criteria.

L. Design isolators for equipment installed outdoors to provide adequate restraint to withstand the force of a 100 mph wind applied to any exposed surface of the isolated equipment. Isolators for outdoor equipment shall have bolt holes for attachment to equipment and to supports. The vibration isolation Vendor shall submit verifying shear and over turning calculations, for their product and equipment installation arrangement, stamped by a licensed Professional. The design and supply of miscellaneous support steel above and below isolators will not be the responsibility of the vibration isolation manufacturer.

M. Static deflection of isolators shall be as provided as noted below. All static deflections stated are the minimum acceptable deflection for the mounts under the equipment operating weight. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

N. Vibration Criteria:

1. Mechanical and electrical equipment operated by motors over one horsepower and unless otherwise noted, and associated piping, shall be isolated from the structure by means of resilient vibration and noise isolators supplied by a single manufacturer to the HVAC Contractor. The isolator manufacturer shall include the complete design for the supplementary basis; a tabulation of the design data on the isolators including outside diameter; free, operating and solid heights of the springs; free and operating heights of the neoprene or fiberglass isolators; and isolation efficiency based on the lowest operating speed of the equipment supported.
2. All rotating equipment shall be balanced both statically and dynamically. The equipment supporting structure shall not have any natural frequencies within ±20% of the operating speeds. The equipment, while operating, shall not exceed a self-excited vibration velocity of 0.10 inches per second when measured with a vibration meter on the bearing caps of the machine in the vertical, horizontal and axial directions, or at the equipment mounting feet if the bearings are concealed.
3. Vibration testing shall be in accordance with procedure established by “Testing Vibration Isolation Systems”, Page 52.38 of ASHRAE HVAC Systems and Applications – 1987.
4. When it is determined by the City of New York that any equipment vibration exceeds the specified level, the contractor in consultation with the Professional shall, at no cost to the City of New York, determine the source of the vibration and make the necessary corrections or replacement to reduce it to the acceptable level.

O. Sound Pressure Levels:

1. The sound pressure levels around mechanical and electrical equipment (boilers, fans, pumps, pressure reducing valves, motors, turbines, elevators, transformers, etc.) in equipment spaces shall not exceed 85 dbA at any point, 3 feet from equipment, with all equipment in the room operating. The sound criteria applies to the complete operating range of each piece of equipment.
2. The maximum interior background sound pressure levels for the various usage areas within the building shall be indicated on Table 2, “Recommended Indoor Design Goals for HVAC System Sound Control” – ASHRAE HVAC Systems and Applications – 1987, Page 52.4, or as otherwise specified. Each area, so designated, shall be tested and reported for noise level with all equipment operating and space unoccupied.
3. Equipment installed outside the building, at grade, in areaways, attached to walls, and on the roof, such as cooling tower fans, air conditioning units, refrigerant condensers, fans, exhaust silencers, air intakes, etc. shall comply with all local, city, state and federal sound level regulations.
4. When equipment or space sound pressure levels exceed the specified criteria, the contractor in consultation with the Professional shall, at no cost to the Department, determine the source of the noise and make the necessary corrections to reduce it to the acceptable levels.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

C. Design application of duct silencers, acoustic housings, seismic snubbers under direct supervision of Professional Engineer licensed in State of New York and experienced in design of this Work.

1.9 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 INERTIA BASES

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Mason Industries - M.I.I.
2. Vibration Eliminator Corp. – V.E.C.
3. VMC Group - V.M.C.I.
4. Or approved equal

B. Furnish materials in accordance with NYCBC.

C. Structural Bases:

1. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.
2. Construction: Welded structural steel with gusset brackets, supporting equipment and motor with motor slide rails.

D. Concrete Inertia Bases:

1. Mass: Minimum of 3 times weight of isolated equipment.
2. Construction: Structured steel channel perimeter frame, with gusset brackets and anchor bolts, adequately reinforced, concrete filled.
3. Connecting Point: Reinforced to connect isolators and snubbers to base.
4. Concrete: Reinforced 3,000 psi concrete.

2.2 FLOOR MOUNTING OF FACTORY ASSEMBLED AIR HANDLING UNITS - MOUNTING TYPE IV

A. This equipment shall be mounted directly on layered neoprene waffle pads similar to model “Super Waffle Pad” by Mason Industries, Inc. or approved equal. Neoprene pads shall sit atop the steel I-beam between the steel I-beam and unit base as detailed. Provide seismic snubbers bolted to concrete pad and unit base rail.

B. Diagonal hanger rod isolators shall be provided as required to limit horizontal motion to 1/4" maximum.

2.3 MOUNTING OF CEILING SUPPORTED FACTORY ASSEMBLED FANS, TUBULAR FANS (MIXED FLOW FANS), AXIAL FANS AND BELTED UTILITY VENT SETS - MOUNTING TYPE V

A. Hung by isolation with retainers containing steel springs and neoprene isolator element. Structural sub-base or unit integral supports if adequate as approved by the Commissioner. Isolator to have allowance of 30 degree of rod misalignment. Isolators shall be as follows:

1. Type 30N - M.I.I.
2. Type RSH 30 - V.M.C.I.
3. Type SNRC - V.E.C.

B. Diagonal hanger rod isolators shall be provided as required to limit horizontal motion to 1/4" maximum under fan operating conditions.

2.4 MOUNTING OF CENTRIFUGAL PUMPS - GREATER THAN 3 HP - MOUNTING TYPE VI

A. Each pump with its driving motor shall be bolted and grouted to a spring supported concrete inertia base reinforced as required.

B. Each concrete base (rectangular or "T" shape) for horizontally split pumps shall include supports and base elbows for the suction and discharge connections. Base elbows shall be bolted and grouted to the concrete foundation.

C. Concrete inertia base thickness shall be as follows. Provide a minimum 2-inch air space between inertia base and housekeeping pad:

Interia Base Guidelines	
Motor Size (hp)	Minimum Concrete Thickness (inches)
3 to 20	6
21 to 50	8
51 to 75	10
> 75	12

D. The spring supported concrete inertia foundation shall be poured within structural perimeter frame (reinforced as shown) of the required thickness indicated on the above schedule. The structural perimeter frame shall be equipped with height saving brackets and stable bare spring isolators having spring diameters no less than 0.8 of the compressed height of the spring at rated load. The mountings shall provide minimum static deflections of 2 inches. The structural perimeter frame, mounting templates, height saving brackets and spring system shall be provided as an assembly by the vibration control vendor. Each structural frame shall include top and bottom reinforcing steel in concrete.

E. Install under inertia bases at suction and discharge base elbow locations and at motor end, a 6" x 6" x 7/8" high resilient pad, to limit movement of base during pump startup.

F. Mounting assemblies shall be one of the following:

1. Type KSL - M.I.I.
2. Type MDF - V.M.C.I.
3. Type SN - V.E.C.

2.5 MOUNTING OF CENTRIFUGAL PUMPS (3 HP OR LESS) - MOUNTING TYPE VII

A. Pumps 3 HP or less shall be bolted to double deflection neoprene isolators. Isolators shall provide a minimum static deflection of 3/8 inch and shall be protected against corrosion. Isolator types shall be one of the following:

1. Type ND - M.I.I.
2. Type RD - V.E.C.
3. Type 368SD - V.M.C.I.

2.6 SUPPORT OF WATER PIPING

A. General: The following water piping shall be resiliently supported.

1. All water piping in Mechanical Equipment Rooms.
2. All water piping located on the roof.
3. Where shown on drawings.

4. All water piping within 50 feet or 100 pipe diameters, whichever is greater, from connected isolated equipment.

B. Resilient diagonal mountings or other approved devices shall be provided as required to limit piping motion due to equipment startup or shutdown, to a maximum of 1/8 inch.

C. Where isolated water piping 8" and over is supported directly be-low exposed steel beams, attachment to the beam shall be made by means of channel beam attachments welded to the underside of the bottom flange and located directly under the web of the beam.

D. The steel spring element of the hangers or floor mounting assembly shall provide 1 inch static deflection.

E. All water piping hanger rod isolators shall be one of the following:

1. Type PC30N - M.I.I.
2. Type RSH 30 - V.M.C.I.
3. Type SNRC - V.E.C.

F. Floor supported water piping shall be mounted on one of the following, or as approved:

1. Type SLR - M.I.I.
2. Type ASCM - V.M.C.I.
3. Type OSC - V.E.C.

G. The all-directional piping anchor isolation mountings shall consist of a telescoping arrangement of two sizes of steel tubing separated by a minimum of 1/2 inch thick heavy duty neoprene and canvas duct isolation pad. Vertical restraints shall be provided by similar material arranged to prevent vertical travel in either direction. The allowable load on the isolation material shall not exceed 500 psi.

H. Mountings shall be Type ADA - Mason Industries or as approved.

I. Piping shall be constructed with a 360 deg. 10 gauge metal sleeve around the piping. The thermal insulation requirements for the piping shall be provided between the piping and the sleeve. Heavy duty neoprene and canvas duct isolation pad of thickness equal to thermal insulation requirements shall space the metal sleeve away from the piping with urethane or other suitable thermal insulation provided in the voids between the pipe sleeve and isolation pad material. The metal sleeve outside diameter shall be smaller than the pipe riser clamp inside diameter in accordance with standard field construction practice. The pipe riser clamp shall be rigidly attached to the steel framing within the shaft.

1. Anchors:

J. The acoustical pipe anchor mountings shall be capable of safely accepting loads developed by the installed piping and shall consist of a bolted assembly of steel plates with laminations and 1/2 inch thick heavy duty neoprene and canvas duct isolation material. A heat shield of 1/4 inch transite shall be provided. The isolation material loading shall not exceed 500 psi.

K. Acoustical pipe anchor mountings shall be Type ADA Mason Industries or as approved.

1. Supports:

L. Piping penetrations of shafts, floor slab and/or partitions: There shall be no direct contact of piping with shaft walls, floor slabs and/or partition. All uninsulated piping shall be sleeved with 1 inch fiberglass the full depth of the penetration.

2.7 GRILLES, REGISTERS AND DIFFUSERS

A. The maximum permissible sound power levels in octave bands of grilles, registers and diffusers when operated in an installed condition per plans and specification, shall be as follows:

Maximum Sound Power Level for Terminal Devices Servicing Occupied Spaces

See Acoustical Performance Criteria
Maximum PWL (db) re 10-12 Watts

Octave Bands	NC-35	NC-40
1	62	66
2	56	60
3	50	54
4	46	51
5	43	48
6	42	47
7	41	46
8	42	47

2.8 VARIABLE AIR VOLUME BOXES

A. Discharge Noise:

1. The maximum permissible sound power levels of these units when operated in an installed condition per plans and specifications shall be such that the resulting sound pressure levels in occupied spaces shall conform to noise criteria levels as stated in "Acoustical Performance Criteria" hereinbefore described. Low pressure duct downstream of units shall be acoustically lined but length of lining shall be minimum 15 feet including all branches within 15 feet.

Maximum Discharge Sound Power Level for Terminal Devices Servicing Occupied Spaces

See Acoustical Performance Criteria
Maximum PWL (db) re 10-12 Watts

Octave Bands	NC-35	NC-40
1	78	82
2	72	75
3	66	70
4	64	67
5	62	66

Maximum Discharge Sound Power Level for Terminal Devices Servicing Occupied Spaces

See Acoustical Performance Criteria
Maximum PWL (db) re 10-12 Watts

Octave Bands	NC-35	NC-40
6	60	65
7	60	65
8	58	64

B. Radiated Noise:

1. Where located exposed or over occupied spaces, the maximum permissible radiated sound power levels in octave bands when operated in an installed condition per plans and specifications, shall be as follows:

Octave Bands Mid/Freq. (cps)	MAXIMUM RADIATED PWL (DB) RE:10-12 WATTS	
	NC-35 (exposed/ACT)	NC-40 (exposed/ACT)
63	60/72	64/76
125	53/66	57/70
250	47/60	52/65
500	47/57	48/62
1000	40/53	45/58
2000	39/51	44/56
4000	39/50	44/55
8000	37/48	42/53

2. The manufacturer shall submit to the Architect guaranteed discharge and radiated sound power levels in octave bands, and shall substantiate that the equipment operating in an installed condition as per plans and specifications shall conform with those discussed above.
3. Should the commissioner desire that units be checked for conformance of discharge and radiated noise to the above acoustical performance, the cost of such tests will be paid up by the City of New York provided that the test proves conformance. Otherwise, the cost of such tests and cost of corrective measures shall be borne by the manufacturer.

2.9 ACOUSTICAL PERFORMANCE WITHIN EQUIPMENT SPACES

A. Equipment room noise levels and noise transmission to adjacent buildings shall comply with all State and City Noise Ordinances.

2.10 MOTOR ACOUSTICAL PERFORMANCE

A. Motor drives for pumps when installed per plans and specifications shall operate with noise levels not exceeding 85 dba.

B. Noise levels shall be determined in accordance with IEEE Standard u/85 Test "Procedure for Air-Borne Noise Measurements on Rotating Electric Equipment."

2.11 RECTANGULAR FACTORY BUILT SOUND TRAPS

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Price Industries
2. IAC
3. Vibro-Acoustics
4. Or approved equal

B. Quality Assurance:

1. Silencers shall be installed in accordance with NFPA 90A and with NFPA 90B.
2. Silencer performance must have been substantiated in a duct-to-reverberant room test facility in accordance with ASTM E477-13. The test facility must provide airflow in both directions through the test silencer. The test set-up shall eliminate effects due to flanking, directivity, end reflection, standing waves and reverberation room absorption. The aero-acoustic laboratory must be currently NVLAP accredited for ASTM E477-13. Test facilities and reports shall be open to inspection from the Commissioner.
3. Silencer manufacturer must have a minimum ten (10) years of industry experience.
4. Silencer manufacturer shall provide a copy of their laboratory NVLAP accreditation certificate for the ASTM E-477-13 test standard with the submittals. Data from non- NVLAP accredited test facilities is not acceptable.
5. The silencer manufacturer shall test silencer(s) as indicated in the silencer schedule if required and at the City of New York expense. Commissioner shall be notified of the test date in advance and tests shall comply with the project criteria.

C. Prefabricated duct silencers shall be constructed of all incombustible materials and shall be standard product of a responsible manufacturer. The outer casing and inner perforated metal liner of the silencer shall be at least 22 gauge galvanized steel sheet and shall be leakproof and shall not fail structurally when subjected to a differential pressure of 8 inches w.g.

D. Silencers shall be Film Lined type.

1. Media shall be of acoustic quality, shot-free glass fiber insulation with long, resilient fibers bonded with a thermosetting resin. Glass fiber density and compression shall be as required to insure conformance with laboratory test data.
2. Media shall be packed with a minimum of 15% compression during silencer assembly.
3. Media shall be resilient such that it will not pull apart during normal applications, and shall resist settling, breakdown, and sagging from vibration. Media shall not rot, mildew, or otherwise deteriorate, and shall have sufficient flexibility to readily form around corners and curved surfaces.
4. Media shall not cause or accelerate corrosion of aluminum or steel

E. Media protection:

1. The acoustic media shall be completely wrapped with polymer film to help prevent shedding, erosion and impregnation.

2. The wrapped acoustic media shall be separated from the perforated metal by a factory-installed acoustically transparent spacer.
3. The spacer shall be flame retardant and erosion resistant.
4. Mesh, screen or corrugated perforated liner will not be acceptable as a substitute for the specified spacer.
5. Silencer manufacturer shall provide a written test report showing silencer assemblies have Class 1 flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84, NFPA 255 or UL 723.

F. Silencers shall be shipped with factory-installed end caps.

G. Pressure drop shall not be greater than shown on the Sound Traps Schedule. Total system pressure before and after the sound traps shall be measured after the traps are installed. Should the pressure drop be greater than specified or scheduled, the Contractor shall replace the traps and/or modify the entrance or discharge aerodynamic flow to achieve the specified results. The cost of corrective measures shall be borne by the Contractor.

H. The sound traps shall provide net insertion ratings under design air flow velocities as scheduled on the drawings:

I. Certification: Certified test data of pressure drop and insertion loss rating shall be submitted by the Contractor for a 24 x 24 cross section rectangular trap or 24 inch diameter conical trap. The certification data for both pressure drop and insertion loss shall be based upon tests of the same trap for both measurements. The certifying laboratory shall be open to inspection and/or test of sound traps upon request commissioner.

J. Provide sound traps as shown on the drawings. Unless otherwise indicated, pressure drop across sound trap, under nominal flow conditions, shall not exceed 0.25" W.G.

2.12 ACOUSTICAL LINING

A. Products: Subject to compliance with requirement, provide products by one of the following:

1. Owens Corning
2. Aeroflex
3. Johns Manville
4. Knauf
5. Or approved equal

B. Duct lining for supply, return and exhaust air systems:

1. Duct lining shall be 1-1/2 lb. per cu. ft. density. Unless greater thicknesses are specified, the minimum thickness installed shall be 1-1/2".
2. Duct lining shall meet requirements of NFPA-90A and all materials used shall have a flame spread rating of 25 or less and smoke developed rating of no higher than 50.
3. The leading edge (facing into the air flow) or each non-abutting section such as the first section facing into the fan, or the first section after a sound trap shall have a metal nosing.

4. Application: All portions of duct designated to receive duct liner shall be completely covered with Duct Liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. The black coated surface of the Duct Liner shall face the air stream. The Duct Liner shall be adhered to the sheet metal with 100% coverage of adhesive and all exposed leading edges and all transverse joints coated with adhesive. Adhesive shall Duct Line, ASC-A-7001C-1972. The Duct Liner shall be additionally secured with mechanical fasteners (mechanical fasteners shall conform to Mechanical Fastener Standard FM-1-1971, available from Sheet Metal and Air Conditioning Contractors National Association), which shall compress the Duct Liner sufficiently to hold it firmly in place. Duct Liner shall be cut to assure overlapped and compressed longitudinal corner joints. Fasteners shall start within 3" of the upstream transverse edges of the liner and 3" from the longitudinal joints and shall be spaced at a maximum of 6" o.c. around the perimeter of the duct, except that they may be a maximum of 6" from a corner break. Elsewhere they shall be a maximum of 16" o.c., except that they shall be placed not more than 6" from a longitudinal joint of the liner nor 12" from a corner break.
5. The following ducts shall be acoustically lined:
    a. Ductwork downstream of VAV terminal units a minimum distance of 15 feet, in all directions, or as shown on drawings.
    b. All supply and return air ductwork in mechanical equipment rooms, but not less than 30 ft. from supply fan discharge and 25 ft. from return fan inlets, in all branches and mains.
    c. Ductwork upstream and downstream of exhaust fans a minimum distance of twenty feet, in all branches or mains.
    d. All transfer ducts and jumper ducts.
    e. In addition to above, wherever shown on drawings.
    f. Dimensions of lined ducts shown on drawings are the inside dimensions of the duct after the lining has been installed.
    g. Duct liner shall meet the requirements of NFPA 90A, 90B and ASTM-C 1071 and installed in accordance with SMACNA.

C. All adhesives shall conform to the current South Coast Air Quality Management District (SCAQMD) Rule #1168. The Volatile Organic Compound (VOC) content shall not exceed 80 grams per liter.

2.13 DUCTWALL EXTERNAL SOUNDPROOFING (DES)

A. Materials:

1. Fiberglass insulation shall be 4 lb. per cubic foot density.
2. Thickness of the fiberglass shall be 1/2 in. greater than height of ductwork angles, one in. minimum.
3. The jacket shall be aluminum (.016) laminated to lead (.015) with a visco-elastic film.
4. Sound transmission loss greater than STC26 for the aluminum/lead laminate.
5. Banding shall be .02 in.x 3/4 in. stainless steel.
6. Sealant: Chil-Seal CP-70.

B. Installation:

1. Seal all duct joints airtight.

2. Adhere fiberglass with 100% coverage of adhesive and stick clips on 18 in., centers on the underside of large ducts where required. Fiberglass must cover angles and protrusions by 1/2 in. minimum. Wrap ductwork and insulation with lead/aluminum lami- nate with largest continuous sheets possible. Overlap all joints 2 in. minimum and seal joints with sealant specified. If fish-mouthing occurs, close gap with sheet metal screws as described below. On the underside of ducts only, stick clips may be used to support jacket. The exterior clip must be isolated from the jacket with an 1/8 in. thick oversized armaflex washer. All duct jacketing must be secured with banding on 12 in. maximum centers. The corners must be reinforced with 3 in. long, lin. x lin. x 1/8 in. thick aluminum extrusion where banding occurs. Use same extrusion under duct to keep jacket from sagging if required. If and only if the banding is not possible, then sheet metal screws (3/4 in. long maximum) may be used to secure the jacketing as described below:
   a. Must not touch interior duct.
   b. After screw has been installed, clean with nonflammable grease solvent.
   c. Dab screw with epoxy adhesive to secure.
   d. Provide DES as shown on drawings only.

2.14 DUCTWORK LAGGING

A. Acoustic Insulation: 2-inch thick, 3 to 5 lb/cu ft density glass fiber or mineral wool insulation.

B. Covering: Gypsum board with surface weight minimum 4 lb/sq ft.

2.15 SEISMIC RESTRAINTS – Refer to 23 05 49.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. Verify equipment, ductwork and piping is installed before work in this section is started.

3.2 EXISTING WORK

A. Provide access to existing piping and ductwork and other installations remaining active and requiring access.

B. Extend existing piping and ductwork installations using materials and methods compatible with existing electrical installations.

3.3 INSTALLATION

A. Support duct silencers rigidly to ductwork. Refer to Section 23 33 00.

B. Lag ductwork, where indicated by wrapping with insulation and covering. Apply covering to be airtight. Do not attach covering rigidly to ductwork.

C. Install isolation for motor driven equipment.

D. Bases:

1. Set steel bases for 1 inch clearance between housekeeping pad and base.
2. Set concrete inertia bases for 2 inch clearance between housekeeping pad and base.

E. Adjust equipment level.

F. Install spring hangers without binding.

G. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

H. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

I. Provide pairs of horizontal limit springs on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans.

J. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05 inch maximum clearance. Provide other snubbers with clearance between 0.15 inch and 0.25 inch.

K. All equipment, piping, etc., shall be mounted on or suspended from approved foundations and supports, all as specified herein, as shown on the drawings, or as required.

L. All floor-mounted equipment shall be erected on 4” high concrete pads over the complete floor area of the equipment, unless specified to the contrary herein. Wherever hereinafter vibration eliminating devices and/or concrete inertia blocks are specified, these items shall, in all cases, be in turn mounted upon 4” high concrete pads unless specified to the contrary herein.

M. The vibration isolation systems shall be guaranteed to have minimum one inch deflection or as indicated on the schedule or as specified.

N. Mounting sizes shall be determined by the mounting manufacturer, and the sizes shall be installed in accordance with the manufacturer's instruction.

O. The installed vibration isolation system for each floor or ceiling supported equipment shall have a maximum lateral motion under equipment startup or shutdown conditions of l/4”. Motions in excess shall be restrained by approved spring type mountings.

P. All mounting systems exposed to weather and other corrosive environments shall be protected with factory applied corrosion resistive materials.

Q. Where steel spring isolation systems are described in the specifications, the mounting assemblies shall utilize bare springs with the spring diameter not less than 0.8 of the loaded operating height of the spring. Each spring isolator shall be designed and installed so that the

ends of the spring remain parallel during and after the spring has reached specified minimum deflection. Springs shall have a reserve deflection of 50% of rated deflection before reaching solid.

R. Vibration isolation equipment submittal drawings shall include the following information:

1. Calculated isolation mounting deflections based on operating weight at each mounting point.
2. Spring diameters, compressed spring heights at rated load; solid spring heights, where steel spring isolation mountings are used.
3. Equipment operating speed.

S. Unless noted otherwise, spring isolators for fans shall have minimum static deflection, when operating at their lowest speed, in accordance with the following table:

Fan CFM	Minimum Static Deflection Inches
< 1,000	0.4"
1,000 to 10,000	1"
< 10,000	2"

T. All neoprene isolators shall have a minimum static deflection of 3/8 inch unless otherwise shown.

3.4 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect isolated equipment after installation and submit report. Include static deflections.

C. After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to mechanical equipment rooms, duct and pipe shafts, and other critical locations. Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements. Submit complete report of test results including sound curves.

D. Furnish services of testing agency to take noise measurement. Use meters meeting requirements of ANSI S1.4.

END OF SECTION 23 05 48

SECTION 23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.
7. Lockout devices.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 09 90 00 - Painting and Coating: Execution requirements for painting specified by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.
2. Commissioner’s color code, if any.

1.4 SUBMITTALS

A. Refer to DCAS General Conditions: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Samples: Submit two tags, labels and pipe markers used on project.

E. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories, and the City of New York's color code.

B. Maintain one (1) copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Craftmark Identification Systems.

2. Safety Sign Co.
3. Seton Identification Products
4. Or approved equal

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color: 2” x 1” x 1/8” thick with 1/4” high characters.

2.2 TAGS

A. Metal Tags:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Craftmark Identification Systems.
   b. Brady
   c. Seton Identification Products
   d. Or approved equal

2. Brass with stamped letters; tag size minimum 2 inches diameter with finished edges.

B. Information Tags:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Craftmark Identification Systems.
   b. Brady
   c. Seton Identification Products
   d. Or approved equal

2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

C. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.3 STENCILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Craftmark Identification Systems
2. Brady
3. Seton Identification Products
4. Or approved equal

B. Stencils: With clean cut symbols and letters of following size:

1. Ductwork and Equipment: 2 inches high letters.

C. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1 and the City of New York's color code.

B. Plastic Pipe Markers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Craftmark Identification Systems.
   b. Brady
   c. Seton Identification Products
   d. Or Approved Equal

2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

2.5 LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Craftmark Identification Systems.
2. Brady
3. Seton Identification Products
4. Or approved equal

B. Description: Aluminum size 1.9 x 0.75 inches, adhesive backed with printed identification.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.3 INSTALLATION

A. Apply stencil painting in accordance with Section 09 90 00.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with stencil painting. Identify in-line pumps and other small devices with tags.

G. Identify control panels and major control components outside panels with nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify air terminal units and radiator valves with numbered tags.

J. Tag automatic controls, instruments, and relays. Key to control schematic.

K. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

L. Identify ductwork with stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

M. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.4 SCHEDULES

A. Provide color-coded valve schedule for each system and enclose in Lexan frame.

END OF SECTION 23 05 53

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SECTION 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Testing, adjusting and balancing of air systems.
2. Testing, adjusting and balancing of hydronic and refrigerating systems.
3. Measurement of final operating condition of HVAC systems.
4. Sound measurement of equipment operating conditions.
5. Vibration measurement of equipment operating conditions.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 09 23 - Direct-Digital Control System for HVAC: Requirements for coordination between DDC system and testing, adjusting, and balancing work.
2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation for HVAC equipment.

1.3 REFERENCES

A. Associated Air Balance Council:

1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

C. Natural Environmental Balancing Bureau:

1. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty or a Copy of NEBB Certificate of Conformance Certification.

C. Prior to commencing Work, submit TAB contractor's qualification including the past five year experience and reference projects and proof of latest calibration date of each instrument.

D. Test Reports: Indicate data on either AABC MN-1 National Standards for Total System Balance forms, forms prepared following ASHRAE 111 or NEBB Report forms.

E. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

F. Submit draft copies of report for review prior to final acceptance of Project.

G. Furnish reports in soft cover, 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations. Reports shall be signed/sealed by a Professional Engineer in the state where the project is located.

H. Preliminary Effort:

1. Immediately after award of the HVAC Contract, the TAB Contractor shall review the Drawings and Specifications and shall indicate any deficiencies (or additional features) in the air or water systems which would preclude (or improve) proper adjusting or balancing. These include:
   a. Additional air volume dampers.
   b. Additional water balance devices.
   c. Installation of additional air flow measuring devices.
   d. Installation of additional "Pete's Plugs" ports, etc.

2. Submit for approval sample forms that he intends to use for tabulating balancing reports which shall include fan and pump or other equipment tags or labels. These forms should be similar to the AABC forms or NEBB equivalent.
3. Describe the instrumentation (including accuracy limitations) of each device proposed for use on this project for air and water balancing. As a minimum, instrumentation usage application and accuracy limitations acceptable on this project shall be those described in "HVAC Systems - Testing, Adjusting and Balancing" published by Sheet Metal and Air-Conditioning National Association, Inc. (SMACNA).

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of flow measuring stations balancing valves and rough setting.

C. Operation and Maintenance Data: Furnish final copy of testing, adjusting and balancing report inclusion in operating and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NYCBC.

B. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance, ASHRAE 111 or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

C. Prior to commencing Work, calibrate each instrument to be used. Upon completing Work, recalibrate each instrument to assure reliability.

1.7 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum five (5) years documented experience certified by AABC or Certified by NEBB.

B. Perform Work under supervision of AABC registered professional engineer experienced in performance of this Work and licensed in State of New York.

1.8 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.9 SEQUENCING

A. Refer to DCAS General Conditions: Work sequence.

B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.10 SCHEDULING

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. Schedule and provide assistance in final adjustment and test of life safety smoke evacuation and smoke control systems with Fire Authority.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 EXAMINATION

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Smoke, fire and volume dampers are in place and operational.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized. Duct leak tests are approved
12. Hydronic systems are flushed, filled, vented and pressure tested.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place or in normal position.
15. Service and balancing valves are open.

3.3 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to the Commissioner to facilitate spot checks during testing.

C. Periodic inspections of the Project during construction

1. Prior to commencement of balancing, the TAB Contractor shall make periodic inspections of the project during construction (as noted below) and shall report in writing to the Commissioner any deviations from Contract Documents relating to testing, balancing, and adjustment work concerning:
   a. Equipment:
      1) Installation
      2) Placement
   b. Inaccessible installation of the following balancing hardware:
      1) Ports

2) Plugs
3) Balance damper handles
4) Other such items

3.4 EXECUTION

A. Assist Division 26 Contractors to set up and test smoke control systems, as part of his Fire Alarm System.

B. The HVAC Contractor and its selected and approved balancing firm shall report to and review the work required with the Commissioner prior to beginning of work. At least two (2) one-day inspections of the Water and Air Systems at appropriate times during construction shall be made by the balancing firm and it shall report its findings to the Commissioner. All openings, pressure taps, wells and closures required, over and above those shown on the drawings, to perform the required test and adjustments shall be installed during or after construction at no additional cost to the City of New York.

C. The Contractor shall furnish all services for a minimum of two complete adjustments of water systems and air handling and exhaust systems, water and air distribution and controls, for the first cooling season and for the first heating season after the job is in complete operation under load conditions.

D. During all tests, it shall be demonstrated that the systems are free from leaks and that all parts of the system will operate correctly. The Balancing firm shall make final adjustments to all equipment and controls as may be required for proper operation, maintaining correct temperatures in all parts of the building. Controls shall be adjusted by the Control Manufacturer's mechanics on the advise of the balancing firm.

E. The final test report shall include appropriate reference to all problems regarding the system(s) encountered prior to, during and after testing and what action should be taken to correct the problem(s), including noise and vibration.

F. The following work shall be included by the balancing firm:

1. Supervise the balancing of all water circulation systems and parts thereof installed under this Contract to obtain the water quantities and temperature drops in all parts of the system specified in the plans and in the specifications, or as required by the Professional.
2. Supervise the balancing of the air conditioning and ventilating systems to achieve the air quantities specified at each air inlet, outlet and damper shown on the plans at the proper conditions of static pressure and temperature differential. Conduct all leakage tests on high (pressure) velocity ductwork in a manner acceptable to the Commissioner. Leakages shall not exceed 3% of total air to be delivered.
3. Enlist and provide cooperation of equipment manufacturer where needed to obtain proper equipment performance. Change motor or fan sheaves to field design capacity or most efficient operation conditions as required.
4. Study and report on noise and vibration problems which may develop in the course of system balancing.
5. Submit separate reports on the cooling and heating water circulating systems, ATC system, and heating and ventilating systems. These reports shall certify test methods and instruments used, all readings obtained, temperature and pressure drops, RPM of

equipment, amperage of all motors, air quantities at each outlet supply, return and air balancing problems encountered, and suggestions. Reports to be submitted to the Commissioner and the City of New York shall include data on all tests in the form normally used by AABC and NEEB. The reports must, however, be varied to suit these specifications. Reports shall include fan and pump curves for the final speeds developed from the fan manufacturer's performance test data for all major equipment and schematics for all systems tested.

6. Perform tests on heating systems when the outside temperature is averaging less than 30°F and on cooling systems when the outside temperature is above 80°F.
7. Instruct the Building Maintenance employees for a minimum of two weeks during the adjusting and balancing period. Obtain signed statements form each employee verifying this instruction has been received by each.
8. Carry out the "start-up" of the various systems with the Contractor and with any necessary assistance of the equipment manufacturer's representative.
9. Furnish all instruments and provide all instrumentation required to perform the above work. The equipment and instrumentation shall remain the property of the balancing subcontractor, however, all equipment must be first approved by the Commissioner before being used on the project.
10. Assist the Commissioning Agent to complete he project commissioning procedure.

3.5 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 5 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 5 percent of design.

3.6 ADJUSTING

A. Refer to DCAS General Conditions: Testing, adjusting and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the City of New York.

H. Prior to starting of balancing work, the Contractor shall:

1. Adjust all balancing cocks and dampers open.
2. Fill, vent, and clean all water systems.
3. Place all equipment in operating condition.
4. Clean all strainers.
5. Remove all temporary air filters and install design filters.

I. For the duration of the balancing work, the Contractor shall:

1. Maintain mechanics at project at all times for system operation, trouble shooting, assistance, etc.
2. Adjust fan drives or blade pitch or replace sheaves as required to meet system performance requirements.
3. Provide necessary mechanical adjustments in conjunction with balancing procedure.
4. Replace all balancing valves or dampers in systems that cannot be manipulated to satisfy balancing requirements.

J. Standard size (5" x 8") index cards, i.e. "check-out cards", shall be enclosed in a Vinafilm binder securely attached to each device as per the above.

K. In cooperation with the Contractor, the TAB Contractor shall check and verify the satisfactory performance of static pressure of mass flow synchronization control loops and the ability of each control loop to hold a set-point and maintain stable fan or flow synchronization control. Operating tolerances for each loop set-point shall be obtained from the ATC Contractor.

L. The TAB Contractor shall use flow meters where they are required for taking data. This shall include the use of air flow metering stations for air flow measurement in preference to taking data via pitot-static tube traverses of ducts where such devices can be used. Where pitot-static tube traverses are performed, the TAB Contractor shall seal test holes with snap-in plugs or he shall use approved caps made for this purpose. The use of tape to seal test holes shall not be allowed.

M. Maintain specified acoustical performance of air systems; use dampering devices at air terminals to produce pressure drops not in excess of 0.15 in. w.g. for air balance trim.

N. With all boxes in the duct system set at maximum flow, the fan capacity output and static pressure capability shall be determined by measurement and it shall be recorded. Fan capacity deficiencies shall be noted, recorded and reported to the Commissioner for corrective action. Duct leakage estimates shall also be noted and recorded and, if in excess of specified allowable reported to the Commissioner for corrective action.

O. After satisfactory balance has been achieved, reset the duct system static pressure controller to the lowest set point compatible with scheduled air delivery.

P. Note and record any box controller limit setting by number where applicable.

Q. If the supply and return air flow serving a particular zone are synchronized for system self-balancing purposes, confirm by measurements the capacity and action of the self-balancing

control loop to track and maintain differential flow requirements. Instrument signal air supply pressures will be recorded where possible, depending upon the control loop's supplier.

R. The aim of all balancing adjustments shall be the minimum use of energy for fluid transport.

S. All fans should be set at their lowest rpm or blade pitch to provide design flow; air dampers are to be used only for final trim.

T. TAB Contractor shall verify accuracy and calibrate all measurement devices (flow sensors, pressure sensors, temperature devices, etc.) provided by Controls Contractor.

3.7 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts. The intent is to utilize minimum site energy and all fan systems should be properly setup to their lowest rpm to achieve design flow rates. Air dampers are to be used for final trim only.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.

O. On fan powered VAV boxes, adjust airflow switches for proper operation.

P. Verify that leakage on terminal boxes is within the allowable rates, not to exceed 2 percent of design flow.

Q. For all air systems, testing shall be done in all modes including minimum outside air mode and 100% economizer mode, etc.

3.8 WATER SYSTEM PROCEDURE

A. Adjust water systems, after air balancing, to obtain design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.

C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

3.9 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing but not limited to the following:

1. HVAC Pumps.
2. Heat Exchangers.
3. Water Cooled Condensing Units.
4. Air Coils.
5. Terminal Heat Transfer Units (Unit heaters, cabinet unit heaters)
6. Air Handling Units.
7. Fans.
8. Air Filters.
9. Air Terminal Units.

10. Air Inlets and Outlets.

B. Report Forms:

1. Title Page:
   a. Name of Testing, Adjusting, and Balancing Agency
   b. Address of Testing, Adjusting, and Balancing Agency
   c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
   d. Project name
   e. Project location
   f. Project Contractor
   g. Project altitude
   h. Report date
2. Summary Comments:
   a. Design versus final performance
   b. Notable characteristics of system
   c. Description of systems operation sequence
   d. Summary of outdoor and exhaust flows to indicate building pressurization
   e. Nomenclature used throughout report
   f. Test conditions
3. Instrument List:
   a. Instrument
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Range
   f. Calibration date
4. Electric Motors:
   a. Manufacturer
   b. Model/Frame
   c. HP/BHP and kW
   d. Phase, voltage, amperage; nameplate, actual, no load
   e. RPM
   f. Service factor
   g. Starter size, rating, heater elements
   h. Sheave Make/Size/Bore
5. V-Belt Drive:
   a. Identification/location
   b. Required driven RPM
   c. Driven sheave, diameter and RPM
   d. Belt, size and quantity
   e. Motor sheave diameter and RPM
   f. Center to center distance, maximum, minimum, and actual
6. Pump Data:
   a. Identification/number
   b. Manufacturer
   c. Size/model

d. Impeller
e. Service
f. Design flow rate, pressure drop, BHP and kW
g. Actual flow rate, pressure drop, BHP and kW
h. Discharge pressure
i. Suction pressure
j. Total operating head pressure
k. Shut off, discharge and suction pressures
l. Shut off, total head pressure

7. Sound Level Report:
   a. Location
   b. Octave bands - equipment off
   c. Octave bands - equipment on
   d. RC level - equipment on
8. Vibration Test:
   a. Location of points:
      1) Fan bearing, drive end
      2) Fan bearing, opposite end
      3) Motor bearing, center (when applicable)
      4) Motor bearing, drive end
      5) Motor bearing, opposite end
      6) Casing (bottom or top)
      7) Casing (side)
      8) Duct after flexible connection (discharge)
      9) Duct after flexible connection (suction)
   b. Test readings:
      1) Horizontal, velocity and displacement
      2) Vertical, velocity and displacement
      3) Axial, velocity and displacement
   c. Normally acceptable readings, velocity and acceleration
   d. Unusual conditions at time of test
   e. Vibration source (when non-complying)

3.10 FINAL APPROVAL

A. Contract shall include an extended period of 120 days after submittal of the final certified test report (approved by the Commissioner) for a given system, during which time the City of New York may request a spot check, retest and/or resetting of any outlet or other item as listed in the certified test report; however, this request may not exceed 10% of the outlets or devices on each central system.

B. If more than 5% of the total devices on a given central system test outside the prescribed limits set for air balance, the City of New York shall have the option of revoking the test report and requiring a complete rebalance of the system in question.

C. If a retest or spot check is requested, the TAB Contractor shall provide technicians and instruments in making any tests required during this period.

D. Final acceptance will not be accorded the certified test report until the extended period of 120 days has expired.

END OF SECTION

SECTION 23 07 00 HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. HVAC piping insulation, jackets and accessories.
2. HVAC equipment insulation, jackets and accessories.
3. HVAC ductwork insulation, jackets, and accessories.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 09 90 00 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.3 REFERENCES

A. ASTM International:

1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
4. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
5. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
6. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
7. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
8. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
9. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
10. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
11. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
12. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

13. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
14. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
15. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
16. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
17. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
18. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
19. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
20. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
21. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
22. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
23. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors':

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
2. UL 1978 - Standard for Safety for Grease Ducts.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Samples: Submit two (2) samples of representative size illustrating each insulation type.

D. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84, UL 723 and NFPA 258.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Perform Work in accordance with NYCBC.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 GLASS FIBER AND MINERAL FIBER INSULATION

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed
2. Knauf
3. Johns Manville
4. Owens-Corning
5. Or approved equal

2.2 CLOSED CELL ELASTOMERIC INSULATION

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. Aeroflex. Aerocell.
2. Armacell, LLC. Armaflex.
3. Nomaco. K-flex.
4. Or approved equal

B. Furnish materials in accordance with NYCBC.

2.3 PIPE INSULATION

A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.

1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Operating Temperature Range: 0 to 850 degrees F.
3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.
5. Density 10 PCF average.

B. TYPE P-3: ASTM C547; semi-rigid, fibrous glass board noncombustible, end grain adhered to jacket.

1. Thermal Conductivity: 0.27 at 75 degrees F (0.040 at 24 degrees C).

2. Operating Temperature Range: 0 to 650 degrees F (minus 18 to 343 degrees C).

3. Vapor Barrier Jacket: ASTM C1136, Type II, factory applied reinforced foil kraft with self-sealing adhesive joints.

4. Jacket Temperature Limit: minus 20 to 150 degrees F (minus 29 to 66 degrees C).

5. Density 3.5 PCF minimum.

C. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.

1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

2.4 PIPE INSULATION JACKETS

A. PVC Plastic Pipe Jacket:

1. Product Description: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.
2. Thickness: 10 mil.
3. Connections: Pressure sensitive color matching vinyl tape.

B. Aluminum Pipe Jacket:

1. ASTM B209.
2. Thickness: 0.016 inch thick sheet.
3. Finish: Smooth.
4. Joining: Longitudinal slip joints and 2-inch laps.
5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3 inches wide; 1/8 inch thick aluminum.

C. Field Applied Glass Fiber Fabric Jacket System:

1. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
2. Glass Fiber Fabric:
   a. Cloth: Untreated; 9 oz/sq yd weight.
   b. Blanket: 1.0 lb/cu ft density.
   c. Weave: 5 x 5

3. Indoor Vapor Retarder Finish:
   a. Cloth: Untreated; 9 oz/sq yd weight.
   b. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.5 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: Steel saddle. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

G. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

H. Adhesives: Compatible with insulation.

I. Removable and Reusable Valve Wraps:

1. Wraps shall be designed for use on insulated pipe systems.
2. Wraps shall be rated for indoors and outdoor use and be UV resistant.
3. Wraps shall be provided with a heavy duty Velcro closure system to allow easy removal and replacement of the wrap.
4. Outer cover of the wrap shall be heavy duty type designed to resist punctures and tears and shall be waterproof.
5. Operating Temperature Range: 0 to 450 degress F.
6. Fire/Smoke Performance (ASTM E 84):
   a. Flame Spread: < 25
   b. Smoke Developed: < 50
7. Jacket Thickness: 10 mils
8. Water Vapor Transmission (ASTM E 96): 0.01 Perms at 37.8C/100F-RH/100%
9. Mullen Burst (STNM D3786-87): 65 PSI
10. Breaking Strength Grab (mc/cd) – (ASTM D5034-90): 43/49 lbs.
11. Tearing Strength Trapezoid (mc/cd) – (ASTM D1117-80): 7/5 lbs.
12. Grade: weatherable
13. Color: white, gloss finish
14. Provide quantity of insulation inserts as required for proper installation with applicable piping system (i.e.: piping insulation thickness and operating temperatures).

2.6 EQUIPMENT INSULATION

A. Type E-2: ASTM C612; glass fiber, rigid board, noncombustible with factory applied reinforced aluminum foil jacket.

1. Thermal Conductivity: 0.24 at 75 degrees F.
2. Operating Temperature Range: 0 to 450 degrees F.
3. Density: 3.0 pound per cubic foot.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

B. TYPE E-5: ASTM C612; glass fiber, semi-rigid board, noncombustible.

1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Maximum Operating Temperature: 850 degrees F.
3. Density: 3.0 pound per cubic foot.

C. Type E-8: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.

1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Operating Temperature Range: Range: Minus 70 to 220 degrees F.

2.7 EQUIPMENT INSULATION JACKETS

A. Aluminum Equipment Jacket:

1. ASTM B209.
2. Thickness: 0.016 inch thick sheet.
3. Finish: Smooth.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

B. Field Applied Glass Fiber Fabric Jacket System:

1. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
2. Glass Fiber Fabric:
   a. Cloth: Untreated; 9 oz/sq yd weight.
   b. Blanket: 1.0 lb/cu ft density.
   c. Weave: 10 x 10.

3. Indoor Vapor Retarder Finish:
   a. Cloth: Untreated; 9 oz/sq yd weight.
   b. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.8 EQUIPMENT INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

2.9 DUCTWORK INSULATION

A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.

1. Thermal Conductivity: 0.25 at 75 degrees F.
2. Maximum Operating Temperature: 250 degrees F.
3. Density: 1.5 pound per cubic foot.

B. TYPE D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied all service facing meeting ASTM C1136, Type II.

1. Thermal Conductivity: 0.22 at 75 degrees F.
2. Density: 4.25 pound per cubic foot.

C. TYPE D-4: ASTM C1071, Type I, flexible, glass fiber duct liner with coated air side.

1. Thermal Conductivity: 0.24 at 75 degrees F.
2. Density: 1.5 pound per cubic foot.
3. Maximum Operating Temperature: 250 degrees F.
4. Maximum Air Velocity: 2,000 feet per minute.
5. 1 inch minimum.
6. Treated with EPA register anti-microbial agent proven to resist microbial growth as determined by ASTM G-21 and G-22.

2.10 DUCTWORK INSULATION JACKETS

A. Outdoor Duct Jacket: Flexible self-adhering weatherproof system similar to Flex Clad 250 or approved equal.

B. Membrane Duct Jacket: ASTM D4637; Type I, EPDM; non-reinforced, 0.060 inch thick, 48-inch wide roll; white color.

2.11 DUCTWORK INSULATION ACCESSORIES

A. Vapor Retarder Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

B. Vapor Retarder Lap Adhesive: Compatible with insulation.

C. Adhesive: Waterproof, ASTM E162 fire-retardant type.

D. Liner Fasteners: Galvanized steel, welded with integral head.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Lagging Adhesive: Fire resistive to ASTM E84, NFPA 255 and UL 723.

G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.

H. Adhesives: Compatible with insulation.

I. Membrane Adhesives: As recommended by membrane manufacturer.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. Verify piping, equipment and ductwork have been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.3 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.

C. Piping Systems Conveying Fluids Below Ambient Temperature:

1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump and expansion joints.
2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
3. Insulate fittings, joints, valves and all appurtenances with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.

D. Glass Fiber Board Insulation:

1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

E. Hot Piping Systems less than 140 degrees F:

1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, valves and all appurtenances with molded insulation of like material and thickness as adjoining pipe. Finish with PVC fitting covers.
3. Insulate unions and flanges.

F. Hot Piping Systems greater than 140 degrees F:

1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, valves and all appurtenances with molded insulation of like material and thickness as adjoining pipe. Finish with PVC fitting covers.
3. Insulate flanges and unions.

G. Inserts and Shields:

1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
2. Piping 2 inches Diameter and Larger: Install saddle between support shield and piping and under finish jacket.

H. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.

I. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.

1. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.
2. Inserts between the pipe and pipe hangers shall consist of rigid pipe insulation of equal thickness to the adjoining insulation and shall be provided with vapor barrier where required. Insulation inserts shall be not less than following lengths:
   a. 2-1/2 in. pipe size and smaller: 6 in. long
   b. 3 in. to 6 in. pipe size: 9 in. long
   c. 8 in. to 10 in. pipe size: 12 in. long
   d. larger than 10 in. pipe size: 18 in. long

J. Insulation Terminating Points:

1. Ducted Coil Branch Piping: Terminate hot water piping at the coil connections including coil header.
2. Condensate Piping: Insulate entire piping system and components to prevent condensation.

K. Closed Cell Elastomeric Insulation:

1. Push insulation on to piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer’s recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

L. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh

reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.

M. Heat Traced Piping Interior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracing.

N. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Aluminum jacket and fitting covers.

O. Heat Traced Piping Exterior to Building: Insulate fittings, joints, valves and all appurtenances with molded insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water.

P. Prepare pipe insulation for finish painting. Refer to Section 09 90 00.

Q. Insulation at Strainers: Provide removable insulation.

R. Insulation at automatic control valves and combo/specialty valves (i.e.: combo ball/union/drain, combo ball/strainer/PT/union/drain, etc.): Provide removable and reusable wrap. Wrap shall be installed to prevent condensation on chilled/condenser/makeup water applications and provide thermal insulation for hot water applications.

3.4 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Below Ambient Temperature:

1. Insulate entire equipment surfaces.
2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
4. Finish insulation at supports, protrusions, and interruptions.

E. Equipment Containing Fluids 140 degrees or Less:

1. Insulate flanges and unions with removable sections and jackets.

2. Install insulation with factory-applied or field applied jackets, with vapor barrier. Finish with glass cloth and adhesive.
3. Finish insulation at supports, protrusions, and interruptions.

F. Equipment Containing Fluids Over 140 degrees F or Less:

1. Insulate flanges and unions with removable sections and jackets.
2. Install insulation with factory-applied or field applied jackets, with vapor barrier. Finish with glass cloth and adhesive.
3. Finish insulation at supports, protrusions, and interruptions.

G. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with aluminum jacket.

H. Equipment Located Exterior to Building: Install vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.

I. Cover glass fiber, cellular glass, hydrous calcium silicate insulation with metal mesh and finish with heavy coat of insulating cement and aluminum jacket.

J. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

K. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

L. Prepare equipment insulation for finish painting. Refer to Section 09 90 00.

3.5 INSTALLATION - DUCTWORK SYSTEMS

A. Duct dimensions indicated on Drawings are finished inside dimensions.

B. All supply, return, outside air, spill air and exhaust air ducts shall be insulated throughout unless specifically noted otherwise. Insulation thicknesses and densities shall meet code required R-values for insulation as installed.

C. Insulated ductwork conveying air below ambient temperature:

1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ductwork conveying air above ambient temperature:

1. Provide with or without standard vapor retarder jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with aluminum jacket.

F. External Glass Fiber Duct Insulation:

1. Secure insulation with vapor retarder jacket with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
2. Secure insulation without vapor retarder jacket with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

G. Duct and Plenum Liner:

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.
6. Provide metal nosings at section joints.

H. Ducts Exterior to Building:

1. Install insulation according to external duct insulation paragraph above.
2. Provide external insulation with vapor retarder jacket. Cover with outdoor jacket finished as specified in this Section.
3. Finish with membrane duct jacket.
4. Calk seams at flanges and joints. Located major longitudinal seams on bottom side of horizontal duct sections.

I. Prepare duct insulation for finish painting. Refer to Section 09 90 00.

3.6 SCHEDULES

A. Cooling Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Condenser Water Supply and Return piping	P-1	All	1.5
Condensate Piping from Cooling Coils and drains	P-1	All	0.75

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Refrigerant	P-5	All	1.5

B. Heating Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Heating Water Supply and Return	P-1	1-1/4 inches and smaller	1.5
		1-1/2 inches to 8 inches	2.0
		10 inches and up	2.5
Low Pressure Steam Supply and condensate return up to 15 psi up to 250 degrees F	P-1 P-3	3 inches and smaller	2.5
		4 inches and up	3.0
Drain Piping	P-1	All	1.0

C. Equipment Insulation Schedule:

EQUIPMENT	INSULATION TYPE	INSULATION THICKNESS inches
Steam-to-Water Heat Exchanger	E-5	3.0
Water-to-Water Heat Exchangers	E-2	1.5
Hot Thermal Storage Tanks	E-2	1.5
Condensate Tanks	E-2	1.5
Hot Water Air Separators	E-8	1.5
Hot Water Expansion Tanks	E-8	1.5
Water Filtration System (i.e.: Tank)	E-8	1.5

D. Ductwork Insulation Schedule:

DUCTWORK SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches
Outside Air Intake	D-2	2
Equipment Casings	D-2	2

DUCTWORK SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches
Supply Ducts (internally insulated) in MER's or as specified	D-4	1.5
Return Ducts (internally insulated) in MER's or as specified	D-4	1.5
Supply Ducts concealed above ceilings that are not internally insulated	D-1	1.5
Return Ducts concealed above ceilings that are not internally insulated	D-1	1.5
Supply Ducts visible above wood slat ceilings that are not internally insulated	D-2	1.5
Return Ducts visible above wood slat ceilings that are not internally insulated	D-2	1.5
Spill/exhaust ducts from louver to motorized damper where not internally lined	D-2	1.5
Ductwork located outdoors.	D-2	2.0
Exhaust Ducts Within 10 feet of Exterior Openings.	D-2	1.5
Supply Ducts Downstream of Variable Air Volume Boxes (internally insulated)	D-4	1.5
Fire-rated duct wrap (as indicated on drawings)	D-3	2.0
Transfer Air Ducts (internally insulated)	D-4	1.0

E. Refer to Section 23 05 48 "Noise and Vibration Controls for HVAC Piping and Equipment" for specific applications of internally insulated ducts.

END OF SECTION 23 07 00

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SECTION 23 08 00 – COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including contract conditions and the scope of work document, and other Division 01 specification sections, apply to this section.

B. Owner's Project Requirements and Basis-of-Design documentation if included are for reference information only.

C. The following specification sections contain information related to the design, installation, testing, and acceptance of the HVAC equipment:

1. Specification Section 01 91 13 – General Commissioning Requirements

1.02 EQUIPMENT SUMMARY

A. This section lists the mechanical equipment items that will be commissioned as a part of the project scope:

1. Building automation system

2. All equipment of the building ventilating, exhaust and air conditioning systems;

a. DOAS units
b. Electric Duct Heaters
c. CRAC units
d. VRF Systems
e. Condensing Units
f. Hot Water Radiant Panels
g. Water Pumps
h. Heat Exchangers

3. The detailed list of HVAC equipment to be commissioned is specified as part of the commissioning plan issued by the commissioning agent

1.03 DEFINITIONS

A. B.A.S. – “Building Automation System”

B. CM – “Construction Manager”

C. CxA – “Commissioning Authority”

D. DOR – “Designer of Record”

E. DDC – “Direct Digital Control”

F. FPT – “Functional Performance Test”

G. HVAC&R – “Heating, Ventilation, Air Conditioning, and Refrigeration”

H. "Systems," "Subsystems," "Equipment," and "Components" – Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

I. PFC – ”Pre-functional (construction) checklist”

J. T.A.B. – “Testing, Adjusting, and Balancing”

1.04 COMPENSATION

A. Should Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.

1. Failure to provide timely notice of commissioning activities schedule changes.

2. Failure to meet the acceptance criteria for test demonstrations.

1.05 DOCUMENTATION

A. MEP Design Review

1. The CxA will perform a commissioning focused design review of the MEP Drawings and specifications for the project and issue comments to the DOR

2. The DOR is responsible for formally addressing each comment issued by the CxA

B. Informational Equipment Submittal

1. Equipment submittals will be submitted for approval by the CM to the Owner, DOR, and CxA to be reviewed concurrently

2. Each equipment submittal is required to contain (at a minimum) the following information:

a. Manufacturer Name
b. Model Number
c. Quantity
d. Installed Options
e. Unit Dimensions
f. Maximum Heating / Cooling Load
g. Electrical Criteria
h. Installation Requirements
i. Wiring Diagrams

j. Performance / Efficiency Ratings
k. Parts Listing
l. Warranty Information

3. Submittal Review Process

a. The submittal review process begins once the CM submits the equipment submittals to the Owner, DOR, and CxA for review and approval.
b. The CxA will review each submittal within seven (7) days of receipt and provide comments directly to the DOR.
c. The DOR will be responsible for deciding whether or not to include the CxA's submittal review comments in their official response to the CM.

C. Pre-Functional (Construction) Checklists

1. PFCs are documents that will be developed by the CxA and completed by the appropriate sub-contractor to confirm that the equipment has been installed per the manufacturer's instruction and in accordance with the approved equipment submittal and relevant specification section

2. Completed PFCs will be utilized as confirmation that the installed equipment is ready to be scheduled for functional testing. Any deviations in installation from the contract documents, manufacturer's recommendations, or design specifications will be noted as a deficiency and recorded on the Commissioning Issues Log

3. Checklist criteria should include (but is not limited to) the following:

a. Manufacturer Name
b. Model Number
c. Serial Number
d. Electrical Criteria
e. Location (i.e. floor, room name / number, etc.)
f. Filter presence (if applicable)
g. Exterior disposition (e.g. cracked, dented, damaged)
h. Deficiencies found during installation

4. Start-up reports are to be issued by the equipment manufacturer or responsible subcontractor to the CxA in addition to the PFCs completed by the CM or subcontractor

D. Duct and Pipe Leakage and cleaning

1. Duct and plenum systems shall be leak pressure-tested in accordance with the procedure outlined in SMACNA-HVAC Air Duct Leakage Test Manual at the specified test pressures and leakage classes.

2. All steam, steam condensate and/or hydronic piping systems shall be hydrostatically tested. Pneumatic testing is not acceptable.

Hydrostatic pressure tests for water and steam piping systems shall include the respective equipment (including valves, strainers, etc.) unless the test pressure exceeds the manufacturer's maximum allowable test pressure as obtained by the Mechanical Contractor.

All required leak testing shall be completed prior to the application of insulation.

3. The CxA must witness all flushing and cleaning of piping.

E. FUNCTIONAL PERFORMANCE TESTS

1. Functional performance tests are documents developed by the CxA and executed by the HVAC&R contractor

2. The CxA requires the approved equipment submittal, sequence of operations, control submittal and completed PFC, and TAB report prior to scheduling functional testing

3. The purpose of the FPTs is to test the operation of the equipment in its various modes of operation. Some modes that may be tested as a part of the equipment's sequence of operations are:

   a. Un-Occupied Mode
   b. Occupied Mode
   c. Hand-OFF-Auto
   d. Heating Mode
   e. Cooling Mode
   f. Emergency Power Mode
   g. Alarms

4. Any deviation in operation from the approved sequence of operations will be recorded as a deficiency and included on the commissioning Deficiency Log which will be issued in its entirety at the culmination of functional testing

F. ISSUES LOG

1. The commissioning issues log is a spreadsheet constructed by the CxA that details all of the installation and operational deficiencies found during the pre-functional and functional testing stages for each equipment item.

2. A deficiency is defined as follows:

   a. Any deviation in the equipment's installation in comparison to the approved equipment submittal, contract drawings, or relevant design specification
   b. Any deviation in an equipment's operation in comparison to the approved sequence of operations, or relevant design specification

3. Once a deficiency is identified by the CxA, it will be added to the deficiency list and marked "OPEN". The list is distributed to the project team where it becomes the CM's responsibility to rectify the issue. Once the issue is addressed, the CxA

will confirm that the CM has corrected the deficiency and mark the deficiency as "CLOSED" on the deficiency list.

4. The Owner will serve as the arbiter in the event that CM and the CxA disagree on a perceived deficiency.

G. Systems Manual

1. Provide operating instructions and maintenance data books for all equipment and materials furnished under this division to the CxA.

2. Submit one (1) copy of operation and maintenance manuals in searchable electronic format (PDF) for review at least ten (10) weeks before Final Review of the project.

3. Operation and maintenance manuals shall include complete periodic maintenance schedules, lubrication, cleaning and servicing data compiled in clearly and easily understandable form. Data shall show serial numbers and model numbers of each piece of equipment, complete lists of replacement parts (including part numbers), motor ratings and actual loads.

4. Include the following information where applicable:

1. Name, location and phone number of nearest service agency and phone number for 24-hour manufacturer service hotline.

2. Narrative describing system operation.

3. Identifying name and mark number.

4. Locations of major equipment (where several similar items are used, provide a list).

5. Complete nameplate data.

6. "Final Reviewed" submittals.

7. Parts lists.

8. Performance curves and data.

9. Wiring diagrams.

10. Lubrication charts.

11. Manufacturers' recommended operation and maintenance instructions with all non-applicable information deleted.

12. List of spare parts recommended for normal service requirements.

13. Assembly and disassembly instructions with exploded view drawings where

available.

14. Troubleshooting diagnostic instructions where available.

15. Description of alarm and trouble codes for software-based systems.

16. Manufacturer recommended and actual set points.

H. FINAL COMMISSIONING REPORT

1. The final commissioning report is developed by the CxA and is a cumulative review of the commissioning process for the project.

2. The results of the functional testing, deficiency resolution, final equipment disposition, and recommendations for on-going systems monitoring and maintenance are included in the report

3. A list of appendices contained in the Final Commissioning Report include:

a. Table of Contents (With Links)
b. Executive Summary (Open Issues shall be highlighted at the beginning)
c. Equipment List
d. Final Commissioning Plan
e. Completed and Blank Pre-Functional Checklists
f. Completed and Blank Functional Performance Tests
g. Completed Deficiency Log
h. Field Observation Reports
i. Start-up Reports
j. TAB Report
k. MEP Static Test Results
l. Training Sign-In Sheets
m. As-Builts

1.06 QUALITY ASSURANCE

A. Testing Equipment, Instrumentation Quality, and Calibration

1. All test equipment used during the commissioning phase of the project will possess the following:

a. Certificate of calibration certified with the date the test equipment was last calibrated
b. Manufacturer, model number, and serial number

2. All test equipment will be capable of meeting the following criteria:

a. Capable of testing and measuring performance within the specified acceptance criteria
b. Calibrated at the manufacturer’s recommended intervals with current calibration tags permanently affixed to the instrument
c. Maintained in good repair and operating condition throughout the

duration of us on the project

d. Recalibrated or repaired if damaged in any way while being used on the project

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 GENERAL EXECUTION REQUIREMENTS

A. Schedule and coordinate commissioning with the construction schedule.

B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.

C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies.

D. Included in the Commissioning Plan is a detailed list of the test demonstrations.

E. Report test data and commissioning issue resolutions.

F. Schedule personnel to participate in and perform Commissioning-Process Work.

G. Installing contractors' commissioning responsibilities include, but are not limited to, the following:

1. Operating the equipment and systems they install during tests.

2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

3.02 HVAC TESTING REQUIREMENTS

A. The commissioning testing schedule will be determined by the CM upon submission of the requisite documentation and completion of equipment installation.

1. The CxA must be notified three (3) business days in advance of the proposed testing date

2. The CxA will make the functional test forms available to the CM in advance of testing

3. The CM (and mechanical contractor) will be responsible for providing the appropriate test equipment to complete functional testing

B. The following requirements are the sole responsibility of the CM and mechanical subcontractors to complete prior to functional testing by the CxA:

1. Certify in writing that all HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the contract documents, approved shop drawings, and submittals.

2. Certify in writing that TAB procedures have been completed and that TAB reports have been submitted to the EOR and CxA for review, discrepancies corrected, and corrective work approved

3. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (e.g. normal, hand, off, auto, occupied, etc.)

4. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions to verify compliance with acceptance criteria

5. Provide personnel capable of accessing, operating, and making changes (if necessary) to the unit

6. Perform functional performance tests written by the CxA, with the CxA in attendance

7. Resolve commissioning deficiencies in a timely fashion and notify the CxA once corrective action is completed

C. Testing should be performed using design conditions whenever possible, however, simulated conditions may be used (e.g. BAS temperature manipulation, shorting sensors, etc.) to test specific modes if deemed necessary by the CxA

D. The sampling method of testing is used when functional testing of large quantities of equipment is required.

1. The sampling method is used on only contractually agreed upon equipment items

2. In the event that 10% of the sample size fails functional testing, the remainder of the sample size will be considered to have failed as well. It will be incumbent upon the CM to resolve the issue and contact the CxA for retesting

E. Deferred (seasonal) testing is only required when functional testing is dependent on the presence of a significant building heating and/or cooling load that cannot be simulated manipulating system set points via the BAS

F. Retesting of commissioned equipment will be required if:

1. 10% of a sample size of equipment fails functional testing

2. Equipment is not ready to be commissioned at the designated testing date

+ + END OF SECTION + +

SECTION 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Control panel enclosures.
2. Thermostats.
3. Alarm system.
4. Control air dampers.
5. Electric damper actuators.
6. Control valves.
7. Electric valve actuators.
8. Direct digital control system components.
9. Differential pressure monitor.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for electric motors.
2. Section 23 09 23 - Direct-Digital Control System for HVAC.
3. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for thermometer sockets and gage taps for placement by this section. Installation requirements for piping products furnished in this section.
4. Section 23 33 00 - Air Duct Accessories: Product requirements for duct mounted thermometers. Installation requirements for dampers and other duct mounted products furnished in this section.

1.3 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality.

C. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

D. ASTM International:

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
2. ASTM A536 - Standard Specification for Ductile Iron Castings.
3. ASTM B32 - Standard Specification for Solder Metal.
4. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
5. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
6. ASTM D2737 - Standard Specification for Polyethylene (PE) Plastic Tubing.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. National Electrical Manufacturers Association:

1. NEMA DC 3 - Residential Controls - Electrical Wall Mounted Room Thermostats.
2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

G. National Fire Protection Association:

1. NFPA 72 - National Fire Alarm Code.
2. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate operating data, system drawings, wiring diagrams, and written detailed operational description of sequences.

C. Product Data: Submit description and engineering data for each control system component. Include sizing as required.

D. Manufacturer's Installation Instructions: Submit installation requirements for each control component.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors.

C. Operation and Maintenance Data: Submit inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.6 QUALITY ASSURANCE

A. Control Air Damper Performance: Test in accordance with AMCA 500.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience, and with service facilities within proximity of Project.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one (1) week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product storage and handling requirements.

B. Accept controls on site in original factory packaging Inspect for damage.

1.10 COORDINATION

A. Section 23 05 00: Requirements for coordination.

B. Coordinate installation of control components in piping systems with work of Section 23 21 16.

C. Coordinate installation of control components in duct systems with work of Section 23 33 00.

1.11 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

1.12 MAINTENANCE SERVICE

A. Refer to DCAS General Conditions: Requirements for maintenance service.

B. Furnish service and maintenance of control system for one (1) year from Date of Substantial Completion.

C. Furnish complete service of controls systems, including callbacks. Perform minimum of four (4) complete normal inspections of approximately eight (8) hours duration in addition to normal service calls to inspect, calibrate, and adjust controls. Submit written report after each inspection.

D. Furnish four (4) complete inspections per year to inspect, calibrate, and adjust controls. Submit written report after each inspection.

E. Examine unit components bi-monthly. Clean, adjust and lubricate equipment.

F. Include systematic examination, adjustment, and lubrication of unit, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.

G. Perform work without removing units from service during building normal occupied hours.

H. Provide emergency call back service at all hours for this maintenance period.

I. Maintain an adequate stock of parts locally, for replacement or emergency purposes. Ensure personnel availability to ensure fulfillment of this maintenance service without unreasonable loss of time.

J. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.

K. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of the City of New York.

1.13 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 CONTROL COMPONENT MANUFACTURERS

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. Honeywell, Building Control Solutions
2. Johnson Controls, Inc.
3. Siemens Building Technologies, Inc.
4. Or approved equal

2.2 CONTROL PANEL ENCLOSURES

A. Furnish for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. Construction: NEMA 250, Type 4 steel stainless steel enclosure.

C. Covers: Continuous hinge, held closed by flush latch operable by key.

D. Enclosure Finish: Manufacturer's standard enamel.

2.3 THERMOSTATS

A. Electric Room Thermostats:

1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
2. Service: cooling and heating one-step cooling and one-step heating.
3. Covers: Locking with set point adjustment and setpoint indication with thermometer.

B. Room Thermostat Accessories:

1. Thermostat Covers: Brushed aluminum.
2. Insulating Bases: For thermostats located on exterior walls.
3. Thermostat Guards: Locking transparent plastic-mounted on separate base.
4. Adjusting Key: Matching device.
5. Aspirating Boxes: For thermostats requiring flush installation.

C. Air-stream Thermostats:

1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
2. Averaging service remote bulb element: 20 feet.
3. Furnish with flange and shield.

2.4 ALARM SYSTEM

A. Enclosure Construction: NEMA 250, Type 4.

B. Furnish alarm panel with individual indication, horn, silenced acknowledge switch, and test switch.

C. At alarm condition indication, light flashes and alarm sounds. Horn stops when acknowledge switch is pushed and system indicates alarm conditions by continuous light until trouble condition has cleared. Alarm sounds again when second alarm occurs before first one has cleared.

D. Furnish remote panels with duplicate functions of primary panel. Furnish alarm silence/acknowledge switch to acknowledge alarm from each panel.

E. Furnish dry contacts at main alarm panel for use with remote alarm monitoring system to indicate each alarm condition.

2.5 CONTROL AIR DAMPERS

A. Performance: Test in accordance with AMCA 500.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage.

C. Blades: Galvanized steel, one-piece aerofoil blade, maximum blade size 8 inches wide, 48 inches long, minimum 22 gage , attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Neoprene mechanically attached, field replaceable.

E. Jamb Seals: Stainless steel spring.

F. Shaft Bearings: Lubricant free, stainless steel, single row, ground, flanged, radial, anti-friction type with extended inner race.

G. Linkage Bearings: Oil impregnated sintered bronze.

H. Control Air Damper Leakage: Maximum leakage rate of 3.0 cfm per square foot at 1.0 inches wg pressure differential.

I. Maximum Pressure Differential: 6 inches wg.

J. Temperature Limits: - 40 to 200°F.

2.6 ELECTRIC DAMPER ACTUATORS

A. Operation: Two-position or Reversing type proportional motor with spring-return as required by operational sequences.

B. Enclosure Rating: NEMA 250 Type 4.

C. Mounting: Direct mount.

D. Stroke: 90 seconds end to end full stroke, 15 seconds return to normal for spring return.

E. Protection: Electronic stall protection.

F. Control Input: 0-10 VDC or 4-20 mA DC.

G. Power: Nominal 24 volt AC.

H. Torque: Size for minimum 150 percent of required duty.

I. Duty cycle: rated for 65,000 cycles.

J. Accessories:

1. Cover mounted transformer.
2. Auxiliary potentiometer.
3. Damper linkage.
4. Direct drive feedback potentiometer.
5. Output position feedback.
6. Field selectable rotational, spring return direction, field adjustable zero and span.
7. End switch.

2.7 CONTROL VALVES

A. All control valves shall be fully proportioning, unless otherwise specified, quiet in operation and shall be arranged to fail safe, in either a normally open or normally closed position, in the event of power or instrument compressed air failure. The open or closed failure position shall be as specified or as required to suit process conditions. All heating valves shall be fail open; all cooling valves shall fail closed. Provisions shall be made for valves operating in sequence, with other valves or dampers, to have adjustable operating ranges and starting points to provide flexibility and adjustment in sequencing and throttling range.

B. Performance Requirements

1. Valves are to be sized and guaranteed to meet the requirements as specified and as indicated on the Drawings.
2. Unless otherwise specified, the following performance requirements shall be used for valve sizing:

C. All control valves shall have a manual override.

D. Flow Rates:

1. Normal flow rate: See equipment schedule on Drawings.
2. Minimum flow rates: 20:1 turndown for heat transfer equipment; 5:1 turndown for pump discharge throttling and for pressure reducing stations.
3. Maximum flow rate: To be considered only where specified or shown on the Drawings.

E. Pressure Drops:

1. The control valve operator shall be sized to shutoff against a differential pressure equal to the pump design head plus 30%.
2. Flowing pressure drop at design conditions: If not indicated on the drawings or in the Specifications, use 5 psi.

F. Cavitation:

1. Valve selections shall be free of cavitation over the whole range of performance. Obtain relevant upstream pressure for each valve prior to valve selection, and include the documentation for the cavitation check in the shop drawing submittal.
2. All valves will be checked for cavitation and noise during their shop drawing review. If any valve shows light incipient cavitation, it may be accepted, but only after consultation with the Commissioner. Any valve which suffers critical or damaging cavitation shall be replaced by the contractor without extra charge.

G. Ports and Trim:

1. Control valves shall be single-seated and shall have equal percentage flow characteristics.

H. Actuator for control valves shall be electric/electronic type or pneumatic type, as applicable.

I. Globe Pattern:

1. 2 inches and Smaller: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with back seating capacity packable under pressure.
2. 2-1/2 inches and Larger: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
3. Hydronic Systems:

J. Rate for service pressure of 125 psig at 250°F.

K. Replaceable plugs and seats of stainless steel.

L. Sizing: Size for 3 psig maximum pressure drop at design flow rate.

M. Furnish two-way valves with equal percentage characteristics. Furnish three way valves with linear characteristics. Size two way valve actuators to close valves against pump shut off head.

N. Ball Valves:

1. Threaded ends for 2-way valves 3 inches and smaller. Threaded ends for 3-way valves 2 inches and smaller.
2. Forged brass body, chrome plated brass ball and blowout proof stem and EPDM O-rings with minimum 600 psig rating.
3. Fluid Temperature Range: minus 20 to 250°F.
4. Sizing: 3 psig maximum pressure drop at design flow rate.
5. Flow Characteristics: Furnish 2-way valves with equal percentage characteristics. Furnish 3-way valves with equal percentage characteristic through control port and linear characteristic through bypass port.
6. Size 2-way valve actuators to close valves against pump shut off head.

O. Butterfly Valves:

1. Service Pressure Rating: 125 psig at 250°F.
2. Construction: ASTM A126 cast-iron or ASTM A536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
3. Body Style: Wafer, or Lug.
4. Disc: Stainless steel.
5. Resilient replaceable seat for service to 250°F.

P. Size for 1 psig maximum pressure drop at design flow rate.

1. Use only for open-close two-position operation.

Q. Terminal Unit Control Valves:

1. Brass body, Class 250, nickel plated brass ball, with optimizer insert for modulating applications, blow out resistant stem, threaded ends.
2. Two or three way as indicated in schedule or on Drawings.
3. Integral actuator.
4. Spring return required for unit ventilator heating valves and other terminal equipment with outside air.
5. Furnish non-spring return valves with manual override capability built into actuator.
6. Minimum Fluid Temperature: 20°F.
7. Maximum Operating Conditions: 250°F.
8. Sizing: 3 psig maximum pressure drop at design flow rate, to close against pump shutoff head.
9. Flow Characteristics: Furnish two-way and three-way valves with equal percentage characteristics.

R. Characterized Control Valves:

1. Factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of the piping system, unless otherwise indicated.
2. Pressure Independent Control Valves

S. Manufacturers:

1. Belimo Aircontrols (USA), Inc.
2. Flow Control Industries
3. _____
4. Or approved equal

T. The modulating control valves shall be pressure independent.

U. The control valves shall accurately control the flow from 0 to 100% full rated flow with an equal percentage flow characteristic. The flow shall not vary more than ± 5% due to system pressure fluctuations across the valve with a minimum of 5 PSID across the valve.

V. Forged brass body rated at no less than 400 PSI, chrome plated brass ball and stem, female NPT union ends, dual EPDM lubricated O-rings and TEFZEL characterizing disc.

W. Combination of actuator and valve shall provide a minimum close-off pressure rating of 200 PSID.

X. The control valve shall require no maintenance and shall not include replaceable cartridges.

Y. All actuators shall be electronically programmed by use of a handheld programming device or external computer software. Programming using actuator mounted switches or multi-turn actuators are NOT acceptable. Actuators for 3-wire floating (tri-state) on 1/2 inch – 1 inch pressure independent control valves shall fill in place and have a mechanical device inserted between the valve and the actuator for the adjustment of flow. Actuators shall be provided with an auxiliary switch to prove valve position.

Z. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory via a single screw on a four-way DIN mounting base.

AA. The control valve shall require no maintenance and shall not include replaceable cartridges.

BB. The manufacture shall warrant all components for a period of 5 years from the date of acceptance, with the first two years unconditional.

CC. The use of pressure independent valves piped in parallel to achieve the rated coil flow shall be permitted. Actuators shall be electronically programmed to permit sequencing the flow with a single control output point. The use of external devices to permit sequencing is NOT acceptable.

DD. Pressure Independent Control Valves:

1. Manufactures: Subject to compliance with requirements, provide products by one of the following:
   a. Belimo Aircontrols (USA), Inc.
   b. _____
   c. _____
   d. Or approved equal

2. NPS 2 and Smaller: Forged brass body rated at no less than 250 PSI, stainless steel ball and stem, female NPT union ends, dual EPDM lubricated O-rings and a brass or TEFZEL characterizing disc.
3. NPS 2-1/2 through 6: GG25 cast iron body according to ANSI Class 125, standard class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring packing design, PTFE seats, and a stainless steel flow characterizing disc.
4. Accuracy: The control valves shall accurately control the flow from 0 to 100% rated flow with an operating pressure differential range of 5 to 50 PSI differential across the valve

with a valve body flow accuracy of +/- 5 total assembly error incorporating differential pressure fluctuation, manufacturing tolerances and valve hysteresis.

5. Flow Characteristics: Equal percentage characteristic.
6. All actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow. Programming using actuator mounted switches or multi-turn actuators are not acceptable.
7. Water coil optimization shall be accomplished by utilizing a pressure independent control valve assembly; two temperature sensors providing feedback of coil inlet and outlet water temperatures; and an electronic flow meter to provide analog flow feedback. Software shall control the valve to avoid the coil differential temperature from falling below a programmed set point, The valve assembly shall be capable of accepting an analog signal representing the coil power required. Real-time data and configuration of valve operating parameters shall be available by means of BACnet MS/TP, BACnet/IP or HTTP. Monitored points shall include, but not be limited to inlet and outlet coil water temperatures, absolute flow, absolute valve position, absolute coil power and total heating/cooling energy in BTU/hr. Configuration points shall include but not be limited to valve, flow, and power settings. Historical trend data shall be stored for up to 13 months and be retrievable in a standard time-stamped format.
8. The manufacturer shall provide a published commissioning procedure following the guidelines of the National Environmental Balancing Bureau (NEBB) and the Testing Adjusting Balancing Bureau (TABB).
9. A wet calibrated electronic flow meter shall provide dynamic feedback to measure flow and verify performance.
10. The control valve shall require no maintenance and shall not include replaceable cartridges.

2.8 ELECTRIC VALVE ACTUATORS

A. Fully factory assembled. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action under every condition.

B. Motor: Permanent split-capacitor or shaded-pole type. Gear trains completely oil immersed and sealed. Furnish spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

C. Actuator: Direct-coupled type non-hydraulic designed for minimum 100,000 full-stroke cycles at rated torque. Furnish actuator with rating of not less than twice thrust needed for actual operation of valve.

1. Coupling: V-bolt and V-shaped, toothed cradle.
2. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
3. Fail-Safe Operation: Mechanical, spring-return mechanism. Furnish external, manual gear release on non-spring-return actuators.
4. Furnish spring-return actuators with manual override. Complete manual override to take no more than 10 turns.
5. Power Requirements:
   a. Two-Position Spring Return: 24 volt AC or DC, maximum 10 vA.

D. Modulating: 24 volt AC, maximum 15 vA.

1. Proportional Signal: 2 to 10 volt dc or 4 to 20 mA, and 2 to 10 volt dc position feedback signal.
2. Temperature Rating: minus 22 to 140°F.
3. Run Time: 200 seconds open, 40 seconds closed.

E. Size for torque required for valve close-off at maximum pump differential pressure, regardless of water loop system pressures.

2.9 INDOOR AIR QUALITY (CO_2/VOC) SENSORS

A. Provide indoor air quality sensors to monitor Carbon Dioxide (CO_2) and Volatile Organic Compound (VOC) levels.

B. The sensors shall be of microprocessor-based photoacoustic type with heated stannic dioxide semiconductor.

C. The CO_2 sensors shall have no more than 1% drift during the first year of operation and minimal drift thereafter so that no calibration will be required.

D. The units shall be wall or duct mounted type as indicated on plans and in the sequence of operation.

E. Wall mounted sensors shall be provided with plastic cover whose color is approved by the Commissioner, without LED indicators.

F. Duct mounted sensors shall be provided with LED indicators in a dust proof plastic housing with transparent cover.

G. The VOC sensor shall have automatic self-calibrating capability to ensure accuracy.

H. The sensor shall meet the following requirements:

Operating voltage:	24 VAC +/- 20%
Frequency:	50/60 Hz
Power consumption:	max. 6 VA
CO2 measuring range:	0 – 2000 ppm
Tolerance:	+/- 100 ppm
Output:	0 – 10 VAC
Calibration:	none required
VOC measurement range:	0 – 10 V VOC
Permissible air velocity in duct:	<26.2 Ft/s.

2.10 RELAYS

A. Control relays shall be UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

B. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable ±200% (minimum) from set point shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

2.11 VOLTAGE TRANSFORMERS

A. AC voltage transformers shall be UL/CSA Recognized, 600 VAC rated, complete with built-in fuse protection.

B. Transformers shall be suitable for ambient temperatures of 40°F to 130°F and shall provide ±0.5% accuracy at 24 VAC and a 5 VA load.

C. Windings (except for terminals) shall be completely enclosed with metal or plastic material.

2.12 DIRECT DIGITAL CONTROL SYSTEM COMPONENTS

A. Temperature Sensors:

1. Type: Resistance temperature detector (RTD) or thermistor.
2. Accuracy:
   a. ±1°F for standard applications. Where high accuracy is required, furnish accuracy of plus or minus 0.2°F.
   b. Sensing Accuracy: ±0.5°FF.

B. Display Accuracy and Resolution: Minimum of plus or minus 1°F.

1. Built-in communications port.
2. Space Sensors: Digital with LCD display, day-night override button, and set point slide adjustment override options. Set point slide adjustment capable of being software limited by automation system to limit amount of room adjustment.

C. Duct Temperature Sensors:

1. Rigid or averaging type as indicated in sequence of operations. Averaging sensor minimum length: 5 feet in length.
2. Duct Cross Sections Greater Than 10 square feet: Furnish serpentine averaging element to sense stratified air temperatures.
3. Piping Temperature Sensors: Furnish with separable brass well.
4. Liquid immersion temperature:

Temperature monitoring range	+30/250°F
Output signal	Changing resistance
Accuracy at Calibration point	±0.5°F

5. Duct (single point) temperature:

Temperature monitoring range	+20/120°F
Output signal	Changing resistance
Accuracy at Calibration point	±0.5°F

6. Duct Average temperature:

Temperature monitoring range	+20° ±120°F
Output signal	4 – 20 mA DC
Accuracy at Calibration point	±0.5°F
Sensor Probe Length	25' L

D. Humidity Sensors:

1. Type: Capacitance or bulk polymer resistance.
2. Drift: Not to exceed 3 percent of full scale per year.
3. Room Sensors:

E. Sensing Range: 0 to 100 percent.

F. Accuracy of plus or minus 3 percent relative humidity.

1. Duct Sensors:
   a. Sensing Range: 0 to 100percent.
   b. Accuracy of plus or minus 3 percent relative humidity.
   c. Furnish with sampling chamber.
   d. Element guard.
   e. Mounting plate.

G. Differential Pressure Switches:

1. Furnish as specified in sequences of operation for status purposes in air and water applications.
2. Fully adjustable differential pressure settings.
3. UL Listed, SPDT snap-acting, pilot duty rated (125 VA minimum).
4. NEMA 250 Type 1 enclosure.
5. Scale range and differential suitable for intended application.

H. Static Pressure Sensor:

1. Non-directional sensor with suitable range for expected input and temperature compensated.
2. Accuracy: plus or minus 1 percent of full scale with repeatability of 0.5 percent.
3. Output: 4 to 20 mA, 0-5 vDC, 0-10 vDC.
4. Building Static Pressure Range: minus 0.1 to 0.1 inches water column, minus 0.25 to 0.25 inches water column, minus 0.5 to 0.5 inches water column, minus 1.0 to 1.0 inches water column, jumper selectable.
5. Duct Static Pressure Range: 0 to 1 inches water column, 0 to 2.5 inches water column, 0 to 5 inches water column, 0 to 10 inches water column, jumper adjustable.

I. Carbon Dioxide Sensors:

1. Sensors designed for indoor carbon dioxide levels in accordance with ASHRAE Standard 62.

2. 4 to 20 ma. or 0-10V linear output over range of 0 to 2000 ppm of carbon dioxide for interface to DDC control system.
3. For duct mounted sensors furnish airtight enclosure complete with sampling tube.

J. Air Flow Switches:

1. Paddle or differential pressure type, as indicated in sequences of operation.
2. UL Listed, SPDT snap-acting with pilot duty rating (125 VA minimum).
3. Appropriate scale range and differential adjustment.
4. Adjustable sensitivity.
5. NEMA 250 Type 1 enclosure.

K. Water Flow Switches:

1. Paddle type with stainless steel or bronze paddle.
2. UL Listed, SPDT snap-acting with pilot duty rating (125 VA minimum).
3. Appropriate scale range and differential adjustment.
4. Adjustable sensitivity.
5. NEMA 250 Type 1 enclosure.
6. Furnish vapor proof type for chilled water applications.

L. Carbon Monoxide Detectors: Single or multi-channel, dual-level detectors, using solid-state sensors with 3 year minimum life, maximum 15 minute sensor replacement, suitable over a temperature range of 23 to 130°F, calibrated for 50 and 100 ppm, with maximum 120 second response time to 100 ppm carbon monoxide.

M. Carbon Dioxide Sensor for outside air measurement, using solid-state infrared sensors, suitable over a temperature range of 0 to 113°F calibrated for 2 percent of 0-2000 ppm, with continuous or averaged reading, 4 to 20 mA or 0-10V output, and wall mounted.

N. Refrigerant Detectors: Dual-level detectors, using solid-state sensors, with alarm preset for 300 ppm, alarm indicator light, alarm silence light and button, alarm test light and button, and trouble light. Provide auxiliary relay preset for 150 ppm.

O. Flow Measurement – Waterside:

1. Onicon Flow Measurement:

P. The hot water flow measurement systems shall be an Onicon F-3000 Inline Electromagnetic Flow Meter, or approved equal.

Q. The flow measurement system shall run on a 115 VAC power source.

R. Accuracy shall be $\pm$0.25% of actual value. Linearity shall be $\pm$0.1% of actual value. Rangeability: 100 - 1.

S. Output shall be 4-20mA DC linear over calibrated range.

T. The flow measurement system shall be in accordance with the P&ID's.

1. Straight Run Requirements:

U. Manufacturer's recommendations shall be carefully adhered to with respect to straight run requirements to obtain specified accuracies.

V. Submit for approval, location of flow elements in piping clearly indicating upstream and downstream straight run dimensions.

1. Tagging:
   a. Each flow element shall have a 1" x 2" stainless steel tag either permanently attached with screws or attached with a six inch chain.
   b. The stainless steel tag shall have the tag number, design flow, and, when applicable, the differential pressure at design flow permanently engraved on its surface.

W. Freezestats:

1. Install freezestats for each hot water coil and provide protection for every square foot of coil surface area with one linear foot of element.
2. Upon detection of low temperature, the freezestats shall stop the associated supply fans and return the automatic dampers to their normal position. Provide manual reset.
3. Low limit freeze protection thermostats shall have 20' low point sensitive elements (not averaging type) installed to cover the entire coil face area. The elements shall be suspended at least 12" to 15" downstream of the preheater coil. These thermostats shall be 24 volt, two-position, manually reset type. Provide multiple freeze-stats to cover entire face of multi-coil banks. Every 20 square feet of coil requires one freeze-stat as minimum. Freezestats shall be hard wired.

X. Current Sensing Relay:

1. Provide split-core, solid-state, adjustable, current operated relay. Provide a relay which changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.
2. Adjust the relay switch point so that the relay responds to motor operation under load as an “on” state and so that the relay responds to an unloaded running motor as an “off” state. A motor with a broken belt is considered an unloaded motor.
3. Provide status device for all fans and pumps.

Y. Pressure Transmitter - Water Side:

1. Transmitter shall provide a 4-20 ma DC output signal linear over calibrated pressure range.
2. Transmitter shall have the capability to adjust zero and span externally over the full range of the instrument.
3. Transmitter shall be capable of operating from -20°F to +180°F and from 0 to 100%RH. Temperature effect shall be $\pm$1.0% of span per 100°F.

4. Transmitter shall be capable of withstanding pressures up to 1000 psig without damage to the instrument.
5. Stability shall be ±0.25% of upper range limit for six months.
6. Accuracy (including linearity, repeatability, and hysteresis) shall be ±0.25% of calibrated span.
7. Transmitter shall be capable to be pipe or panel mounted in any position with no effect upon operation.
8. Transmitter shall be furnished with flat mounting bracket for vertical mounting to a 2 inch pipe stand and drain/vent valve applicable for service conditions.

Z. Differential Pressure Transmitter - Water Side:

1. Transmitter shall provide a 4-20 ma DC output signal linear over calibrated pressure range.
2. Transmitter shall have the capability to adjust zero and span externally over the full range of the instrument.
3. Transmitter shall be capable of operating from -20°F to +180°F and from 0 to 100%RH. Temperature effect shall be ±1.0% of span per 100°F.
4. Transmitter shall be capable of withstanding pressures ranging from 0 psig to 2000 psig on either side without damage to the instrument.
5. Stability shall be ±0.25% of upper range limit for six months.
6. Accuracy (including linearity, repeatability, and hysteresis) shall be ±0.20% of calibrated span. Linearity shall be ±0.1% of span; hysteresis shall be ±0.05% of span.
7. Transmitter shall be capable to be pipe or panel mounted in any position with no effect upon operation.
8. Transmitter shall be furnished with flat mounting bracket for vertical mounting to a 2 inch pipe stand and drain/vent valve applicable for service conditions.

AA. Temperature Transmitter - Water Side:

1. Transmitter shall provide a 4-20 ma DC output signal linear over calibrated temperature range.
2. Transmitter shall have the capability to adjust zero and span externally over the full range of the instrument.
3. Transmitter shall be capable of operating from -25°C to +85°C.
4. Transmitter output shall fail upscale on loss of sensor input.
5. Stability shall be ±0.20% of calibrated span for six months.
6. Accuracy (including linearity, repeatability, and hysteresis) shall be ±0.20% of calibrated span.
7. Transmitter shall be furnished with mounting bracket for mounting to a 2 inch pipe stand. Transmitter shall be capable to be pipe or panel mounted in any position with no effect upon operation.
8. Transmitter to be furnished complete with integrally mounted 100 Ohm Platinum RTD sensor.

BB. Differential Temperature Transmitter - Water Side:

1. Transmitter shall provide a 4-20 ma DC output signal linear over calibrated temperature range.

2. Transmitter shall have the capability to adjust zero and span externally over the full range of the instrument.
3. Transmitter shall be capable of operating from -25°C to +85°C.
4. Transmitter output shall fail upscale on loss of sensor input.
5. Stability shall be ±0.20% of calibrated span for six months.
6. Accuracy (including linearity, repeatability, and hysteresis) shall be ±0.10% of calibrated span.
7. Transmitter shall be capable to be pipe or panel mounted in any position with no effect upon operation.
8. Transmitter to be furnished complete with two (2) 100 Ohm Platinum RTD sensors wired in compensation loop configuration.
9. Transmitter shall be furnished with mounting bracket for mounting to a 2 inch pipe stand.
10. Natural Gas Flow Meters:

CC. Meters shall be clamp-on type similar to Parametrics with 4-20 mA and pulse output.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. Verify air handling units and ductwork installation is complete and air filters are in place before installing sensors in air streams.

C. Verify location of thermostats and other exposed control sensors with Drawings before installation.

D. Verify building systems to be controlled are ready to operate.

3.3 INSTALLATION

A. Install thermostats, space temperature sensors and other exposed control sensors after locations are coordinated with other Work.

B. Install thermostats, space temperature sensors and other exposed control sensors no more than 48 inches above floor to comply with ADA. Align with light switches and humidistats. Install freeze protection thermostats using flanges and element holders.

C. Install guards on thermostats in public areas.

D. Install control panels adjacent to associated equipment on vibration free walls or freestanding supports. Use one cabinet for each system. Install engraved plastic nameplates for

instruments and controls inside cabinet and engraved plastic nameplates on cabinet face. Label with appropriate equipment or system designation.

E. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

F. Install all devices, sensors, etc. in sheet metal enclosures to prevent dust, dirt and water damage. Provide outdoor rated enclosures for devices exposed to weather.

3.4 ELECTRICAL WIRING AND MATERIALS

A. Install, connect and wire the items included under this Section and all other Sections of HVAC work. This work includes providing required conduit, wire, fittings, backboxes, transformers and related wiring accessories. All conduit, wiring and accessories shall be installed in accordance with Division 26 Specifications. Refer to controls system conduit schedule on contract drawings for conduit utilization requirements.

B. All wiring and conduit to be compliant to local building code and the NEC.

3.5 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions: Field inspecting, testing, adjusting, and balancing.

B. After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

3.6 DEMONSTRATION AND INSTRUCTING

A. Refer to DCAS General Conditions: Requirements for demonstration and instructing.

B. Demonstrate complete operation of systems, including sequence of operation prior to Date of Substantial Completion.

C. Demonstrate complete and operating system to City of New York.

END OF SECTION 23 09 00

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SECTION 23 09 23 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Control equipment and software.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 09 00 - Instrumentation and Control for HVAC: Control system components.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI MC85.1 - Terminology for Automatic Control.

B. ANSI/ASHRAE Standard 135 – BACNET – A Data Communication Protocol for Building Automation and Control Networks.

1.4 SYSTEM DESCRIPTION

A. Automatic temperature controls field monitoring and control system using field programmable microprocessor.

B. Open-Protocol Niagara framework, latest version.

C. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

D. Provide computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

E. Provide controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and when directly connected to control units. Individual terminal unit control is specified in Section 23 09 00.

F. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories to operate mechanical systems, and to perform functions specified.

G. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

H. The entire system shall be UL 864 listed for smoke control operation and meet all NYCBC requirements for smoke exhaust.

I. Main system riser shall be Ethernet based Cat-6. Fiber for runs exceeding 300ft.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate the following:

1. Trunk cable schematic showing programmable control-unit locations and trunk data conductors.
2. System schematics, including:
    a. Sequence of Operations:
        1) System riser diagrams, wiring diagrams, flow diagrams for each system and equipment.
        2) Connected data points, including connected control unit and input device.
        3) System graphics showing monitored systems, data connected and calculated point addresses, and operator notations. Submit demonstration diskette containing graphics.
        4) System configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
        5) Description and sequence of operation for operating, user, and application software.
        6) Use terminology in submittals conforming to ASME MC85.1.
        7) Submit BACNET system architecture drawings and BACNET compliant devices.

C. Product Data: Submit data for each system component and software module.

D. Manufacturer's Installation Instructions: Submit installation instruction for each control system component.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.
2. Submit data specified in "Submittals" in final "Record Documents" form.

C. Operation and Maintenance Data:

1. Submit interconnection wiring diagrams complete field installed systems with identified and numbered system components and devices.
2. Submit keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Submit inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.7 QUALITY ASSURANCE

A. The BAS system shall be designed and installed, commissioned and serviced by manufacturer employed, factory-instructed personnel. Manufacturer shall have an in-place support facility within proximit of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.

1. The manufacturer shall provide an on-site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the Building Automation System (BAS).
2. The Contractor shall be regularly engaged in the manufacturing, installation and maintenance of BAS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the manufacture, installation and maintenance of BAS systems similar in size and complexity to this project. A maintained service organization consisting of at least ten (10) competent servicemen for a period of not less than ten years and provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.

B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

C. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX; Standard ULC C100, category UUKL7; and under Standard UL 864, categories UUKL, UDTZ, and QVAX, and be so listed at the time of bid. All floor level controllers shall comply, at a minimum, with UL Standard UL 91 6category PAZX; Standard UL 864, categories UDTZ, and QVAX and be so listed at the time of Bid. The purpose of the regulation is to minimize electromagnetic interference between electronic products, which may diminish the performance of electrical products or disrupt essential communications.

D. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

E. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products

from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

F. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.

G. Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one (1) week prior to commencing work of this section.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

1.11 MAINTENANCE SERVICE

A. Refer to DCAS General Conditions: Requirements for maintenance service.

B. Furnish service and maintenance of control systems for one (1) year from Date of Substantial Completion.

C. Furnish complete service of controls systems, including callbacks. Make minimum of 4 complete normal inspections of approximately 8 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls. Submit written report after each inspection.

D. Furnish four (4) complete inspections per year, one in each season, to inspect, calibrate, and adjust controls. Submit written report after each inspection.

E. Examine unit components bi-monthly. Clean, adjust and lubricate equipment.

F. Include systematic examination, adjustment, and lubrication of unit, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.

G. Perform work without removing units from service during building normal occupied hours.

H. Provide emergency call back service during working hours for this maintenance period.

I. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

J. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.

K. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of the City of New York.

1.12 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Furnish two printer ink cartridges and cartons of printer paper.

PART 2 - PRODUCTS

2.1 DIRECT DIGITAL CONTROLS

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. Honeywell
2. Johnson Controls
3. Distech
4. Vykon-Tridium
5. Or approved equal

B. Furnish materials in accordance with NYCBC.

C. Manufacturer shall furnish a system that utilizes Niagara framework.

2.2 OPERATOR WORKSTATION

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:
1. Dell
2. HP
3. _____
4. Or approved equal

B. Furnish materials in accordance with NYCBC.

C. Furnish each operator workstation consisting of the following:

1. Personal Computer: IBM PC compatible with sufficient memory and hard drive storage to support graphics, reports, and communication requirements, or Approved Equal. Furnish with the following minimum configuration requirements:
   a. Processor: Intel Xeon.
   b. Hard Drive: 1 Terabyte.
   c. Memory: 8 Gigabyte.
   d. Ports: Required serial, parallel, network communications, USB, and cables for proper system operation.
   e. Expansion Slots: 1 used for LAN card, 1 available.
   f. LAN Card: EtherNet - RJ45 (100 base-T minimum).
   g. Mouse: two-button optical type wireless.

D. Keyboard: 104 key.

1. Monitor: Minimum of 24 inch color, flat panel LED display.
2. Operating System: Latest Windows OS.
3. Printer: Furnish each operator workstation with laser printer and associated cables. Printer capable of minimum of 25 pages per minute (PPM) operation and compatible with standard parallel or USB communications or network capable.
4. System Support: Minimum ten (10) work stations connected to multi-user, multi-tasking environment with concurrent capability to:
   a. Access Direct Digital Control network.
   b. Access or control same control unit.
   c. Access or modify same control unit database.
   d. Archive data, alarms, and network actions to hard disk regardless of what application programs are being currently executed.
   e. Develop and edit database.
   f. Implement and tune Direct Digital Control.
   g. Develop graphics.
   h. Control facility.

2.3 CONTROL UNITS

A. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment located in NEMA enclosures.

B. Battery Backup: For minimum of 100 hours for complete system including RAM without interruption, with automatic battery charger.

C. Control Units Functions:

1. Monitor or control each input/output point.
2. Completely independent with hardware clock/calendar and software to maintain control independently.
3. Acquire, process, and transfer information to operator station or other control units on network.

4. Accept, process, and execute commands from other control unit's or devices or operator stations.
5. Access both data base and control functions simultaneously.
6. Record, evaluate, and report changes of state or value occurring among associated points. Continue to perform associated control functions regardless of status of network.
7. Perform in stand-alone mode:
    a. Start/stop.
    b. Duty cycling.
    c. Automatic Temperature Control.
    d. Demand control via a sliding window, predictive algorithm.
    e. Event initiated control.
    f. Calculated point.
    g. Scanning and alarm processing.
    h. Full direct digital control.
    i. Trend logging.
    j. Global communications.
    k. Maintenance scheduling.

D. Global Communications:

1. Broadcast point data onto network, making information available to other system controls units.
2. Transmit input/output points onto network for use by other control units and use data from other control units.

E. Input/output Capability:

1. Discrete/digital input (contact status).
2. Discrete/digital output.
3. Analog input.
4. Analog output.
5. Pulse input (5 pulses/second).
6. Pulse output (0-655 seconds in duration with 0.01-second resolution).

F. Monitor, control, or address data points. Include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs. Furnish control units with minimum 30 percent spare capacity.

G. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

H. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard-wired LAN or 60 seconds over voice grade phone lines.

I. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:

1. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from workstation.
2. Control output points but change only database state or value; leave external field hardware unchanged.
3. Enable control-actions on output points but change only data base state or value.

J. Local display and adjustment panel: Integral to control-unit containing digital display, and numerical keyboard. Display and adjust:

1. Input/output point information and status.
2. Controller set points.
3. Controller tuning constants.
4. Program execution times.
5. High and low limit values.
6. Limit differential.
7. Set/display date and time.
8. Control outputs connected to the network.
9. Automatic control outputs.
10. Perform control unit diagnostic testing.

K. Points in "Test" mode.

L. Direct Digital Control Controller:

1. Direct Digital Control Controllers shall be a minimum 16-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a minimum of three (3) Floor Level Application Specific Controller Device Networks.
2. Each Direct Digital Control Controller shall have sufficient memory to support its own operating system and databases, including:
   a. Control processes
   b. Energy management applications
   c. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
   d. Historical/trend data for points specified
   e. Maintenance support applications
   f. Custom processes
   g. Operator I/O
   h. Dial-up communications

M. Manual Override Monitoring

1. Each Direct Digital Control Controller shall support firmware upgrades without the need to replace hardware.

2. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.
3. Direct Digital Control Controllers shall provide a minimum two (2) RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. Direct Digital Control Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.
4. The operator shall have the ability to manually override automatic or centrally executed commands at the Direct Digital Control Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.

N. Switches shall be mounted either within the Direct Digital Control Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.

O. Direct Digital Control Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. Direct Digital Control Controllers shall also collect override activity information for reports.

1. Direct Digital Control Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.
2. Each Direct Digital Control Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The Direct Digital Control Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
3. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
    a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V.
    b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact.
    c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power.
    d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max).

P. Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:

1. IEEE Standard 587-1980
2. UL 864 Supply Line Transients
3. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)
4. In the event of the loss of normal power, there shall be an orderly shutdown of all Direct Digital Control Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and

battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 60 days.

Q. Upon restoration of normal power, the Direct Digital Control Controller shall automatically resume full operation without manual intervention.

R. Should Direct Digital Control Controller memory be lost for any reason, the user shall have the capability of reloading the Direct Digital Control Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

1. Provide a separate Direct Digital Control Controller for each AHU and/or other HVAC systems indicated in Section 3. It is intended that each unique system be provided with its own point resident Direct Digital Control Controller.

S. HVAC Mechanical Equipment Controllers:

1. HVAC Mechanical Equipment Controllers shall be a minimum 12-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors.
2. Each HVAC Mechanical Controller shall have sufficient memory to support its own operating system and databases, including:
   a. Control processes
   b. Energy management applications
   c. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
   d. Historical/trend data for points specified
   e. Maintenance support applications
   f. Custom processes
   g. Operator I/O

T. Dial-up communications

1. Each HVAC Mechanical Equipment Controller shall support firmware upgrades without the need to replace hardware.
2. HVAC Mechanical Equipment Controllers shall provide a RS-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.
3. HVAC Mechanical Equipment Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.
4. Each HVAC Mechanical Equipment Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all components. The HVAC Mechanical Equipment Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
5. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
   a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V

b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact
c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power
d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)
e. Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:
f. IEEE Standard 587-1980
g. UL 864 Supply Line Transients

U. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

1. In the event of the loss of normal power, there shall be an orderly shutdown of all HVAC Mechanical Equipment Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

V. Upon restoration of normal power, the HVAC Mechanical Equipment Controller shall automatically resume full operation without manual intervention.

1. Should HVAC Mechanical Equipment Controller memory be lost for any reason, the user shall have the capability of reloading the HVAC Mechanical Equipment Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

W. Floor Level Network Application Specific Controllers (ASC)

1. Each Direct Digital Control Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASCs) through Floor Level LAN Device Networks.
2. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Provide the following types of ASCs as a minimum:
   a. Central System Controllers.

X. Terminal Equipment Controllers:

1. Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.

Y. Central System Controllers:

1. Provide for control of central HVAC systems and equipment including, but not limited to, the following:
   a. Air handling units
   b. Split system
   c. Chilled water system
   d. Hot water systems

Z. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Provide a hand/off/automatic switch for each digital output for manual override capability. Switches shall be mounted either within the controller's key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides. In addition, each switch position shall be supervised in order to inform the system that automatic control has been overridden.

AA. Each controller shall support its own real-time operating system. Provide a time clock with battery backup to allow for stand-alone operation in the event communication with its Direct Digital Control Controller is lost and to ensure protection during power outages.

BB. All programs shall be field-customized to meet the user's exact control strategy requirements. Central System controllers utilizing pre-packaged or canned programs shall not be acceptable. As an alternative, provide Direct Digital Control Controllers for all central equipment in order to meet custom control strategy requirements.

CC. Programming of central system controllers shall utilize the same language and code as used by Direct Digital Control Controllers to maximize system flexibility and ease of use. Should the system controller utilize a different control language, provide a Direct Digital Control Controller to meet the specified functionality.

DD. Each controller shall have connection provisions for a portable operator's terminal. This tool shall allow the user to display, generate or modify all point databases and operating programs.

EE. Provide a door-mounted interface terminal to allow for direct-user access to the controller.

1. The terminal shall provide the user with the following functionality as a minimum:
   a. View and set date and time
   b. Modify and override time-of-day schedules
   c. Viewpoints and alarms
   d. Monitor points
   e. Command and modify setpoints

2. Provide local user display in accordance with paragraph 2.11.
3. Terminal Equipment Controllers:
   a. Provide for control of each piece of equipment, including, but not limited to, the following:
      1) Variable Air Volume (VAV) boxes
      2) Terminal Devices

FF. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, 3-15 psi pneumatic, 0-10v, allowing for interface to a variety of modulating actuators.

GG. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the FLN, BLN or MLN is not acceptable.

HH. Additional features

1. The enclosure for all controllers shall be NEMA rated which shall not be mounted directly to the unit nor to the wall. The conduit entering points must be located at bottom of the enclosure.
2. All controllers shall have manual overrides at the panels to manually adjust the setpoints without using computer or hand-held device.

2.4 LOCAL AREA NETWORKS (LAN)

A. The design of the BAS shall network operator workstations and standalone Direct Digital Control Controllers. The network architecture shall consist of three levels, a campus-wide (Management Level Network) Ethernet network based on TCP/IP protocol, high performance peer-to-peer building level network(s) and Direct Digital Control Controller floor level local area networks with access being totally transparent to the user when accessing data or developing control programs. All controllers shall be standalone Direct Digital Control controllers. Loss of network communications shall not stop/limit the control sequences specified herein.

B. Provide communication between control units over local area network (LAN).

C. LAN Capacity: Not less than 100 stations or nodes.

D. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, less than 3 seconds. Furnish automatic reconfiguration when station is added or lost. In event transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

H. System shall have the capability to communicate with a BACnet network over Ethernet or BACnet/IP (according to Annex J). The intent is to use the system provided under this contract to communicate with control systems provided by other vendors. In order to accomplish monitoring, commanding, and alarming as described in sections 2.10.B and 2.10.D, the following BACnet objects and services must be supported by the system.

1. The following BACnet standard objects, at a minimum, must be supported by the system:
   a. Device
   b. Analog Input
   c. Analog Output
   d. Binary Input
   e. Binary Output

I. Notification Class

1. The following BACnet services must be supported for the system to act as a BACnet server as described below:
   a. For the system to communicate with/on a BACnet network, it must support the following:

BACnet Service	Initiate	Execute
Who-Has		X
I-Have	X	
Who-Is		X
I-Am	X	

   b. For the system to allow other BACnet devices to monitor its point values, the system must support the following:

BACnet Service	Initiate	Execute
Read Property		X

   c. For the system to allow other BACnet devices to command its point values, the system must support the following:

BACnet Service	Initiate	Execute
Write Property		X

   d. For the system to be able to send alarms to other BACnet devices and receive alarm acknowledgement, the system must support the following:

BACnet Service	Initiate	Execute
Add List Element		X
Remove List Element		X
Acknowledge Alarm		X
Get Alarm Summary		X
Confirmed or Unconfirmed Event Notification	X	

   e. If the system will be sending messages to other BACnet devices via COV, it must support the following:

BACnet Service	Initiate	Execute
Subscribe COV		X
Confirmed or Unconfirmed COV Notification	X	

2. The following BACnet services must be supported for the system to act as a BACnet client as described below:
   a. For the system to communicate with/on a BACnet network, it must support the following:

BACnet Service	Initiate	Execute
Who-Has		X
I-Have	X	
Who-Is		X
I-Am	X	

b. For the system to be able to monitor point values from other BACnet devices, the system must support the following:

BACnet Service	Initiate	Execute
Read Property	X	

c. For the system to be able to command point values in other BACnet devices, the system must support the following:

BACnet Service	Initiate	Execute
Write Property	X	

d. For the system to be able to receive alarms from points in other BACnet devices, the system must support the following:

BACnet Service	Initiate	Execute
Add List Element	X	
Remove List Element	X	
Acknowledge Alarm	X	
Get Alarm Summary	X	
Confirmed or Unconfirmed Event Notification		X

e. If the system is capable of receiving BACnet point messages via COV, it must support the following:

BACnet Service	Initiate	Execute
Subscribe COV	X	
Confirmed or Unconfirmed COV Notification		X

J. Peer-to-Peer Building Level Network:

1. All operator devices either network resident or connected via dial-up modems shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.
2. The peer-to-peer network shall support a minimum of 100 Direct Digital Control controllers and PC workstations.
3. Each PC workstation shall support a minimum of 4 peer to peer networks hardwired or dial up.
4. The system shall support integration of third party systems (fire alarm, security, lighting, PCL, air conditioning units, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for interprocess control. All exchange points shall have full system functionality as specified herein for hardwired points.
5. Field panels must be capable of integration with open standards including Modbus, BACnet, and Lonworks as well as with third party devices via existing vendor protocols.
6. Telecommunication Capability:

a. Auto-dial/auto-answer communications shall be provided to allow Direct Digital Control Controllers to communicate with remote operator stations and/or remote terminals via telephone lines. A remote location for monitoring will be determined by the City of New York.
b. Auto-dial Direct Digital Control Controllers shall automatically place calls to workstations to report alarms or other significant events. The auto-dial program shall include provisions for handling busy signals, "no answers" and incomplete data transfers.
c. Operators at dial-up workstations shall be able to perform all control functions, all report functions and all database generation and modification functions as described for workstations connected via the network. Routines to automatically answer calls from remote Direct Digital Control or HVAC Mechanical Equipment Controllers shall be inherent in the Controller. The use of additional firmware or software is not acceptable. The fact that communications are taking place with remote Direct Digital Control or HVAC & Mechanical Equipment Controllers over telephone lines shall be completely transparent to an operator.
d. Multiple modems shall be supported by Direct Digital Control or HVAC & Mechanical Equipment Controllers on the Peer-to-Peer Network to ensure continuous communication to workstation.

K. Management Level Network:

1. All PCs shall simultaneously direct connect to the Ethernet and Building Level Network without the use of an interposing device
2. Operator Workstation shall be capable of simultaneous direct connection and communication with BACnet, OPC, and Apogee networks without the use of interposing devices.
3. The Management Level Network shall not impose a maximum constraint on the number of operator workstations.
4. When appropriate, any controller residing on the peer to peer building level networks shall connect to Ethernet network without the use of a PC or a gateway with a hard drive.
5. Any PC on the Ethernet Management Level Network shall have transparent communication with controllers on the building level networks connected via Ethernet, as well as, directly connected building level networks. Any PC shall be able to interrogate any controller on the building level network.
6. Any break in Ethernet communication from the PC to the controllers on the building level networks shall result in an alarm notification at the PC and shall not stop/limit operation of the system.
7. The Management Level Network shall reside on industry standard Ethernet utilizing standard TCP/IP, IEEE 802.3
8. Access to the system database shall be available from any client workstation on the Management Level Network.

2.5 OPERATING SYSTEM SOFTWARE

A. Input/output Capability From Operator Station:

1. Request display of current values or status in tabular or graphic format.
2. Command selected equipment to specified state.

3. Initiate logs and reports.
4. Change analog limits.
5. Add, delete, or change points within each control unit or application routine.
6. Change point input/output descriptors, status, alarm descriptors, and unit descriptors.
7. Add new control units to system.
8. Modify and set up maintenance scheduling parameters.
9. Develop, modify, delete or display full range of color graphic displays.
10. Automatically archive select data even when running third party software.
11. Capability to sort and extract data from archived files and to generate custom reports.
12. Support two printer operations.
13. Alarm printer: Print alarms, operator acknowledgments, action messages, system alarms, operator sign-on and sign-off.
14. Data printer: Print reports, page prints, and data base prints.
15. Select daily, weekly or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.
16. Print selected control unit database.

B. Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.

C. Data Base Creation and Support: Use standard procedures for changes. Control unit automatically checks workstation data base files upon connection and verify data base match. Include the following minimum capabilities:

1. Add and delete points.
2. Modify point parameters.
3. Change, add, or delete English language descriptors.
4. Add, modify, or delete alarm limits.
5. Add, modify, or delete points in start/stop programs, trend logs, and other items.
6. Create custom relationship between points.
7. Create or modify Direct Digital Control loops and parameters.
8. Create or modify override parameters.
9. Add, modify, and delete applications programs.
10. Add, delete, develop, or modify dynamic color graphic displays.

D. Dynamic Color Graphic Displays:

1. Utilizes custom symbols or system supported library of symbols.
2. Sixteen (16) colors.
3. Sixty (60) outputs of real-time live dynamic data for each graphic.
4. Dynamic graphic data.
5. 1,000 separate graphic pages.
6. Modify graphic screen refresh rate between 1 and 60 seconds.

E. Operator Station:

1. Accept data from LAN as needed without scanning entire network for updated point data.
2. Interrogate LAN for updated point data when requested.

3. Allow operator command of devices.
4. Allow operator to place specific control units in or out of service.
5. Allow parameter editing of control units.
6. Store duplicate data base for every control unit and allow down loading while system is on line.
7. Control or modify specific programs.
8. Develop, store and modify dynamic color graphics.
9. Data archiving of assigned points and support overlay graphing of this data using up to four (4) variables.

F. Alarm Processing:

1. Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state or value and alarms causing automatic dial-out.
2. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
3. Print on line changeable message, up to 60 characters in length, for each alarm point specified.
4. Display alarm reports on video. Display multiple alarms in order of occurrence.
5. Define time delay for equipment start-up or shutdown.
6. Allow unique routing of specific alarms.
7. Operator specifies when alarm requires acknowledgment.
8. Continue to indicate unacknowledged alarms after return to normal.
9. Alarm notification:
10. Print automatically.
11. Display indicating alarm condition.
12. Selectable audible alarm indication.

G. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change of state, specified state, or alarm occurrence or return to normal.

H. Automatic Restart: Automatically start field equipment on restoration of power. Furnish time delay between individual equipment restart and time of day start/stop.

I. Messages:

1. Automatically display or print user-defined message subsequent to occurrence of selected events.
2. Compose, change, or delete message.
3. Display or log message at any time.
4. Assign any message to event.

J. Reports:

1. Manually requested with time and date.

2. Long term data archiving to hard disk.
3. Automatic directives to download to transportable media including floppy diskettes for storage.
4. Data selection methods to include data base search and manipulation.
5. Data extraction with mathematical manipulation.
6. Data reports to allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
7. Generating reports either normally at operator direction, or automatically under workstation direction.
8. Either manually display or print reports. Automatically print reports on daily, weekly, monthly, yearly or scheduled basis.
9. Include capability for statistical data manipulation and extraction.
10. Capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

K. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

L. Data Collection:

1. Automatically collect and store in disk files.
2. Daily electrical energy consumption, peak demand, and time of peak demand for up to electrical meters over 2-year period.
3. Daily consumption for up to 30 meters over a 2 year period.
4. Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.
5. Archiving of stored data for use with system supplied custom reports.

M. Graphic Display: Support graphic development on work station with software features:

1. Page linking.
2. Generate, store, and retrieve library symbols.
3. Single or double height characters.
4. Sixty (60) dynamic points of data for each graphic page.
5. Pixel level resolution.
6. Animated graphics for discrete points.
7. Analog bar graphs.
8. Display real time value of each input or output line diagram fashion.

N. Maintenance Management:

1. Run time monitoring, for each point.
2. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
3. Equipment safety targets.
4. Display of maintenance material and estimated labor.
5. Target point reset, for each point.

O. Advisories:

1. Summary containing status of points in locked out condition.
2. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
3. Report of power failure detection, time and date.
4. Report of communication failure with operator device, field interface unit, point and programmable control unit.

2.6 LOAD CONTROL PROGRAMS

A. General: Support inch-pounds and S.I. metric units of measurement.

B. Demand Limiting:

1. Monitor total power consumption for each power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.
2. Input: Pulse count from incoming power meter connected to pulse accumulator in control unit.
3. Forecast demand (kW): Predicted by sliding window method.
4. Automatically shed loads throughout the demand interval selecting loads with independently adjustable on and off time of between one and 255 minutes.
5. Demand Target: Minimum of 3 for each demand meter; change targets based upon (1) time, (2) status of pre-selected points, or (3) temperature.
6. Load: Assign load shed priority, minimum "On" time and maximum "Off" time.
7. Limits: Include control band (upper and lower limits).
8. Output advisory when loads are not available to satisfy required shed quantity, advise shed requirements and requiring operator acknowledgment.

C. Duty Cycling:

1. Periodically stop and start loads, based on space temperature, and according to various On/Off patterns.
2. Modify off portion of cycle based on operator specified comfort parameters. Maintain total cycle time by increasing on portion of cycle by equal quantity off portion is reduced.
3. Set and modify following parameters for each individual load.
    a. Minimum and maximum off time.
    b. On/Off time in one-minute increments.
    c. Time period from beginning of interval until cycling of load.
    d. Manually override the Direct Digital Control program and place a load in an On or Off state.
    e. Cooling Target Temperature and Differential.
    f. Heating Target Temperature and Differential.
    g. Cycle off adjustment.

D. Automatic Time Scheduling:

1. Self-contained programs for automatic start/stop/scheduling of building loads.

2. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.
3. Special day's schedule supporting up to 30 unique date/duration combinations.
4. Number of loads assigned to time program; with each load having individual time program.
5. Each load assigned at least 16 control actions for each day with 1 minute resolution.
6. Furnish the following time schedule operations:
    a. Start.
    b. Optimized Start.
    c. Stop.
    d. Optimized Stop.
    e. Cycle.

E. Optimized Cycle.

1. Capable of specifying minimum of 30 holiday periods up to 100 days in length for the year.
2. Create temporary schedules.
3. Broadcast temporary "special day" date and duration.

F. Start/Stop Time Optimization:

1. Perform optimized start/stop as function of outside conditions, inside conditions, or both.
2. Adaptive and self-tuning, adjusting to changing conditions unattended.
3. For each point under control, establish and modify:
    a. Occupancy period.
    b. Desired temperature at beginning of occupancy period.
    c. Desired temperature at end of occupancy period.

G. Night Setback/Setup Program: Reduce heating space temperature set point or raise cooling space temperature set-point during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.

H. Calculated Points: Define calculations and totals computed from monitored points (analog/digital points), constants, or other calculated points.

1. Employ arithmetic, algebraic, Boolean, and special function operations.
2. Treat calculated values like any other analog value; use for any function where a "hard wired point" might be used.

I. Event Initiated Programming: Any data point capable of initiating event, causing series of controls in a sequence.

1. Define time interval between each control action between 0 to 3600 seconds.
2. Output may be analog value.
3. Provide for "skip" logic.
4. Verify completion of one action before proceeding to next action. When not verified, program capable of skipping to next action.

J. Direct Digital Control: Furnish with each control unit Direct Digital Control software so operator is capable of customizing control strategies and sequences of operation by defining appropriate control loop algorithms and choosing optimum loop parameters.

1. Control loops: Defined using "modules" are analogous to standard control devices.
2. Output: Paired or individual digital outputs for pulse width modulation, and analog outputs.
3. Firmware:
    a. PID with analog or pulse-width modulation output.
    b. Floating control with pulse-width modulated outputs.
    c. Two-position control.
    d. Primary and secondary reset schedule selector.
    e. Hi/Low signal selector.
    f. Single pole double-throw relay.

K. Single pole double throw time delay relay with delay before break, delay before make and interval time capabilities.

1. Direct Digital Control loop: Downloaded upon creation or on operator request. On sensor failure, program executes user defined failsafe output.
2. Display: Value or state of each of lines interconnecting Direct Digital Control modules.

L. Fine Tuning Direct Digital Control PID or floating loops:

1. Display information:
    a. Control loop being tuned.
    b. Input (process) variable.
    c. Output (control) variable.
    d. Set-point of loop.
    e. Proportional band.
    f. Integral (reset) Interval.

M. Derivative (rate) Interval.

1. Display format: Graphic, with automatic scaling; with input and output variable superimposed on graph of "time" versus "variable".

N. Trend logging:

1. Each control unit capable of storing samples of control unit's data points.
2. Update file continuously at operator assigned intervals.
3. Automatically initiate upload requests and then stores data on hard disk.
4. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
5. Co-ordinate sampling with specified on/off point- state.
6. Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time versus data.

2.7 HVAC CONTROL PROGRAMS

A. General:

1. Support Inch-pounds and S.I. metric units of measurement.
2. Identify each Control system.

B. Optimal Run Time:

1. Control start-up and shutdown times of equipment for both heating and cooling.
2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.
5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
6. Operator commands:
    a. Define term schedule.
    b. Add/delete fan status point.
    c. Add/delete outside air temperature point.
    d. Add/delete mass temperature point.
    e. Define heating/cooling parameters.
    f. Define mass sensor heating/cooling parameters.
    g. Lock/unlock program.
    h. Request optimal run-time control summary.
    i. Request optimal run-time mass temperature summary.
    j. Request point summary.

C. Request saving profile summary.

1. Control Summary:
    a. Control system begin/end status.
    b. Optimal run time lock/unlock control status.
    c. Heating/cooling mode status.
    d. Optimal run time schedule.
    e. Start/Stop times.
    f. Selected mass temperature point ID.
    g. Optimal run-time system normal start-times.
    h. Occupancy and vacancy times.

D. Optimal run time system heating/cooling mode parameters.

1. Mass temperature summary:
    a. Mass temperature point type and ID.
    b. Desired and current mass temperature values.
    c. Calculated warm-up/cool-down time for each mass temperature.

d. Heating/cooling season limits.
e. Break point temperature for cooling mode analysis.

2. Point summary:
   a. Control system identifier and status.
   b. Point ID and status.
   c. Outside air temperature point ID and status.
   d. Mass temperature point ID and status.
   e. Calculated optimal start and stop times.
   f. Period start.

E. Supply Air Reset:

1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.
2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
   a. Raising cooling temperatures to highest possible value.
   b. Reducing heating temperatures to lowest possible level.

3. Operator commands:
   a. Add/delete fan status point.
   b. Lock/unlock program.
   c. Request point summary.
   d. Add/Delete discharge controller point.
   e. Define discharge controller parameters.
   f. Add/delete air flow rate.
   g. Define space load and load parameters.

F. Request space load summary.

1. Control summary:
   a. Control system status (begin/end).
   b. Supply air reset system status.
   c. Optimal run time system status.
   d. Heating and cooling loop.
   e. High/low limits.
   f. Deadband.
   g. Response timer.

G. Reset times.

1. Space load summary:
   a. System status.
   b. Optimal run time status.
   c. Heating/cooling loop status.
   d. Space load point ID.

e. Current space load point value.
f. Control heat/cool limited.
g. Gain factor.
h. Calculated reset values.
i. Fan status point ID and status.
j. Control discharge temperature point ID and status.
k. Space load point ID and status.
l. Airflow rate point ID and status.

H. Static Pressure Reset:

1. Monitor static pressure in supply air system and corresponding VAV box position.
2. Reduce static pressure setpoint and resultant fan speed to utilize minimum fan energy.

I. Enthalpy Switchover:

1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.
2. Operator commands:
   a. Add/delete fan status point.
   b. Add/delete outside air temperature point.
   c. Add/delete discharge controller point.
   d. Define discharge controller parameters.
   e. Add/delete return air temperature point.
   f. Add/delete outside air dewpoint/humidity point.
   g. Add/delete return air dewpoint/humidity point.
   h. Add/delete damper switch.
   i. Add/delete minimum outside air.
   j. Add/delete atmospheric pressure.
   k. Add/delete heating override switch.
   l. Add/delete evaporative cooling switch.
   m. Add/delete air flow rate.
   n. Define enthalpy deadband.
   o. Lock/unlock program.
   p. Request control summary.

J. Request HVAC point summary.

1. Control summary:
   a. HVAC control system begin/end status.
   b. Enthalpy switchover optimal system status.
   c. Optimal return time system status.
   d. Current outside air enthalpy.
   e. Calculated mixed air enthalpy.
   f. Calculated cooling cool enthalpy using outside air.
   g. Calculated cooling cool enthalpy using mixed air.
   h. Calculated enthalpy difference.

i. Enthalpy switchover deadband.
j. Status of damper mode switch.
k. Freeze protection.
l. Smoke Control.

2.8 CHILLER PLANT CONTROL PROGRAMS

A. Control function of condenser water reset, chilled water reset, and chiller sequencing. Support inch-pounds and S.I. metric units of measurement.

B. Condenser Water Reset: Automatically reset controlled condenser water temperature using measured outside wet bulb temperature and load being handled.

C. Chilled Water Reset: Automatically reset controlled chilled water temperature satisfying cooling coil requiring greatest cooling.

D. Chiller Sequencing: Determine combination of chillers most efficiently satisfies chilled water load, by cycling chillers, based on comparing load to switchover limits defined for each chiller.

E. Chiller Plant Optimization Program: This program shall be based on a knowledge of requirements in this Section, as well as consultation with manufacturers of chillers and all auxiliaries such as pumps, cooling towers, etc., as to performance and operation of each component, not only at design conditions but at all other load conditions as well.

F. System analysis and programming shall be done in stages as described below and contractor shall provide all required hardware required for its implementation:

1. Control leaving chilled water temperature of each chiller.
2. Turn on and off as needed auxiliary motors, valves, pumps, and so on, all under full software stored program control.
3. Chiller water temperature reset.
4. Control or proportion the total refrigeration (tons) load each chiller will produce at various partial loads, based on optimized efficiency of operation of total plant.
5. Control condenser water temperature and relate to actual needs of Chiller Plant.
6. Adjust speed of variable frequency drives to maintain proper condenser water and chilled water flow rates to each chiller.

2.9 PROGRAMMING APPLICATION FEATURES

A. Trend Point:

1. Sample up to 50 points, real or computed, with each point capable of collecting 10,000 samples at intervals specified in minutes, hours, days, or month.
2. Output trend logs as line-graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique color, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

B. Alarm Messages:

1. Allow definition of minimum of 100 messages, each having minimum length of 100 characters for each individual message.
2. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totaled point's warning limit, hardware elements advisories.
3. Output assigned alarm with "message requiring acknowledgment".
4. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

C. Weekly Scheduling:

1. Automatically initiate equipment or system commands, based on selected time schedule for points specified.
2. Program times for each day of week, for each point, with one minute resolution.
3. Automatically generate alarm output for points not responding to command.
4. Allow for holidays, minimum of 366 consecutive holidays.
5. Operator commands:
   a. System logs and summaries.
   b. Start of stop point.
   c. Lock or unlock control or alarm input.
   d. Add, delete, or modify analog limits and differentials.
   e. Adjust point operation position.
   f. Change point operational mode.
   g. Open or close point.
   h. Enable/disable, lock/unlock, or execute interlock sequence or computation profile.
   i. Begin or end point totals.
   j. Modify total values and limits.
   k. Access or secure point.
   l. Begin or end HVAC or load control system.
   m. Modify load parameter.

D. Modify demand limiting and duty cycle targets.

1. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

E. Interlocking:

1. Permit events to occur, based on changing condition of one or more associated master points.
2. Binary contact, high/low limit of analog point or computed point capable of being used as master. Master capable of monitoring or commanding multiple slaves.
3. Operator commands:
   a. Define single master/multiple master interlock process.
   b. Define logic interlock process.
   c. Lock/unlock program.
   d. Enable/disable interlock process.
   e. Execute terminate interlock process.
   f. Request interlock type summary.

F. Interface to World Wide Web:

1. Contractor shall provide all programming and interfaces as required to display and access all system features, including alarms, maintenance messages, graphics, etc. on the World Wide Web.
2. The central BAS console shall be arranged to monitor, control and supervise all system items specified in this section, remotely, via the World Wide Web, using secured network connections. Specific alarms, as defined by the City of New York, shall be connected to the Campus Public Safety Network. Contractor shall be responsible for all software and hardware requirements, as required for a complete and operational system. Contractor shall be responsible for coordinating network interface requirements with the City of New York.
3. Coordinate Uniform Resource Locator (URL) address name with City of New York and provide all fees associated with obtaining rights to URL. Contractor shall be responsible for coordinating and obtaining Internet Service Provider.

2.10 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Disconnect Switch: Factory-mount on equipment.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. Verify conditioned power supply is available to control units and to operator workstation.

C. Verify field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.3 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator workstation. Implement features of programs to specified requirements and appropriate to sequence of operation.

C. Install with 120 volts alternating current, 15 amp dedicated emergency power circuit to each programmable control unit.

D. Install electrical material and installation in accordance with appropriate requirements of Division 26.

E. Install all devices, sensors, etc. in sheet metal enclosures to prevent dust, dirt and water damage. Provide outdoor rated enclosures for devices located outdoors.

3.4 MANUFACTURER'S FIELD SERVICES

A. Refer to DCAS General Conditions: Manufacturers' field services.

B. Start and commission systems. Allow adequate time for start-up and commissioning prior to placing control systems in permanent operation.

C. Furnish service technician employed by system installer to instruct the Commissioner in operation of systems plant and equipment for 3-day period.

3.5 COMMISSIONING, TESTING AND ACCEPTANCE

A. Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets which shall be submitted prior to acceptance testing. Commissioning work which requires shutdown of system or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the City of New York and Commissioner to ensure systems are available when needed. Notify the City of New York in writing of the testing schedule so that Commissioner is present throughout the commissioning procedure.

1. Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications and approved shop drawings. Test, calibrate and bring on line each control sensor and device. Commissioning to include, but not be limited to:
   a. Sensor accuracy at 10, 50 and 90% of range.
   b. Sensor range.
   c. Verify analog limit and binary alarm reporting.
   d. Point value reporting.
   e. Binary alarm and switch settings.
   f. Actuator ranges.

B. Fail safe operation on loss of control signal, electric power, network communications.

C. After control devices have been commissioned (i.e. calibrated, tested and signed off), each BAS program shall be put on line and commissioned. The Contractor shall, in the presence of the City of New York and Commissioner, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy's. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and retested.

D. After all BAS programs have been commissioned, the contractor shall verify the overall system performance as specified. Tests shall include, but not be limited to:

1. Data communication, both normal and failure modes.
2. Fully loaded system response time.

3. Impact of component failures on system performance and system operation.
4. Time/Date changes.
5. End of month/ end of year operation.
6. Season changeover.
7. Global application programs and point sharing.
8. System backup and reloading.
9. System status displays.
10. Diagnostic functions.
11. Power failure routines.
12. Battery backup.
13. Smoke Control, stair pressurization, stair, vents, in concert with Fire Alarm System testing.
14. Testing of all electrical and HVAC systems with other division of work.

E. Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that sensors and control devices maintain specified accuracy's and the system performance does not degrade over time.

F. Using the commissioning test data sheets, the contractor shall demonstrate each point. The contractor shall also demonstrate all system functions. The contractor shall demonstrate all points and system functions until all devices and functions meet specification.

G. The contractor shall supply all instruments for testing and turn over same to the City of New York after acceptance testing.

1. All test instruments shall be submitted for approval.

H. Test Instrument Accuracy:

Temperature:	1/4F or 1/2% full scale, whichever is less.
Pressure:	High Pressure (psi): 1/2 psi or 1/2% full scale, whichever is less.
Low Pressure: (in w.c.)	1/2% of full scale
Humidity:	2% RH
Electrical:	1/4% full scale

I. After the above tests are complete and the system is demonstrated to be functioning as specified, a thirty day performance test period shall begin. If the system performs as specified throughout the test period, requiring only routine maintenance, the system shall be accepted. If the system fails during the test, and cannot be fully corrected within eight hours, the City of New York may request that performance tests be repeated.

3.6 DEMONSTRATION AND INSTRUCTING

A. Refer to DCAS General Conditions: Requirements for demonstration and instructing.

B. Furnish basic operator instructions for 16 persons on data display, alarm and status descriptors, requesting data, execution commands and log requests. Include a minimum of 40 hours instructor time. Furnish instructions on site.

C. Demonstrate complete and operating system to City of New York.

3.7 ELECTRICAL WIRING AND MATERIALS

A. Install, connect and wire the items included under this Section and all other Sections of HVAC work. This work includes providing required conduit, wire, fittings, backboxes, transformers and related wiring accessories. All conduit, wiring and accessories shall be installed in accordance with Division 26 Specifications. Refer to controls system conduit schedule on contract drawings for conduit utilization requirements.

B. All wiring and conduit to be compliant to local building code and the NEC.

END OF SECTION 23 09 23

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SECTION 23 09 93 SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes points to be connected to Direct Digital Control system and overall sequences.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 09 00 - Instrumentation and Control for HVAC: For equipment, devices, and system components to implement sequences of operation.
2. Section 23 09 23 - Direct-Digital Control System for HVAC: For equipment, devices, system components, and software to implement sequences of operation.
3. All sections related to products requiring control and monitoring.

1.3 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate mechanical system controlled and control system components.

1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
2. Submit flow diagrams for each control system, graphically depicting control logic.
3. Submit draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
4. Coordinate submittals with information requested in Section 23 09 00 and 23 09 23.

1.4 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 POINTS TO BE CONNECTED TO DIRECT DIGITAL CONTROL SYSTEM

A. Condenser Water System: Refer to drawing M-804.

B. Hot Water Heating System:

1. Start/Stop and running status for hot water pumps and standby pumps
2. Pressure differential control valve position feedback
3. Hot water BTU meters
    a. Supply temperature
    b. Return temperature
    c. Flow
4. Refer to drawing M-805 for points to be connected for heat exchanger.

C. Dedicated Outside Air System and Fan Coil Units:

1. Refer to Sequences of Operations on drawing M-803.

D. All Pumps and fans:

1. Start/Stop and running Status
2. Interlock with respective system
3. Alarm failure on start/stop
4. VFD’s – Full communication via software protocol

E. Refrigerant Leak Detection Systems:

1. Low, medium and high level alarms
2. Common Trouble alarm

F. Miscellaneous HVAC Points:

1. Filtration system fault
2. Outdoor air temperature and relative humidity
3. Variable Frequency Drives - General Fault
4. Heat tracing control panel via BMS interface
5. Electric pipe heat trace fault.

G. Miscellaneous Plumbing Points:

1. Domestic hot water heaters high temperature and pressure alarms
2. Sump Pumps and ejectors High Level Alarms

3. Domestic booster pump system via BMS interface

H. Miscellaneous Electrical Points:

1. Full communication with generator via communication protocol (BMS Contractor is responsible for providing communications protocol)
2. Fire Alarm Status
3. Building Electrical Consumption (KWH), at each existing electrical service
4. Lighting Controls Interface

3.3 HOT WATER RADIANT PANELS

A. Refer to drawing M-802 for hot water radiant panel sequence of operations.

3.4 STEAM TO CONDENSER WATER HEAT EXCHANGER

A. Refer to drawing M-804 & M-805 for steam to condenser water heat exchanger sequence of operations.

3.5 ELECTRIC DUCT HEATER

A. Refer to drawing M-803 for electric duct heater sequence of operations.

3.6 DEDICATED OUTSIDE AIR SYSTEMS

A. Refer to drawing M-803 for sequence of operations.

3.7 DIFFERENTIAL PRESSURE CONTROLLERS

A. A differential pressure controller, pipe to sense differential pressure between supply and return lines, shall control a bypass water valve to maintain an adjustable pressure differential between the supply and return lines. Provide bypass controls, controllers, sensors and transmitters for each chilled water and hot water system.

B. Refer to drawings M-802, 804, 805 for additional information.

3.8 UNIT HEATERS AND CABINET HEATERS

A. For each hydronic unit heater, a line voltage electric thermostat and aquastat shall start and stop the unit motor and engage heater to maintain an adjustable space temperature. An automatic control valve shall stop water flow through unit heater when motor is off.

B. For each hydronic cabinet heater, provide automatic summer shut-off valve, hot water control valve, thermostat and aquastat. Control valve shall modulate water flow as called for by the return air thermostat.

C. Electrical cabinet units shall be provided with return air thermostat to control the heating elements.

3.9 NIGHT SET-BACK MODE FOR ALL HVAC SYSTEMS

A. Refer drawing M-802 for this information.

3.10 PUMPS

A. All pumps shall have start/stop and status indication at the BMS.

3.11 REFRIGERANT LEAK DETECTION SYSTEM

A. The refrigerant leak detection system (infrared type) shall continuously measure and display refrigerant concentration. The system shall provide visual alarms when preset limits are exceeded, as well as relay and analog output for alarms and control.

B. Alarm Set Point Levels - Three separate alarm set point levels shall be provided. The set points shall be independently adjustable for any value for a given range. The set points shall provide drive signals to user interface relays. The alarm set points shall have the capability of providing the user a selection of larching or non-larching mode.

Set Point	Service
1	Low level alarm set at 20 PPM
2	High level alarm set at 100 PPM or activation of Emergency Breakglass Ventilation Switch. Automatically starts exhaust fans and opens ventilation dampers and shuts down chillers.
3	High-high level alarm set at 200 PPM. Actuates flashing beacon and audible horn.
4	Common trouble alarm indicating malfunction of the refrigerant leak detection monitor

C. Audible horns producing 100dB, and flashing beacon shall be provided.

D. Refrigerant Leak Mode:

1. Note that refrigerant leak and associated panel alarm must be cleared prior to initiating normal sequence of operation.
2. Note: Activation of emergency breakglass ventilation switch shall also activate refrigerant ventilation system.

3.12 FIRE-SMOKE DAMPERS (NORMAL OPERATION)

A. Fire smoke dampers shall close when respective fan is off.

B. When fan is commanded to start, respective fire-smoke damper shall open and fan shall start after dampers are proven open through end switches.

3.13 WATER ALARM SYSTEMS

A. Provide overflow drip pan installed under all split AC units, 3-inch deep, welded galvanized, 20 gauge construction.

B. Leak detector sensor shall be provided in drip pan. When water is detected in drip pan, visible pilot light and audible horn (with silence switch) shall be annunciated on face of a local alarm panel in the vicinity of the respective unit.

3.14 EMERGENCY SHUTDOWN SWITCHES

A. Provide emergency breakglass shutdown switches at locations indicated, to shutdown chillers. Upon shut-down, an alarm shall annunciate at the BMS system. Activation shall automatically start MER exhaust fan, opening the damper located approximately 18" AFF.

B. Provide emergency breakglass shutdown switches at locations indicated to shutdown boilers. Upon shutdown, an alarm shall annunciate at the ATC system.

3.15 VARIABLE FREQUENCY DRIVES (VFD)

A. VFD's shall have four district modes of operation:

1. OFF – VFD and motor are off.
2. HAND – VFD output is manually controlled via speed selector input on drive.
3. AUTO – VFD output is controlled by BMS.
4. BYPASS – Drive Electronics are bypassed and unit acts as an across-the-line-starter operating at 100% speed. This allows for maintenance of drive while motor is still operating.

B. VFD's shall have full communication capabilities with the BMS. Provide all interfaces, gateways, etc. as required for communications between the VFD's and BMS.

END OF SECTION 23 09 93

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SECTION 23 21 16 HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Pressure gages.
2. Pressure g-age taps.
3. Thermometers.
4. Thermometer supports.
5. Test plugs.
6. Expansion tanks.
7. Diaphragm-type expansion tanks.
8. Bladder-type expansion tanks.
9. Air vents.
10. Air separators.
11. Strainers.
12. Relief valves.
13. Drain Valves

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 21 16 - Hydronic Piping Specialties: Execution requirements for piping connections to products specified by this section.
2. Section 23 21 23 - Hydronic Pumps: Execution requirements for piping connections to products specified by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

B. ASTM International:

1. ASTM E1 - Standard Specification for ASTM Thermometers.
2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

C. American Water Works Association:

1. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
2. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
3. AWWA C702 - Cold-Water Meters - Compound Type.
4. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

D. Underwriters Laboratories Inc.:

1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
2. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit for manufactured products and assemblies used in this Project.

1. Manufacturer’s data indicating use, operating range, total range, accuracy, and location for manufactured components.
2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
4. Submit electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection, and hookup configuration. Include pipe and accessory elevations.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of actual locations of components and instrumentation, flow controls and flow meters.

C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience, and with service facilities within 100 miles of Project.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.8 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product storage and handling requirements.

B. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions: product requirements.

B. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.10 FIELD MEASUREMENTS

A. Verify field measurements before fabrication.

1.11 MAINTENANCE SERVICE

A. Refer to DCAS General Conditions: Maintenance service.

B. Furnish service and maintenance of glycol fluid and glycol charging components for one (1) year from Date of Substantial Completion.

1.12 MAINTENANCE MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance materials.

B. Furnish two (2) bottles of red gage oil for static pressure gages.

1.13 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Furnish two (2) pressure gages with pulsation damper dial thermometers.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES

A. Gage: ASME B40.1, UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

1. Case: Cast aluminum.
2. Bourdon Tube: Brass.
3. Dial Size: 4-1/2 inch and 8-1/2 inch diameter.
4. Mid-Scale Accuracy: One percent.
5. Scale: Both psi and kPa.

B. Scale ranges shall be:
1. Oil Pumps - 0 PSI to 125 PSI
2. Other Systems - 0 PSI to (2 x Operating Pressure) PSI (Minimum 0 PSI to 30 PSI)

2.2 PRESSURE GAGE TAPS

A. Needle Valve: Brass, 1/4 inch NPT for minimum 300 psi.

B. Ball Valve: Stainless Steel, 1/8 inch NPT for 250 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

D. Siphon: Steel, Schedule 40, 1/4 inch NPT angle or straight pattern.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Weksler
2. Taylor
3. Mueller
4. Or approved equal

B. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.

1. Size: 9 inch scale.
2. Window: Clear [glass] [Lexan].
3. Stem: Brass, 3-1/2 inch long.
4. Accuracy: ASTM E77 2 percent.
5. Calibration: Both degrees F and degrees C.

C. Scale ranges should be as follows:
1. Hot water - 30°F to 240°F
2. Condenser water - 20°F to 120°F

2.4 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions.

B. Flange: 3-inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.5 TEST PLUGS

A. 1/4 inch NPT or 1/2 inch NPT brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with:

1. Neoprene core for temperatures up to 200 degrees F.
2. Nordel core for temperatures up to 350 degrees F.
3. Viton core for temperatures up to 400 degrees F.

B. Test Kit:

1. Carrying case, internally padded and fitted containing:
   a. Two 3-1/2 inch diameter pressure gages.
   b. One gage adapters with 1/8 inch probes.
   c. Two 1-1/2 inch dial thermometers.
      1) Scale range: 0 to 200 degrees F.

2.6 DIAPHRAGM-TYPE EXPANSION TANKS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Bell & Gosset
2. Taco
3. _____
4. Or approved equal.

B. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure, with flexible butyl diaphragm sealed into tank, and steel support stand.

C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to minimum pressure required to flood highest point in piping system plus 5 psig.

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow prevention device, test cocks, strainer, vacuum breaker, and by-pass valves to meet local code.

E. Provide closed expansion tanks for the closed water systems where located and of sizes and capacities as indicated on Drawings. Drain lines shall terminate at nearest floor drain. Tanks shall be constructed in accordance with ASME Code for unfired vessels.

F. Provide concrete pad for floor-mounted tanks and proper support from structure for suspended tanks.

G. Install all accessories and trim as shown on typical details for expansion tanks including pressure gauges and pressure reducing valves.

2.7 BLADDER-TYPE EXPANSION TANKS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Bell & Gosset
2. Taco
3. _____
4. Or approved equal.

B. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII; supplied with National Board Form U-1, rated for working pressure, with replaceable heavy duty butyl bladder, and steel support stand.

C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to minimum pressure required to flood highest point in piping system plus 5 psig.

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow prevention device, test cocks, strainer, vacuum breaker, and by-pass valves to meet local code.

E. Provide closed expansion tanks for the closed water systems where located and of sizes and capacities as indicated on Drawings. Drain lines shall terminate at nearest floor drain. Tanks shall be constructed in accordance with ASME Code for unfired vessels.

F. Provide concrete pad for floor-mounted tanks and proper support from structure for suspended tanks.

G. Install all accessories and trim as shown on typical details for expansion tanks including pressure gauges and pressure reducing valves.

2.8 AIR VENTS

A. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

B. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

C. Where the hot and cold water system is trapped and air is liable to be pocketed, furnish and install a manual vent to properly relieve the system of air. The discharge from these vents shall be piped with copper tubing to the nearest slop sink, floor drain or to a location easily accessible from the floor.

2.9 AIR SEPARATORS

A. Combination Air Separators/Strainers: Steel, tested and stamped in accordance with ASME Section VIII to suite the operating pressure, tangential inlet and outlet connections, and internal stainless steel air collector tube. Provide with high capacity automatic air vent and factory hanging brackets.

2.10 STRAINERS

A. Size 2 inches and Smaller:

1. Screwed brass, iron or steel body to suite the working pressure (minimum 175 psig), Y pattern with 1/32 inch stainless steel perforated screen.

B. Size 2-1/2 inches to 4 inches:

1. Flanged iron or steel body to suite the working pressure (minimum 175 psig), Y pattern with 3/64 inch stainless steel perforated screen.

C. Size 5 inches and Larger:

1. Flanged iron or steel body to suite the working pressure (minimum 175 psig), bask-et pattern with 1/8 inch stainless steel perforated screen.

2.11 WATER RELIEF VALVES

A. Where required provide ASME water relief valve of. Each valve shall be provided with manual lifting lever capable of opening the valve as desired. A discharge line shall be run to floor drain from each valve. No shutoff valve shall be placed between relief valve and system

2.12 DRAIN VALVES

A. Provide drain valves with hose bibb end at all low points of water systems. Drain valves shall be gate type. Minimum 3/4" drain size shall be used up to 4" pipe size. 2" drain size shall be used for pipes 5" size and over. Also provide a fill valve for each water system, with a back-flow preventer as described below. All drain and fill valves shall have caps or plugs as applicable.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION - THERMOMETERS AND GAGES

A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.

1. In inlet and outlet of water coil.
2. In inlet and discharge side of each pump.
3. At each expansion tank.
4. At inlet and outlet of each cooling tower.
5. Inlet and outlet of each duplex oil strainer and condenser water filter.
6. Other locations as shown on the drawings.
7. Inlet and outlet of each heat exchanger.

B. Install gage taps in piping

C. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

E. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Install at the following locations:

1. In inlet and outlet water connections at each water coil bank in each air handling unit.
2. In inlet and outlet of hot water boilers.
3. Supply, return and mixed air duct of each air handling unit.
4. In supply and return water connection to each heating coil provide a thermometer and pressure gauge.
5. Inlet and outlet of each cooling tower.
6. Condenser water header.
7. At other locations shown on drawings.

F. Coil and conceal excess capillary on remote element instruments.

G. Provide instruments with scale ranges selected according to service with largest appropriate scale.

H. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

I. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.3 INSTALLATION - HYDRONIC PIPING SPECIALTIES

A. Locate test plugs adjacent to thermometers and thermometer sockets and pressure gage taps as indicated on Drawings.

B. Where large air quantities accumulate, provide enlarged air collection standpipes.

C. Install manual air vents at system high points.

D. For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.

E. Provide drain valves at all coils, pieces of equipment and at all low points in system. Pipe to local floor drain.

F. Provide air separator on suction side of system circulation pump and connect to expansion tank.

G. Provide drain and hose connection with valve on strainer blow down connection.

H. Support pump fittings with floor mounted pipe and flange supports.

I. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

J. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

K. Pipe relief valve outlet to nearest floor drain.

L. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

3.4 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Test for concentration of glycol and water solution and submit written test results.

3.5 CLEANING

A. Refer to DCAS General Conditions: Requirements for cleaning.

B. Clean and flush glycol system before adding glycol solution.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Refer to DCAS General Conditions: Requirements for protecting installed construction.

B. Do not install hydronic pressure gauges until after systems are pressure tested.

END OF SECTION 23 21 16

SECTION 23 21 23 HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Base mounted pumps.

1.3 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

B. Underwriters Laboratories Inc.:

1. UL 778 - Motor Operated Water Pumps.

1.4 PERFORMANCE REQUIREMENTS

A. Provide pumps to operate at system fluid temperatures indicated on Drawings without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements. Submit also, manufacturer model number, dimensions, service sizes, and finishes. Submit motor data per Section 23 05 13. Motors shall be TEFC, except where noted otherwise.

C. Manufacturer's Installation Instructions: Submit application, selection, and hookup configuration with pipe and accessory elevations. Submit hanging and support requirements and recommendations.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Execution and Closeout Requirements.

B. Operation and Maintenance Data: Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

C. Maintain one (1) copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Administrative Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product Requirements.

B. Protect systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Furnish one (1) set of mechanical seals for each pump.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR ALL PUMPS

A. Pumps shall be selected to operate at or near their point of peak efficiency thus allowing for operation at capacity of approximately 25% beyond design capacity. In addition, the design

impeller diameter shall not exceed 90% of the maximum impeller diameter available for that model.

B. In order to ensure stable operation and prevent any possibility of hunting, the pump curve shall be continuously rising from maximum capacity up to the shutoff head.

C. All pump casings shall be hydrostatically tested at 1-1/2 times design working pressure. The Design Working pressure is sum of total dynamic head plus total system static water head. The pump manufacturer shall be responsible for his service department aligning of all flexibility coupled units in the field prior to start-up. Alignment shall be with dial indicator with accuracy of plus or minus .002 inches.

D. Each pump shall be guaranteed to circulate not less than the specified quantity of water against the specified circulating head when operating continuously, without overheating the motor or bearings, or the like, and without producing noise, audible anywhere in the building, outside of the space in which the pumps are installed.

E. Pumps and pump motors shall be selected for parallel operation where any system is shown or piped to operate with two or more pumps. Pump motor horsepower shall be selected to ensure non-overloading condition.

F. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Bell & Gossett.
2. Amstrong.
3. Taco.
4. Or approved equal

2.2 BASE MOUNTED PUMPS

A. Type: Horizontal shaft, single stage, direct connected, end suction or horizontal split casing.

B. Casing: Cast iron or cast steel to suite working pressure (with a minimum 175 psig working pressure), with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Bronze, fully enclosed, keyed to shaft.

D. Bearings: Permanently lubricated roller or ball bearings.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Carbon rotating against stationary ceramic seat, 225 degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling with coupling guard.

H. Baseplate: Cast iron or fabricated steel with integral drain rim.

1. Motors: In accordance with Section 21 05 13. 1750 rpm unless specified otherwise. All motors shall be inverter duty rated for VFD application.
2. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. Provide for pumps having “mechanical” seals, flush type glands and cyclo-clean separator to be connected to pump discharge with all required piping and fittings.

B. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4 inches and over.

C. Install pumps on inertia block with vibration isolators. Refer to Section 23 05 48.

D. Provide line sized shut-off valve and strainer on pump suction. Provide check valve, balancing valve, and line sized shut-off valve on pump discharge. Use of triple duty valves is not acceptable.

E. Provide air cock and drain connection on horizontal pump casings.

F. Provide drains for bases and seals. Pipe drains to floor drains.

G. Check, align, and certify alignment of base mounted pumps prior to start-up.

H. Install base-mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Provide interia blocks when required, refer to section 23 05 48 for additional information.

I. Lubricate pumps before start-up.

J. Install Work in accordance with NYCBC.

K. Pressure gauges shall be installed on the suction and discharge connection of each pump. Two pressure gauges shall be provided on the pump suction; one on either side of the strainer.

L. Each unit shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for Using Agency’s reference.

M. All pump casings shall be hydrostatically tested at 1-1/2 times design working pressure. The pump manufacturer shall be responsible for his service department aligning in the field prior to start-up of all flexibly coupled units. Alignment shall be with dial indicator with accuracy of plus or minus .002 inches. The pump manufacturer must submit a written report certifying that the alignment work has been performed by his personnel and that the pumps are ready for operation.

3.3 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect for alignment of base mounted pumps.

END OF SECTION 23 21 23

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SECTION 23 22 16 STEAM AND CONDENSATE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Pressure gages.
2. Pressure gage taps.
3. Strainers.
4. Steam traps.

B. Related Sections:

1. Section 23 05 03 - HVAC Piping: Execution requirements for piping connections to products specified by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

B. ASTM International:

1. ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications.
2. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

C. Con Edison Steam Service Rule Book.

1.4 PERFORMANCE REQUIREMENTS

A. Steam Traps:

1. Select to handle minimum of three times maximum condensate load of apparatus served, and in no cases less than 200 pounds per hour capacity.
2. Pressure Differentials:
   a. Low Pressure Systems 15 psi maximum: 1/2 psi.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit for manufactured products and assemblies used in this Project.

1. Manufacturer’s data and list indicating use, operating range, total range, accuracy, and location for manufactured components.
2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
4. Submit electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection, and hookup configuration. Include pipe and accessory elevations.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of actual locations of components and instrumentation, flow controls and flow meters.

C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction and replacement parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience, and with service facilities within 100 miles of Project.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one (1) week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Product storage and handling requirements.

B. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions - Product Requirements.

B. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.11 FIELD MEASUREMENTS

A. Verify field measurements before fabrication.

1.12 MAINTENANCE MATERIALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Spare parts and maintenance materials.

B. Furnish two (2) bottles of red gage oil for static pressure gages.

1.13 EXTRA MATERIALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two (2) pressure gages with pulsation damper.

C. Furnish two (2) service kits for each size and type of steam trap.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Trerice.
2. Ashcroft.
3. _____
4. Or approved equal.

B. Gage: ASME B40.1 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

1. Case: Cast aluminum.
2. Bourdon Tube: Brass.
3. Dial Size: 4-1/2 inches and 8-1/2 inches in diameter.
4. Mid-Scale Accuracy: One percent.
5. Scale: Both psi and kPa.

2.2 PRESSURE GAGE TAPS

A. Ball Valve: Stainless Steel, 1/8 inch NPT for 250 psi.

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

C. Siphon: Steel, Schedule 40, 1/4 inch NPT angle or straight pattern.

D. Scale ranges shall be:
1. Steam Systems - 0 PSI to (2 x Operating Pressure) PSI (Minimum 0 PSI to 30 PSI)

2.3 STRAINERS

A. Sizes 2 inches and Smaller:

1. Screwed iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

B. Sizes 2-1/2 inches to 4 inches:

1. Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

C. Sizes 5 inches and Larger:

1. Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.4 FLOAT AND THERMOSTATIC TRAPS

A. Trap:

1. Construction: ASTM A126, or semi-steel body and bolted cover, stainless steel or bronze bellows type air vent, stainless steel float, stainless steel lever and valve assembly
2. Rating: 150 psig WSP.
3. Features: Access to internal parts without disturbing piping, bottom drain plug.
4. Accessories: Gage glass with shut-off cocks.

2.5 THERMOSTATIC TRAPS

A. Freeze Proof:

1. Trap: Cast iron body for 300 psig WSP, bronze bellows, stainless steel valve and seat, external adjustment.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 INSTALLATION - GAGES

A. Install pressure gages with pulsation dampers. Provide ball valve to isolate each gage. Install siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.

B. Provide instruments with scale ranges selected according to service with largest appropriate scale.

C. Install gages in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust gages to final angle, clean windows and lenses, and calibrate to zero.

3.3 INSTALLATION - STEAM SYSTEM SPECIALTIES

A. Steam Traps:

1. Provide minimum 3/4 inch size on steam branches.
2. Install with union or flanged connections at both ends.
3. Provide gate valve and strainer at inlet, and gate valve [and check valve] at discharge.
4. Provide minimum 10 inch long, line size dirt pocket between apparatus and trap.
5. Other locations indicated on Drawings or specified.

B. Install thermostatic steam traps on the following pieces of equipment:

1. Unit ventilators.

C. Install float and thermostatic steam traps on the following pieces of equipment:

1. Heat exchangers.

D. Install all steam and condensate specialties required by Con Edison’s rules and regulations. As a minimum, install strainers upstream of:

1. Automatic control valves
2. Steam traps
3. Branch blow-off valve for each strainer

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for protecting installed construction.

B. Remove thermostatic elements from steam traps during temporary and trial usage, and until system has been operated and dirt pockets cleaned of sediment and scale.

C. Do not install steam pressure gauges until after systems are pressure tested.

END OF SECTION 23 22 16

SECTION 23 23 00 REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Refrigerant piping.
2. Unions, flanges, and couplings.
3. Pipe hangers and supports.
4. Refrigerant moisture and liquid indicators.
5. Valves.
6. Refrigerant strainers.
7. Refrigerant pressure regulators.
8. Refrigerant pressure relief valves.
9. Refrigerant filter-driers.
10. Refrigerant solenoid valves.
11. Refrigerant expansion valves.
12. Electronic expansion valves.
13. Refrigerant receivers.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports, sleeves, and firestopping for placement by this section.
2. Section 23 05 48 - Noise and Vibration Controls for HVAC Piping and Equipment: Product requirements for Vibration Isolation for placement by this section.
3. Section 23 05 53 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.
4. Section 23 07 00 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.

1.3 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. ARI 495 - Refrigerant Liquid Receivers.

2. ARI 710 - Liquid-Line Driers.
3. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.
4. ARI 750 - Thermostatic Refrigerant Expansion Valves.
5. ARI 760 - Solenoid Valves for Use with Volatile Refrigerants.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. American Society of Mechanical Engineers:

1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B31.5 - Refrigeration Piping.
4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
5. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
6. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

G. Underwriters Laboratories Inc.:

1. UL 429 - Electrically Operated Valves.

1.4 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.

C. Provide pipe hangers and supports in accordance with ASME B31.5, MSS SP 58, MSS SP 69, and MSS SP 89.

D. Provide receivers on systems with piping runs exceeding 50 feet.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.

C. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Refrigerant Specialties: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes for the following:
    a. Refrigerant moisture and liquid indicators.
    b. Refrigerant strainers.
    c. Refrigerant pressure regulators.
    d. Refrigerant pressure relief valves.
    e. Refrigerant filter-driers.
    f. Refrigerant solenoid valves.
    g. Refrigerant expansion valves.
    h. Electronic expansion valves.

D. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of refrigerant leak test piping system pressure test.

F. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.

G. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

H. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of valves, equipment and refrigerant accessories.

C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.5 code for installation of refrigerant piping systems.

B. Perform Work in accordance with applicable code for welding hanger and support attachments to building structure.

C. Perform Work in accordance with NYCBC.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience, approved by manufacturer.

C. Design piping system and hangers and supports under direct supervision of commissioner experienced in design of this Work. Layout and sizing of piping shall be approved by the manufacturer.

1.9 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.10 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product storage and handling requirements.

B. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.

C. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions: Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.12 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.13 MAINTENANCE MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Furnish two (2) refrigerant oil test kits each containing everything required for conducting one test.

1.14 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Furnish two (2) packing kits for each size and valve type.

C. Furnish two (2) refrigerant filter-dryer cartridges of each type.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn or annealed.

1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B. Steel Pipe: ASTM A53, Grade B, Schedule 40, black for all refrigerant relief vent piping.

1. Fittings: ASTM A234 forged steel welding type.
2. Joints: Welded.

2.2 UNIONS, FLANGES AND COUPLINGS

A. 2 inches and Smaller:

1. Ferrous Piping: 450 psig malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. 2-1/2 inches and Larger:

1. Ferrous Piping: 450 psig forged steel, slip-on.
2. Copper Piping: Bronze.
3. Gaskets: 1/16 inch thick preformed neoprene.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 PIPE HANGERS AND SUPPORTS

A. Reference Section 23 05 29 for support requirements.

2.4 REFRIGERANT MOISTURE AND LIQUID INDICATORS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div. Model.
3. Sporlan Valve Co. Model.
4. Or approved equal

B. Indicators:

1. Port: Single, UL listed.
2. Body: Copper or brass, flared or solder ends.
3. Sight glass: Color-coded paper moisture indicator with removable element cartridge and plastic cap.
4. Maximum working pressure: 500 psig
5. Maximum working temperature: 200 degrees F.

2.5 VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Or approved equal

B. Diaphragm Packless Valves:

1. UL listed, globe or angle pattern, forged brass body and bonnet solder or flared ends.
2. Phosphor bronze and stainless steel diaphragms, rising stem and hand wheel.
3. Stainless steel spring, nylon seats, disc with positive back seating.
4. Maximum working pressure: 500 psig.
5. Maximum working temperature: 275 degrees F.

C. Packed Angle Valves:

1. Forged brass, solder or flared ends.
2. Forged brass seal caps with copper gasket, rising stem and seat with back seating, molded stem packing.
3. Maximum working pressure: 500 psig.
4. Maximum working temperature: 275 degrees F.

D. Ball Valves:

1. Two-piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals, soldered or threaded ends.
2. Maximum working pressure: 500 psig.
3. Maximum working temperature: 325 degrees F.

E. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends.
2. Maximum working pressure: 500 psig.

F. Refrigerant Check Valves:

1. Manufacturers: Subject to compliance with requirement, provide products by one of the following:
   a. Alco Controls Div, Emerson Electric Co.
   b. Parker Hannifin Corp., Refrig. & Air Cond. Div.
   c. Sporlan Valve Co. Model.
   d. Or approved equal

2. Globe Type:
   a. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc.
   b. Maximum working pressure: 500 psig.
   c. Maximum working temperature: 300 degrees F.

3. Straight Through Type:
   a. Spring, neoprene seat.
   b. Maximum working pressure: 500 psig.

c. Maximum working temperature: 200 degrees F.

2.6 REFRIGERANT STRAINERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Or approved equal

B. Straight Line or Angle Line Type:

1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass.
2. Maximum working pressure: 450 psig.

C. Straight Line, Non-Cleanable Type:

1. Steel shell, copper plated fittings, stainless steel wire screen.
2. Maximum working pressure: 500 psig.

2.7 REFRIGERANT PRESSURE REGULATORS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Or approved equal

B. Brass body, stainless steel diaphragm, pilot operated with remote pressure pilot, adjustable over 0 to 80 psig range, for maximum working pressure of 450 psig.

2.8 REFRIGERANT PRESSURE RELIEF VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Or approved equal

B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB; for standard 450 psig setting; selected to ASHRAE 15.

2.9 REFRIGERANT FILTER-DRIERS

A. Manufacturers:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Or approved equal

B. Replaceable Cartridge Angle Type:

1. Shell: ARI 710, UL listed, brass, removable cap, for maximum working pressure of 500 psig.

C. Permanent Straight Through Type:

1. ARI 710, UL listed, steel shell with molded desiccant filter core, for maximum working pressure of 500 psig.

2.10 REFRIGERANT SOLENOID VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Or approved equal

B. Valve: ARI 760, pilot operated, copper or brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly, integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psig. Stem designed to allow manual operation in case of coil failure.

C. Coil Assembly: UL 429, UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

D. Electrical Characteristics: 120 volts.

2.11 REFRIGERANT EXPANSION VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Or approved equal

B. Angle or Straight Through Type: ARI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, mechanical pressure limit (maximum operating pressure MOP feature), non-adjustable superheat setting, replaceable inlet strainer, with replaceable capillary tube and remote sensing bulb and remote bulb well.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and oversized at part load.

2.12 ELECTRONIC EXPANSION VALVES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Or approved equal

B. Valve:

1. Brass bodies with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.
2. Electrical Characteristics: 12 VA, 12 volts DC.

C. Evaporation Control System:

1. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, pre-selection allowance for electrical defrost and hot gas bypass.
2. Electrical Characteristics: 12 VA, 115 volts, single phase, 50/60 Hz.

D. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

2.13 REFRIGERANT RECEIVERS

A. Internal Diameter 6 inches and Smaller: ARI 495, UL listed, steel, brazed; 450 psig maximum pressure rating, with taps for inlet, outlet, and pressure relief valve.

B. Internal Diameter 6 inches and Larger: ARI 495, welded steel, tested and stamped in accordance with ASME Section VIII; 450 psig with taps for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.3 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.4 REFRIGERANT PIPE SIZING

A. Submit manufacturer’s computerized calculations in accordance with ASHRAE procedures to confirm pipe sizes.

3.5 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Reference Section 23 05 29 for support requirements.

3.6 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Route piping parallel to building structure and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.

E. Install pipe identification in accordance with Section 23 05 53.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 13.

H. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

I. Flood refrigerant piping system with nitrogen when brazing.

J. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 90 00.

K. Install valves with stems upright or horizontal, not inverted.

L. Insulate piping and equipment; refer to Section 23 07 00.

M. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.

N. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

O. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

P. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

Q. Fully charge completed system with refrigerant after testing.

R. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

S. Install refrigerant piping in accordance with ASME B31.5.

3.7 INSTALLATION - REFRIGERANT SPECIALTIES

A. Refrigerant Liquid Indicators:

1. Install line size liquid indicators in main liquid line downstream of condenser.
2. When receiver is provided, install line size liquid indicators in liquid line downstream of receiver.
3. Install line size liquid indicators downstream of liquid solenoid valves.

B. Refrigerant Valves:

1. Install service valves on compressor suction and discharge.
2. Install gage taps at compressor inlet and outlet.

3. Install gage taps at hot gas bypass regulators, inlet and outlet.
4. Install check valves on compressor discharge.
5. Install check valves on condenser liquid lines on multiple condenser systems.
6. Install refrigerant charging valve in liquid line between receiver shut-off valve and expansion valve.

C. Strainers:

1. Install line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, install single main liquid-line strainer.
3. On steel piping systems, install strainer in suction line.
4. Install shut-off valves on each side of strainer.

D. Install pressure relief valves on ASME receivers. Install relief valve discharge piping to terminate outdoors.

E. Filter-Dryers:

1. Install permanent filter-dryers in low temperature systems.
2. Install permanent filter-dryer in systems containing hermetic compressors.
3. Install replaceable cartridge filter-dryer vertically in liquid line adjacent to receivers.
4. Install replaceable cartridge filter-dryer upstream of each solenoid valve.

F. Solenoid Valves:

1. Install in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Install in liquid line of single or multiple evaporator systems.
3. Install in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

3.8 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test refrigeration system with dry nitrogen to 1.3 times working pressure. Perform final tests at 27 inches vacuum and working pressure using electronic leak detector.

D. Repair leaks.

E. Retest until no leaks are detected.

END OF SECTION 23 23 00

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SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. System cleaner.
2. Closed system treatment (water).
3. Condenser water system treatment.
4. Chemical feeder equipment including associated feeders, pumps, tanks, controls, meters and valves.
5. Test equipment.
6. Filtration system (closed systems)

1.3 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 PERFORMANCE REQUIREMENTS

A. Provide system to treat water available at project site to maintain the characteristics of water in closed, steam, condenser and open systems required by the equipment and piping material it serves, but not less than the following:

1. Chemical Treatment for Closed Systems:

System	Treatment and Chemical Conditions	Control Level
Hot Water	Buffered sodium nitrite as sodium nitrite	1500 ppm
	pH	7.0-9.0 (2)
Chilled Water	Buffered sodium nitrite as sodium nitrite	500 ppm
	pH	7.0-9.0 (2)

2. Notes:
   a. Apply non-oxidizing Environmental Protection Agency Registered biocides when necessary. (Two biocides must be furnished for alternate applications).
   b. Apply acid or alkali, if required to be determined from an analysis of makeup water and local atmospheric conditions.
   c. Actual cycles of concentration to be determined from an analysis of the makeup water.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

C. Product Data: Submit chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit placement of equipment in systems, piping configuration, and connection requirements.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Manufacturers Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout products.

B. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

C. Operation and Maintenance Data: Submit data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with NYCBC.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience and with service facilities within 100 miles of Project with water analysis laboratories and full time service personnel.

B. The Water Treatment Company shall be actively engaged in the treatment of water systems and shall employ a full time staff of laboratory personnel who regularly analyze samples in accordance with the standard methods of the American Public

C. Health Association and to the American Society for Testing Materials. The laboratory shall be equipped with Atomic absorption and X-ray spectroscopy equipment for the complete analysis of scale and deposit samples.

D. The technical service shall include monthly service calls during which time the company's field representative will analyze all waters being treated. A service report will be written detailing the chemical levels in each system and detail any necessary chemical or equipment changes that must be made. The field service representative shall hold a degree in chemistry or in chemical engineering from an accredited college or university, and shall be certified as a Water Technologist by the Association of Water Technologies.

E. Where new water systems are shown to be interconnected with existing systems, the Water Treatment Co. shall modify above specified treatment to match existing chemicals and control levels practiced by the City of New York.

1.9 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

1.12 MAINTENANCE SERVICE

A. Refer to DCAS General Conditions: Article 37 – General Mechanical Requirements for specific maintenance service requirements

B. Furnish monthly technical service visits for one (1) year starting at Date of Substantial Completion, to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements and corrective actions needed. Submit two copies of field service report after each visit.

C. Furnish laboratory and technical assistance services during this maintenance period.

D. Furnish onsite inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

1.13 MAINTENANCE MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Furnish chemicals for treatment and testing during warranty period.

PART 2 - PRODUCTS

2.1 SYSTEM CLEANER

A. Product Description: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tri-Poly phosphate and sodium molybdate.

B. Biocide; chlorine release agents including sodium hypochlorite or calcium hypochlorite.

C. Chemical cleaning procedure and chemical deposit shall be in accordance with local code and health regulation.

2.2 CLOSED SYSTEM TREATMENT (WATER)

A. Furnish materials in accordance with NYCBC.

B. Sequestering agent to reduce deposits and adjust pH ; polyphosphate.

C. Corrosion inhibitors; liquid boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulfites.

D. Conductivity enhancers; phosphates or phosphonates.

2.3 BY-PASS (POT) FEEDER

A. 6.0 gal capacity up to 10,000 gallon system capacity, 10 gallon for systems over 10,000 gallon capacity quick opening cap for working pressure suitable for system pressure with a minimum rating of 175 psig.

2.4 SOLUTION METERING PUMP

A. Positive displacement, diaphragm pump with adjustable flow rate, thermoplastic construction, continuous-duty fully enclosed electric motor and drive, and [built-in] relief valve.

B. Electrical Characteristics:

1. 120 volts, single phase, 60 Hz.

2.5 SOLUTION TANKS

A. 50 gallon capacity, polyethylene, self-supporting, 1 gallon graduated markings; molded fiberglass cover with recess for mounting pump, agitator, and liquid level switch.

2.6 AGITATOR

A. Totally enclosed electric motor, stainless steel clamp and motor mount, 1/2 inch diameter coated Type 316 stainless steel propeller.

B. Electrical Characteristics:

1. 120 volts, single phase, 60 Hz.

2.7 LIQUID LEVEL SWITCH

A. Polypropylene housing with integrally mounted PVC air trap, receptacles for connection to metering pump, and low level alarm.

B. Electrical Characteristics:

1. 120 volts, single phase, 60 Hz.

2.8 CONDUCTIVITY CONTROLLER

A. Packaged monitor controller with solid state circuiting, five percent accuracy, linear dial adjustment, built-in calibration switch, on-off switch and light, control function light, output to control circuit and recorder.

B. Electrical Characteristics:

1. 120 volts, single phase, 60 Hz.

2.9 WATER METER

A. Displacement type cold-water meter with sealed, tamper-proof magnetic drive, impulse contact register, single-pole, double-throw, dry contact switch.

B. Electrical Characteristics:

1. 120 volts, single phase, 60 Hz.

2.10 SOLENOID VALVES

A. Forged brass body globe pattern, normally open or closed as required, general-purpose solenoid enclosure, and continuous duty coil.

B. Electrical Characteristics: 120 volts, single phase, 60 Hz.

2.11 TIMERS

A. Electronic timers, infinitely adjustable over full range, 150 second and five minute range, mounted together in cabinet with hands-off-automatic switches and status lights.

B. Electrical Characteristics:

1. 120 volts, single phase, 60 Hz.

2.12 TEST EQUIPMENT

A. Furnish white enamel test cabinet with local and fluorescent light, capable of accommodating 4 - 10 ml zeroing titration burettes and associated reagents.

B. Furnish following test kits:

1. Alkalinity titration test kit.
2. Chloride titration test kit.
3. Sulphite titration test kit.
4. Total hardness titration test kit.
5. Low phosphate test kit.
6. Conductivity bridge, range 0 - 10,000 micro-ohms.
7. Creosol red pH slide, complete with reagent.
8. Portable electronic conductivity meter.
9. High nitrite test kit.

2.13 FILTRATION SYSTEM (CLOSED SYSTEMS)

A. Description

1. Scope: This section specified a High Efficiency Sand Filtration System rated for 0.25 micron particle removal for the cooling system described below:
   a. Inlet Filter Pressure:
   b. City Water Pressure: Between 40 and 80 PSI

2. Operating Requirements
   a. Filter shall operate continuously removing suspended particles from the tower water until either a pressure drop across filter bed of 18 psi is reached or 24 hours have elapsed. At either point, filter shall automatically backwash for 5 minutes on each vessel sequentially. After backwash cycle, filter shall automatically return to filtration mode.
   b. To conserve water and minimize load to floor drain, maximum backwash flow rate shall be 12 GPM per square foot of filter surface area.

3. Filtration System Sizing
   a. It shall be the responsibility of the filter manufacturer to size the filtration system, based on their published literature, to meet the specification, including performance criteria. The selection and sizing of the filtration system shall be

based on tower operation (evaporation and Blowdown). Local air quality, makeup water and tower water chemistry will also be considered.

B. General

1. Filter shall be designed to provide 0.25 micron filtration by utilizing ultrafine sand with an effective size of not more than 0.12 millimeters.
2. Filter design flow rate shall be greater than 20 GPM per square foot of surface area.
3. Filter shall be sized to remove at least 50% (by count) of the 0.5 micron particles and at least 80% (by count) of the 2 micron particles typically found in cooling water, within 30 days of startup.
4. Filter system shall be rated for 70 psig inlet pressure to filter pump.
5. Tanks shall be #304L stainless steel rated for 100 psig operating pressure.
6. Manifold shall be Type L copper.
7. System shall be factory assembled and tested for rated pressure and control functions.
8. Backwash shall be City Water.

C. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. AmeriWater
2. Nalco-UltraTreat
3. _____
4. Or approved equal

D. General Construction Requirements

1. Filter shall comprise #304L stainless steel vessel(s) with Type L copper manifold and cast iron circulating pump. The backwash shall be for city water. The filter shall be mounted on a stainless steel skid.

E. Components

1. Natural quartz media shall meet AWWA B-100, ANSI and NSF-61 standards for consistently uniform and chemically inert filter media. Crushed or ground media is not acceptable.
2. Valves shall be Johnson Controls two-piece brass ball type with EPDM stem seals, blowout proof stem design, stainless steel ball and stem, PTFE seats. Valves shall be actuated with individual 24V electric motor on each valve. The drain valve(s) shall be spring return normally closed.
3. Filter shall be equipped with two pressure gauges. The gauges shall be anti-filter and shall have a stainless steel casing, with brass internals. The minimum face size shall be no less than 2-1/2 inches. One gauge marked (IN) shall be connected to the filter pump discharge and the second gauge marked (OUT) shall be connected to the outlet side of the filter.
4. Top inlet distributor shall be Copper. Under drain shall be 316 stainless steel wedge wire screen pipe.
5. Backwash flow control shall be rated for full backwash flow with backwash water from 40 psig to 80 psig.

6. Filter pump shall be cast iron, close coupled with mechanical seal. Pump motor to be TEFC with a service factor of not less than 1.15.
7. Filter control shall be mounted in a NEMA 4X enclosure and shall contain the following:
   a. An Allen Bradley 1200 Series PLC.
   b. A Siemens motor starter and service disconnect.
   c. Two step-down transformers to convert 3 phase power to 115 VAC to operate control components and further convert 115 VAC to 24V for valve actuation.
   d. A pressure differential switch factory set to initiate backwash at 18 PSI differential across the filter bed.
   e. A manual backwash switch, of a momentary contact design, mounted on the outside of the control panel door.
   f. A backwash indicating light for each vessel, pump status light and pump on/off switch mounted on the outside of the control panel door.
   g. A non-resettable backwash counter mounted on the outside of the control panel door to indicate the number of times the filter has backwashed.
   h. PLC shall be programmed to control valve actuation, duration of the backwash cycle and pump on/off. Backwash shall be initiated by the 24-hour timer, pressure differential switch or manual backwash button. An internal delay of no less than 15 seconds shall be built into the program timer to avoid false backwashing.
   i. PLC shall also include a set of dry contacts that can be connected to the BMS to monitor backwash frequency.
   j. The entire industrial control package shall be UL and cUL listed.

F. A cross-linked high-density polyethylene tank to store backwash water until it can be slowly discharged to the sanitary drainage system. Tank shall be supplied with a backwash connection, overflow and drain connection with ball valve piped to funnel drain. A water level controller, avocado float, in tank to interrupt backwash if tank becomes full.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 PREPARATION

A. Operate, fill, start and vent systems prior to cleaning. Use water meter to record capacity in each system. Place terminal control valves in open position during cleaning.

3.3 CLEANING

A. Concentration:

1. As recommended by manufacturer.
2. One pound per 100 gallons of water contained in the system.
3. One pound per 100 gallons of water for hot systems and one pound per 50 gallons of water for cold systems.

B. Hot Water Heating Systems:

1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
3. Circulate for 6 hours at design temperatures, then drain.
4. Refill with clean water and repeat until system cleaner is removed.

C. Use neutralizer agents on recommendation of system cleaner supplier and acceptance of the Commissioner.

D. Flush open systems with clean water for one hour minimum. Drain completely and refill.

E. Remove, clean, and replace strainer screens.

F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.4 INSTALLATION

A. Install Work in accordance with NYCBC.

3.5 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and interconnecting piping. Install around balancing valve downstream of circulating pumps.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. Install 3/4 inch water coupon rack around circulating pumps with space for 12 test specimens.

3.6 INSTALLATION – FILTRATION SYSTEM

A. Place vessels as shown in installation drawing and level. Use manifold as guide for spacing.

B. Install upper and lower manifolds as per manufacturer’s instructions.

C. Install piping between manifold and pump(s) if necessary.

D. Attach control panel to vessel mount.

E. Connect control wiring to valves.

F. Connect electrical power to control panel and control to pump(s) according to local electrical codes and wiring diagram supplied by manufacturer.

G. Install media according to manufacturer’s instructions.

3.7 GENERAL REQUIREMENTS

A. Water treatment company, under the jurisdiction of the Contractor, shall retain title for all equipment and shall provide all apparatus and services to the City of New York during the period of his Contract which shall terminate one year after acceptance of entire system. He shall relinquish ownership at the end of one year after acceptance of work and thereon they shall remain the property of the City of New York.

B. Appropriate chemicals for cleaning the interior of all systems prior to initial operation, to remove and/or dissolve foreign substances, shall be supplied by the water treatment company.

C. Contractor shall place caution signs in a conspicuous location on each system, indicating that the system water is treated and giving instructions as to handling of wetted parts and possibly toxicity of the treated water.

3.8 DEMONSTRATION

A. Refer to DCAS General Conditions: Requirements for demonstration and instructing.

B. Furnish eight-hour instructing course for operating personnel, instruction to include installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start up of systems.

END OF SECTION 23 25 00

SECTION 23 31 00 HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Duct Materials.
2. Flexible ducts.
3. Insulated flexible ducts.
4. Single wall spiral round ducts.
5. Single wall spiral flat oval ducts.
6. Double wall spiral insulated round ducts.
7. Double wall spiral insulated flat oval ducts.
8. Transverse duct connection system.
9. Casings.
10. Ductwork fabrication.
11. Duct cleaning.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 09 90 00 - Painting and Coating: Execution requirements for Weld priming, weather resistant, paint or coating specified by this section.
3. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
4. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.3 REFERENCES

A. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

4. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High- Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Air Duct Leakage Test Manual.
2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:

1. UL 181 - Factory-Made Air Ducts and Connectors.

E. National Air Duct Cleaners Association

1. NADCA Standards for duct cleaning.

1.4 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 3/8 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:

1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.

2. Duct layout, indicating pressure classifications and sizes in plain view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
3. Fittings.
4. Reinforcing details and spacing.
5. Seam and joint construction details.
6. Penetrations through fire rated and other walls.
7. Terminal unit installation.
8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
9. Submit shop drawings indicating duct runs, material, extent of internal lining, fire dampers, volume dampers access doors and elevation of all ducts.
10. Also submit a book of Shop Standards for Sheetmetal Fabrication, for approval, before starting fabrication of any portion of ductwork.

C. Product Data: Submit data for duct materials, duct liner and duct connectors

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Maintain one (1) copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.9 PRE-INSTALLATION MEETINGS

A. Convene minimum one (1) week prior to commencing work of this section.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Refer to DCAS General Conditions - Product Requirements.

B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

C. Maintain temperatures during and after installation of duct sealant.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90/A90M.

B. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

C. Stainless Steel Ducts: ASTM A167, Type 316.

D. Fasteners: Rivets, bolts, or sheet metal screws.

E. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 INSULATED FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Clevaflex.
2. Flexmaster.
3. _____
4. Or approved equal.

B. UL 181, Class 1, constructed with interior liner of round corrugated aluminum duct with exterior fiberglass insulation and vinyl film vapor barrier.

1. Pressure Rating: 10 inches wg positive or negative.
2. Maximum Velocity: 4000 fpm.
3. Temperature Range: -20°F to 210°F.
4. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.
5. Furnish each flexible duct section with integral clamping devices for connection to round or oval fittings.
6. Join each flexible duct section to main trunk duct through sheet metal fittings. Construct fittings of galvanized steel and equip with factory installed volume damper having positive locking regulator. Provide fittings installed in lined ductwork with insulation guard.
7. Flexible metal duct connections shall, unless noted otherwise, be equal in size to the unit inlet connections, or shall be provided with adapters to match flexible hose to the unit inlet.
8. At points of connection between the flexible duct and unit, permacel EZ-4719 or Minnesota Mining sealing compound shall be placed on the metallic surface and the flexible ductwork clipped over. A stainless steel clamp shall be placed over the connections, similar to Ideal Type 52 worm gear drive.
9. Flexible ducts shall not be used for supporting diffusers from overhead supply ducts. Also, do not use hose ducts at VAV box inlets.
10. Up to 18 inches long flexible metal duct may be used between conventional air diffusers and low pressure, constant volume supply duct mains provided that a six-sided sheet-metal box is installed at the diffuser with dimensions 2" larger than the diffuser inlet collar size. For example: For a 10" neck diffuser, provide a sheetmetal box of 12" x 12" x 12" connecting one side to the diffuser and adjacent side to the flexible duct. Provide spin collar and damper for each diffuser take-off where required. Support the sheet metal box directly from the structure.

2.3 SINGLE WALL SPIRAL ROUND DUCTS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. McGill AirFlow Corporation.
2. Semco Incorporated.
3. Spiral Mfg. Co., Inc.
4. Or approved equal.

B. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

C. Follow requirement in Section 23 05 48 “Noise and Vibration Controls for HVAC Piping and Equipment” for internal duct insulation (liner).

D. Construct duct with the following minimum gages and in accordance with NYCBC, NYCMC and SMACNA:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22

Diameter	Gauge
38 inches to 50 inches	20
52 inches to 84 inches	18

E. Construct fittings with the following minimum gages and in accordance with NYCBC, NYCMC and SMACNA:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.4 SINGLE WALL SPIRAL FLAT OVAL DUCTS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. McGill AirFlow Corporation.
2. Semco Incorporated
3. Tangent Air Corp.
4. Spiral Mfg. Co., Inc.
5. Or approved equal

B. Product Description: Machine made from round spiral lockseam duct constructed of galvanized steel; rated for 10 inches wg pressure.

C. Follow requirement in Section 23 05 48 “Noise and Vibration Controls for HVAC Piping and Equipment” for internal duct insulation (liner),

D. Joints: Either fully welded or bolted flange with gasket material in accordance with manufacturer’s recommendations.

E. Construct duct with the following minimum gauges and in accordance with NYCBC, NYCMC and SMACNA:

Major Axis Dimension	Gauge
7 inches to 24 inches	24
25 inches to 48 inches	22
50 inches to 70 inches	20
72 inches to 82 inches	18
84 inches and larger	16

F. Construct fittings with the following minimum gauges:

Major Axis Fitting Dimension	Gauge
7 inches to 36 inches	20
37 inches to 60 inches	18
62 inches and larger	16

2.5 SINGLE WALL LONGITUDINALLY WELDED ROUND AND FLAT OVAL DUCTWORK FOR FUME HOOD EXHAUST AND KITCHEN HOOD EXHAUST

A. Minimum 18 gauge 316 stainless steel ductwork with fully welded longitudinal seam.

B. Transverse joints shall be fully welded.

C. Construct duct in accordance with NYCBC, NYCMC and SMACNA.

2.6 DOUBLE WALL SPIRAL INSULATED ROUND DUCTS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. McGill AirFlow Corporation
2. Semco Incorporated
3. Spiral Mfg. Co., Inc.
4. Or approved equal

B. Product Description: Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 1 inch thick glass fiber insulation, solid galvanized steel inner wall; fittings manufactured with solid inner wall.

C. Construct round duct with the following minimum gages and in accordance with NYCBC, NYCMC and SMACNA:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

D. Construct round fittings with the following minimum gages and in accordance with NYCBC, NYCMC and SMACNA:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18

Diameter	Gauge
62 inches to 84 inches	16

E. The inner wall thickness shall be a minimum of 26 gauge.

2.7 DOUBLE WALL SPIRAL INSULATED FLAT OVAL DUCTS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. McGill AirFlow Corporation.
2. Semco Incorporated.
3. Spiral Mfg. Co., Inc.
4. Or approved equal

B. Product Description: Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 1 inch thick glass fiber insulation, solid galvanized steel inner wall; fittings manufactured with solid inner wall.

C. Construct flat oval duct with the following minimum gauges and in accordance with NYCBC, NYCMC and SMACNA:

Major Axis Dimension	Gauge
7 inches to 24 inches	24
25 inches to 48 inches	22
50 inches to 70 inches	20
72 inches to 82 inches	18
84 inches and larger	16

D. Construct flat oval fittings with the following minimum gauges and in accordance with NYCBC, NYCMC and SMACNA:

Major Axis Fitting Dimension	Gauge
7 inches to 36 inches	20
37 inches to 60 inches	18
62 inches and larger	16

E. The inner wall thickness shall be a minimum of 24 gauge.

2.8 TRANSVERSE DUCT CONNECTION SYSTEM

A. Product Description: SMACNA "E" rated and SMACNA "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.9 LONGITUDINAL SEAMS

A. Rectangular ducts shall be Pittsburgh lock with sealed pocket.

B. Welded ducts shall have butt-welded seams or lap (socket) welded seams to suite the sheet thickness.

2.10 CASINGS/PLENUMS

A. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for operating pressures indicated.

B. Reinforce access door frames with steel angles tied to horizontal and vertical plenum supporting angles. Furnish hinged access doors where indicated or required for access to equipment for cleaning and inspection.

C. Provide all metal housing, casings or plenums. Metal casings or plenums shall be constructed and jointed by external 1-1/2" standing seams of No. 16 USS gauge galvanized steel sheets, reinforced with 1-1/2" x 1-1/2" x 1/4" angles spaced not more than 3'-0" apart. Additional angles shall be provided wherever necessary to prevent vibration.

D. Bottom panels shall be constructed to form watertight pans not less than 6" deep, with brass drains with strainers and threaded outlets located in each compartment where required. The bottom of each compartment shall be pitched to the drain. Provide water seal in drain lines to carry lines to nearest indirect drain.

E. Casing or plenums shall be provided with steel supports, of type approved by the Commissioner to properly support the equipment and to maintain pitch to the drains. Where insulated, they shall be arranged with adequate means of attaching the insulation, including the bottom, if any.

F. The Contractor shall provide heavy rigid plates with all required drilling and cutouts, heavy braced to reduce vibration, for the installation of thermometers, thermostats and other instruments.

G. Longitudinal reinforcing angles shall be installed on the inside in accordance with the following schedule:

Height of Side Walls or Width of Roof	No. Angles	Angle Spanning	Length of Casing	Diagonal Bracing Pairs of Braces
Up to 6'	0	-	Any	None
Up to 8'	1	Middle	Any	None
8' to 12'	2	1/3 points	Any	None
Over 12'	Variable	4' Centers	3&4 Panels	1
			5&6 Panels	2
			7&8 Panels	3

1. Angle size shall be 1-1/2" x 1-1/2" x 1/8" to 12' casing length, and 1-1/2" x 1/2" x 3/16" over 12' casing length.
2. Provide knee-bracing for top of casing wherever required.

H. All joints shall be caulked with Minnesota Mining Formula EC 1057 or Alumastic to make them airtight.

I. Casing or plenums shall be supported on galvanized steel legs. The bottom at the floor and at any other connection to masonry shall be riveted to 1-1/2" x 1-1/2" x 1/8" galvanized steel angles which shall be secured to masonry with expansion shields and caulked tight with cement.

J. Provide angles above and below access doors and frames for access doors.

2.11 DOUBLE WALL PLENUMS

A. General:

1. Double-wall (insulated) pressurized plenum equipment enclosures shall be provided for all mixed air, return air and supply air discharge plenums. All panels and components shall be prefabricated and supplied by a nationally recognized manufacturer with published standards of construction, assembly and technical performance. The manufacturer shall have produced a standardized prefabricated panel system for at least 10 years. Construction and performance of the installed system and components shall conform to all specifications listed in this document. The system and components shall not be susceptible to damage from extended exposure to airflow, pressure differentials, vibration, air temperature or humidity.

B. Joint Construction:

1. Panels shall be of “snap-lock” construction, such that adjacent panels are held together rigidly with an integral, continuous self-locking joint on both inside and outside panel surfaces. These joints shall not require screws, H-connectors, tape or any other type of additional fasteners or connectors.
2. For plenums in contact with air having temperature less than 60°F. during the summer, thermal break joints shall be provided.

C. Panel Construction:

1. All panels shall be 4 inches thick, with a solid galvanized steel exterior shell, and a perforated interior galvanized steel shell.
2. The outer and inner shells shall be tack or spot welded to perimeter and internal longitudinal steel channels and box-end internal closures, in such a manner and spacing that the panel assembly will not fail at the maximum operating loads specified in the Structural Performance specifications given in this document.
3. The outer shell shall be constructed of galvanized steel with a minimum 20-gauge thickness.
4. The inner shall be constructed of galvanized steel with a minimum 22-gauge thickness.
5. Perforated materials shall be 3/32-inch-diameter round holes with staggered spacing, 3/16 inch on center. The perforated material shall have a 23 percent open area.
6. All perimeter and internal longitudinal steel channel members shall be constructed of ASTM Type A-446 structural quality galvanized steel with a minimum 18-gauge thickness of ASTM Type A-526 commercial-quality galvanized steel with a minimum 16-gauge thickness.
7. All steel panel surfaces, internal channels, and trim items shall be fabricated from zinc-coated steel with a hot-dipped galvanized coating (minimum G-90 coating class as

determined by ASTM A-525) and shall meet all requirements of ASTM A-526 for commercial-quality galvanized carbon steel.

8. Each panel assembly shall be completely filled with acoustical/thermal insulating material that is non-combustible, inert, mildew-resistant and vermin-proof. Insulation shall not settle within the panel assembly. No insulating materials shall be used that have a flame spread greater than 25 or a smoke developed greater than 50.

D. Components and Installation:

1. All plenum base channels shall be installed on a level concrete curb, the dimensions of which shall be determined from plan-view shop drawings of the system provided by the system manufacturer. Spacing of base channel attachments shall be as outlined in the manufacturer's standard details of assembly.
2. All assembly trim items shall be constructed of hot-dipped galvanized steel (minimum 18-gauge thickness) and furnished in standard lengths to be field cut to the required dimensions. Spacing of sheet metal screws, application of duct sealant and positioning of trim shall be in accordance with the plenum manufacturer's published erection and installation details.
3. All mechanical joints and external trim items shall be sealed with a UL-Classified duct sealant in accordance with manufacturer's recommendations. In order to show that joints have been sealed properly, enough sealant shall be used to that excess sealant is extruded from all completed external joints.
4. For enclosures to be installed indoors, joints and trim shall be sealed with a solvent- based duct sealant that is a polymeric rubber formulated to withstand temperatures from -20 to +150°F. Sealant shall be formulated such that surface preparation or solvent cleaning is not necessary. Sealant shall have a UL Classification marking with a flame spread of 15 and smoke developed of 20 when applied to 18-gauge galvanized steel and a flame spread of 10 and smoke developed of 0 when applied to organic reinforced cement board, both at a coverage of 31 square feet per gallon. Sealant shall exceed 750 hours without becoming brittle under ASTM-D572 test conditions (oxygen bomb).
5. Personnel access doors shall be provided where specified on drawings and shall be 24 inches wide by 60 inches high unless otherwise indicated. All doors shall be the same nominal thickness as the prefabricated standard door panel in which they are mounted. All access door panels and doors shall be constructed with a solid inner and outer shall (minimum 20-gauge thickness). Each door shall be installed in the door panel at the factory and shall have a minimum of two ball-bearing hinges and two wedge-lever door latches. All levers shall be operable from the interior and exterior sides of the door panels. All doors shall be installed to open against the air pressure differential. Doors shall seat against neoprene gasket materials, installed around the entire perimeter of the door frame in such a manner that door operation will provide direct compression with no sliding action between the door and gasket.
6. Doors shall be furnished with windows, which are composed of double-glazed layers of wire-reinforced safety-glass, separated by an air space, and sealed against acoustical and air leakage by interior and exterior rubber seals.
7. Openings for pipe and conduits shall be field cut to ensure proper positioning. All framing members, collars and bellmouth fittings shall be insulated, welded and sealed according to the plenum manufacturer's published installation details.

E. Structural Performance:

1. The entire plenum installation shall be designed by the plenum manufacturer to be self-supporting. Where roof spans and wall loadings require additional structural strength, it shall be provided by heavier panel skins, additional internal longitudinal reinforcing members or additional structural members and necessary supporting pipe columns. The installer shall furnish and install all structural members and pipe columns according to the drawings and published installation details provided by the plenum manufacturer.
2. The finished plenum installation shall be above to withstand a positive internal static pressure of 6 inches wg and a negative internal static pressure of 6 inches wg.
3. Under the conditions specified in the previous section, the assembled structure shall not exhibit any panel joint deflections in excess of L/200, where L is the unsupported span length of any panel section within the completed plenum.

F. Acoustical Performance:

1. The plenum manufacturer shall provide certified testing data obtained from an acoustical laboratory, listing sound absorption and transmission loss characteristics of the panel assembly. When requested by the Commissioner, the plenum manufacturer shall arrange to have a copy of all pertinent acoustical laboratory reports forwarded directly from the laboratory to the Commissioner.
2. When tested according to ANSI/ASTM C423-66 or a subsequent version of this standard, the panel assembly shall have minimum sound absorption coefficients, as shown in the following table, in the 1/3 octave band center frequencies. The coefficients used shall be those reported by the acoustical laboratory.

Sound Absorption Coefficients
1/3 Octave Band

Center Frequency (Hz)	125	250	500	1000	2000	4000	NEC
	0.63	1.09	1.17	1.08	1.03	0.97	1.00

3. When tested according to ANSI/ASTM E90-70 or a subsequent version of this standard, the panel assembly shall have minimum airborne sound transmission losses, as shown in the following table, in the combined full octave band center frequencies.

Sound Transmission Losses
Octave Band

Center Frequency (Hz)	125	250	500	1000	2000	4000	8000
	16	24	35	45	53	58	37

G. Thermal Performance:

1. Insulating materials used in all prefabricated panel assemblies shall have the following maximum thermal conductance at a mean temperature of 75°F: 0.06 Btu per hour per square foot per degree Fahrenheit.

2.12 ACCESS DOORS FOR CASING AND PLENUMS

A. Access doors not less than 20" x 48" shall be provided in equipment casings and plenums. They shall consist of No. 16 USS gauge galvanized steel sheets mounted on angle frames with crossbracing to prevent sagging or warping, and shall have sponge rubber gaskets.

1. Door shall be installed on angle or channel frames, extended where required to finish flush with insulation. In insulated casings, the doors shall be of double construction, filled with insulation 1" thick. Door openings in casings shall have angle frames to provide a true and uniform seating surface for the gasketed doors.

B. Each door shall be equipped with three (3) six screw "T" shaped extra heavy zinc plated hinges with brass pins as manufactured by Ferrum Co. No. 245 or approved equal. Provide three (3) cast zinc lever type fasteners. Ventlock No. 310 or approved equal. Inside release levers shall be provided for each door.

2.13 INSULATED PANELS

A. Provide insulated panels for all spaces to be blanked off inside fan housings and for unused portions of louvers and where noted on the drawings.

B. Inside and outside sheets of panels shall be constructed of alloy 25 hard aluminum sheet 20 B & S gauge. Insulation shall be 1-1/2" thick polyurethane.

C. Sections over 24" long shall be internally braced with inside Z-bars.

D. Panels shall be assembled and installed in such a manner as to be completely airtight and rigid.

2.14 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with NYCBC, NYCMC, NFPA 96 and SMACNA HVAC Duct Construction Standards - Metal and Flexible. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Ductwork shall be continuous, shall be built with joints and seams presenting a smooth surface on the inside and neatly finished on the outside. All joints and seams for supply, exhaust, make-up and return air ductwork shall be sealed airtight with approved non-hardening resilient caulking compound. "Airtight" shall mean duct leakage not exceeding 5% of design air quantity. Should duct leakage exceed this limit, Contractor shall reseal as required and rebalance systems at no cost to the City of New York. All ductwork shall be sealed with high pressure duct sealant. Seal Class A, as defined by SMACNA, shall be provided for all ductwork.

C. Ductwork is exposed to view and considered an architectural component of the project. External tapes are not allowed and sealants/welds shall be finished in a workmanlike manner. All welding burns shall be filed and scraped clean. Excess sealants and filler material shall be removed. Duct supports shall have a finished appearance.

D. See Section 23 05 48 for Noise and Vibration Controls for HVAC Piping and Equipment.

E. Fabricate ducts having pressure class equal to or greater than the static pressure of the fans or equipment to which the duct is connected.

F. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

G. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream unless noted otherwise.

H. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

I. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

2.15 HANGERS AND SUPPORTS

A. Where hanger straps are used they shall be 1" x 18 ga. minimum, galvanized steel.

B. Rectangular duct risers shall be supported at each floor by angles or channels secured to the sides of the duct with welds, bolts, sheet metal screws or blind rivets.

C. Ducts over 60 inches wide shall be suspended on a trapeze type hanger. The duct shall not be secured to the hanger.

D. Hanger spacing shall vary between 4 ft. and 8 ft. depending on duct size and distance between construction joints, such that, 4 ft. sections shall be supported every 4 ft.

E. Provide inserts, fishplates and other methods recommended by SMACNA, and as approved, for supporting hanger straps and trapeze hangers. Do not use or submit power actuated fasteners, expansion nails or pins for supporting duct hangers.

2.16 DUCT SEALANTS

A. Use the following sealants for joints and seams and for acoustic lining and vapor barrier application to all ductwork unless called for otherwise:

1. Foster #32-19 or Childers CP-146 for sealing high and low pressure ductwork
2. 3M-425 for taping joints in vapor-proof barriers
3. Foster #85-20/85-60 or Childers CP-127 for attaching acoustic lining
4. Foster #30-36 or Childers CP-50AMV1 for binding edges on acoustic lining
5. Foster #30-65 or Childers CP-35 as a vapor barrier coating on insulation

B. Use equivalent sealants if any of the above cannot provide flame spread rating of 25 and smoke developed rating 50 or less.

C. Duct sealants and adhesives shall meet the latest VOC requirements of the South Coast Air Quality Management District (Rule #1168) and the content of VOC shall not exceed 250 grams per liter.

D. Vapor barrier coatings shall meet the VOC requirements of Green Seal GS-11, 1993.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Section 23 05 00: Coordination and project conditions.

B. Verify sizes of equipment connections before fabricating transitions.

3.3 INSTALLATION

A. Install and seal ducts in accordance with NYCBC, NYCMC, NFPA 96 and SMACNA HVAC Duct Construction Standards - Metal and Flexible. All seams and joints shall be sealed to meet SMACNA Seal Class A.

B. During shipping, storage on-site and throughout construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system throughout the entire fabrication and installation process.

C. Provide internally insulated (lined) ductwork in accordance with Section 23 05 48, Noise and Vibration Controls for HVAC Piping and Equipment.

D. Use crimp joints with beaded sleeve couplings for joining round duct sizes 8 inches and smaller. Use flanged joints for ducts larger than 8 inches.

E. Install duct hangers and supports in accordance with Section 23 05 29.

F. Use double nuts and lock washers on threaded rod supports.

G. Set plenum doors 6 to 12 inches above floor. Arrange door swing so fan static pressure holds door in closed position.

H. Casings: Install floor-mounted casings on 4 inch high concrete curbs. Refer to Section 03 30 00. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, furnish liner of 18 gage galvanized expanded metal mesh supported at 12-inch centers, turned up 12 inches at sides with sheet metal shields.

I. Coordinate with all affected trades to ensure that no ceilings, equipment or other materials other than as specifically provided herein are supported from ductwork or the ductwork hanger system.

J. Coordinate with others as necessary to ensure that access doors have been provided in hung ceilings, shaft wall, or other construction, of ample size for proper operation and maintenance of the installation.

K. While the drawings shall be adhered to as closely as possible, the right is reserved to vary the run and size of ducts during the progress of the work if required to meet structural conditions.

L. Sheet metal sub-contractor shall install all ductwork in strict adherence to the ceiling height schedules indicated on the drawings. Sheet metal sub-contractor shall consult with the Heating, Fire Protection, Electric and Plumbing sub-contractors and shall, in conjunction with the above contractors, establish the necessary space requirements for each trade. The sheet metal ductwork shall, whether indicated or not, rise and/or drop and/or change in shape to clear any and all conduits, lighting fixtures, sprinklers, plumbing and heating piping to maintain the desired ceiling heights.

M. Transition pieces from rectangular to round at fan discharge shall be 16 gauge all-welded construction. Provide suitable angle reinforcement. Branches off medium and high pressure duct mains shall have conical taps.

N. Provide watertight stainless steel or copper counter flashings around all ducts passing through openings in exterior wall or through roof.

O. Provide a fire damper and sheetmetal sleeve for each duct penetration through fire rated walls. Wherever ducts penetrate Mechanical Equipment Room walls, floor and ceiling slabs, and no fire smoke or fire damper is required, the entire space between duct and wall sleeve or slab opening shall be tightly packed with approved soundproof material. Each face of opening shall further be caulked airtight with approved non-hardening resilient caulking.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers to low pressure ducts with 18 inches maximum length of flexible duct held in place with strap or clamp.

C. Connect air outlets and inlets to supply ducts with 18 inches maximum length of flexible duct. Do not use flexible duct to change direction.

3.5 DUCT PRESSURE TEST

A. Pressure Testing of Ductwork

1. Air pressure testing during erection shall include separate air leakage tests of plenum, the horizontal distribution system ductwork and, after all ductwork is installed and the central station apparatus is erected, leakage testing of the entire System. The testing shall apply to all ductwork in systems constructed to 3" w.g. or higher pressure classes.
2. Test all ductwork at corresponding pressure class to which it is constructed. Duct leakage shall be limited to the following:

Average Size of Run Diameter or Equivalent	100 ft. Run (A)	(B)
12 inches or less	10	1"
20 inches or less	15	2"
30 inches or less	25	6"
40 inches or less	30	9"
50 inches or less	30	9"

(A) Permissible loss in cfm.
(B) Corresponding differential gauge reading (0.875 inch diameter orifice plate)

3. Tests shall be made prior to insulation of system being tested using suitable test equipment including test blower, "U" tube, orifice, tubing and cocks, arranged to indicate the amount of air leakage.
4. The leakage tests of the ductwork shall be made with pressure in the system, obtained by operation of the test blower.
5. All joints shall be inspected and checked for audible leakage, repaired if necessary and retested.
6. Contractor shall test ductwork using SMACNA leakage test methods to limit amount of leakage per sq. ft. of ductwork prescribed for Leakage Class 6 or 6" WG Duct Design.

3.6 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Final cleaning.

B. Scope of Work:

1. Mechanical Contractor shall provide all labor, materials, facilities, equipment and services to thoroughly clean HVAC system including all supply air and exhaust ductwork, associated air devices, turning vanes, dampers, reheat coils, etc. Mechanical Contractor shall remove, store and re-install ceiling tiles as required for access to systems. Mechanical Contractor shall provide and install duct access doors as required for proper access. Mechanical Contractor shall repair or replace all damaged ceiling tiles, wall penetrations, ceiling penetrations, floor penetrations, insulation, control components or other damaged items to match existing.
2. Determine cleaning method to prevent damage to existing systems. Notify the Commissioner of proposed method and impact on system prior to start. Also notify the Commissioner of any system defects discovered during cleaning process.

C. Clean duct systems with high power vacuum machines. Protect equipment with potential to be harmed by excessive dirt with filters, or bypass during cleaning. Install access openings into ductwork for cleaning purposes.

D. The duct system shall be inspected and certified by an air system cleaning specialist, member of NADCA, to confirm that it meets all NADCA standards.

3.7 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN

A. The Contractor shall incorporate all protective measures as required to prevent the contamination of the duct system and air distribution system. Air pollutants as described in the "SMACNA-IAQ Guidelines for Occupied Buildings Under Construction" Tables 2-2 and 2-3 shall be prevented from entering the duct system and air distribution system. Preventative measures including, but not limited to the following, shall be incorporated:

1. All stored ductwork and air distribution equipment shall be kept dry and clean.
2. Sealing of all ductwork and louvers prior to finish cleaning of building.
3. Utilization of temporary filters.
4. Sealing of fans, fan coil units, etc.
5. Duct and equipment cleaning.
6. Provisions for temporary construction exhaust fans to remove dust, odors, etc.
7. HVAC protection as defined in Chapter 3 of the above noted SMACNA manual.
8. Source control as defined in the above noted SMACNA manual.
9. Pathway interruption as defined in the above noted SMACNA manual.
10. Housekeeping as defined in the above noted SMACNA.
11. Scheduling as defined in the above noted SMACNA manual.

B. Contractor shall coordinate systems installation with General Contractor and develop construction Indoor Air Quality plan. Plan shall be submitted to Professional for review. Plan shall identify methods to prevent contamination of the duct system along with schedule/phasing issues.

C. If the Contractor does not meet the requirements of this section, the entire duct system shall be cleaned as noted in paragraph 3.5 of this Section.

D. It is the intent that the permanent HVAC systems will not be used for temporary heating and cooling. Contractors shall provide temporary heating and cooling as required to meet construction requirements.

E. After final cleaning of HVAC system and building, the system shall be flushed with 100% outdoor air for a two-week time period in accordance with ASHRAE Standard 62. After flush- out procedure, permanent final filters shall be installed in their respective systems.

F. After completion of the job, Contractor shall submit a letter indicating that the IAQ measures noted in this project have been met. The letter shall include specific dates for all cleaning, flushing and filter replacements.

3.8 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply	Galvanized Steel

AIR SYSTEM	MATERIAL
Supply	Galvanized Steel
Return and Spill	Galvanized Steel
General Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel
Outside Air Plenum	304 Stainless Steel
Exterior Ductwork	304 Stainless Steel

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Constant Volume Supply	3 inch wg regardless of velocity.
Variable Air Volume Supply (downstream of VAV boxes)	2 inch wg regardless of velocity.
Variable Air Volume Supply (upstream of VAV boxes)	6 inch wg
Return and Relief, Spill	3 inch wg
General Exhaust	3 inch wg

1. Note: Minimum pressure class for systems other than those listed above shall be 2” w.g.

END OF SECTION 23 31 00

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SECTION 23 33 00 AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Back-draft dampers.
2. Combination fire-and-smoke dampers.
3. Duct access doors.
4. Dynamic fire dampers.
5. Smoke dampers.
6. Volume control dampers.
7. Remote cable control damper.
8. Flexible duct connections.
9. Duct test holes.
10. Dial thermometers.
11. Static pressure gages.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 09 00 - Instrumentation and Control for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
2. Section 23 09 23 - Direct-Digital Control System for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
3. Section 23 31 00 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.

1.3 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:

1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

D. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
2. SMACNA – Fire, Smoke and Radiation Damper Installation Guide

E. Underwriters Laboratories Inc.:

1. UL 555 - Standard for Safety for Fire Dampers.
2. UL 555C - Standard for Safety for Ceiling Dampers.
3. UL 555S - Standard for Safety for Smoke Dampers.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors, and duct test holes.

C. Product Data: Submit data for shop fabricated assemblies and hardware used.

D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.

1. Fire dampers including locations and ratings.
2. Smoke dampers including locations and ratings.
3. Backdraft dampers.
4. Flexible duct connections.
5. Volume control dampers.
6. Cable control dampers.
7. Duct access doors.
8. Duct test holes.

E. Product Data: For fire dampers, smoke dampers, and combination fire and smoke dampers, submit the following:

1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
2. Indicate materials, construction, dimensions, wiring diagrams and installation details.
3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

F. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of access doors, test holes.

C. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.6 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

C. Perform Work in accordance with NYCBC and NYCMC.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

1.8 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Product storage and handling requirements.

B. Protect dampers from damage to operating linkages and blades.

C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

D. Storage: Store materials in a dry area indoor, protected from damage.

E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work where appropriate with building control Work.

1.12 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for duct accessories.

1.13 EXTRA MATERIALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two (2) of each size and type of fusible link.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR ALL ACCESSORIES

A. All accessories shall have a pressure rating equivalent to the duct system that they are installed in.

B. Material construction shall match system that accessories are installed in.

2.2 BACK-DRAFT DAMPERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Ruskin.
2. Greenheck.
3. Air Balance, Inc.
4. Or approved equal

B. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel. Blades, maximum 6 inch width, center pivoted, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop,

steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.3 COMBINATION FIRE AND SMOKE DAMPERS (FSD)

A. Subject to compliance with requirement, provide products by one of the following:

1. Ruskin.
2. Greenheck.
3. _____
4. Or approved equal

B. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S.

C. Fire Resistance: 1-1/2 hours.

D. Leakage Rating: Class I, maximum of 8 cfm at 4 inches wg differential pressure.

E. Damper Temperature Rating: 350 degrees F.

F. Frame: 13 gage, galvanized steel.

G. Blades:

1. Style: Airfoil-shaped, single piece, double skin.
2. Action: Opposed.
3. Orientation: Horizontal.
4. Material: Minimum 16 gage equivalent thickness, galvanized steel.
5. Width: Maximum 6 inches.

H. Bearings: Stainless steel pressed into frame.

I. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

J. Linkage: Concealed in frame, 304 stainless steel.

K. Release Device: Close in controlled manner and allow damper to be automatically reset.

L. Actuator:

1. Type: Electric 120 volt, 60 hertz, two-position, fail close.
2. Mounting: External.
3. Each combination fire smoke damper shall be equipped with a UL Classified “Fire Stat” to permit damper to reopen during dynamic smoke control and shall mechanically and electrically close damper upon reaching the damper’s maximum degradation test temperature in accordance with UL555S. Damper can be opened via the Fire Alarm System for smoke purge. The damper operation and construction shall meet requirements of UL555S, latest edition.

4. All wiring material required to interconnect the operator with detection and/or alarm or other systems shall be furnished by this Contractor.

M. Fall-safe design shall enable damper to automatically assume the desired position when power is interrupted.

N. Finish: Mill galvanized.

O. Damper switch package to remotely indicate blade positions.

P. Factory installed sleeve and mounting angles per local codes. Furnish silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements.

Q. Damper for Out-of-Wall (OW) installations shall have factory-provided integral sleeve with UL required insulation. Sleeve configurations shall meet project requirement.

2.4 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Fabrication: Rigid and close fitting of galvanized steel or stainless steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch thick insulation with sheet metal cover, minimum 22 gage interior casing.

1. Less than 12 inches square, secure with sash locks.
2. Up to 18 inches Square: Furnish two hinges and two sash locks.
3. Up to 24 x 48 inches: Three hinges and two compression latches.
4. Larger Sizes: Furnish additional hinge.
5. Access doors located on the bottom of ducts shall have cam fasteners in lieu of hinges in order to avoid interference with ceiling channel supports.
6. Provide access doors upstream and downstream of reheat coils.
7. Provide access door for all dampers including volume dampers, fire dampers, smoke dampers, combination dampers and motorized dampers.
8. Access panels with sheet metal screw fasteners are not acceptable.

2.5 DYNAMIC FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555.

B. Fire Resistance: 1-1/2 hours.

C. Dynamic Closure Rating: Dampers classified for dynamic closure to 2000 fpm and 4 inches wg static pressure.

D. Construction:

1. Integral Sleeve Frame: Minimum 14 gage roll formed galvanized steel. Length: 12 inches.

2. Blades:
   a. Style: Curtain type.
   b. Action: Spring closure upon fusible link release.
   c. Material: Minimum 24 gage roll formed, galvanized steel.

3. Closure Springs: Type 301 stainless steel, constant force type.

E. Fusible Link Release Temperature: 212 degrees F.

F. Mounting: Vertical or horizontal as indicated on Drawings.

G. Duct Transition Connection, Damper Style:

1. B style - rectangular connection, blades out of air stream, high free area.
2. G style - A style connection, grille mounting tabs at end of sleeve for grille.

H. Finish: Mill galvanized.

I. Manufactures: Subject to compliance with requirement, provide products by one of the following:

1. Ruskin
2. Greenheck
3. _____
4. Or approved equal.

J. Damper for Out-of-Wall (OW) installations shall have factory-provided integral sleeve with UL required insulation. Sleeve configuration shall meet project requirements.

2.6 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Ruskin.
2. Greenheck.
3. _____
4. Or approved equal

B. Fabricate in accordance with NFPA 90A and UL 555S.

C. Fire Resistance: 1-1/2 hours.

D. Leakage Rating: Class I, maximum of 8 cfm at 4 inches wg differential pressure.

E. Damper Temperature Rating: 350 degrees F.

F. Frame: 16 gage, galvanized steel.

G. Blades:

1. Style: Airfoil-shaped, single piece, double skin.
2. Action: Opposed.
3. Orientation: Horizontal.
4. Material: Minimum 16 gage equivalent thickness, galvanized steel.
5. Width: Maximum 6 inches.

H. Bearings: Stainless steel pressed into frame.

I. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

J. Linkage: Concealed in frame, 304 stainless steel.

K. Actuator:

1. Type: Electric 120 volt, 60 hertz, two-position, fail close and Electric 24 volt, 60 hertz, two-position, fail close.

L. Sleeve: Factory installed 20 gage sleeve, minimum 12 inches long.

M. Finish: Mill galvanized.

2.7 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 inches x 72 inches. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.

1. Multi-blade dampers shall be provided in all ducts with any dimension equal to or larger than 12”.

C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

1. Quadrants:
2. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
3. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
4. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.8 REMOTE CABLE CONTROL VOLUME DAMPERS

A. Provide cable control system for all volume dampers located above gypsum board and other inaccessible ceilings.

B. Bowden cable control kit shall provide all required hardware that shall be mounted onto all rectangular and round volume dampers and provide all interlocking gears and cabling for ceiling mounted control. Coverplate shall be 7/8-inch diameter cold rolled steel cover with zinc plating for painting by General Contractor. Provide five (5) 12-inch wrenches for operation.

2.9 FLEXIBLE DUCT CONNECTIONS

A. Provide a suitable flexible connection in both the intake and discharge sides of each fan (excluding RF-2 & RF-3) and each air handling unit (excluding AHU-2 & AHU-3), where they connect to ductwork.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Connector: Fabric crimped into metal edging strip.

1. Fabric: UL 181 Class 0 listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
2. Net Fabric Width: Minimum 6 inches wide; maximum 10 inches wide.
3. Metal: 3 inch wide and 24 gage galvanized steel.

D. High Density Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs. per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.10 DUCT TEST HOLES

A. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

B. Provide tappings in ducts for thermometers where specified. In addition, provide an airtight plugged tapping located as follows:

1. Upstream of each reheat coil.
2. Downstream of each reheat coil.
3. In each supply and return air duct at each floor.

2.11 DIAL THERMOMETERS

A. Thermometer: ASTM E1, stainless steel case, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.

1. Size: 3 inch.
2. Lens: Clear Lexan.

3. Accuracy: 1 percent.
4. Calibration: Degrees F.

2.12 STATIC PRESSURE GAGES

A. Dial Gages: 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front calibration adjustment, 2 percent of full scale accuracy.

B. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. Verify rated walls are ready for fire damper and fire smoke damper installation. Verify the framed opening size in dry walls.

C. Verify ducts and equipment installation is ready for accessories.

D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry and lighting arrangement.

3.3 INSTALLATION

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Install dampers and accessories where indicated on Drawings.

C. Access Doors: Install access doors at the following locations and as indicated on Drawings:

1. Spaced every 50 feet of straight duct.
2. Before and after each reheat coil.
3. Before and after each duct mounted filter.
4. Before and after each duct mounted coil.
5. Before and after each duct mounted fan.
6. Before and after each automatic control damper.
7. Before and after each fire damper, smoke damper, combination fire and smoke damper.
8. Before and after each duct accessory.
9. Downstream of each terminal unit.

D. Access Door Sizes: Install minimum 12 x 12 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated on Drawings. Install 4 x 4 inch for balancing dampers only. Coordinate locations prior to fabrication/installation.

1. Where minimum door sizes cannot be provided, door size shall be 1” smaller than duct size.

E. Install temporary duct test holes where required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

F. Install fire dampers, combination fire and smoke dampers and smoke dampers at locations as indicated on Drawings and where required. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A UL555 and UL555S.
2. Install dampers square and free from racking with blades running horizontally.
3. Do not compress or stretch damper frame into duct or opening.
4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.4 INSTALLATION - THERMOMETERS

A. Install thermometers in air duct systems on flanges.

B. Locate duct-mounted thermometers minimum 10 feet downstream of mixing-dampers, coils, or other devices causing air turbulence.

C. Install static pressure gages to measure across filters and filter banks, (inlet to outlet). On multiple banks, provide manifold and single gage.

D. Provide instruments with scale ranges selected according to service with largest appropriate scale.

E. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

F. Adjust thermometers to final angle, clean windows and lenses, and calibrate to zero.

G. Install thermometers in the following locations:

1. Each supply air zone.
2. Outside air.
3. Return air.
4. Mixed air.

3.5 DEMONSTRATION

A. Refer to DCAS General Conditions: Requirements for demonstration and training.

B. Demonstrate re-setting of fire dampers and fire smoke dampers to Owner's representative.

3.6 STATIC PRESSURE AND FILTER GAGES:

A. Install filter and static pressure gages in the following locations:

1. Built up filter banks.
2. Unitary filter sections.
3. Supply fan discharge.

END OF SECTION 23 33 00

SECTION 23 34 00 HVAC FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Direct drive ceiling mounted centrifugal exhaust fans.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
2. Section 23 05 48 - Noise and Vibration Controls for HVAC Piping and Equipment: Product requirements for resilient mountings and snubbers for fans for placement by this section.
3. Section 23 07 00 - HVAC Insulation: Product requirements for power ventilators for placement by this section.
4. Section 23 09 00 - Instrumentation and Control for HVAC: Product requirements for control components to interface with fans.
5. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
6. Section 23 31 00 - HVAC Ducts and Casings: Product requirements for hangers for placement by this section.
7. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.3 REFERENCES

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:

1. AMCA 99 - Standards Handbook.
2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. American Refrigeration Institute:

1. ARI 1060 - Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.

D. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.
2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. Underwriters Laboratories Inc.:

1. UL 705 - Power Ventilators.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.

C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit fan manufacturer’s instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Submit motor data in accordance with 23 05 13.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: All fans shall be UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. Balance Quality: Conform to AMCA 204.

E. Energy Recovery Unit Wheel Energy Transfer Rating: Meet ARI 1060.

F. Perform Work in accordance with NYCBC.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one (1) week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product storage and handling requirements.

B. Protect motors, shafts and bearings from weather and construction dust.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

B. Furnish five-year manufacturer’s warranty for fans.

1.12 MAINTENANCE SERVICE

A. Refer to DCAS General Conditions: Requirements for maintenance service.

1.13 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Furnish two (2) sets of belts for each fan.

PART 2 - PRODUCTS

2.1 DIRECT DRIVE CEILING MOUNTED CENTRIFUGAL EXHAUST FANS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Greenheck Corp.
2. Loren Cook Company
3. Twin Cities.
4. Or approved equal.

B. General Description:

1. Base fan performance at standard conditions (density 0.075 Lb/ft3)
2. Ceiling mounted applications
3. Performance capabilities up to 1,600 cubic feet per minute (cfm) and static pressure to 0.75 inches of water gauge
4. Fans are available in nineteen sizes (50 - 1550 unit sizes)
5. Maximum operating temperatures is 130 Fahrenheit (54.4 Celsius)
6. Sound levels as low as 0.7 AMCA sones
7. UL/cUL listed for above bathtub exhaust
8. Fans are UL/cUL listed 507 - Electric Fans
9. Each fan shall bear a permanently affixed manufacture's nameplate containing the model number and individual serial number

C. Wheel:

1. Forward curved centrifugal wheel
2. Constructed of galvanized steel or calcium carbonate filled polypropylene
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05

D. Motors:

1. Motor enclosures shall be open driproof (ODP), opening in the frame body and or end brackets
2. Motors are permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase
3. Motor shall be mounted on vibration isolators and be accessible for maintenance
4. Thermal overload protection

E. Housing:

1. Constructed of heavy gauge galvanized steel
2. Interior shall be lined with 0.5 inches of acoustical insulation
3. Profile as low as 10 ½ inches

F. Spring Loaded Aluminum Backdraft Damper:

1. Prevents air from entering back into the building when fan is off
2. Eliminates rattling or unwanted backdrafts

G. Outlet:

1. Type of outlet: Square or Round
2. Field rotatable from horizontal to vertical discharge
3. Duct collar shall include an aluminum backdraft damper

H. Grille:

1. Types: Designer, Decorative, Aluminum, or Stainless Steel as selected by the Commissioner.
2. Constructed of high impact polystyrene for sizes 50 thru 390, plastic shall be factory standard on unit under 390
3. Constructed of aluminum non-yellowing for sizes 410 thru 1550, aluminum shall be factory standard on units over 410.

I. External Electrical Access:

1. Eliminates removing the motor pack which saves time on installation

J. Mounting Brackets:

1. Fully adjustable for multiple installation conditions

K. Options/Accessories:

1. Ceiling Radiation Damper:
   a. None

2. Disconnect Switches:
   a. None; to be provided by the electrical sub-contractor. Refer to electrical drawings for additional information. Coordinate with electrical contractor.

3. Grille Filter:
   a. Washable aluminum mesh filter that goes between fan and grille
   b. Reduces sound levels
   c. Traps dirt before entering the fan.

4. Lights:
   a. None

5. Motion Detectors:
   a. None

6. Speed Controls:
   a. Controls the fan's output

b. Fan can be adjusted to 60 percent of full speed
c. Can be used to operate more than on fan at a time

7. Time Delay Switch:
   a. Save energy by automatically turning off the fan
   b. On a delay of 1 to 60 minutes after the light on fan has been turned off.

8. Transformers:
   a. None

9. Wall Discharge:
   a. None

10. Roof Discharge:
    a. None

11. Flat Roof Caps:
    a. None

12. Vibration Kit:
    a. Available for suspended installations
    b. Includes prepunched hole for ease of installation and shall have all hardware to mount one unit.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Coordination and project conditions.

B. Verify roof curbs are installed and dimensions are as shown on shop drawings.

3.3 INSTALLATION

A. Secure roof and wall fans with cadmium plated steel lag screws to structure.

B. Suspended Cabinet Fans: Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Install motorized dampers on inlet to roof and wall exhaust fans.

D. Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on Drawings.

E. Install safety screen where inlet or outlet is exposed.

F. Pipe scroll drains to nearest floor drain.

G. Provide adjustable sheaves required for final air balance. Replace adjustable sheave with fixed sheaves after balancing as required.

H. Each fan shall be factory painted inside and out with high grade machinery grey enamel paint.

I. Fans with wheel diameters up to 27 inches shall have overhung wheel and pulley, Arrangement 2. Fans with larger diameter wheels shall have overhung pulley, Arrangement 3. Fans with wheels 24 inches and larger shall have cleanout door in scroll, with wedge type latches.

J. Fans too large to pass through available doorways may be split in halves along center of shaft, with hubs, etc., arrange to bolt together when erected. Such bolts shall have double nuts and cotter pins to prevent same from loosening. Provide scroll drains in all fans.

K. Fan wheel diameters shown are minimum diameter. Fan BHP indicated for each duty shall not be exceeded over its entire operating range.

L. Exhaust fans exposed to outdoor weather shall have two coats of chlorinated rubber base paint applied in the factory.

M. Insulated fans: Cleanout doors shall be raised type to finish flush with outside of insulation covering.

3.4 MANUFACTURER'S FIELD SERVICES

A. Refer to DCAS General Conditions - Quality Requirements: Requirements for manufacturer’s field services.

B. Before start-up, factory technician shall be on site to certify the alignment in a written report.

C. Furnish services of factory trained representative for minimum of one (1) day to start-up, calibrate controls, and instruct the City of New York on operation and maintenance.

3.5 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of fan cabinet.

3.6 DEMONSTRATION

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate fan operation [and maintenance procedures].

3.7 PROTECTION OF FINISHED WORK

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION 23 34 00

SECTION 23 36 00 AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Single duct pressure independent air terminal units.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for fan powered terminal units for placement by this section.
2. Section 23 09 00 - Instrumentation and Control for HVAC: Product requirements for control components to interface with air terminal units.
3. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
4. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.

1.3 REFERENCES

A. American Refrigeration Institute:

1. ARI 880 - Air Terminals.
2. ARI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. National Fire Protection Association:

1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

D. Underwriters Laboratories Inc.:

1. UL 181 - Factory-Made Air Ducts and Connectors.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings indicating airflow, static pressure, heating coil capacity and NC designation. Include electrical characteristics and connection requirements. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 inch to 4 inches wg.

C. Manufacturer's Installation Instructions: Submit support and hanging details, and service clearances required.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of units and controls components.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.6 QUALITY ASSURANCE

A. Test and rate air terminal unit’s performance for air pressure drop, flow performance, and acoustical performance in accordance with ARI 880 and ARI 885. Attach ARI seal to each terminal unit.

B. Perform Work in accordance with NYCBC and Building Standard.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. Coordinate Work with Sections 23 09 00, 23 09 23 and 23 09 93.

1.11 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

1.12 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Requirements for extra materials.

PART 2 - PRODUCTS

2.1 SINGLE DUCT PRESSURE INDEPENDENT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Anemostat Air Products.
2. Nailor.
3. Titus
4. Or approved equal.

B. Product Description: Pressure independent air terminal units for connection to central air systems, with electronic/Direct Digital Controls and with or without heating coils.

C. Identification: Furnish each air terminal unit with identification label and airflow indicator. Include unit nominal airflow, maximum factory-set airflow and minimum factory-set airflow and coil type.

D. Basic Assembly:

1. Casings: Minimum 22 gage galvanized steel.
2. Lining: Minimum 1/2 inch thick fiber-free insulation, 1.5 lb./cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements. Minimize mold growth to meet ASTM G21/22.

E. Basic Unit:

1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.

2. Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings; maximum damper leakage: 2 percent of design air flow at 3 inches rated inlet static pressure.
3. Mount damper operator to position damper normally open.

F. Attenuation Section: Line attenuation sections with 2-inch thick insulation where indicated on drawings.

G. Automatic Damper Operator:

1. Terminal units shall be complete with 24 volt electric motor drive and Direct Digital Control modules furnished and installed at the factory by the terminal unit manufacturer. They shall be mounted in an easily accessible enclosure, and completely wired requiring only power, signal and room temperature sensor connection. An automatic air measuring device shall indicate cfm of each box instantaneously on the portable field console. The terminal unit manufacturer shall pipe the controller's transducers to the box flow sensor. The terminal unit manufacturer will coordinate with the manufacturer of the Direct Digital Control modules to ensure that the actuators positively lock on the terminal unit shaft/linkage. The terminal unit manufacturer must mount the Direct Digital Control controllers to the terminal units. In addition, the terminal unit manufacturer shall coordinate with ATC Contractor for initial damper set-up and adjustments.
2. Terminal units shall be pressure independent and shall reset primary air volume as determined by the space temperature sensor and/or carbon dioxide sensors regardless of changes in system air pressure. The primary air shall be normally open on loss of power unless otherwise specified. Terminal units shall have test ports for manual verification and calibration of the air flow measuring device. Terminal unit controllers shall include provision for automatic calibration of air flow measuring device.
3. Velocity Reset Controller and Sensor:
   a. Electric: 24 volt.
   b. Calibration pressure taps for pressure independent control to compensate for varying inlet static pressure.
   c. Minimum and maximum limits set at reset device.
   d. Maintain airflow to within 5 percent of set point with inlet static pressure variations up to 4 inches.

4. Sound Ratings: Not to exceed criteria listed in Specifications Section 23 05 48 - Noise and Vibration Controls for HVAC Piping and Equipment.

H. Each terminal unit shall be provided with a 120V to 24V transformer. The transformer shall be factory mounted within the control box. There shall be a separation baffle within the control box to keep the 120V components (120V/24V transformer) separated from the low voltage components (terminal unit controller).

I. Temperature Sensor: Refer to Sections 23 09 23 and 23 09 93.

J. Sequence of Operation: Refer to Section 23 09 93.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 EXAMINATION

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. Verify ductwork is ready for air terminal installation.

3.3 INSTALLATION

A. Connect to ductwork in accordance with Section 23 31 00.

B. Install ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork. All unit supports shall clear the access panels on the boxes.

D. Install minimum 1-1/2 inch thick lined ductwork downstream of units. Refer to Section 23 05 48 - Noise and Vibration Controls for HVAC Piping and Equipment.

E. Install Work in accordance with NYCBC.

3.4 ADJUSTING

A. Refer to DCAS General Conditions: Requirements for starting and adjusting.

B. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to 0 percent full flow.

3.5 INTERFACING WITH automatic temperature controls (atc) vendor - division 23 09 93

A. The following equipment will be furnished by the ATC Contractor and installed by the terminal unit manufacturer:

1. Damper motor.
2. Direct Digital Control microprocessor.
3. Pressure transducers if it is not self-contained in the Direct Digital Control microprocessor.

B. Contractor shall exchange information and coordinate the following set points with the ATC Contractor for each box.

1. Maximum primary air velocity or CFM set point.
2. Minimum primary air velocity or CFM set point.

3. Cooling set point.
4. Heating set point.
5. Terminal unit discharge air volume (CFM).

C. All VAV boxes shall be identified on the bottom of the unit and on the shipping carton with the floor and box number that identifies it along with the CFM settings.

END OF SECTION 23 36 00

SECTION 23 37 0 AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Diffusers.
2. Registers
3. Grilles.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 09 90 00 - Painting and Coating: Execution and product requirements for Painting of ductwork visible behind outlets and inlets specified by this section.
2. Section 23 33 00 - Air Duct Accessories: Volume dampers for inlets and outlets.

1.3 REFERENCES

A. Air Movement and Control Association International, Inc.:

1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, throw and noise level.

C. Samples: Submit one (1) of each required air outlet and inlet type.

D. Test Reports: Rating of air outlet and inlet performance.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ANSI/ ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

C. Perform Work in accordance with NYCBC.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience, and with service facilities within 100 miles of Project.

1.8 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.9 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL SQUARE PLAQUE CEILING DIFFUSERS (CD-1)

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Titus
2. Tuttle & Baily
3. Krueger
4. Or approved equal.

B. Type: 22 gauge steel face panel that captures a secondary 22 gauge panel. The face panel is removable by means of four hanger brackets. The exposed surface shall be smooth, flat, and free of visible fasteners. The back of the face panel shall have an aerodynamically shaped, rolled edge to ensure a tight horizontal discharge pattern. Ceiling diffusers with a 24 x 24-inch full face shall have no less than an 18 x 18-inch face panel size.

C. The backpan shall be one piece precision die-stamped and shall include an integrally drawn inlet (welded-in inlets and corner joints are not acceptable). The diffuser backpan shall be constructed of 22-gauge steel. The diffuser neck shall have a minimum of 1¼-inch depth available for duct connection.

D. Frame: To match ceiling construction.

E. Fabrication: 22 gauge steel with baked enamel. Custom color selected by the Commissioner.

F. Accessories: Butterfly damper and multi-louvered equalizing grid with damper adjustable from diffuser face. Molded and foil-baked insulation blankets.

2.2 ARCHITECTURAL SQUARE PLAQUE CEILING DIFFUSERS (CD-2)

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Titus
2. Tuttle & Baily
3. Krueger
4. Or approved equal.

B. Type: 22 gauge steel face panel that captures a secondary 22 gauge panel. The face panel is removable by means of four hanger brackets. The exposed surface shall be smooth, flat, and free of visible fasteners. The back of the face panel shall have an aerodynamically shaped, rolled edge to ensure a tight horizontal discharge pattern. Ceiling diffusers with a 24 x 24-inch full face shall have no less than an 18 x 18-inch face panel size.

C. The backpan shall be one piece precision die-stamped and shall include an integrally drawn inlet (welded-in inlets and corner joints are not acceptable). The diffuser backpan shall be constructed of 22-gauge steel. The diffuser neck shall have a minimum of 1¼-inch depth available for duct connection.

D. Performance requirements: The diffuser shall be capable of providing the throws indicated on the contract schedules with the listed CFMs to guarantee required ADPI performance for low airflows listed on the contract documents without “dumping” air. Diffuser shall be specifically designed for dedicated outside air systems (DOAS).

E. Frame: To match ceiling construction.

F. Fabrication: 22 gauge steel with baked enamel. Custom color selected by the Commissioner.

G. Accessories: Butterfly damper and multi-louvered equalizing grid with damper adjustable from diffuser face. Molded and foil-baked insulation blankets.

2.3 CEILING RETURN GRILLES (RG-1 & EG-1)

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Titus
2. Tuttle & Baily
3. Krueger
4. Or approved equal.

B. Type: Steel return grilles shall be 3/4 inch blade spacing of the sizes and mounting types shown on the plans and schedule. The fixed deflection blades shall be available parallel to the long or short dimension of the grille. Construction shall be of steel with a 1-1/4 inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.

C. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be available at 35°

D. Frame: To match ceiling construction.

E. Fabrication: Steel with baked enamel. Custom color selected by the Commissioner.

F. Accessories: Opposed blade damper, operable from the face of the grille.

2.4 LINEAR SUPPLY DIFFUSERS (LD-1)

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Titus
2. Tuttle & Baily
3. Krueger
4. Or approved equal.

B. Furnish materials in accordance with NYCBC.

C. Provide all materials and equipment required for a complete installation of all linear and modular slot air distribution systems as shown on the architectural and mechanical drawings and/or indicated in the architectural or mechanical specifications. The systems shall be complete in every respect and shall include all required appurtenances. Mechanical contractor shall furnish and install all plenums, hoods, blank-offs and associated sheet metal components including all duct connections thereto.

D. Provide all continuous linear slot and modular slot diffusers as shown on the drawings. The slot diffusers shall integrate into the ceiling system.

E. The linear slot diffusers shall have a single slot unless shown otherwise and shall be capable of being used for supply air, return air, exhaust air or any combination thereof.

F. The linear slot diffusers shall be capable of supporting the ceiling system. Linear diffusers supported by screws in the flanges or from air plenums are unacceptable. For lay-in ceiling, provide hanger wire support clips that are integral with the linear slot diffusers allowing the linear slot diffusers to be supported from the building structure with ceiling wire. For hard ceilings, provide clips that are integral with the linear slot diffusers allowing the diffusers to be secured directly to the ceiling framing without the requirement for hanger supports. Provide spline clips to secure joints and ceiling tees to the diffusers.

G. Provide ends and corners as required. Ends shall be butt type, field installed, or mitered picture frame type factory installed, as indicated herein or shown on the drawings. Corners shall be mitered one-piece unit.

H. Pattern controllers shall be one-piece extruded aluminum, 24 inches long maximum, positioned between spring loaded spacers. Pattern controllers shall allow the airstream to be directed flat against the ceiling in either direction or downward as well as allowing throw reduction every two feet along the entire length of the linear slot diffusers. The airstream shall be maintained at the ceiling plane and shall not dump when volume is reduced. Only extruded aluminum pattern controllers are acceptable. Where shown or noted pattern controllers shall be designed to allow the airstream to be jetted into the occupied space and be adjustable to vector the airstream as required.

I. Material shall be minimum wall thickness 0.062 inches extruded aluminum. Spring steel retainers shall be used under the spacers to hold the slot diffusers assembly tightly together and allow the slot diffusers to be disassembled easily for field trimming. Materials other than extruded aluminum and spring steel will not be accepted.

J. Flanges exposed to view shall be painted factory standard white. All other surfaces shall be painted flat black. Provide paint samples if requested.

K. Model numbers are indicated on the plan schedules.

L. All slot diffusers shall be performance tested with air plenums as a composite assembly in full accordance with ASHRAE, and/or ARI standards. If requested, the contractor shall provide for a visit by the Commissioner to the product testing laboratory to verify performance data and testing procedures. All cost associated thereto shall be provided at the expense of the contractor.

M. Frame: Tapeable edge shall be provided for all linear diffusers.

N. Plenum: Custom fabricated by mechanical contractor per contract documents.

2.5 SUPPLY REGISTERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Titus
2. Tuttle & Baily
3. Krueger
4. Or approved equal.

B. Furnish materials in accordance with NYCBC.

C. Steel supply grilles shall be double deflection of the sizes and mounting types shown on the plans and outlet schedule. The deflection blades shall be available parallel to the long dimension of the grille. Construction shall be of steel with a 1-1/4 inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.

D. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be spaced on ¾-inch centers. Blades shall have steel friction pivots on both ends to allow individual blade adjustment without loosening or rattling. Plastic blade pivots are not acceptable.

E. Provide opposed-blade volume damper shall be constructed of heavy gauge steel. Damper must be operable from the face of the grille.

F. Fabrication: Aluminum extrusions with factory finish. Custom color by commissioner.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Coordination and project conditions.

B. Verify inlet and outlet locations.

C. Verify ceiling and wall systems are ready for installation.

3.3 INSTALLATION

A. Install diffusers to ductwork with airtight connection.

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 23 33 00.

C. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Section 09 90 00.

D. Provide mounting frame/border to match ceiling construction for each type of outlet.

E. Install insulation blanket on diffusers and taped to duct collar insulation and edges of diffuser to make air tight.

F. Install or secure the retainer cable for diffusers having removable cores.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION 23 37 00

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SECTION 23 57 00 HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Shell and tube type heat exchangers.
2. Plate type heat exchangers.
3. Accessories and trim.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
2. Section 23 05 03 - Product requirements for hydronic piping connected to heat exchangers.
3. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Execution requirements for heat exchanger supports specified by this section.
4. Section 23 07 00 - HVAC Insulation: Field applied insulation for heat exchangers.
5. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for heat exchanger trim for placement by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate dimensions, locations, size of taps and support frame.

C. Product Data: Submit performance data.

D. Test Reports: Indicate shop test reports of tube bundle shop pressure tests.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit start-up and shut down instructions, assembly drawings, and spare parts lists.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NYCBC.

B. Code compliance in accordance with ASME Boiler and pressure Vessel Code, Section VIII, Division 1 with U symbol stamped.

1.7 QUALIFICATIONS

A. Manufacturer: Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three (3) years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one (1) week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept heat exchangers on site in factory protective packaging. Inspect for damage.

C. Protect openings with temporary caps to prevent entry of foreign material.

1.10 WARRANTY

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for warranties.

1.11 EXTRA MATERIALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish two (2) sets of replacement gaskets.

C. Furnish one (1) set of wrenches for disassembly of plate type heat exchangers.

PART 2 - PRODUCTS

2.1 SHELL AND TUBE TYPE HEAT EXCHANGERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:
   1. Bell & Gosset
   2. Taco.
   3. Yula.
   4. Or approved equal.

B. Furnish materials in accordance with NYCBC.

C. Tubes: U-tube type with 3/4 inch OD minimum seamless copper tubes suitable for 150 psig Working pressure. Water velocity shall not exceed 7.5 feet per second in tube.

D. Shell: Steel with threaded or flanged piping connections and necessary taps for thermometer wells and drains, steel saddle and attaching U-bolts, prime painted.

E. Heads: Cast iron or fabricated steel with steel or bronze tube sheets, threaded or flanged for piping connections.

F. Water Chamber and Tube Bundle: Removable for inspection and cleaning.

G. Design: Heating fluid in shell and heated fluid in tubes.

H. Provide on each exchanger a brass-mounted, pop-relief valve for connection with the water outlet pipe (between the exchanger and the shut-off valve). Valves shall be set to discharge at a pressure approximately 15 psi above the normal working pressure at the exchangers.

I. Heat Exchanger Performance: Reference Contract Drawings.

J. Test Pressure: 1.5 times design pressure.

2.2 PLATE TYPE HEAT EXCHANGERS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:
   1. Bell & Gosset
   2. Taco.
   3. Yula.
   4. Or approved equal.

B. Frames: Carbon steel with baked epoxy enamel paint, stainless steel side bolts, shroud carrying bar and guilding bar shall be 316 stainless steel.

C. Plates: Stainless steel Type 316, 0.6 mm thick.

D. Gaskets: Double Nitrile rubber.

E. Provide support column suitable for 15% additional plates. Upper carrying bar and lower guiding bar shall be fixed to the support column and header frame plates.

F. Nozzles: 150 psig (7.18 kPa) ASA rubber rated flange type.

G. Heat Exchanger Performance: See Contract Drawings.

H. The movable frame plate shall be equipped with steel roller bearing.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. Install Work in accordance with NYCBC.

B. Install with clearance to permit removal of [tube bundle] [plates] with minimum disturbance to installed equipment and piping.

C. Support heat exchangers on inertia block with anchor bolts.

D. Make connections to heat exchangers with unions or flanges.

E. Install heat exchanger to allow draining and install drain connection at low point. Pitch shell to completely drain condensate.

F. Install piping from relief valve to nearest floor drain.

G. Provide heavy galvanized angle supports for heat exchangers.

H. Install water to water heat exchanger with the following piping accessories on hot water piping connections. Refer to Section 23 21 13.
   1. On supply:
      a. Thermometer well and thermometer.
      b. Well for control system temperature sensor.
      c. Shutoff valve.
      d. Strainer.

e. Control valve.
f. Pressure gage.

2. On return:
   a. Thermometer well and thermometer.
   b. Well for control system temperature sensor.
   c. Pressure gage.
   d. Shutoff valve.
3. Relief valve on secondary hot side.

I. Install steam-to-water heat exchanger with the following trim:
1. Pressure gage on shell tapping with pigtail siphon.
2. Vacuum breaker.
3. Relief Valve.

J. Install steam to water heat exchanger with the following piping accessories on steam piping connections.

1. On supply:
   a. Shutoff valve.
   b. Strainer.
   c. Control valve.
   d. Pressure gage.

2. On return:
   a. Steam trap.
   b. Shutoff valve.

K. Install valves and piping specialties in accordance with details as indicated on Drawings.

L. Install steam traps with outlet minimum 12 inches below heat exchanger.

END OF SECTION 23 57 00

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SECTION 23 73 00 DEDICATED OUTDOOR AIR SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Modular factory fabricated air-handling units and accessories.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for housekeeping pads specified by this section.
2. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for electric motors for placement by this section.
3. Section 23 05 48 - Noise and Vibration Controls for HVAC Piping and Equipment: Product requirements for Vibration Isolation for placement by this section.
4. Section 23 07 00 - HVAC Insulation: Product requirements for insulation for placement by this section.
5. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
6. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
7. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.
8. Section 23 33 00 - Air Duct Accessories: Product requirements for flexible duct connections for placement by this section.

1.3 REFERENCES

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:

1. AMCA 99 - Standards Handbook.
2. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
4. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
5. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

C. Air-Conditioning and Refrigeration Institute:

1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
2. ARI 430 - Central-Station Air-Handling Units.
3. ARI 610 - Central System Humidifiers for Residential Applications.
4. ARI Guideline D - Application and Installation of Central Station Air-Handling Units.

D. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.

E. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

F. Underwriters Laboratories Inc.:

1. UL 900 - Air Filter Units.
2. UL - Fire Resistance Directory.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

C. Product Data, Submit the following:

1. Published Literature: Indicate capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
3. Fans: Performance and fan curves with specified operating point plotted, power, RPM.
4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
5. Finish and color chart.
6. Dampers: Include leakage, pressure drop, and sample calibration curves. Indicate materials, construction, dimensions, and installation details.
7. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring. Indicate factory installed and field installed wiring.
8. Furnish one print and one sepia of each of the following for approval:
   a. Floor plan showing dimensions and details for installation, including total weight of unit and of each section for multiple section units.
   b. Front and side views as required to completely describe accessories and show required dimensions.
   c. Details of housing construction showing materials of construction, structural elements, methods of providing thermal breaks and door seals, equipment supports, housing insulation and piping, details of wall air sealing design, electrical and control penetration of housing and assembly instructions and requirements.

d. Submit complete shop Drawings on fans, coils, condensate drain system, filters, etc. contained within the unit including fan performance curves.
e. Submit design performance including motor horsepower, CFM, fan static, coil conditions and internal unit pressure drops.
f. Approval of Drawings does not relieve the supplier from his responsibility of furnishing the specified product under these Specifications.
g. After the installation of the units is complete, furnish one complete set of full size blue line prints and one unfolded full size 'sepia" of each drawing as-built to the City of New York.

9. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
10. Estimated gross weight of each installed unit.
11. Installation, Operating and Maintenance manual (IOM) for each model.
12. Microprocessor Controller (DDC) specifications to include available options and operating protocols. Include complete data on all factory-supplied input devices.
13. AHRI Certified coil performance ratings with system operating conditions indicated. Ratings shall be in accordance with Standard 410.
14. Color chart including a palette of available standard paint finishes.
15. Energy wheel performance data for both summer and winter operation.

D. Samples: Submit two (2) of each type of replacement filter media with frame.

E. Manufacturer's Installation Instructions: Submit.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.6 QUALITY ASSURANCE

A. Outside Air Damper Leakage: Test in accordance with AMCA 500.

B. Perform Work in accordance with NYCBC.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

1.8 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product storage and handling requirements.

B. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.

C. Protect units from weather and construction traffic by storing in dry, roofed location.

1.10 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

1.11 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Furnish one set of fan belts for each unit.

C. Furnish one (1) set of filters for use during construction and one (1) set of filters for replacement at beginning of balancing per unit.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Trane Performance Climate Changer
2. York Solution XT High Performance
3. Daikin McQuay Vision Custom
4. Or approved equal

2.2 GENERAL

A. Unit layout and configuration shall be as defined in project plans and schedule.

B. Manufacturer to provide a full perimeter integral base frame for either ceiling suspension of units or to support and raise all sections of the unit for proper trapping. Base frame will either be bolted construction or welded construction. Refer to schedule for base height and construction type. Contractor will be responsible for providing a housekeeping pad. Unit base frames not constructed of galvanized steel shall be chemically cleaned and coated with both a rust-

inhibiting primer and finished coat of rust-inhibiting enamel. Unit base height to be included in total height required for proper trap height.

2.3 UNIT CASING

A. Unit manufacturer shall ship unit in segments as specified by the contractor for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.

B. Casing performance - Casing air leakage shall not exceed 1% of design airflow at the specified casing pressure.

C. Air leakage shall be determined at a casing static pressure of 6 inches w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class.

D. Under 55F supply air temperature and design conditions on the exterior of the unit of 81F dry bulb and 73F wet bulb, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing to the Engineer and Owner, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them. In lieu of AHU manufacturer providing a written guarantee, the installing contractor must provide additional external insulation on AHU to prevent condensation.

E. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8-inch w.g., whichever is less, and shall not exceed 0.0042 per inch of panel span (L/240).

F. Floor panels shall be double-wall construction and designed to support a 300-lb load during maintenance activities and shall deflect no more than 0.0042 per inch of panel span.

G. Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized interior, to facilitate cleaning of unit interior.

H. Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 13 Hr*Ft2*°F/BTU.

I. Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A.

J. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.

K. Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.

L. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.

M. Traction enhancements shall be applied to the unit floor to improve the walking surface in those unit sections where the floor is fully accessible, and not impeded by internal structural or functional features.

2.4 ACCESS DOORS

A. Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.

B. All doors shall be provided with a thermal break construction of door panel and door frame.

C. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.

D. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.

E. Handle hardware shall be designed to prevent unintended closure.

F. Access doors shall be hinged and removable without the use of specialized tools.

G. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.

H. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.

I. All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.

J. Multiple door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit.

K. A shatterproof window shall be provided in access doors. Window shall be thermal dual pane.

L. Test ports shall be supplied in access doors as defined in the unit schedule to facilitate the field commissioning by the test and balance contractor. Test ports shall not compromise the ASHRAE leakage class of the unit.

2.5 PRIMARY DRAIN PANS

A. All cooling coil sections shall be provided with an insulated, double-wall, stainless steel drain pan.

B. The drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements.

C. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.

D. All drain pan threaded connections shall be visible external to the unit. Threaded connections under the unit floor shall not be accepted.

E. Drain connections shall be of the same material as the primary drain pan and shall extend a minimum 2-1/2-inch beyond the base to ensure adequate room for field piping of condensate traps.

F. The installing contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.

G. Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing.

2.6 FANS

A. Fan sections shall have a minimum of one hinged and latched access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components. Construct door(s) per Section 2.04.

B. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans that are selected with inverter balancing shall first be dynamically balanced at design RPM. The fans then will be checked in the factory from 25% to 100% of design RPM to insure they are operating within vibration tolerance specifications, and that there are no resonant frequency issues throughout this operating range. Inverter balancing that requires lockout frequencies inputted into a variable frequency drive to in order to bypass resonant frequencies shall not be acceptable. If supplied in this manner by the unit manufacturer, the contractor will be responsible for rebalancing in the field after unit installation. Fans selected with inverter balancing shall have a maintenance free, circumferential conductive micro fiber shaft grounding ring installed on the fan motor to discharge shaft currents to ground.

C. Belt-driven fans shall be provided with grease lubricated, self-aligning, anti-friction bearings selected for L-50 200,000-hour average life per ANSI/AFBMA Standard 9. Lubrication lines for both bearings shall be extended to the drive side of the AHU and rigidly attached to support

bracket with zerk fittings. Lubrication lines shall be a clear, high-pressure, polymer to aid in visual inspection. If extended lubrication lines are not provided, manufacturer shall provide permanently lubricated bearing with engineering calculations for proof of bearing life.

D. Fans, including belt driven and direct drive plenum fans with integral frame motors, shall be mounted on isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.

E. Direct drive plenum fans provided with ECM motors shall be balanced to a G6.3 per AMCA 204. No vibration isolation base required for these type fans. Motors for these fan types shall include an integral PID controller that will accept a 0-10VDC input signal for variable speed control.

F. Fan airflow measurement systems shall be provided to measure fan airflow directly. The accuracy of the devices shall be no worse than +/- 5 percent when operating within stable fan operating conditions. Devices shall not affect the submitted fan performance and acoustical levels. Devices that obstruct the fan inlet or outlet shall not be acceptable. Devices shall be connected to transducers with selectable 4-20 mA or 2-10 VDC output. Signal shall be proportional to air velocity.

G. Fan belts shall be enclosed as required by OSHA standard 29 CFR 1910 to protect worker from accidental contact with the belts and sheaves.

2.7 MOTORS AND DRIVES

A. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.

B. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.

C. Fan Motors shall be heavy duty, open drip-proof operable at 208 volts, 60Hz, 3-phase. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies.

D. Belt driven fans shall use 4-pole, 1800 rpm, motors, NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.

E. Direct driven fans utilizing integral frame motors shall use 2-pole (3600 rpm), 4-pole (1800 rpm) or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.

F. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.

G. V-Belt Drive shall be fixed pitch rated at 1.5 times the motor nameplate. Drives 20 hp and larger or any drives on units equipped with VFDs shall be fixed pitch.

H. All belt driven fans with motors 15 hp and larger shall be equipped with multiple belt drives.

I. Manufacturer shall provide for each belt driven fan a nameplate with the following information to assist air balance contractor in start up and service personnel in maintenance. Fan and motor sheave part numbered. Fan and motor bushing part numbered. Number of belts and belt part numbered. Fan design RPM and motor HP. Belt tension and deflection. Center distance between shafts

2.8 COILS

A. Coils section header end panel shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit.

B. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.

C. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.

D. Construct coil casings of galvanized steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.

E. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.

F. When two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil. The intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate drain pan shall be constructed of the same material as the sections primary drain pan.

G. The intermediate drain pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil.

H. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The intermediate drain pan outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.

I. Coil shall have a flexible epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Coating process shall ensure complete coil encapsulation and a uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges. Corrosion durability shall be confirmed through testing to no less than 5,000 hours salt spray per ASTM B117.

J. Refrigerant Cooling Coils

1. Refrigerant suction and liquid connections shall be clearly labeled on unit exterior.
2. Coils shall be proof tested to 450 psig and leak tested to 300 psig air pressure under water. After testing, insides of tubes shall be air dried, charged with dry nitrogen or dry air, and sealed to prevent contamination.
3. Refrigerant suction and liquid headers shall be constructed of copper tubing. Suction and liquid connections shall penetrate unit casings to allow for sweat connections to refrigerant lines.
4. Tubes shall be 1/2 inch O.D., minimum .016 inch thick copper. Fins shall be aluminum.
5. Coils shall have equalizing type vertical distributors sized in conjunction with capacities of coils.

2.9 INTEGRAL FACE AND BYPASS

A. Integral face and bypass coils shall be provided as indicated on the schedule and drawings. Coils shall meet performance as defined on the schedule. Coils shall consist of a built-in series of finned heating, and bypass areas, with mechanically interlocked dampers. Coils to be constructed of 14-gage galvanized steel, with fins shall be no less than .010-inch thick aluminum, and tubing with minimum .035-inch thick copper tubing. Coils shall be certified to, and bear the AHRI 410 Standard label.

B. Dampers shall be arranged to completely enclose and isolate heating elements. Coils shall include mixing baffles to minimize downstream mixing distance to 24-inches. At minimum distance, leaving air temperature shall vary no more than +/- 5 deg F from the average leaving air temperature.

C. Manufacturer shall extend coil connections on horizontal-tube coils through the unit casing wall to facilitate piping. Coil connection penetrations through unit casing shall be provided by unit manufacturer on vertical-tube coils. Installing contractor shall be responsible for providing flexible connector on return header, and supply/return piping through unit casing wall.

2.10 FILTERS

A. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have side access filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement. Filters to be of size, and quantity needed to maximize filter face area of each particular unit size.

B. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule

C. Manufacturer shall provide one set of startup filters.

D. Each filter section shall be provided with a factory-installed, flush-mounted Dwyer dial-type differential pressure gauge piped to both sides of the filter to indicate status. Gauge shall maintain a +/- 5 percent accuracy within operating temperature limits of -20°F to 120°F. Filter sections consisting of pre- and post-filters shall have a gauge for each.

2.11 DAMPERS

A. All dampers, with the exception of external bypass, shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Blade arrangement (opposed) shall be provided as indicated on the schedule and drawings. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 3 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.

B. Airflow measuring stations shall be provided and located in the outside and/or return air paths to measure airflow. Airflow measuring stations shall be tested per AMCA Standard 611 and licensed to bear the AMCA Ratings Seal for airflow measurement performance. Integral control damper blades shall be provided as galvanized steel and housed in a galvanized steel frame. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage.

1. The airflow measurement station shall measure up to 100 percent of the total outside air and/or return air. The airflow measurement station shall be capable of measuring down to 300 fpm. The airflow measuring device shall adjust for temperature variations. Output shall be provided from the station as a 2-10 VDC signal. Signal shall be proportional to air velocity. The accuracy of the measuring station shall be no greater than +/- 5 percent. Airflow measuring stations shall be mounted on the AHU interior.
2. The installing contractor shall provide duct-mounted pleated media MERV 8 filtration upstream of airflow monitoring stations requiring air straightening vanes to prevent blockage of vanes. A filter access door shall be provided for filter replacement that does not degrade the specified duct leakage class. Duct-mounted filtration section with access door for filter removal shall be tested for compliance to specified duct leakage class on the schedule and plans.

2.12 ACCESS SECTIONS

A. Access sections shall be provided where indicated in the schedule and plans to allow additional access for inspection, cleaning, and maintenance of unit components. The unit shall be installed for proper access. Procedure for proper access, inspection and cleaning of the unit shall be provided in the AHU manufacturer's maintenance manual. Access section doors shall be constructed per Section 2.04.

2.13 INTERNAL FACE AND BYPASS SECTION

A. Dampers shall be provided as indicated on the schedule and plans to divert airflow around the coil internally within the air handling unit. Dampers shall be low leak and opposed blade arrangement. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 5 CFM/square foot at one inch water gauge. All leakage testing and pressure ratings shall be based on AMCA

Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.

B. Safety

1. Access doors shall be provided at the location of each UV-C light as indicated on the plans and schedule. All sections of the air handler with access doors where the UV-C lights may pose a risk for direct exposure shall have a mechanical interlock switch that disconnects power to the lights when the door is opened.
2. In addition to the mechanical interlock switch, each unit shall be equipped with an externally mounted on-off/disconnect/shut off switch that disconnects power to the UV-C lights. The switch shall be equipped with a lock-out/tag-out to prevent unwanted operation of the UV-C lights.
3. A view port with cover shall be provided in each UV section to allow viewing of the UV-C light array confirming operation. The view port and other AHU windows shall be treated to assure the UV-C energy emitted through it is below the threshold limits specified by NIOSH and ACGIH.
4. Units shall have a safety warning label applied to the exterior of each section containing UV-C lights.
5. Complete safety, maintenance and servicing instructions for the UV-C lights and fixtures shall be incorporated into the air handler manufacturer's standard installation, operating and maintenance manuals.

2.14 TOTAL ENERGY RECOVERY WHEEL SECTION

A. Total energy recovery wheels shall be provided as indicated on the schedule and drawings. Wheels shall be integral parts of the AHUs and shall be sized per the ventilation requirement of the units. Additional outside air units, or other field assembled and ducted energy recovery devices, are not acceptable. Mixed air units with economizing shall be constructed with internal bypass dampers such that the pressure drop across the wheel does not increase during economizing. External bypass and multiple duct connections are not acceptable.

B. The air handling unit shall be certified by AHRI to contain a rotary energy recovery wheel certified to ANSI/AHRI Standard 1060 and bears the AHRI 1060 label. Performance characteristics of the energy wheel shall be provided as defined by AHRI 1060 definitions. The energy wheel shall be a total energy wheel, with the sensible and latent effectiveness reported and within 5% of each other. The calculated total net effectiveness of the recovery wheel shall not be less than 70% when the specified ventilation flow rate equals the exhaust flow rate. The energy wheels EATR shall be less than the value indicated in the schedule and drawings. Wheel face velocity and pressure drop shall not exceed performance as defined on schedule. The energy recovery cassette shall be an Underwriters Laboratories (UL) Recognized Component certified for mechanical, electrical, and fire safety in accordance with UL Standard 1812.

C. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belts. The total energy recovery wheel shall incorporate a desiccant without the use of binders or adhesives, which may plug the desiccant aperture. The adsorbent shall not be applied as a glued on surface coating and not susceptible to erosion, abrasion, or delamination. Coated segments shall be washable using standard detergent or alkaline-based coil cleaners. The adsorbent shall be selected for its high affinity for water vapor and shall not dissolve or deliquesce in the presence of water or high humidity. The

rim shall be continuous rolled stainless steel to form an even concentric circle to prevent leakage around the rim and to minimize wear of components. All diameter and perimeter seals shall be provided as part of the cassette assembly. Perimeter seals shall be self-adjusting; diameter seals shall be adjustable.

D. Wheel drive motor shall be provided mounted in the cassette frame. Wheel drive motor shall be thermally protected and UL Component Recognized. Drive belts shall not require belt tensioner. On units that require drive belt tensioner for the wheel belt/motor assembly, the unit manufacturer shall provide at no additional charge to the customer a visual inspection every four months, and adjustment if necessary, of the recommended belt tension during the unit warranty period. Wheel motors shall be of the voltage, phase, frequency, and Hp indicated on the schedule and drawings.

E. Wheel bearings shall be permanently sealed and lubricated and have a minimum L-10 life of 400,000 hours.

F. Access doors shall be provided for the removal of wheel segments. Doors shall be located to allow access to the entire upstream and downstream face of each wheel. Adequate space and access shall be provided for energy wheel motor, bearing and belt removal.

G. Energy recovery wheels shall be designed with variable effectiveness control, to vary the wheel's recovery capacity. Variable effective control shall be done by an internal bypass damper provided by the AHU Manufacturer. The wheel's variable effectiveness control shall have the ability to modulate the total energy recovery ability down to at least 40% of the initial recovery capacity. Variable frequency speed control is not an acceptable method for controlling variable effectiveness.

H. Frost prevention shall be achieved by outside air bypass, return air preheat, or outside air preheat, depending upon design conditions. Frost set point temperatures based on the scheduled design air conditions shall be provided by the AHU Manufacturer. Variable frequency speed control is not an acceptable method of frost control. Winter design supply and exhaust air conditions leaving the energy wheel shall be provided by the AHU Manufacturer and shall include any de-rate in performance due to frost prevention measures.

I. Control of energy wheels shall be incorporated and an integral part of the AHU control systems and shall be as described under the AHU control specifications. Secondary independent wheel controllers are not acceptable.

J. Access doors shall be provided on all air entering and air leaving sides of wheel to allow for wheel maintenance, belt or motor removal. Access doors shall be constructed per Section 2.04.

2.15 CONVENIENCE OUTLETS

A. A 15-amp, 115V GFCI convenience outlet shall be provided by the AHU manufacturer. The outlet shall be separate from the load side of the equipment per NEC requirements. Installing contractor shall be responsible for providing 115V supply to the factory-mounted GFCI outlet circuit per NEC (even when single-point power is specified to be provided by AHU manufacturer).

2.16 VARIABLE FREQUENCY DRIVES (VFDS)

A. Variable frequency drives shall be provided, mounted and wired by the AHU manufacturer as indicated on the schedule and drawings. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. The VFDs shall be UL listed. The listing shall allow mounting in plenum or other air handling compartments.

B. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.

C. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.

D. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.

E. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL 508 certified for the building and assembly of option panels. Assembly of separate panels with options by a third-party is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel.

F. The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.

G. The VFDs full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.

H. The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.

I. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor’s speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.

J. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.

K. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.

L. Galvanic and/or optical isolation shall be provided between the VFDs power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

M. The VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.

N. Protective Features

1. Protection shall be provided against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VFD overtemperature and motor overtemperature. The VFD shall display all faults as words. Codes are not acceptable.
2. The VFD shall be protected from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD shall continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, 313 V AC for 460 volt units, and 394 volts for 600 volts units.
3. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
4. The VFD package shall include semi-conductor rated input fuses to protect power components.
5. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the AHU manufacturer shall ensure that inverter rated motors are supplied.
6. The VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
7. The VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
8. The VFD shall catch a rotating motor operating forward or reverse up to full speed.
9. The VFD shall be rated for 100,000 amp interrupting capacity (AIC).
10. The VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD shall identify which of the output phases is low or lost.
11. The VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt units, 539 V AC on 460 volt units, and 690 volts on 600 volt units.

O. Interface Features

1. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference. On units with bypass, a VFD/Off/Bypass selector switch shall be provided.
2. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
3. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
4. A lockable, alphanumeric backlit display keypad shall be provided. The keypad shall be remotely mountable up to 10 feet away using standard 9-pin cable.
5. The keypads for all sizes of VFDs shall be identical and interchangeable.

6. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFDs keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.
7. The display shall be programmable to display in English, Spanish and French at a minimum.
8. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
9. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
10. The VFD shall include a standard EIA-485 communications port and capabilities to be connected at a future date to a Johnson Controls N2 Metasys or Siemens FLN system at no additional cost to the owner. The connection shall be software selectable by the user.
11. At a minimum, the following points shall be controlled and/or accessible:
12. VFD Start/Stop
13. Speed reference
14. Fault diagnostics
15. Meter points:
    a. Motor power in HP
    b. Motor power in kW
    c. Motor kW-hr
    d. Motor current
    e. Motor voltage
    f. Hours run
    g. 2 feedback signals
    h. DC link voltage
    i. Thermal load on motor
    j. Thermal load on VFD
    k. Heatsink temperature

16. Four additional Form C 230 volt programmable relays shall be available for field installation within the VFD
17. LonWorks® communication shall be available for factory or field installation within the VFD.
18. Two set-point control interfaces (PID control) shall be standard in the unit. The VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
19. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
20. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFDs unable to show these four displays simultaneously shall provide panel meters.
21. Sleep mode shall be provided to automatically stop the VFD when its speed drops below set ¿sleep¿ level for a specified time. The VFD shall automatically restart when the speed command exceeds the set ‘wake’ level.
22. The sleep mode shall be functional in both follower mode and PID mode.
23. A run permissive circuit shall be provided to accept a ¿system ready¿ signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an

output signal as a start command to actuate external equipment before allowing the VFD to start.

24. The following displays shall be accessible from the control panel in actual units: Reference Signal Value, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and unit CFM.
25. The display shall be programmed to read in inches of water column (in-wg).
26. The VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
27. If the temperature of the VFDs heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFDs heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
28. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
29. The VFD shall store in memory the last 10 faults and related operational data.
30. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
31. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
32. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
33. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24V DC status indication.
34. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

P. Adjustments

1. The VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
2. A minimum of sixteen preset speeds shall be provided.
3. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
4. Four current limit settings shall be provided.
5. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.
6. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
7. An automatic ‘on delay’ shall be selectable from 0 to 120 seconds.

Q. Service Conditions

1. VFDs shall provide full output in an ambient temperature from -10 to 50°C (14 to 104°F).
2. VFDs shall provide full output in a relative humidity from 0 to 95%, non-condensing.
3. VFDs shall provide full output up to 3,300 feet elevation without derating.

4. VFDs shall provide full output with an AC line voltage variation from -10 to +10% of nominal voltage.
5. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

R. Warranty
1. The VFD shall be warranted by the manufacturer for a period of 42 months from date of shipment, or 36 months from start-up, whichever occurs first. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory-authorized on-site service.

2.17 FACTORY-INSTALLED MOTOR WIRE TERMINATION, VFD, AND COMBINATION STARTER/DISCONNECT ENCLOSURES

A. VFDs shall be factory mounted on the drive side of the fan section. VFD may be mounted on the interior of the unit, accessible from the unit exterior through an access door, or on the casing exterior in a NEMA Type 1 enclosure for indoor units. If not mounted on the fan section due to NEC disconnect height limitations or serviceability constraints in the mechanical equipment room, VFD may be mounted in another location other than the fan.

B. Any welds shall be properly finished with no rough edges. Enclosures shall house circuit breaker disconnects, bypass circuitry, Drive-OFF-Bypass switches, manual speed controls, and control transformers. VFDs and starter/disconnects shall have an external disconnect located on the outside of the access door.

2.18 VFD PER FAN

A. Multiple VFDs on a common panel, shall be provided for each fan array to provide redundancy in case of loss of function of one of the VFDs or motors. Individual VFD shall be sized based on motor FLA to reduce overall panel input current. In the event of a VFD failure, the remaining VFDs must be capable of compensating and maintaining normal fan array operation.

B. VFD panel shall have a common disconnect that is accessible from the outside of the unit. Disconnect shall open input power to all VFDs simultaneously. Disconnect shall be lockable in the off position. Disconnect shall utilize circuit breaker to provide overcurrent and short circuit protection.

C. VFD panel shall be provided with a common point connection for speed input signal, start/stop signal, fault status, and field interlock connection

D. VFD panel shall be provided with a single point of field connection for field input power. Each VFD shall be supplied with independent input fusing, as required. Panel shall be provided with short circuit current of <<SHORT_CIRCUIT_RATING_MULTI_VFD>> RMS symmetrical.

E. Externally mounted VFDs shall be provided with independent keypad.

2.19 MOTOR OVERLOAD PANEL FOR FAN

A. A motor overload panel provides a single unit mounted UL508A listed control panel with all fans pre-wired to it, such that one properly sized VFD may be field connected with no additional provisions required for protection of the individual motors. The control panel enclosure will be

mounted on the exterior of the fan section and will be NEMA type 1 for indoor units and NEMA type 4 for outdoor units. A single power distribution block shall be provided for connection of the field mounted VFD with one conductor per phase. An electronic motor overload protector with lockable manual isolation switch shall be provided for each motor in the array. Each motor in the array shall be independently grounded with a dedicated green conductor. A minimum of one open ground lug per fan plus one shall be provided for field use. Each motor overload protector shall be provided with an auxiliary contact and all auxiliary contacts will be wired in series to a terminal block for generic trip signaling. The panel will be rated for WYE power systems up to 600V.

2.20 FACTORY WIRING OF LIGHTS, VFDS, AND COMBINATION STARTERS/DISCONNECTS

A. VFDs shall be wired per NEC, UL, and NFPA 90A requirements. Units with factory-mounted controls shall also include power wiring from the VFD or starter/disconnect control transformer to the control system transformers. Units with VFDs and factory-mounted controls shall have a binary start-stop signal and an analog speed signal wired from the direct digital controller to the VFD.

B. All power wiring for voltages greater than 24V and traveling through multiple unit sections shall be contained in an enclosed, metal, power-wiring raceway or EMT. Sections less than 6-inch in length may be contained in FMC.

C. After mounting and wiring of VFDs, on the AHUs, trained factory personnel shall ensure proper operation of each VFD, through a thorough factory test. Testing shall include a Hypot test of unit wiring to ensure that no weaknesses exist in wiring or motor. Each VFD shall be energized and the fan run to ensure the VFD will operate throughout the usable range of the drive and that the fan rotation is correct. Each VFD with bypass shall also be tested in the bypass position to ensure the bypass is operational.

D. For fan motors not supplied with a factory mounted and wired starter or VFD, the unit manufacturer shall supply a 4 X 4 NEMA 4 junction box on the exterior of the fan section(s) with wiring, prewired to the fan motor, to allow for ease of field installation of a starter or VFD.

E. On units provided with factory mounted and wired supply fan starter or VFD and DDC controls, the manufacturer shall provide a single point of power. Line-to-24v transformers shall be provided with sufficient vA to power the unit mounted controller and factory installed control points.

2.21 FACTORY-ENGINEERED AUTOMATIC TEMPERATURE CONTROLS

A. Unit shall be provided with a factory wired, installed and tested unit controller, capable of standalone unit control, or tied into a building automation system through Bacnet communication. All control points in unit shall be tested at the unit manufacturers' facility prior to shipment.

B. Damper actuators shall be selected, provided, and mounted by the AHU manufacturer on each damper. Actuators shall be of sufficient size and quantity to ensure complete damper operation. Actuators shall be direct coupled to minimize linkage.

C. Differential pressure switches shall be provided by the AHU manufacturer. Pressure switches shall be factory installed across each filter bank for individual filters to monitor clean/dirty filter status.

D. Differential pressure gauges shall be provided by the AHU manufacturer. Pressure gauges shall be factory installed across each filter bank for individual filters. The gauge shall be diaphragm-actuated dial type.

E. A momentary push-button reset circuit using a double-pole low limit switch shall be provided by the AHU manufacturer. Low limits shall be factory engineered to maximize coil coverage. Capillary radius clips shall be used at low limit bends to ensure no crimping or wear of low limits. Low limits shall be wired to shut down the fan to protect the unit.

F. Fan status switches shall be provided and mounted by the AHU manufacturer.

G. On variable volume units, a discharge temperature sensors shall be provided and mounted on the fans by the AHU manufacturer. Temperature sensors mounted within the AHU shall have sensor material selected to integrate with the BAS controller.

H. Outside air temperature sensors shall be provided at the jobsite.

I. Averaging temperature sensors shall be provided by the AHU manufacturer. Sensors shall be factory engineered to accurately measure mixed air temperatures. Capillary radius clips shall be used at capillary bends to ensure no crimping or wear of the tube. Temperature sensors mounted within the AHU shall have sensor material selected to integrate with the BAS controller.

J. For variable-air-volume units, duct static pressure switches shall be provided by the AHU manufacturer in the unit. Switches shall be piped in the field.

K. See section 2.09, paragraph B for specifications on "Outside and Return Airflow Measuring Stations".

L. See section 2.06, paragraph E for specifications on "Fan Airflow Measurement Systems".

2.22 UNIT DDC CONTROLLER

A. One programmable DDC controller shall be provided by the AHU manufacturer for each AHU as indicated on the schedule and drawings. Control of multiple units from a single controller is not acceptable. Each programmable DDC controller shall use the LonTalk protocol and shall be LonMark certified to ensure open communication with other open BASs. Complete communications and diagnostics including all AI, BI, AO, BO, set points and alarms shall only require a twisted pair of wires between the unit controller and the BAS. Each unit controller shall be factory wired to the unit end devices. For indoor units, each controller shall have a user display touch screen for user interface. The display on indoor units shall be unit mounted in the factory. For outdoor units, one portable user display touch screen for user interface shall be provided for all controllers. Displays shall give user access to AHU status, set points and alarms.

B. The programmable DDC controller and the control components shall be selected, mounted, wired and tested by the AHU manufacturer to ensure delivery of specified performance and to

minimize jobsite startup time. Testing shall be performed to ensure wiring continuity between the controller and all devices, and to ensure proper operation of the end devices. DDC controllers shall be located on unit as indicated on the drawings.

C. Factory mounted controller shall be preprogrammed at the factory to minimize startup delay of the unit(s) at the job site. Controller shall be programmed with manufactures preferred standard basic programming based on unit configuration and options. Any additional programming or custom programming shall be provided at the job site by the unit manufacturer or controls contractor.

2.23 FACTORY TESTING

A. A factory air leakage test shall be performed to verify the air handling unit conforms to the specified air leakage requirement. The entire unit shall be tested at specified total unit static as selected and specified from the TOPSS selection. Leakage shall be calculated by totaling all leakage either into or out of the unit casing. Leakage shall not exceed specified leakage amount. Air pressure and casing leakage shall be measured by a third party calibrated and certified apparatus. A written test report shall be prepared by the manufacturer and issued to the owner or owner representative.

B. A factory unit deflection test shall be performed to verify the air handling unit does not exceed L/240 of the panel span at the specified total unit static as selected and specified from the TOPSS selection. A written test report shall be prepared by the manufacturer and issued to the owner or owner representative.

C. The owner or designated representative shall witness the leakage and/or deflection test(s) at the factory. The owner will be notified a minimum of 10 days in advance of the testing to provide time to coordinate travel arrangements. Written test report(s) shall be prepared by the manufacturer and issued and presented to the owner or owner representative after testing.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. Install in accordance with ARI 430.

B. Install 8 inches (minimum) galvanized steel support to raise unit to accommodate cooling coil drain. Refer to drawings for additional information. Install larger steel support if called for on drawings.

C. Install restraining snubbers as required. Refer to Sections 23 05 48.

D. Install floor mounted units on concrete housekeeping pads at least 4 inches high and 6 inches wider than unit. Refer to Section 03 30 00.

E. Provide fixed sheaves required for final air balance.

F. Unit manufacturer shall provide factory trained service personnel that are employees of the manufacturer to supervise installation and start-up of the air handling units on the job site.

G. Insulate coil headers located outside airflow as specified for piping. Refer to Section 23 07 00.

H. Install condensate piping with trap and route from drain pan to nearest floor drain.

3.3 MANUFACTURER'S FIELD SERVICES

A. Refer to DCAS General Conditions: Requirements for manufacturer’s field services.

B. Furnish services of factory-instructed representative for minimum of one (1) day to start-up, calibrate controls, and instruct the City of New York on operation and maintenance.

3.4 CLEANING

A. Refer to DCAS General Conditions: Requirements for cleaning.

B. Vacuum clean coils and inside of unit cabinet.

C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.5 DEMONSTRATION

A. Refer to DCAS General Conditions: Requirements for demonstration and training.

B. Demonstrate unit operation and maintenance.

C. Furnish services of manufacturer's technical representative for one (1) hour day to instruct the City of New York's personnel in operation and maintenance of units. Schedule instructions with the City of New York, provide at least 7 days’ notice to the Commissioner of instructing date.

3.6 PROTECTION OF FINISHED WORK

A. Refer to DCAS General Conditions: Requirements for protecting finished Work.

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated and fan has been test run under observation.

END OF SECTION 23 73 00

SECTION 23 81 43 VARIABLE REFRIGERANT SYSTEM – HEAT RECOVERY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. The HVAC basis of design shall be Water Source Heat Recovery VRF as scheduled.

B. Bidders shall provide the minimum system as indicated on drawing, including Heat Recovery as defined by model and family numbers. All systems shall be capable of providing the scheduled capacity at the location of the indoor unit regardless of pipe length. Nominal or catalog capacities will not be accepted.

C. The Heat Recovery system shall consist of Water Source unit(s), multiple indoor units, and VRF System Controls.

D. If the application calls for simultaneous heating and cooling with multiple zones and multiple controllers, and the installing contractor submits a Heat Pump system, the submittal shall be summarily rejected. The contractor shall then be required to resubmit and install a simultaneous heating and cooling system. The contractor shall bear all additional costs required to provide a simultaneous heating and cooling system, with no additional cost to The City of New York.

E. BAS System Controls, installation, and integration shall be provided by the manufacturer of the VRF system. This is to ensure sole source responsibility for the BAS control system including non-VRF systems.

1.3 QUALITY ASSURANCE

A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

D. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1230.

E. System start-up supervision shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in system configuration and operation. The representative shall provide proof of manufacturer certification indicating successful completion within no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals.

1.4 DELIVERY, STORAGE AND HANDLING

A. Installing contractor will take all reasonable and appropriate care to store and handle equipment per the manufacturer's recommendation.

1.5 SUBMITTALS

A. Installing contractor shall provide the following:

1. VRF Guide Specification
2. VRF Dimensional Data for all products submitted
3. VRF Product Data for all products submitted.
4. VRF Select report showing design conditions, total load profile, and actual capacity at actual Indoor Unit location,
5. VRF Select Piping and Wiring layout showing estimated piping, wiring sizes, equipment quantities, piping length estimate, and additional refrigerant charge.
6. VRF Select Schedule showing the performance for all pieces of equipment.

1.6 INSTALLATION AND OPERATION MANUALS

A. The City of New York shall be provided with a complete and comprehensive electronic set of Installation and Operation Manuals.

1.7 QUALIFICATIONS

A. Manufacturer shall have a minimum of twenty-five (25) years of HVAC experience in the North America market.

B. Manufacturer to have Local Factory Service within seventy-five (75) miles of jobsite.

C. The VRF system shall be installed by a certified installer with extensive VRF installation and service training. The mandatory contractor service and install training shall be performed by the manufacturer.

1.8 WARRANTY

A. The VRF units shall be covered by the manufacturer's limited warranty for a period of one (1) year parts and seven (7) year compressor to The City of New York from date of installation.

B. Manufacturer shall have a minimum of fifteen (15) years continuous experience providing VRF systems in the U.S. market.

C. All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

D. The VRF system shall be installed by a contractor with extensive install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Mitsubishi VRF
2. Daikin
3. Panasonic
4. Hitachi
5. Or approved equal.

2.2 WR2-SERIES STANDARD EFFICIENCY (HEAT RECOVERY), WATER COOLED OUTDOOR UNITS

A. General:

1. The outdoor unit modules shall be water-cooled, direct expansion (DX), multi-zone units used specifically with VRF components described in this section and Part 5 (Controls). The outdoor unit modules shall be equipped with a single compressor which is inverter- driven and multiple circuit boards—all of which must be manufactured by the branded VRF manufacturer. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.
2. Outdoor unit systems may be comprised of multiple modules with differing capacity if a brand other than basis of design is proposed. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install alternate units shall be incurred by the contractor. Contractor responsible for ensuring alternative brand compatibility in terms of availability, physical dimensions, weight, electrical requirements, piping costs, etc.
3. Outdoor unit shall have a sound rating no higher than 58 dB(A) individually or 60 dB(A) twinned. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
4. Refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller or comparable branch devices shall be insulated in accordance with the installation manual.
5. The outdoor unit shall have the capability of installing the main refrigerant piping through the front of the unit. Contractor bidding alternative manufacturer(s) assumes responsibility for ensuring compliance with required space and service clearances with no changes to existing spaces.
6. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
7. The water-source unit shall have a freeze protection mode. Additionally, each module must include a field-installed flow switch sensor to shut the unit off in the event of water flow failure.
8. The water source unit must be installed with strainer in water line near water inlet to protect heat exchanger from debris in water lines. Units with plate heat exchangers require field-installed 60 mesh strainer and units with tube-in-tube heat exchangers require field-installed 25 mesh strainer.

9. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
10. VRF system shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.
11. The water-source unit shall be capable of continuous operation in heating or cooling mode with entering supply water temperature range between 23°F and 113°F without external, field-installed bypass valves.
12. The water-source unit shall have 0-10V output signal or two position valve closure interlock available for conformance with IECC requirements.
13. The water-source units are intended for installation indoors with an ambient temperature between 32oFDB and 104oFDB.
14. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors (which may fail) to engage oil return sequence are not allowed.

B. Unit Cabinet:

1. The cabinet(s) shall be fabricated of hot-dip galvanized steel sheet for corrosion resistance.
2. The water-source systems can be mounted side-by-side or stacked (with proper structural supports) depending on selected connection locations.

C. Inverter Cooler:

1. The water-source unit shall have an internal direct expansion type inverter cooler. The inverter cooler shall provide cooling for all internal cabinet components eliminating the need for cabinet ventilation along with associated clearance requirements and additional space cooling load.
2. Alternate systems without integral cooling for internal cabinet components shall require additional indoor unit(s) sized for total heat rejection of water-source unit and additional outdoor unit capacity must be added to account for load. Submitted efficiency data must be corrected to reflect system capacity reduction due to cooling capacity applied to heat rejected by HVAC equipment.

D. Refrigerant Piping

1. R410A refrigerant shall be required for systems.
2. Polyolester (POE) oil—widely available and used in conventional domestic systems— shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.
3. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the VRF equipment manufacturer and installed in accordance with manufacturer recommendations.

4. All refrigerant piping must be insulated with ½" closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.
5. Refrigerant line sizing shall be in accordance with manufacturer specifications. Future changes to indoor unit styles or sizes must be possible without resizing/replacing refrigerant piping to any other branch devices or indoor units.

E. Water -Refrigerant Heat Exchanger Coil and Connections

1. The water-source heat exchanger shall be a cross-flow, stainless steel brazed plate heat exchanger. The channel plate shall be constructed from AISI 316 SS. The Frame/Pressure plate shall be constructed from AISI 304 SS. The brazing material shall be pure copper.
2. The heat exchanger shall be rated for a maximum of 2.0 MPa (290 psi).
3. Water connections on unit shall utilize standard national pipe thread (NPT) connections as is standard for US piping. Alternate pipe thread standards which may appear physically similar but require adapters are not allowed.
4. The water-source unit shall be approved for use in a closed water loop system.

F. Compressor

1. Each outdoor unit module shall be equipped with only inverter driven scroll hermetic compressors. Non inverter-driven compressors, which may cause inrush current (demand charges) and require larger generators for temporary power shall not be allowed.
2. Compressor shall have an inverter to modulate capacity. The capacity for each compressor shall be variable with a minimum turndown not greater than 24%.
3. The compressor shall be equipped with an internal thermal overload.
4. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

G. Controls

1. Condensing unit shall include Variable Evaporator Temperature or comparable method of varying system evaporator (refrigerant) temperature in order to reduce compression ratio and power consumption during light load or mild ambient temperatures. Multiple evaporator refrigerant temperature settings shall be required in order to optimize efficiency within required system-specific performance and installation constraints. System shall reduce compression ratio only when/if all indoor units are within 1.8F of setpoint; reducing compression ratio based solely on ambient temperature risks discomfort and is not allowed. Variable Evaporator Temperature or comparable method shall incorporate override or disable capability based on external signal to allow for space humidity control or load demand.
2. Water-source modules shall contain a terminal block with dry contacts for proof of flow status via a field provided flow switch, as well as a dry contact to energize the control circuit for an auxiliary dedicated pump or motorized isolation valve.
3. Two-stage condenser water flow shall be utilized during periods when all indoor units on a water source system are OFF by installing motorized two position valves (provided by contractor) on each of the water source modules tied to the appropriate terminal block. Systems comprised of twinned modules will not de-energize the field provided two position valves on any of the modules, until all the modules become thermally inactive

AND all connected indoor units are OFF. Contractor to coordinate with respective manufacturer for piping/wiring requirements.

4. Modulating Water Flow Control
   a. Each Water Cooled Module shall be supplied with a pressure independent characterized control valve capable of modulating water flow through each water cooled module independently of the rest of the condenser water system.
   b. Valve shall maximize energy efficiency of each Water Cooled Module by accurately matching the water cooled units demand output to flow requirements through custom manufacturer supplied actuator programming.
   c. Each valve shall include an Ultrasonic flow meter that will constantly monitor flow to each water cooled module ensuring any variation in system pressure doesn't affect the flow through each Water Cooled Module.
   d. Each valve shall utilize Ultrasonic flow meter for proof of flow and protect each water cooled unit's brazed plate heat exchanger in event of any water system failure.
   e. Each actuator shall have its own built in web browser for setup utilizing pre-programmed drop down list for each water cooled unit/module size for easy startup and commissioning of system.
   f. Each valve shall be self-balancing due to its pressure independent nature, use of Auto-flow valve or circuit setter for condenser water balancing is not allowed.
   g. Systems utilizing pressure dependent condenser water control valves shall not be allowed.
   h. Utilization of paddle or differential flow switches shall not be allowed. Only ultrasonic or thermal flow switches shall be allowed as they can provide accuracy to protect each heat exchanger without potential fouling of switch due to contaminants in the condenser water loop.
   i. Valve packages that do not give direct feedback of flow to each water cooled module shall not be allowed as they can allow the water cooled units to run at less- efficient flow rates with no correction.
   j. Valve package shall be provided by VRF manufacturer, field provided valve packages shall not be allowed.
5. Valve shall include BACnet IP or MS/TP connection to allow monitoring of flow through each module as well as valve open percentage.
6. The water source outdoor unit shall be an integral part of the system & control network described in Part 5 (Controls) and react to heating/cooling demand as communicated from connected indoor units over the control circuit. Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.
7. The unit shall have the capability of 4 levels of demand control for each refrigerant system based on external input.
8. The unit shall have the capability of interlocking operation of the water circuit and error detection.

H. Electrical:

1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz or 460 volts, 3-phase, 60 hertz per equipment schedule.
2. The outdoor unit shall be controlled by integral microprocessors.
3. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.3 BRANCH CIRCUIT (BC) CONTROLLERS AS REQUIRED FOR SIMULTANEOUS HEAT/COOL SYSTEMS

A. General

1. BC (Branch Circuit) Controllers (or comparable branch devices) shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices which do not include controlled refrigerant subcooling risk bubbles in liquid supplied to indoor unit LEVs and are not allowed.
2. BC Controllers (or comparable branch devices) shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish and be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. BC Controllers (or comparable branch devices) shall be suitable for use in plenums in accordance with UL1995 ed 4.

B. BC Unit Cabinet:

1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house two tube-in-tube heat exchangers.

C. Refrigerant Piping (specifications in addition to those for outdoor unit):

1. All refrigerant pipe connections shall be brazed.
2. Future changes to indoor unit quantities or sizes served by BC Controller or comparable branch device must be possible with no piping changes except between the branch device and indoor unit(s) changing. Systems which might require future piping changes between branch device and outdoor unit—if changes to indoor unit quantities or sizes are made—are not considered equal and are not allowed.

D. Refrigerant valves:

1. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.

E. Future Use Branch:

1. Each VRF system shall include at least one (1) unused branch or branch device for future use. Future-use branches or branch devices shall be fully installed & wired in central location with capped service shutoff valve & service port.

F. Condensate Management:

1. BC Controller (or comparable branch device) must have integral resin drain pan or insulate refrigeration components with removable insulation that allows easy access for

future service needs. Cabinets filled with solid foam insulation do not allow for future service and are not allowed.

G. Electrical:

1. The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz. The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).
2. The BC Controller shall be controlled by integral microprocessors
3. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total.

2.4 HIGH STATIC, CEILING-CONCEALED DUCTED INDOOR UNIT

A. General:

1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3- minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

B. Unit Cabinet:

1. The cabinet shall be ceiling-concealed, ducted with a fixed rear return and a horizontal discharge supply.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

C. Fan:

1. Indoor unit shall feature adjustable external static pressure settings up to 1.00 in. WG.
2. The indoor unit fan shall be an assembly with one or two statically and dynamically balanced Sirocco fan(s) direct driven by a single motor with permanently lubricated bearings.

D. Filter:

1. Return air shall be filtered by a field-supplied filter.

E. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.
2. The coils shall be pressure tested at the factory.
3. Coil shall be provided with a sloped drain pan. Units without sloped drain pans which must be installed cockeyed to ensure proper drainage are not allowed.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

G. Controls:

1. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
2. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
3. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
4. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

2.5 MEDIUM STATIC CEILING-CONCEALED DUCTED INDOOR UNIT

A. General:

1. The ceiling-concealed ducted indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self- diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

B. Unit Cabinet:

1. The unit shall be ceiling-concealed, ducted—with a 2-position, field adjustable return and a fixed horizontal discharge supply.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

C. Fan:

1. Indoor unit shall feature multiple external static pressure settings ranging from 0.14 to 0.60 in. WG.
2. The indoor unit fan shall be an assembly with statically and dynamically balanced Sirocco fan(s) direct driven by a single motor with permanently lubricated bearings.
3. The indoor fan shall consist of three (3) speeds, High, Mid, and Low plus the Auto-Fan function

D. Filter:

1. Return air shall be filtered by means of a standard factory installed return air filter.
2. Optional return filter box (rear or bottom placement) with high-efficiency filter as noted on equipment schedule.

E. Optional Filter Frame and Filter:

1. Filter frame shall be constructed of 20 gauge G-60 galvanized steel. Knurled thumb screws on access door allow filter replacement. Foam gasket provides air-tight connection to indoor unit and access door. Filter frame shall be configurable for rear or bottom return.
2. Filter shall be rated MERV 13 when tested in accordance with ANSI/ASHRAE 52.2 Standard Rated Class 2 under U.L. Standard 900.

F. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.
2. The coils shall be pressure tested at the factory.
3. Coil shall be provided with a sloped drain pan. Units without sloped drain pans which must be installed cockeyed to ensure proper drainage are not allowed.
4. The unit shall be provided with an integral condensate lift mechanism able to raise drain water 27 inches above the condensate pan.

G. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

H. Controls:

1. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
2. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
3. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
4. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

2.6 CONTROLS

A. Overview

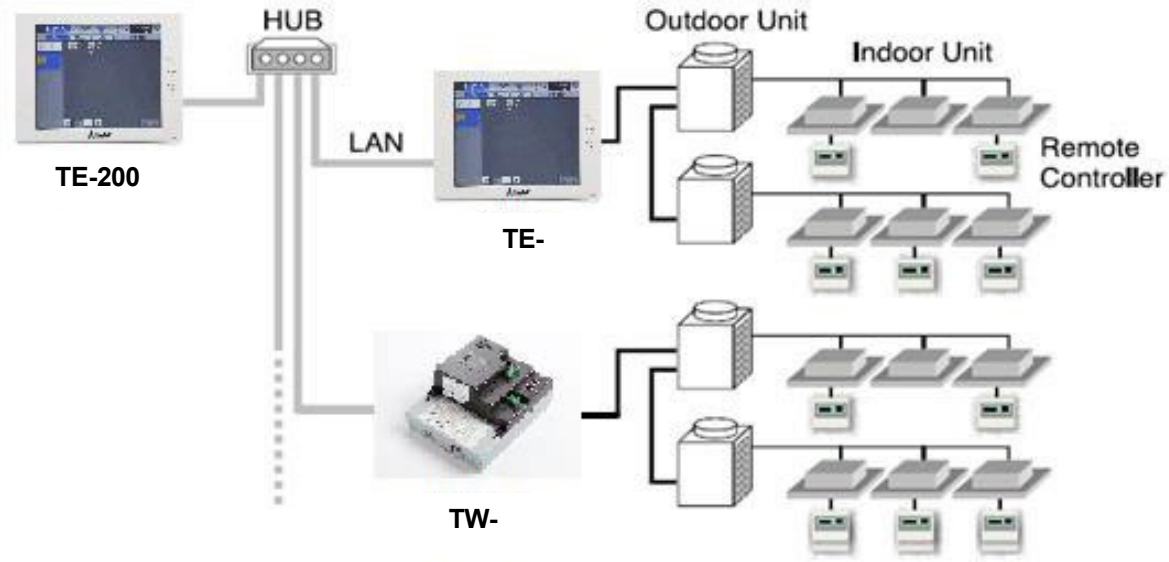
1. The control system shall consist of a low voltage communication network and a web- based interface. The controls system shall gather data and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
2. Furnish energy conservation features such as optimal start, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

3. System shall be capable of email generation for remote alarm annunciation.
4. Provide BACNet interface for tie-in to BMS System.

B. Electrical Characteristics

1. General:
   a. Controller power and communications shall be via a common non-polar communications bus and shall operate at 30VDC.
2. Wiring:
   a. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
   b. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.
3. Wiring type:
   a. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.
   b. Network wiring shall be CAT-5 with RJ-45 connection.

C. City Multi Controls Network
1. The CITY MULTI Controls Network (CMCN) consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces. The below figure illustrates a sample CMCN System Configuration.



CMCN System Configuration

D. Centralized Controller (Web-Enabled)

1. TE-200 Centralized Controller:
   a. The TE-200A Centralized Controller shall be capable of controlling a maximum of two hundred (200) indoor units across multiple CITY MULTI outdoor units with the use of three (3) TE-50A expansion controllers. The TE-200A Centralized Controller shall be approximately 11-5/32" x 7-55/64" x 2-17/32" in size and shall be powered with an integrated 100-240 VAC power supply. The TE-200A Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. When being used alone without the expansion controllers, the TE-200A Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a collection of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the TE-200 Centralized Controller shall include on/off, operation mode selection (cool, heat, auto (R2/WR2-Series only), dry, setback (R2/WR2-Series only) and fan), temperature setting, fan speed setting, and airflow direction setting. Since the TE-200A provides centralized control it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the TE-200A Centralized Controller shall allow the user to define both daily and weekly schedules (up to 24 scheduled events per day) with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

TE-200 (Centralized Controller)			
Item	**Description**	**Operation**	**Display**
ON/OFF	Run and stop operation.	Each Block, Group or Collective	Each Group or Collective
Operation Mode	Switches between Cool/Dry/Auto/Fan/Heat. (Group of Lossnay unit: automatic ventilation/vent-heat/interchange/normal ventilation) Operation modes vary depending on the air conditioner unit. Auto mode is available for the R2/WR2-Series only.	Each Block, Group or Collective	Each Group
Temperature Setting	Sets the temperature from 57°F – 87°F depending on operation mode and indoor unit.	Each Block, Group or Collective	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Block, Group or Collective	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model. *1. Louver cannot be set.	*1 Each Block, Group or Collective	Each Group
Schedule Operation	Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized start setting is also available. *1. The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority. Twenty-four events can scheduled per day, including ON/OFF, Mode, Temperature Setting, Air Direction, Fan Speed and Operation Prohibition. Five types of weekly schedule (seasonal) can be set. Settable items depend on the functions that a given air conditioning unit supports.	*2 Each Block, Group or Collective	Each Group
Optimized Start	Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time.	Each Block, Group or Collective	Each Block, Group or Collective
Night Setback Setting	The function helps keep the indoor temperature in the temperature range while the units are stopped and during the time this function is effective.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *3. Centrally Controlled is displayed on the remote controller for prohibited functions.	Each Block, Group or Collective	*3 Each Group
Room Temp	Displays the room temperature of the group. Space temperature displayed on the indoor unit icon on the touch screen interface.	N/A	Each Group

Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed *4. When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection	N/A	*4 Each Unit or Collective
Outdoor Unit Status	Compressor capacity percentage and system pressure (high and low) pressure (excludes S-Series)	Each ODU	Each ODU
Connected Unit Information	MNET addresses of all connected systems	Each IDU, ODU and BC	Each IDU, ODU and BC
Ventilation Equipment	This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between “Hi”, “Low” and “Stop”. When setting a group of only free plan LOSSNAY units, you can switch between “Normal ventilation”, “Interchange ventilation” and “Automatic ventilation”.	Each Group	Each Group
Multiple Language	Other than English, the following language can be chosen. Spanish, French, Japanese, Dutch, Italian, Russian, Chinese, and Portuguese are available.	N/A	Collective
External Input / Output	By using accessory cables you can set and monitor the following. Input By level: “Batch start/stop”, “Batch emergency stop” By pulse: “batch start/stop”, “Enable/disable remote controller” Output: “start/stop”, “error/Normal” *5. Requires the external I/O cables (PAC-YG10HA-E) sold separately.	*5 Collective	*5 Collective

b. All TE-200A Centralized Controllers shall be equipped with two RJ-45 Ethernet ports to support interconnection with a network PC via a closed/direct Local Area Network (LAN) or to a network switch for IP communication to up to three TE-50A expansion controllers for display of up to two hundred (200) indoor units on the main TE-200A interface.

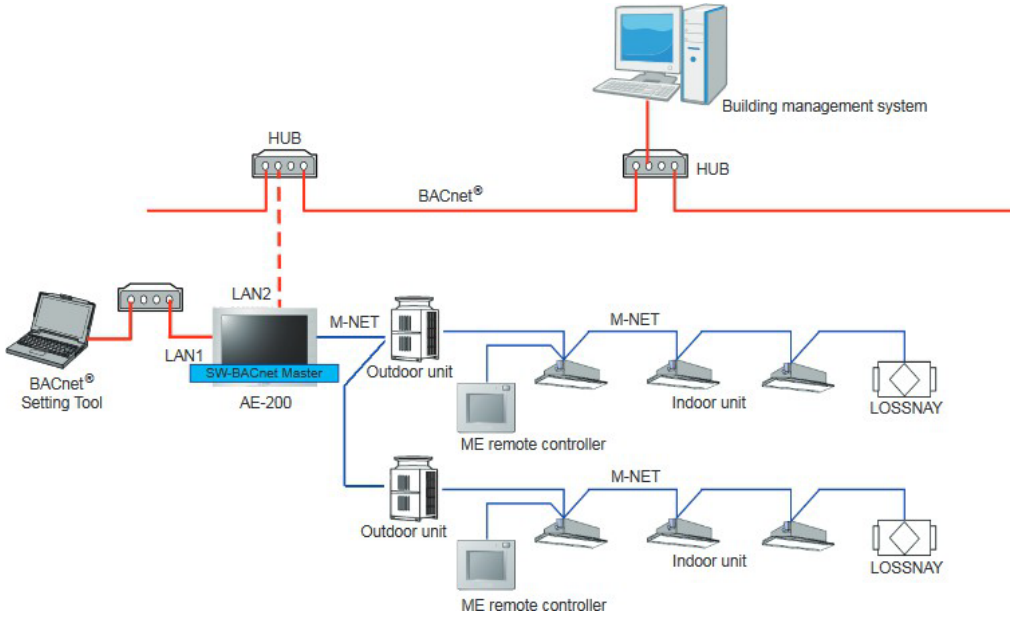
c. The TE-200A Centralized Controller shall be capable of performing initial settings via the high-resolution, backlit, color touch panel on the controller or via a PC browser using the initial settings.

E. Wireless Thermostat

1. Wireless, wall mounted remote controller kit (MHK1)
   a. The Wireless, wall mounted remote controller kit (MHK1) shall consist of a wireless, wall mounted controller (MRCH1), a wireless receiver (MIFH1) and a cable (MRC1) to connect the receiver to the indoor unit. The controller shall be white in color with a light-green LCD display and a backlight feature. The MRCH1 shall consist of four Function buttons below the display, and Increase/Decrease Set Temperature buttons and a Hold button to the right of the display. The controller shall have a built-in temperature sensor and a battery holder, using two AA alkaline batteries. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and temperature changes shall be by increments of 1°F (0.5°C).
   b. The MHK1 uses Honeywell RedLINKTM technology, and the wireless receiver is specially designed for Mitsubishi units. Linking to the wireless network shall be done from the receiver and from the remote controller. There shall not be any interference with other wireless devices or neighboring RedLINKTM products. Communication shall be automatically restored after power resumes and after batteries are replaced.

F. CMCN Remote Controllers: System Integration

1. The CMCN shall be capable of supporting integration with Building Management Systems (BMS).
2. BAC-HD150: BACnet® Interface:
   a. The Mitsubishi Electric Cooling & Heating BACnet® interface, BAC-HD150, shall be compliant with BACnet® Protocol (ANSI/ASHRAE 135-2004) and be Certified by the (BTL) BACnet® Testing Laboratories. The BACnet® interface shall support BACnet Broadcast Management (BBMD). The BACnet® interface shall support a maximum of 50 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address.
   b. Licenses:
      1) SW-BACnet Master: Master Controller license for TE-200A and TW-50A
      2) SW-BACnet Expansion: Expansion Controller license for TE-50A and TW-50A
   c. SW-BACnet Specifications:
      1) Control up to 50 groups
      2) 1 to 16 indoor units can be collectively controlled in a group
      3) Supports dual set point functionality (connected model dependent)
      4) BTL Compliant
      5) BACnet communication specifications are based on ANSI/ASHRAE Standards 135-2010
   d. PC Requirements:
      1) Refer to Instrumentation and Controls Section 230900



e. TE-200/TE-50/TW-50 BACnet Point List

Object List
On Off Setup
On Off State, Number of ON/OFF, Cumulative operation time
Alarm Signal (4-digit error code)
Error Code
Operational Mode Setup
Operational Mode State
Fan Speed Setup
Fan Speed State
Room Temp [Water Temp]
Set Temp [Set Water Temp]
Set Temp Cool
Set Temp Heat
Set Temp Auto
Filter Sign [Circulating Water Exchange Sign]
Filter Sign Reset [Circulating Water Exchange Sign Reset]
Prohibition On Off
Prohibition Mode
Prohibition Filter Sign Reset [Prohibition Circulating Water Exchange Sign Reset]
Prohibition Set Temperature

M-NET Communication State
System Forced Off
Air Direction Setup
Air Direction State
Set High Limit Setback Temp
Set Low Limit Setback Temp
Ventilation Mode Setup
Ventilation Mode State
Air To Water Mode Setup
System Alarm Signal (4-digit error code)
PI Controller Alarm Signal (4-digit error code)
Group Apportioned Electric Energy
Interlocked Units Apportioned Electric Energy
PI controller Electric Energy 1–4
Pulse Input Electric Energy 1–4
Group Apportionment Parameter
Interlocked Units Apportionment Parameter
Night Purge State
Thermo On Off State
Trend Log Room Temp
Trend Log Group Apportioned Electric Energy
Trend Log Interlocked Units Apportioned Electric Energy
Trend Log PI controller Electric Energy 1–4
Trend Log Pulse Input Electric Energy 1–4
Trend Log Group Apportionment Parameter
Trend Log Interlocked Units Apportionment Parameter

PART 3 - EXECUTION

3.1 INSTALLATION

A. System shall be installed in accordance with manufacturer’s guidelines.

B. Installing contractor shall attend and successfully complete the VRF Installation factory training class. Contractor shall submit certificate of completion as part of project closeout documents.

C. Installing contractor shall install units to comply with all applicable building codes.

D. VRF systems shall be installed in such a way as to permit access for routine maintenance.

3.2 COMMISSIONING

A. Upon completion of installation and prior to final commissioning, contractor shall provide revised piping layout reflecting actual installation conditions to VRF technician.

B. The system shall then be reviewed and commissioned by a Factory VRF Technician. Contractor shall provide a verified and submitted commissioning report to Factory Service Department, and to the owner's agent verifying the system has met the requirements for proper installation, and function.

C. Engage a Factory Certified VRF Technician to train owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 81 43

SECTION 23 82 00 CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Runtal Radiators (Panel Radiators)
2. Electric unit heaters.

B. Related Sections (list below may not include all sections but is intended as a guide):

1. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
2. Section 23 07 00 - HVAC Insulation: Execution requirements for insulation specified by this section.
3. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.
4. Section 23 31 00 - HVAC Ducts and Casings: Execution requirements for ducts specified by this section.

1.3 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

B. Sheet Metal and Air Conditioning Contractors:

1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. UL.

D. NEC and NYCEC.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers.

C. Product Data: Submit coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions. Submit mechanical and electrical service locations, capacities and accessories or optional items.

D. Samples: Submit one sample of each radiation cabinet detailed.

E. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.

C. Operation and Maintenance Data: Submit manufacturer’s descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NYCBC.

B. Maintain one (1) copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Refer to DCAS General Conditions: Pre-installation meeting.

B. Convene minimum one (1) week prior to commencing work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions: Product storage and handling requirements.

B. Accept units on site in factory packing. Inspect for damage. Store under roof.

C. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

1.12 EXTRA MATERIALS

A. Refer to DCAS General Conditions: Spare parts and maintenance products.

B. Furnish two (2) sets of filters.

PART 2 - PRODUCTS

2.1 RUNTAL RADIATORS

A. Provide steel panel radiator elements of lengths and in locations as indicated, and of capacities, style and having accessories as scheduled. The wall hung heating panel radiation shall be of one-piece all-welded steel construction, consisting of flattened water tubes welded to headers at each end. The radiator shall include an integral heavy gauge (0.09" minimum) all welded perforated top grille. RF models to have steel corrugated fins welded to the rear side of the water tubes to increase the convective output of the unit. There shall be no less than 32 fins per foot. Fins shall start within 1" of the headers, and shall be spot-welded three times per tube.

B. The radiator's headers shall include all necessary inlet, outlet and vent connections as required. Provide ¾" NPT tapered thread for supply and return piping, and 1/8" for the vent connection. Internal baffling is provided where required for proper water flow.

C. The radiant heating panels shall be available in lengths 2'-0" to 29'-6" in two inch even increments without the need for splicing. The panel radiation shall be capable of being mounted to typical stud wall construction without additional blocking or strapping. Provide floor post mounting, wall mounting with the radiation. Panel radiation expansion shall not exceed 1/64" per foot of radiation at 215ºF. The installer shall provide adequate expansion compensation for each radiator.

D. Ribbed pipe cover trims, finished to match the radiators, shall be provided with the radiation.

E. The radiation manufacturer shall provide combination shutoff valve/union fitting of less than two inches in width for the supply and return to each panel radiator, to be field installed by others.

F. Runtal-Flex connectors shall be used where appropriate to provide expansion compensation for the radiators.

G. The panel radiation shall be manufactured in the USA.

H. Pressure ratings: Pressure ratings for the radiation shall be as follows:

I. HIGH: Working pressure – 128 PSI maximum, Test Pressure – 184 PSI maximum

J. Finishes: The panel radiation shall be cleaned and phophatized in preparation for the powder coat finish. The radiation is then finish painted with a gloss powder coat finish, for a total paint thickness of 2-3 mils (0.002" – 0.003"). Color selection shall be per Architect.

K. Warranty: All Runtal radiators shall be covered for a minimum of five years.

L. Manufacturer: Subject to compliance with requirements, provide flat tube panel radiation as manufactured by Runtal North America, Inc.

2.2 ELECTRIC UNIT HEATERS

A. Assembly: UL listed and labeled assembly with terminal box and cover, and built-in controls.

B. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

C. Cabinet: 0.0478-inch thick steel with easily removed front panel with integral air outlet and inlet grilles.

D. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

E. Fan: Direct-drive propeller type, statically and dynamically balanced, with fan guard.

F. Motor: Permanently lubricated, sleeve bearings for horizontal models; ball bearings for vertical models.

G. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Furnish thermal overload. Provide integral disconnect switch and return air thermostat.

H. Electrical Characteristics: Refer to Contract Drawing.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions: Coordination and project conditions.

B. For recessed units, verify recess dimensions are correct size.

C. Verify wall construction is ready for installation.

D. Verify ductwork is ready for installation.

E. Verify concealed blocking and supports are in place and connections are correctly located.

3.3 INSTALLATION

A. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.

B. Finned Tube Radiation: For surface-mounted units, run cover wall-to-wall unless otherwise indicated. Center elements under windows. Where multiple windows occur over units, divide element into equal segments centered under each window. Align cabinet joints with window mullions. Install wall angles where units butt against walls.

C. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as allowed by manufacturer to maintain greatest headroom unless otherwise indicated.

D. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals.

3.4 CLEANING

A. Refer to DCAS General Conditions: Final cleaning.

B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

D. Install new filters.

END OF SECTION 23 82 00

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SECTION 26 05 00 GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. General Requirements for Electrical Work in accordance with the Contract Documents.

B. Related Documents:

1. This Section, 26 05 00, governs all requirements as applicable to the Electrical work specified in other Sections of Division 26.

C. Division of Responsibility:

1. The requirements under Section 26 05 00 are intended for the party or parties who have been duly awarded the applicable portion of work to be performed under the indexed sections of Division 26 also known as the Electrical Work.
2. In addition to electrical work required under Division 26, the scope of electrical work specified under Division 26 shall include the provision of all required power wiring to the equipment specified under General Construction Trades and Divisions 21, 22, 23, 26, 27 and 28. Provide power to all doors, motors, electric heaters, light fixtures, heat tracing equipment, control panels, electrically actuated valves, dampers, and other devices, specified under the various sections of all Divisions included in the project.

1.3 REFERENCE

A. Compliance with the following codes and standards shall be required as applicable:

1.	ANSI	American National Standards Institute
2.	ASTM	American Society for Testing Materials
3.	CBM	Certified Ballast Manufacturers.
4.	DEMA	Diesel Engine Manufacturer’s Association
5.	EPA	United Stated Environmental Protection Agency
6.	ETL	Intertek/Electric Testing Laboratories
7.	FM	Factory Mutual
8.	ICEA	Insulated Cable Engineers Association
9.	IEEE	Institute of Electrical and Electronics Engineers
10.	IES	Illumination Engineering Society of North America

11.	NEC	National Electrical Code
12.	NYCEC	New York City Electrical Code
13.	NEMA	National Electrical Manufacturers Association
14.	NETA	Inter-National Electric Testing Association
15.	NFPA	National Fire Protection Association
16.	NFC	National Fire Codes (NFPA)
17.	IBC-NY	International Building Code – 2014, New York Edition
18.	NYRSC	New York Rehabilitation Sub-Code
19.	OSHA	Occupational Safety and Health Administration
20.	UL	Underwriters' Laboratories, Inc.

B. Conform to materials and equipment rating standards, listings or classifications of the above organizations as well as ratings, listings or classifications accepted under local codes and laws.

1.4 DEFINITIONS

A. "Provide" means furnish and install, complete, the specified material, equipment or other item and perform all required labor to make a finished installation.

B. "Furnish and install" has the same meaning as given above for "Provide."

C. Refer to DCAS General Conditions for other definitions.

1.5 CONTRACT DRAWINGS

A. The Contract Drawings indicate, in schematic and diagrammatic form, the extent and general arrangement of the various electrical systems. If the Contractor deems that any departures from these drawings are necessary, detailed drawings and descriptions of these departures and a statement of the reasons shall be submitted to the Commissioner for review and comment as soon as practicable. No departures from the arrangements shown on the Contract Drawings shall be made without prior written approval of the Commissioner. Provide all devices, conduit, wire, misc. steel, etc., for a complete installation.

B. Conduits and other raceway systems shall be installed as shown or as noted on the Contract Drawings. Elevations and dimensions where indicated are a guide only and are subject to change with actual job conditions and clearances. Relocation resulting from interferences shall be made at no additional cost to the City of New York.

1.6 REVIEW OF CONTRACT DOCUMENTS AND SITE

A. With the submission of his Bid, Contractor shall give written notice to the City of New York of any materials or apparatus believed in-adequate or unsuitable, in violation of laws, ordinances, rules or regulations of the City of New York, and any necessary items of work omitted. In the absence of such written notice it is mutually agreed that the Contractor has included the cost of all required items in his Proposal for a complete project.

B. Contractor shall acknowledge that he has examined the Plans, Specifications and Site, and that from his own investigations he has satisfied himself as to the nature and location of the work; the general and local conditions, particularly those bearing upon transportation, disposal,

handling and storage of materials; availability of labor, water, electric power, roads and uncertainties of weather; the conformation and condition of the ground; the character, quality and quantity of surface and subsurface materials to be encountered; the character of equipment and facilities needed preliminary to and during the execution of the work; all federal, state, county, township and municipal laws, ordinances and regulations particularly those relating to employment of labor, rates of wages, and construction methods; and all other matters which can in any way affect the work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with the available information concerning these conditions will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work.

C. The City of New York assumes no responsibility for any understanding or representation made during or prior to the negotiation and execution of this Contract unless such understanding or representations are expressly stated in the Contract, and the Contract expressly provides that the responsibility, therefore, is assumed by the City of New York.

1.7 STANDARD PRODUCTS AND APPROVED EQUAL CLAUSE

A. Each item of equipment furnished by the Contractor shall be essentially the standard product of the manufacturer. All material and equipment shall be of the best quality normally used in good commercial practice and shall be the product of reputable manufacturers. Each major component shall bear a nameplate giving the name and address of the manufacturer and the catalog number or designation located in an easily visible location.

B. Throughout the Specification types of material and equipment may be specified by manufacturer's name and catalog number as a basis of design and for convenience only, and not for the purpose of limiting competition, except for items for which "no substitutions will be accepted" is specifically indicated.

C. Where the Contractor proposes to use an item of equipment other than that specified or shown on the Contract Drawings which requires any redesign of structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, all such redesign, all new drawings and detailing required therefore, shall be prepared by the Contractor without cost to the City of New York and submitted to the Commissioner for his review.

1.8 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Procedure:

1. Prepare a schedule of specific submissions at the outset of the Project for the Commissioner's review and approval; make submissions listed below and in the other Sections of Division 26 of the Project Specifications.
   a. If submissions listed in other Sections of Division 26 are more specific than those listed below, comply with the more specific requirements.
   b. Failure of the Contractor to submit Shop Drawings in ample time for checking shall not entitle him to an extension of Contract time, and no claim for extension by reason of such default will be allowed.

c. Piecemeal submittals are unacceptable and will not be reviewed. No submittal shall be considered for review, the review of which is contingent upon acceptance of other features for which submittals have not been submitted.
d. Submittals from Vendor without Contractor's review and approval stamp will not be reviewed.
e. Submittals shall not be used by the Contractor as a means to secure approval of a substitution. Contractor must indicate all deviations, omissions and substitutions in his submittal; if there are none of these 3 exceptions, he shall then state on the submittal: "No Exception Taken". Any submittal without stated exceptions, or without statement that no exception is taken, will not be reviewed and will be rejected and returned to Contractor for rectification.
f. All products of a similar nature (i.e., Panelboards, fuses, wiring devices, etc.) shall be provided by one manufacturer.

C. Shop Drawings:

1. Manufacturer's Drawings:
   a. Submit equipment listed in all applicable Sections - include material specifications, operating characteristics and finishes, specified agency listings or approvals.
   b. Cuts, brochures or other literature submitted for expeditious approval but incomplete or missing items of hardware or software (performance data) shall be re-submitted until all system or equipment components have been reviewed and approved. Any item not included in the original or first submission shall be considered outstanding work until such item of equipment or work has been submitted or installed in place exactly conforming to the intent of the contract documents.
   c. Contractor shall provide preliminary layout drawings of all major pieces of equipment (i.e., switchgear, switchboards, transformers), confirming that the submitted product physically fits within the architectural enclosures. This drawing is required along with the manufacturer's product data.

2. Installation Drawings:
   a. Furnish coordinated drawings of equipment installation, including interconnecting conduit and supports. Minimum scale for these drawings shall be 1/4 inch equals 1 foot.
   b. Coordinate space requirements for mechanical, plumbing and other trades in the vicinity of work.
   c. Include connections, anchorages and fastenings for equipment and conduit.
   d. Make allowance for clearances for access to and maintenance of equipment.
   e. Do not install any conduits or equipment, in any area, prior to obtaining approval of its layout by means of submitting shop drawings.
   f. Any missing items of equipment, material or labor, during initial submission of shop drawings, are to be completed and re-submitted for final approval. Shop drawing should not be used as a vehicle for obtaining variances, deviation or omission from the scope of Contract Documents. Approval of a submittal shall pertain to the portions that conform to the intent of the Contract Documents.
   g. Submission of any missing, incomplete or otherwise deviant layout is subject to re-submission until all contract requirements have been properly included or shown on the same layout.

D. Required Samples:

1. Color samples, for prefinished items.
2. Natural finish metals, for quality of finish.

E. Reports:

1. Compliance with listings and approvals for equipment and for fire ratings.
2. Acceptance certificates from inspecting agencies.
3. Complete printed and illustrated operating instructions where required in report format.
4. Manufacturer's performance tests on operating equipment.
5. Performance reports for vibration isolation equipment.
6. Additional reports as noted in other sections.

F. Specific references to any article, device, product or material, fixture or item of equipment by name, make or catalog number shall be interpreted as establishing a basis of cost and a standard quality. All devices shall be of the make and type listed by Special Agencies, such as the Underwriters' Laboratories, and where required, approved by the City of New York.

G. Contractor shall be responsible for any deviations in equipment size or configuration and access requirement, from specified products.

1.9 COORDINATION

A. Contractor shall prepare preliminary shop drawings suitable for use in coordinating his work with the work of other trades. The HVAC Section shall prepare and furnish sepia prints at 3/8" = 1'- 0" scale with all trades indicating piping, ductwork and conduit in relation to all structural elements of the construction, including floor elevations; steel locations, size, and elevations; partitions locations; door locations and direction of swing; and all other information required to assure coordination of the electrical, sheetmetal and piping trades and fire protection in relation to the Architectural function of the project. Coordination meetings shall be held under the supervision of the Commissioner). Each trade shall have proper representation at all coordination meetings for the purpose of detailing, on the sepia print mentioned above, the exact location and routing of their work. After the conclusion of the coordination at the working meetings, each trade shall sign the coordinated sepia, copies of which shall be distributed to all parties concerned including the City of New York. Final shop drawings of all trades shall be in accordance with the coordinated drawing, after which final shop drawings shall be submitted for final approval.

B. If the Contractor installs work so as to cause interference with work of other trades, he shall make necessary changes in work to correct the condition without extra charge.

C. Dimensional layout plans of equipment rooms shall be made showing all bases, pads and inertia blocks required for electrical equipment. Include dimensions of bases, bolt layouts, details, etc.

D. Contractor shall furnish all necessary templates, patterns, etc., for installing work and for purpose of making adjoining work conform, furnish setting plans and shop details to other trades as required.

1.10 MEASUREMENTS

A. Contractor shall base all his measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. He shall verify all measurements at site; and check the correctness of same as related to the work.

1.11 LABOR AND MATERIALS

A. All materials and apparatus required for the work shall be new, of first-class quality, and shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces.

B. Contractor shall remove all materials delivered, or work erected, which does not comply with Contract Drawings and Specifications, and replace with proper materials, or correct such work as directed, at no additional cost to the City of New York.

1.12 COVERING OF WORK

A. No electrical equipment, raceways or other work of any kind shall be covered up or hidden from view before it has been examined by the Commissioner. Any unsatisfactory or imperfect work or materials that may be discovered shall be removed and corrected immediately after being rejected and other work and materials shall be provided which shall be satisfactory to the Commissioner.

1.13 PROTECTION

A. Contractor shall protect the work and material of all trades from damage by his work or workmen, and shall replace all damaged material with new.

B. Contractor shall be responsible for work and equipment until his work is finally inspected, tested, and accepted; he shall protect his work against theft, injury or damage; and carefully store material and equipment received on site which is not immediately installed; close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.

C. Contractor shall be responsible for the preservation of all public and private property, along and adjacent to the work, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits and other underground structures or utilities, and shall carefully protect from disturbance or damage all property marks until an authorized agent has witnessed or otherwise referenced their location, and shall not remove them until directed.

D. All mechanical and electrical equipment delivered to the site shall have appropriate wrapping to protect them from rain, flood, wind, construction debris and all types of water damage normally encountered at construction sites. Protection of equipment such as switchboard, transformers, panelboards, luminaires and similar equipment shall be the responsibility of the Contractor receiving such equipment at the jobsite for installation under Division 26.

1.14 CUTTING AND PATCHING

A. Provide all cutting, rough and finish patching required for systems and equipment included in these specifications.

B. Furnish and locate all sleeves and inserts required before the new floors and walls are built; Contractor shall pay the cost of cutting and patching required for pipes where sleeves and inserts were not installed in time, or where incorrectly located. Provide all drilling required for the installation of hangers.

C. All holes cut through concrete slabs or arches shall be punched or drilled from the underside. No structural members shall be cut without the written approval of the Commissioner and/or the Structural Engineer and all such cutting shall be done in a manner directed by him.

D. Contractor shall not do any cutting that may impair strength of building construction. No holes, except for small screws, may be drilled in beams or other structural members without obtaining prior approval. All work shall be done in a neat manner by mechanics skilled in their trades and as approved.

E. Provide sleeves and fire stopping at all conduit penetrations in floors, walls and roof penetrations in accordance with recognized standards.

1.15 CONCRETE AND GROUTING

A. Requirements for concrete and grouting are specified in other Sections.

1. Concrete shall be 3,000 psi stone concrete with water reducing admixture, except where otherwise specified.
2. Concrete shall have air entraining admixture where exposed to weather.

B. Contractor shall provide housekeeping pads, roof curbs, thrust blocks, inertia blocks, etc.

C. Concrete housekeeping pads: 4" minimum thickness, sized to cover the full area of each piece of equipment provided and overlap equipment 4” all around.

D. Concrete bases: Dimension and height to suit the approved equipment.

E. All concrete work related to electrical equipment shall be provided by the Trade Contractor of Division 26, unless otherwise noted in the Contract Documents.

1.16 ACOUSTICAL PERFORMANCE OF EQUIPMENT AND SYSTEMS

A. All work shall be designed to operate, and shall operate, under all conditions of load, without any objectionable sound or vibration. Sound or vibration noticeable outside of the room in which installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound or vibration conditions considered objectionable and caused by failure to follow the Contract Documents or manufacturer’s installation instructions shall be corrected in an approved manner by the Contractor at his expense.

1.17 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Demonstration and Instructing for the City of New York's Personnel:

1. After all equipment is functioning properly, each electrical system including fire alarm is to be automatically operated for ten (10) working shifts, and not to be adjusted during this period, as scheduled at the convenience of the Commissioner. Any adjustments will void the test and start the time period all over again.
2. The hours of operation for each building are to include the City of New York's designated personnel in each shift.
3. During this period, instruct the City of New York's personnel in the use, operation and maintenance of all equipment of each system. Lessons will include a lecture-type instruction given in a non-machine room environment. During the lesson, normal operation of the system installed and operating will be explained, along with troubleshooting procedures. This will be followed by a field inspection and demonstration of equipment.
4. The above instruction is exclusive of that required of specified equipment manufacturers. If more stringent or longer instruction is indicated for specific equipment or systems, these shall supersede the above requirements.

B. Operating and Maintenance Data:

1. Provide four (4) complete sets of manufacturer's catalogs, instructions, maintenance and repair information and parts lists for operating equipment and devices.
   a. Include factory-furnished wiring diagrams and control diagrams.
   b. Submit seven (7) sets of instructions for distribution.

2. Data for the equipment actually installed is to be submitted.
3. The data is to be carefully checked for accuracy by comparison with the installed equipment nameplates.
4. Provide a recommended list of spare parts for equipment and list of special, non-standard tools to service equipment.
5. Index and assemble the instructions in durable loose-leaf binders.
6. The completed binders are to be available at the time the equipment installation begins.
7. In addition, follow all requirements of Division 01.

1.18 RECORD DRAWINGS

A. Provide and maintain a currently up-to-date record set of reproducible prints showing all changes, additions or omissions made during construction. Contractor shall, at his own expense, produce the Record Drawings.

B. Deliver four (4) sets of all as-built drawings and one (1) set of reproducible of the record drawings to the City of New York before submitting requisition for final payment.

C. Shop Drawings shall be cross-referenced on the mylar copies for this requirement where applicable.

D. AutoCAD background, if desired to be obtained from the Commissioner, sign release and indemnification and pay fee.

E. Submit AutoCAD compatible as-built drawing files.

1.19 WARRANTY

A. The following supplements the General Conditions for Electrical Work:

1. Non-durable, expendable items such as lamps are not subject to replacement after the date of acceptance.
2. Warranty time limits for equipment exceeding those indicated in DCAS General Conditions are specified in the applicable Sections of Division 26.

B. In addition, follow all requirements of DCAS General Conditions and Addendum to General Conditions - Execution and Closeout Requirements: Closeout procedures.

1.20 INDEMNIFICATION

A. This Contractor covenants and agrees:
1. That the Contractors, their Subcontractors and their agents, servants and employees shall provide and maintain a safe place of work, and that they shall comply with all laws and regulations of any governmental Authority Having Jurisdiction thereof.
2. To indemnify, defend and hold harmless the Owner, Owner's agents and Engineer from and against any liability, loss, damage or expense, including attorney's fees arising from a failure or alleged failure on the part of the Contractors, their Subcontractors and their agents, servants and employees to provide and maintain a safe place to work or to comply with all laws and regulations of any governmental Authority Having Jurisdiction thereof.
3. That the Contractors, their Subcontractors and their agents, servants and employees shall indemnify, defend and hold harmless the Owner, Owner's agents and Engineer from and against any liability, loss, damage or expense, including attorneys' fees, arising from a failure or alleged failure on the part of the Contractors, their Subcontractors and their agents, servants and employees to discharge the obligations assumed by them in the performance of the work, including any act or omission allegedly resulting in death, personal injury, property damage or improper construction, construction techniques, or the use of improper or inappropriate material or tools.
4. That any controversy or dispute to which the Contractor, the Owner and the Consulting Engineers are parties shall be submitted to the American Arbitration Association for decision in accordance with the rules of such association for construction industry disputes. All Contractors, including Subcontractors assigned to this Contractor, likewise agreed to submit to such arbitration any dispute between or among them, the Contractor, the Owner and the Consulting Engineers, and the Contractor agrees to make available to the Consulting Engineers, on demand, signed copies of the Contract between the Owner and the Contractor and between the Contractor and his Subcontractors. The Contractor and each Subcontractor agree that by submitting a bid which is accepted, this paragraph shall be deemed a written agreement to submit any controversy thereafter arising to arbitration.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. Refer to Section 26 05 53 for requirements.

2.2 ACCESS DOORS

A. General:

1. Provide steel, flush four-sided frame and door assembly, chemically cleaned after fabrication and painted with rust inhibitive primer.
2. Provide hardware and locking devices.
3. Provide access doors required for access to electrical work through finished wall construction and non-removable ceiling construction.
4. Coordinate location information with appropriate trades.
5. Security Areas shall be provided with security access doors.

B. Provide flush type access door or panel no smaller than 18" x 18" and no larger than 30" x 30" for all junction or pull boxes located in chases, walls, non-accessible hung ceilings or floors. Finish shall be prime coat, except floor panels which shall be polished brass or chrome plate. Doors and trim 14 gauge steel, frame 16 gauge steel, with flush concealed and standard flush locks, screwdriver operated cams.

1. All panels and their exact location subject to approval of the Commissioner.
2. Where space conditions prevent door swinging open, provide removable door on lift-up hinges. This will only be accepted on a case-by-case basis. This condition must be submitted to the City of New York and Commissioner for approval prior to installation.
3. Furnish a complete list locating all access doors required in finished walls, ceilings, partitions, shafts and other inaccessible locations.
4. Provide 2 hour fire-rated access doors where indicated on the drawings.

2.3 PRIME PAINTING

A. All exposed conduits, outlet boxes, pull boxes, splice boxes, support, etc. in finish spaces shall be painted as specified herein.

B. All ungalvanized surfaces shall be painted with zinc chromate, or approved equal, and all galvanized surfaces shall be prime coated with a phosphate pretreatment coating, dry film thickness of 0.35 with a 0.50 mil. one coat Glid-Guard galvanized steel primer Y5229.

2.4 CLEANING AND ADJUSTING

A. Notification:

1. Inform the City of New York and Commissioner of all cleaning schedules one week prior to starting.

2. Notify the City of New York and Commissioner again, 48-hours prior to each event. If neither attends the procedures, notify in writing, the specific task performed 24-hours after each event.
3. Damage to the building and equipment resulting from tests shall be repaired at no additional cost to the City of New York.
4. Tests claimed to have been performed without following above procedures shall be deemed as not performed.

B. Cleaning:

1. Clean out all debris and dirt from the interior of all switchboards, panelboards, transformers and switches. Blow out transformers with dry nitrogen; pressure shall not exceed 15 psi. Use Vacuum cleaner with bag and cartridge filters to remove dirt and debris from the interior of unit substations, switchboards, panelboards, ATS's and switches. After cleaning, the systems shall be tested by an independent organization, approved by the City of New York prior to testing.
2. Clean all materials and equipment; leave in condition ready to operate and ready to receive succeeding finishes where required.
3. Clean the operating equipment and systems to be dust free inside and out.

C. Permanent Equipment Operating During Construction:

1. Use only in same service as the permanent applications, provided that written approval is granted by the City of New York.
2. Expendable media, including lamps used for temporary operation and similar materials are to be replaced just prior to final acceptance.

D. Retouch or repaint equipment furnished with factory finish as required to provide same appearance as new.

E. Tools:

1. Provide one set of specialized or non-standard maintenance tools and devices required for servicing the installed equipment.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 GENERAL

A. Temporary Protection:

1. Provide and maintain protection for the work whether completed or in progress.
2. Provide suitable coverings and enclosures.

B. Scaffolding, Rigging and Hoisting:

1. Provide all scaffolding, rigging and hoisting services necessary for erection, and/or delivery into the premises, of any equipment and apparatus furnished. Remove from the premises when no longer required.

C. Waterproofing:

1. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Commissioner before work is done. This Contractor shall provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

3.3 EQUIPMENT BASES, PLATFORMS AND SUPPORTS

A. Provide supporting platforms, steel supports, anchor bolts, inserts, etc., for all equipment and apparatus requiring access for service and maintenance.

B. Obtain prior approval for installation method of structural steel required to frame into building structural members for the proper support of equipment, conduit, etc. Welding will be permitted only when approved by the Commissioner or the Structural Engineer.

C. Submit shop drawings of supports for approval to the Commissioner before fabricating or constructing.

D. Provide leveling channels, anchor bolts, complete with nuts and washers, for all apparatus and equipment secured to concrete pads and further supply exact information and dimensions for the location of these leveling channels, anchor bolts, inserts, concrete bases and pads.

E. Where supports are on concrete construction, take care not to weaken concrete or penetrate waterproofing.

3.4 ACCESSIBILITY

A. The installation of electrical equipment, including panelboards, disconnect switches, motor starters, etc., shall be in accordance with the requirements of Article 110 or the National Electrical Code relative to workspace around equipment. Equipment which is installed and does not have the working space required by the NEC, shall be relocated by the Contractor at no additional cost to the City of New York.

3.5 PROTECTION

A. Contractor shall protect the work and material of all trades from damage by his work or workmen, and shall replace all damaged material with new material. The plan shall outline corrective action to repair and/or replace the object(s) including all materials to be utilized. Implementation of corrective plan shall be subject to final approval from the Commissioner.

B. The Building systems are to remain active during the project as the construction will be phased. Refer to Scope of Work document prepared by the Commissioner.

C. Contractor shall be responsible for protecting and maintaining the systems for the duration of the project. Contractor shall note that the building shall remain in operation throughout the duration of construction.

D. Contractor shall be responsible for work and equipment until his work is finally inspected, tested and accepted; he shall protect his work against theft, injury or damage; and carefully store material and equipment received on site which is not immediately installed; close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.

E. Contractor shall be responsible for the preservation of all public and private property, along and adjacent to the work, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits and other underground structures or utilities, and shall carefully protect from disturbance or damage all property marks until an authorized agent has witnessed or otherwise referenced their location, and shall not remove them until directed.

F. Where conduit, wire or equipment to remain is inadvertently damaged or disturbed, cut out and remove damaged section and provide new pipe, ductwork, insulation or equipment of equal capacity and quality.

G. Where conduit and wiring to remain are inadvertently damaged or disturbed, cut out and remove damaged portion and all damaged wiring from the source switchboard, panelboard or pullbox to the destination connection point. Provide new wiring of equal capacity.

H. Vibration: Contractor shall reduce the construction dust not to adversely affect operation of the building. Contractor shall keep vibration to a minimum and not have adverse effect to the operation of the building.

I. Dust Control: Provide adequate filters and dust collectors as required for building operation.

3.6 DEMOLITION WORK RELATED TO EXISTING WORK

A. Contractor shall disconnect and remove all abandoned, unused or discarded equipment (piping, conduits, wires, ductwork, tubing, supports, etc.) from the areas of work as indicated on Drawings.

B. Contractor shall mark out all items to be removed and all items to remain in the field and review with the Commissioner prior to demolition.

C. Provide firestopping at all conduit/pipe penetrations at rated construction, where ducts, piping/conduit, etc. have been removed.

D. Whenever existing equipment is disconnected from its services, remove all pipe, conduit or duct branches or runnouts to the point of connection to the existing pipe riser or electrical panel or duct shaft as the case may be. Cap off pipes or ducts near the risers, valved outlets or at mains.

E. Cutting shall be done carefully in order not to disturb systems or services in areas where demolition is not required.

F. Fully charged fire extinguisher and/or active hoses are to be on sight for fire watch during all burning conditions that require Oxygen/Accel gas for cutting or welding, soldering and the creation of dust, that may activate the fire alarm system, requires that the system be put on bypass for the affected zones. Coordinate shutdown with the City of New York.

G. Equipment specified or indicated to be demolished shall be removed from the project site. All ballasts shall be tested for PCBs and mercury before removal. Test results shall be submitted to the City of New York, and ballasts shall be disposed of properly.

H. All circuits affected by the demolition work shall be de-energized at their source prior to beginning any demolition work.

I. Provide additional support for all existing conditions, cabling and devices to remain which are affected by demolition of existing ceilings and partitions.

J. Protect existing systems, pipes, conduits and communications wiring to remain with flame retardant plywood.

K. Where portions of existing branch circuits or feeders are removed, maintain the continuity of circuiting to remaining devices and maintain and restore, if interrupted, all conduits, circuits and feeders passing through areas of work and servicing undisturbed areas.

L. Drawings are general in nature and do not indicate full extent of removal required, including all hangers, supports, ancillary devices, etc.

3.7 MODIFICATION OF EXISTING WORK

A. Contractor shall perform all work as shown or as specified, within the existing site and structures as part of this Contract without detriment to the existing systems or equipment to be kept in operation or maintained in their places.

B. For full extent of modifications to be done to existing systems, Contractor shall inspect existing systems and site conditions to familiarize himself with the complexity of his work related to removals and relocations required, and the existing finishes to be preserved without any damage resulting from possible careless installation procedures. Upon written request by the bidders, The City of New York shall make the existing schematic plans available for inspection (at his own address) without any responsibility for their completeness or accuracy.

C. As-Built drawings are not available on the existing installations. Any drawings that may be available to the Contractor are for information only. All field criteria must be field verified by Contractor.

D. Contractor shall provide all temporary work, conduit, wiring, equipment, remove, relocate existing work and reconnect with new material, supports, accessories to keep existing system, building in operation and for installation of new work as part of the project cost.

E. All cutting shall be done only by mechanics skilled in the particular trade which is affected. No cutting shall be done without proper protections against damage, dirt and dust resulting therefrom or without proper safeguards to workmen, the public, and occupants of buildings.

F. Before cutting is started in any location, Contractor shall carefully investigate conditions influencing human and structural safety. Existing conduit, wiring and items concealed in walls and slabs, wherever these walls and slabs are removed, shall be properly relocated, rerouted or removed as the case may require.

G. General Construction trades shall perform all finish masonry, repairing, restoring and finishing of all cut openings, closing up of existing openings, and removing and restoring the affected sections of the suspended ceilings.

H. If, during partial occupancy of the building, circumstances necessitate temporary shutdown of any facilities or otherwise interfere with access to building, the City of New York shall be given a minimum of 48 hours' notice before doing such work.

I. In all areas where interface, relocation or alternation work is to be done, Contractor shall disconnect and remove from the premises all existing conduit, wiring, etc., that will not be required to remain in service after the alterations are completed. All such equipment (except as requested as salvage by the City of New York) shall become the property of this Contractor, and he shall remove same from the premises immediately upon disconnection. Existing conduit, wiring, etc., being removed shall not be reused.

J. Contractor shall move or relocate any existing electrical equipment, conduit, wiring, etc., which may temporarily interfere with the construction, (to a temporary location) if the existing equipment is to be kept in operation during construction. He shall also install temporary conduit, wiring or equipment that might be required (during demolition or excavation and during the construction of tunnels, retaining walls, footings or columns) for offsetting all conduit around the construction area in order to maintain services to the existing systems. Provide temporary piers, supports and hangers as required for excavation.

K. Provide all cuts and openings through structural slabs and walls. Contractor shall coordinate his work with concrete contractor and provide necessary dimensions for all openings.

L. Upon completion, remove all temporary conduit/wiring and equipment, shoring, scaffolds, etc., and leave all areas clean and free from material and debris resulting from work performed under this Section. Provide rough patching in areas shown.

3.8 USE OF EQUIPMENT

A. The use of any equipment, or any part thereof, for purposes other than testing even with the City of New York's consent, shall not be construed to be an acceptance of the work on the part of the City of New York, nor shall it be construed to obligate the City of New York in any way to accept improper work or defective materials.

B. Use of permanent equipment for temporary services must be approved in writing by the City of New York.

3.9 CODES, RULES, PERMITS & FEES

A. The Contractor shall give all necessary notices, obtain all permits and filings including, but not limited to NYC Building Code, NYC Fire Department requirements, and pay all government sales taxes, fees, and other costs, in connection with his work. However, all utility connections,

extensions, and tap fees for water, storm, sewer, gas, telephone and electricity shall be paid directly to utility companies and/or agencies by the City of New York, unless otherwise indicated. The Contractor shall file all necessary plans, prepare all documents and obtain all necessary approvals of the City of New York; obtain all required certificates of inspection for his work and deliver same to the Commissioner before request for acceptance and final payment for the work.

B. The complete design and construction shall conform to the requirements of the NYC-BC, NFPA, NEC, UL and any other local or state code which may govern.

3.10 FINAL REVIEW

A. Contractor shall arrange and schedule final review of work and shall notify the Commissioner in writing that the Contractor has thoroughly checked his work and, in the opinion of the Contractor, is ready for final review.

B. During the entire period schedule for these reviews, the Contractor and representatives of each manufacturer of equipment involved shall be present. All of these organizations shall have sufficient and competent personnel present so that adjustments can be made to all systems without delay.

3.11 ACCEPTANCE

A. The operation or the temporary use of the equipment and the mechanical and electrical installation, by the City of New York does not constitute an acceptance of the work. The final acceptance is to be made after the Contractor has adjusted his equipment, demonstrated that it fulfills the requirements of the Contract Documents, and has furnished all the required Certificates. Warranties and guaranties are effective after the acceptance.

3.12 PHASING

A. The work provided under this project will take place in an occupied building. All existing utilities and services including, but not limited to, HVAC, Electrical, Plumbing, Fire Protection, Data and Security Services, must remain active throughout the duration of construction. Coordinate all work with the Commissioner, including phasing of removals and installation of new systems.

END OF SECTION 26 05 00

SECTION 26 05 02 INSPECTION AND TESTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Panelboards.
2. Cables - Low voltage - 600V.
3. Transformers - Low voltage.
4. Switches - Low voltage.
5. Circuit Breakers - Low voltage – Molded case.
6. Grounding System.

B. The Contractor shall perform routine insulation resistance, continuity, and phase rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.

C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the power requirements.

D. The Contractor shall notify the testing firm when equipment becomes available for acceptance testing. Work shall be coordinated to expedite project scheduling.

E. The testing firm shall notify the Consultant 48 hours prior to the commencement of any testing.

F. Any system, material or workmanship which is found to be defective on the basis of acceptance testing shall be reported to the Consultant.

G. The testing firm shall maintain a written record of all tests and, upon completion of the project, shall assemble and certify a final test report.

H. Related Sections:

1. Section 26 05 19: Low Voltage Power Conductors and Cables
2. Section 26 05 26: Grounding and Bonding for Electrical Systems
3. Section 26 22 00: Low-voltage Transformers
4. Section 26 24 16: Panelboards

1.3 REFERENCES

A. American National Standards Institute (ANSI)

1. ANSI C2 - National Electrical Safety Code.

B. International Electrical Testing Association (NETA)

1. ANSI/NETA ATS-2009 - Standard for Acceptance Testing Specification.
2. ANSI/NETA MTS-2007 - Standard for Maintenance Testing Specification.

C. National Fire Protection Association (NFPA)

1. NFPA 70 - The National Electrical Code.
2. NFPA 70B - Electrical Equipment Maintenance.
3. NFPA 70E - Standard for Electrical Safety in the Workplace.

D. New York City Electrical Code.

E. Occupational Safety and Health Administration (OSHA) Regulations.

F. Manufacturer's instruction manuals.

G. Equipment shop drawings for equipment installed on the project.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Qualifications of the Testing firm, including current OSHA accreditation or NETA member status.

C. Qualifications of the technicians to be assigned to perform the work of this section.

D. Test reports for each piece of equipment on the project tested, typed, bound and labeled. The report shall include:

1. Summary of project.
2. List of test equipment used, including manufacturer, model number and serial number, and the most recent calibration date for each piece of test equipment.
3. Listing of equipment tested.
4. Test results.
5. Recommendations.

E. Furnish copies of the complete test report to the Consultant within 7 days of the completion of testing.

1.5 QUALITY ASSURANCE

A. Perform electrical testing in accordance with NETA Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems and the manufacturer's instructions.

1.6 QUALIFICATIONS

A. Contractor to engage an experienced firm specializing in testing and adjusting of systems and equipment specified in this Section. Firm shall have performed Inspection and Testing on projects similar in cost, material, design, and extent to the work indicated in this Section, and Inspection and Testing work has resulted in demonstrated successful operation of the installed equipment.

B. The testing firm shall be corporately and financially independent test organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.

C. The lead on-site technical person shall be currently certified by NETA in electrical power distribution system testing.

D. The testing firm shall utilize technicians who are regularly employed by the firm for testing services.

1.7 PRE-TESTING CONFERENCE

A. Convene one week prior to commencing work of this Section, under provisions of General Conditions.

PART 2 - MATERIALS - NOT USED

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSPECTION

A. Installations will be subject to review by the Commissioner. Where equipment, material or workmanship does not conform to the requirements of the specifications or the Contract Documents, the work shall be corrected to the satisfaction of the Commissioner at no additional cost to the City of New York.

3.3 TESTING FIRMS

A. American Electrical Testing Company.

B. Elemco Testing Company.

C. High Voltage Maintenance Corporation.

D. M & L Power Systems Maintenance, Inc.

E. Or Approved Equal.

F. Other NETA full member companies may be located by contacting the NETA office at (888) 300-6382 or http://www.netaworld.org.

3.4 EXAMINATION

A. Verify that systems are complete before commencing work. Ensure the following conditions:

1. Proper anchorage, required area clearances and proper alignment.
2. Inspect for physical damage, insulation contaminants, condensation or debris.
3. Compare equipment name plate information with the latest one-line diagram and latest shop drawings with Commissioner's Action Stamp; report discrepancies.
4. Verify fuse and/or circuit breaker sizes and types correspond to drawings.
5. Verify the location and condition of all safety grounds.

B. Submit field reports. Report defects and deficiencies noted during the performance of services which prevent system testing.

C. Beginning of work means acceptance of existing conditions.

3.5 PREPARATION

A. Safety and Precautions: Safety practices shall include, but are not limited to, the following requirements:

1. Occupational Safety and Health Act.
2. Applicable state and local safety operating procedures.
3. NFPA 70E.
4. American National Standards for Personnel Protection.

B. All tests shall be performed with equipment de-energized. Safety grounds shall be installed where required, except where such grounds conflict with testing requirements.

C. The testing firm shall have a designated safety representative on the project to supervise the testing operations with respect to safety.

D. Provide instruments required for testing and adjusting equipment and systems. Make instruments available to the Commissioner to facilitate spot checks during tests.

3.6 INSPECTION AND TESTING

A. Switchgear and Switchboard Assemblies:

1. Test in accordance with NETA ATS Section 7.1.1 and 7.1.2.

B. Cables - Low voltage - 600V maximum:

1. Test in accordance with NETA ATS Section 7.3.2.

C. Transformers:

1. Test in accordance with NETA ATS Section 7.2.1.

D. Switches - Low Voltage

1. Test in accordance with NETA ATS Section 7.5.1.

E. Circuit breakers - Low voltage – Molded case:

1. Test in accordance with NETA ATS Section 7.6.1.2.
2. All test shall be performed after all settings have been inputted to devices based on the approved short circuit and overcurrent protection device coordination study furnished by the contractor.

F. Grounding System:

1. Test in accordance with NETA ATS Section 7.13.

3.7 SCHEDULE

A. New equipment requiring inspection and electrical testing:
1. Panelboards.
2. All 600V conductors No. 2 AWG and larger.
3. All molded case circuit breakers, 100A and larger.
4. All dry type low voltage transformers.
5. Fusible and non-fusible switches.
6. Grounding systems.

END OF SECTION 26 05 02

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SECTION 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Building Wire and Cable.
2. Metal Clad Cable (Type MC).
3. Mineral Insulated Cable (MI).
4. Wiring Connectors and Connections.

B. Related Sections:

1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.

1.3 REFERENCES

A. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.
2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Underwriter's Laboratories:

1. UL 83 – Thermoplastic-Insulated Wire and Cables.
2. UL 486A & 486B – Wire Connectors.
3. UL 486C – Splicing Wire Connectors.
4. UL 486D – Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
5. UL 486E – Standard for Safety for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.

6. UL 510 – Standard for Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
7. UL 1569 – Standard for Metal-Clad Cables.
8. UL 1581 – Reference Standard for Electrical Wires, Cables and Flexible Cords.
9. UL 2225 – Standard for Metal-Clad Cables and Cable-Sealing Fittings for Use in Hazardous (Classified) Locations.
10. UL 2196 – Tests for Fire Resistive Cables.

1.4 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:

1. Solid conductor for feeders and branch circuits 12 AWG and smaller.
2. Stranded conductors for control circuits.
3. Conductor not smaller than 12 AWG for power and lighting circuits.
4. Conductor not smaller than 14 AWG for control circuits.
5. Use minimum No. 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet. Use minimum No. 8 AWG conductors for 20 ampere, 120 volt branch circuits longer than 200 feet (67 m). Increase conductor size for larger distances to limit voltage drop to code acceptable levels.
6. Use minimum No. 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet. Increase conductor size for larger distances to limit voltage drop to code acceptable levels.

B. Wiring Methods: Provide the following wiring methods:

1. Utilize building wire in raceway for feeders and branch circuits. Utilize metal clad cable for branch circuits only.
2. Concealed Dry Interior Locations: Use only building wire in raceway or metal clad cable.
3. Exposed Dry Interior Locations: Use only building wire, in raceway.
4. Above Accessible Ceilings: Use only building wire in raceway or metal clad cable.
5. Wet or Damp Interior Locations: Use only building wire in raceway.
6. Exterior Locations: Use only building wire, Type USE-2 or XHHW insulation, in raceway.
7. Underground Locations: Use only building wire, Type USE-2 or XHHW insulation in raceway.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data:

1. Submit for building wire (each cable assembly type).
2. Submit for wiring connectors, including insulating materials.
3. Submit for tapes, including arc-proofing tapes.
4. Submit for cable ties.

C. Test Reports: Indicate procedures and values obtained.

D. Test Reports: Submit Calibration reports for torque drivers and torque wrenches used for electrical connections. Torque drivers and wrenches shall be lab calibrated prior to use on the project and every three months thereafter.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions.

B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Perform work in accordance with NFPA 70 – The National Electrical Code as amended by Authorities Having Jurisdiction.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

1.9 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

A. Refer to DCAS General Conditions.

B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Colonial Wire and Cable Co.
2. Diamond Wire & Cable Co.
3. Essex Group Inc.
4. General Cable Co.
5. Southwire, Inc.

6. American Insulated Wire, Inc.
7. Tyco Thermal Controls Pyrotenax 1850.
8. Or approved equal.

2.2 BUILDING WIRE

A. Product Description: Single conductor insulated wire.

B. Conductor: Copper. Solid for No. 12 AWG and smaller; stranded (Class B) for No. 10 AWG and larger.

C. Insulation Ratings: 600 Volt; 90 degrees C.

D. Insulation Types:

1. Type THHN/THWN or XHHW insulation for feeders and branch circuits installed indoors.
2. Type USE-2 or XHHW for feeders and branch circuits installed under floor slabs, underground or in wet or damp locations.

E. For conductor sizes No. 6 AWG and smaller, conductor insulation shall be color coded as indicated in the table under Item 3.6.

2.3 METAL CLAD CABLE TYPE MC

A. Conductor: Copper.

B. Insulation Voltage Rating: 600 volts; 90 degrees C.

C. Insulation Material: Type THHN/THWN or XHHW.

D. Conductor insulation shall be color coded as indicated in the table under Item 3.7.

E. Armor Material: Steel.

F. Armor Design: Interlocked metal tape.

G. Ground: Full size, green insulated.

H. AC Type cable will not be allowed on this project.

I. MC cable connectors shall be made of steel and shall have insulated throats. Die cast connectors will not be acceptable.

2.4 MINERAL INSULATED CABLE TYPE MI

A. Description: NFPA 70 Type MI, Single conductor insulated cable.

B. Conductor: Copper, solid for No. 10 AWG to 500 kCMIL.

C. Insulation Ratings: 600VAC, 90 degrees C.

D. Termination Temperature Rating: 105 degrees C.

E. Cable Ampacity Rating: 90 degrees C based on single conductors in free air per Table 310.17 of NFPA 70.

F. Insulation Material: Magnesium Oxide refractory mineral.

G. Metal-Sheath Material: Seamless soft-drawn copper.

H. Fire Rating: Cable assembly, including supports shall have a 2-hour fire rating as listed and classified by Underwriters Laboratories, Inc.

2.5 WIRING CONNECTORS

A. General:

1. Temperature rating of all connections and insulation materials shall not be less than that of the conductors and in no case shall be less than 75 degrees C.
2. Connectors with a copper rating shall be copper with tin-plating.
3. Pre-molded insulators shall be by the same manufacturer as the connector.

B. Hydraulic Compression Splices – Standard or long barrel butt splices:

1. FCI Burndy: YS-L or YS series.
2. Thomas & Betts: 54800 or 54500 series.
3. Ilsco: CT or CTL series.
4. Or approved equal

C. Hydraulic Compression Terminations – one-hole and two-hole, long barrel lugs:

1. FCI Burndy: YA, YAZ or YA-2N series.
2. Thomas & Betts: 54100, 54900 or 54800 series.
3. Ilsco: CRA, CRL or CRL2 series.
4. Or approved equal

D. Hydraulic Compression Taps – ‘H’ shaped copper crimp tap:

1. FCI Burndy: YH or YSH series.
2. Thomas & Betts: CHT series.
3. Ilsco crimps.
4. Or approved equal

E. Lugs, Bolt Type:

1. FCI Burndy, Type KA-U.
2. ILSCO Type TA.

3. Thomas & Betts.
4. Or approved equal.

F. Heat Shrink Tubing:

1. FCI Burndy, Type HS-H-PF.
2. ILSCO Type Heavy Wall.
3. Tyco Electronics/Raychem Type WCSM.
4. Thomas & Betts Type HSFR.
5. Or approved equal

G. Spring Wire Connectors:

1. Buchanan.
2. Ideal.
3. King Industries.
4. NSI Industries.
5. Thomas & Betts.
6. 3M.
7. Or approved equal

H. Crimp Type Connectors (power and control wiring, No 10 AWG and smaller):

1. FCI Burndy.
2. Buchanan.
3. ILSCO.
4. Thomas & Betts.
5. Or approved equal

2.6 POWER DISTRIBUTION BLOCKS

A. Power distribution blocks shall consist of a tin-plated copper or tin-plated aluminum (6061-T6) box connector mounted on a polycarbonate base with a see through cover.

B. The blocks shall have line and load connections as indicated on the Drawings. Blocks shall be constructed using tin-plated 6061-T6 aluminum and shall be UL Listed for both copper and aluminum conductors. Blocks shall have the number of poles as indicated on the Drawings.

C. Power distribution blocks shall be equal to Bussmann No. 16300 Series.

D. Other manufacturers include Ferraz-Shawmut, Ilsco, and Littelfuse.

2.7 CONDUCTOR PULLING LUBRICANTS

A. Description: Water soluble, polymer-based, non-toxic and non-sensitizing wire lubricant with volatile solids less than 6%. The lubricant shall have no flash point in gel state and shall leave a non-flammable residue when dry. Lubricant shall be approved by the conductor manufacturer as being suitable for use with their insulation.

B. Appearance: Thick gel material, suitable for application with electrically operated pumping equipment.

C. Useful temperature range: 20 - 100 degrees F.

D. Lubricant shall be equal to the following:

1. American Polywater Corporation; Polywater Clear, Polywater J.
2. Ideal Industries; Clear Glide or AquaGel II.
3. International Products Corporation; P-80.
4. Or approved equal

2.8 TAPE

A. Insulation tape shall have a minimum of 350 volts per mil dielectric strength. Vinyl tape shall be equal to 3M Scotch No. 33. Tape for conductor phase identification shall be equal to 3M Scotch No. 35.

B. Rubber tape shall be self-fusing, non-corrosive, with minimum 350 volts per mil dielectric strength, and meeting the requirements of Federal Specification HH-I-553. Self-fusing rubber tape shall be equal to 3M No. 2155.

2.9 ARC/FIREPROOFING TAPE

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. 3M.
2. Plymouth Rubber Company/ Bishop.
3. Ideal.
4. Or approved equal

B. The tape shall consist of a flexible, unsupported intumescent elastomer. The tape shall be .030 inches thick and shall be capable of 100% elongation. The tape shall be self-extinguishing and shall not support combustion. The tape shall be non-corrosive to metallic cable sheaths and compatible with synthetic cable jackets. The tape shall be secured by a band consisting of two layers of glass cloth electrical tape.

C. Arc-proofing tape shall be 3M No. 77 with 3M Scotch No. 69 glass cloth tape or Bishop No. 53 with Plymouth/Bishop No. 77 Plyglas glass cloth tape, or Approved Equal.

D. All fireproofing tapes shall be products of one manufacturer.

2.10 CABLE SUPPORTS

A. For hangers, supports and anchors see speciation Section 26 05 29.

B. MC cable supports shall consist of threaded bridle rings installed on beam clamp or threaded rod. Bridle rings shall be by Caddy. Supports shall be installed not more than 6ft apart.

C. THHN cable supports shall be installed in NEMA rated boxes sized accordingly with NEC. THHN cable supports shall consists of wedging plug and malleable iron body as manufactured by O-Z/Gedney, S-style or approved equal.

2.11 CABLE TIES

A. Cable ties shall be self-locking type with a minimum width of .180 inches.

B. All cable ties shall be suitable for use in air handling plenums or equipment and shall be manufactured using Halar or an equal low smoke density material and shall meet UL 94V-O flammability requirement.

C. Cable ties shall be as manufactured by the following:

1. FCI Burndy.
2. Panduit.
3. Thomas & Betts.
4. Or approved equal.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Coordination and project conditions.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.3 PREPARATION

A. Conduits and raceways shall be installed and completed prior to the installation of conductors.

B. Prior to installing cables in conduits, visually inspect conduits for damage. Thoroughly swab conduits and raceways before installing conductors. Verify that bushings are in place and properly secured to prevent damage to conductors.

3.4 APPLICATION

A. Wire and cable for miscellaneous systems, such as Intercom, CATV, CCTV, Fire Alarms, Security Alarm Systems, and Telecommunications are specified in the Technical Specification Sections for those systems.

3.5 GENERAL WIRING REQUIREMENTS

A. Wiring shall be provided complete from point of service connection to all receptacles, lighting fixtures, power outlets, outlets for future extensions and other devices as shown. Slack wire shall be provided for all future connections. Unless otherwise specified, branch circuit conductors shall be No. 12 AWG or larger. In outlet boxes for future installations, ends of wires shall be taped and blank covers installed. Type of blank covers in finished areas are to be coordinated with the Commissioner. Circuit identification shall be indicated on box cover and on a cable tray within the box.

B. Cables shall not be bent either permanently or temporarily during installation to radii less than that recommended by the manufacturer.

C. Conductors not larger than No. 10 AWG located in branch circuit panelboards, signal cabinets and switchboard shall be bundled. Conductors larger than No. 10 AWG located in switchboard, distribution panels and pullboxes shall be bundled in individual circuits. Bundling and cabling shall be done with cable ties.

D. Use minimum No. 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet. Use minimum No. 8 AWG conductors for 20 ampere, 120 volt branch circuits longer than 200 feet (67 m). Increase conductor size for larger distances to limit voltage drop to code acceptable levels.

E. Use minimum No. 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet. Increase conductor size for larger distances to limit voltage drop to code acceptable levels.

F. Where homerun circuit numbers are shown, such numbers shall be followed in connecting circuits to panelboards. Each branch circuit homerun containing two or more circuits with a common neutral shall be connected to the circuit breakers or switches in a three or four-wire branch circuit panelboard so that no two of the circuits will be fed from the same phase.

G. Where conductors of different feeders are bundled by circuit in switchboards, distribution panels, pull boxes and cable support boxes, the conductor bundles shall be provided with arc- proofing as specified below.

3.6 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and secure wiring inside boxes, equipment, and panelboards.

C. Identify wire and cable under provisions of Section 260553. Identify each conductor with its circuit number or other designation indicated. Wire shall be color coded as indicated in Item 3.6 below.

D. Special Techniques - Building Wire in Raceway:

1. Installation equipment shall be provided to prevent cutting and abrasion of conduits or conductors. Ropes used for pulling of feeders shall be made of polyethylene or other non-metallic material.

2. Pulling lines shall be attached to conductor cables by means of either woven basket grips or pulling eyes attached directly to the conductors. Rope hitches shall not be used.
3. Pull all conductors into raceway at same time.
4. Install building wire 4 AWG and larger with pulling equipment.
5. Apply conductor pulling lubricant to conductors No. 4 AWG and larger as the conductors enter the raceway. For conductors No. 1/0 AWG and larger, the lubricant shall be applied as recommended by the cable manufacturer, as the conductors enter the conduit.
6. Upon completion of conductor pulling, clean wire pulling lubricant from exposed portions of cables. If cables will not be immediately terminated, cut exposed copper conductor to insulation and seal conductor ends.
7. Install vertical conductor supports when installing conductors. Conductor supports shall be installed in accordance with the manufacturer's instructions.

E. Special Techniques - Cable:

1. Protect exposed cable from damage.
2. Support cables above accessible ceiling, using spring metal clips or threaded bridle rings to support cables from structure. Do not rest cable on ceiling panels.
3. Use suitable cable fittings and connectors.
4. Provide separate bundles of MC cables. Each bundle shall not consist more than 6 single circuit MC cables. Each bundle of cables shall be provided with separate supports.

F. Special Techniques - Wiring Connections:

1. Perform all connection work in strict accordance with recommendations of manufacturers of the wire and connecting devices, unless otherwise noted.
2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
3. Clean conductor surfaces before installing lugs and connectors.
4. Apply anti-oxidation inhibitor compound containing copper to all stranded copper wire connections.
5. Install hydraulic compression connectors for terminations, splices and taps, for conductor sizes No. 6 AWG and larger.
6. Utilize hydraulic tools for compression connectors in accordance with manufacturers' recommendations. Tools shall be non-removable until completion of the connection and shall leave an embossed mark to verify that proper die has been used.
7. Tools shall provide a hexagonal or circumferential crimp to the connectors. Indentation type tools are not acceptable.
8. Splices, taps and termination lugs shall be insulated with heavy wall heat shrink tubing. Tubing shall overlap the conductor insulation by a minimum of 2-inches. The tubing shall be applied using electric heat guns. Open flames or torches shall not be used.
9. Tighten all busbar and stud connections with Belleville washers, or manufacturer standard washers, utilizing torque wrench or torque indicating washer designed for the purpose by the connector manufacturer.
10. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, No. 6 AWG and larger.
11. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, No. 8 AWG and smaller.

G. Connector Application

1. Connectors applications listed shall be utilized when equipment is not provided with factory installed lugs.
2. Wire to busbar for wire sizes No. 1/0 AWG and smaller; one-hole hydraulic compression lug.
3. Wire to busbar for wire sizes No. 2/0 AWG and larger; two-hole hydraulic compression lug.
4. Wire to Stud, switch, or circuit breaker; one-hole mechanical lug.
5. Stranded wire, No. 8 AWG or larger splice, tap, or pigtail connection; hydraulic compression connector with heavy-wall heat shrink tubing or pre-molded thermoplastic insulator by connector manufacturer with two half-lapped layers of vinyl tape.

H. Install solid conductor for feeders and branch circuits No. 12 AWG and smaller.

I. Where branch circuit conductors are terminated on terminal strips within equipment or control panel enclosures, stranded conductors may be used for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid conductors, install crimp-on terminals for conductor terminations. Do not place bare stranded conductors directly under terminal screws.

3.7 WIRE COLOR

A. The covering of wires and cables shall have a distinctive color code for identification of individual conductors.

B. Secondary service, feeder and branch circuit conductors throughout the electrical system shall be color coded as follows:

Phase	208/120 Volts	480/277 Volts
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray or white with tracer
Ground	Green	Green
Isolated Ground	Green with tracer	
Neutral of Ground fault circuit	White with tracer	

C. For conductor sizes No. 6 AWG and smaller, conductor insulation shall be color coded as indicated in the table above.

D. For conductor sizes No. 4 and larger, conductors shall be identified colored tape or heat shrink tubing at terminals, splices and boxes. Tape shall be applies half lapped, with a minimum length of 6 inches.

E. Neutral Conductors: When two or more neutrals are located in one conduit, individually identify each neutral to match the related phase conductor.

3.8 ARC/FIREPROOFING

A. Where more than one set of cables, that are protected by more than one over-current protective device, are installed in a common equipment enclosure or box and any wire is larger than No. 4 AWG, then all sets of conductors shall be covered with arcproof and fireproof tape. Where necessary to facilitate taping, boxes shall be oversized.

B. Tape shall be applied in a single layer, one half lapped, or as recommended by the manufacturer to conform to the above requirements. The tape shall be applied with the coated side next to the cable and shall be held in place with a random wrap of one half inch wide, pressure-sensitive fiberglass backed color plastic film tape. This tape shall not support combustion per ASTM.

3.9 MOTOR AND CONTROL WIRING

A. Provide all wiring to and between motors, starters, disconnect switches and other related electrical equipment except where such items are factory wired.

B. Provide control wiring in conduit at 120 volts or higher for control devices wired with branch circuits serving utilization equipment, unless otherwise specified in other Division of the Specifications.

C. For control devices operating at voltages lower than 120 volts nominal, refer to the respective equipment Sections.

3.10 FIELD QUALITY CONTROL

A. In addition to any testing specified elsewhere in these Specifications, the Contractor shall perform basic testing of his work.

B. Contractor shall verify the continuity of all branch circuit wiring.

C. Contractor shall verify that branch circuits are properly terminated.

D. Measure the tightness of all conductor terminations using calibrated torque drivers or torque wrenches.

E. Verify the insulation integrity of all feeders using a 1,000 volt insulation resistance tester. Digital multi-meters shall not be used to verify insulation integrity.

F. Inspect and test in accordance with NETA ATS, except Section 4 – Division of Responsibility.

G. Perform inspections and tests listed in NETA ATS, Section 7.3.2 – Cables, Low-Voltage, 600 Volt Maximum.

H. The Contractor shall provide a written report of the testing and shall include the following information:

1. Name of the test technician and the technician’s company.

2. Contact information for the testing company.
3. Date of tests, including start and stop time.
4. Temperature and humidity (measured) conditions and general observation of the testing environment.
5. Instruments used, including serial numbers, calibration date and documentation of calibration.
6. Identification of circuit or equipment tested. Identification shall correspond to the project drawings.
7. Test performed and test results.

END OF SECTION 26 05 19

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SECTION 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Active electrodes.
2. Wire.
3. Mechanical connectors.
4. Exothermic connections.

B. Related Sections:

1. Division 03 - Concrete

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.
2. NFPA 99 - Standard for Health Care Facilities.

1.4 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:
1. Metal building frame.
2. Design Requirements

1.5 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.6 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit data on grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Installation Instructions: Submit for active electrodes.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and grounding electrodes.

1.8 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Perform Work in accordance with 2014 New York Building Code.

C. Maintain one (1) copy of each document on site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three (3) years documented experience.

1.10 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.11 COORDINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Requirements for coordination.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

2.1 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: 4 AWG.

C. Grounding Electrode Conductor: Copper conductor with green insulation.

D. Bonding Conductor: Copper conductor bare.

2.2 MECHANICAL CONNECTORS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Erico, Inc.
2. ILSCO Corporation
3. O-Z Gedney Co.
4. Thomas & Betts, Electrical
5. Or approved equal

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.3 EXOTHERMIC CONNECTIONS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Copperweld, Inc.
2. ILSCO Corporation
3. O-Z Gedney Co.
4. Thomas & Betts, Electrical
5. Or approved equal

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.3 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.4 INSTALLATION

A. Install in accordance with IEEE 142.

B. Install additional rod electrodes to achieve specified resistance to ground.

C. Install grounding and bonding conductors concealed from view.

D. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, and/or bushing.

E. Install continuous grounding using underground coldwater system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

F. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

G. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.

H. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

I. Bonding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC as well as equipment grounding conductor.

J. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.5 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground resistance testing in accordance with IEEE 142.

E. Perform leakage current tests in accordance with NFPA 99.

F. Perform continuity testing in accordance with IEEE 142.

G. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION 26 05 26

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SECTION 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.
9. Seismic restrain.

B. Related Sections:

1. Division 03 - Cast-In-Place Concrete
2. Section 26 05 33 - Raceways and Boxes for Electrical Systems.

1.3 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.4 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.5 SYSTEM DESCRIPTION

A. Firestopping Materials: UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.

B. Firestop interruptions to fire rated assemblies, materials, and components.

C. Seismic isolation in this Section applies to life safety systems as follows:

1. All equipment related to emergency power generation and distribution.
2. All power feeders related to fire pump, fire alarm system, emergency lighting and emergency generator fuel oil system.
3. All emergency power distribution feeders 2” and larger.

D. Listed equipment/systems shall be seismically restrained in accordance with the requirements of the NYCBC.

E. Purchased and/or fabricated equipment must be designed to safely accept external forces in accordance with NYCBC in any direction for all rigidly and resiliently supported equipment conduit without failure and permanent displacement of the equipment.

F. Seismic restraint calculations shall be submitted for all listed equipment and feeders related to life safety systems. Calculations for factory fabricated internally isolated equipment shall be submitted. These calculations shall be prepared, signed and sealed by a Professional Engineer licensed in the State of New York and submitted to the Commissioner for approval.

1.6 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to FM for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from applicable code agency indicating approval of materials used.

1.7 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

F. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by a Professional Engineer licensed in the State of New York and suitable for presentation to the Commissioner for acceptance as meeting code fire protection requirements.

I. Concrete Pull-out Tests:

1. Contractor shall provide on-site testing by an accredited testing laboratory, demonstrating compliance with specifications. Testing shall be performed to the loading requirements of the New York City Building Code or by requirements of the Project Manual or 5x the load being placed on the most heavily loaded anchor/support; whichever is most restrictive. Test a minimum of 3 anchors/supports in each zone, of each floor, evenly distributed over the area where anchors/supports will be installed. Tested anchors/supports can be used in the final assemblies. Submit reports to the Commissioner.

1.8 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

B. Floor Penetrations Within Wall Cavities: T-Rating is not required.

C. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

D. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

E. Fire Resistant Joints between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

F. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

G. Maintain one (1) copy of each document on site.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three (3) years document experience.

1.10 DELIVERY, STORAGE AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when the temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Allied Tube & Conduit Corp.
2. Electroline Manufacturing Company
3. O-Z Gedney Co.
4. Or approved equal

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

2.2 ANCHORING SYSTEM

A. Provide system by Hilti as listed below or approved equal.

1. Anchor: HIT-TZ, fabricated of carbon steel ASTM A510 with chemical composition of AISI 1038.
2. Adhesive “Fast cure adhesive” with maximum cure time of 30 minutes at 68 degrees F equal to HIT HY 150 max.

B. Examine the areas and conditions where specialty anchoring system is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

C. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

D. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction and the manufacturer’s recommended installation procedures.

E. Install the following manufacturer’s guidelines:

1. Drill hole using a roto-hammer or Hilt diamond coring machine.

2. Push the HIT-TZ in the hole to verify sufficient hole depth (only threads visible). For floor applications, pushing the rod compacts to the drill dust.
3. Inject adhesive staring from the bottom of the hole.
4. Fill hole 1/2 to 2/3 full. If the hole is full of water, it is suggested to start injecting from the bottom of the hole and fill entirely with adhesive.

F. Anchoring system shall be required to comply with the following:

1. Each anchor shall be able to hold 5x the load being placed or as required by the New York City Building Code or as required by the Project Manual, whichever is most restrictive.

G. Engineering Data:

1. Before any anchor system is installed, submit engineering data drawings to the Commissioner for review indicating how performance standards specified here shall be met. The Contractor is responsible for the structural design and supports for these systems and must show his proposed systems on these drawings.
2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of New York and shall be signed and sealed by this Engineer.

H. Quality Assurance:

1. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance for the work of this Section.
2. Manufacturers shall provide training for all workers to install system.

I. Contractor to provide on-site testing by an accredited testing laboratory, demonstrating compliance with specifications. Testing shall be performed to the loading requirements of the New York City Building Code or by requirements of the Project Manual or 5x the load being placed on the most heavily loaded anchor; whichever is most restrictive. Test a minimum of 3 anchors in each zone, of each floor, evenly distributed over the area where anchors will be installed. Tested anchors can be used in the final assemblies. See Volume 3 Structural drawings Key Plan for locations of the zones (Outer Portion, Corridor and Core). Supply reports to the Commissioner.

2.3 FORMED STEEL CHANNEL

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division
4. Unistrut Corp.
5. Or approved equal

B. Product Description:

1. For indoor installation: Zinc coated (12 gage) thick steel. With holes 1-1/2 inches on center. For MI cable supports provide PVC coated channels.
2. For outdoor installation: Hot dip galvanized (12 gage) thick steel. With holes 1-1/2 inches on center.

2.4 SPRING STEEL CLIPS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division
4. Unistrut Corp.
5. Or approved equal

B. Product Description: Mounting hole and screw closure.

2.5 SLEEVES

A. Furnish materials in accordance with 2014 NYC Building Code.

B. Sleeves Through Non-fire Rated Floors: 18 gage thick galvanized steel.

C. Sleeves Through Non-fire Rated, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

D. Sleeves Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

E. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Thunderline Link-Seal, Inc.
2. NMP Corporation
3. Northern Manufacturing Co.
4. Or approved equal

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FIRESTOPPING

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. International Protective Coating Corp.
5. 3M fire Protection Products
6. Specified Technology, Inc.
7. Or approved equal

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer’s full range of colors.

2.8 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Mineral fiberboard.
2. Mineral fiber matting.
3. Sheet metal.
4. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.3 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Obtain permission from the Commissioner before using powder-actuated anchors.

E. Do not drill or cut structural members.

F. Obtain permission from the Commissioner before drilling or cutting structural members.

3.4 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Terracotta Structural Elements: Provide adhesive anchors.
2. Steel Structural Elements: Provide beam clamps, spring steel clips.
3. Concrete Surfaces: Provide adhesive anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts.
5. Solid Masonry Walls: Provide adhesive anchors.
6. Sheet Metal: Provide sheet metal screws.

B. Inserts:

1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. All outdoor mounted equipment shall be anchored (bolted or welded) to the structural elements of the building to withstand 120 mph wind force. Contractor to submit shop drawing and calculations signed and sealed by license professional experienced with work and licensed in State of NY.

G. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with a minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every 10ft.

3.5 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit, and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Remove dam material after firestopping material has cured.

F. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and roof as follows:

G. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

H. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

I. Pack void with backing material.

J. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

1. Where cable tray, bus, cable bus, conduit, wireway, trough, etc. penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions and code requirements.

K. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition, floor, ceiling, and roof opening as follows:

L. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

M. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

N. Install type of firestopping material recommended by manufacturer.

1. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
2. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
3. Interior partitions: Seal all penetrations. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.6 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 3 inches beyond supported equipment for all floor mounted electrical equipment. Field coordinate lay-out and pad dimensions with dimensions of approved equipment. Refer to Division 03.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.7 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install chrome plated steel escutcheons at finished surfaces.

3.8 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.9 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.10 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 26 05 29

SECTION 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Conduit and tubing
2. Surface raceways
3. Wireways
4. Outlet boxes
5. Pull and junction boxes

B. Related Sections:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
3. Section 26 05 34 - Floor Boxes for Electrical Systems.
4. Section 26 05 53 - Identification for Electrical Systems.
5. Section 26 27 26 - Wiring Devices.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. For data/voice back box and raceway requirements refer to section contract drawings.

C. In or Under Slab on Grade: Provide thick wall nonmetallic conduit unless specified otherwise on contract drawings. Provide cast or nonmetallic metal boxes.

D. Outdoor Locations, Above Grade: Provide rigid galvanized steel conduit. Provide cast metal outlet, pull, and junction boxes.

E. In Slab Above Grade: Provide PVC-coated rigid steel conduit. Provide sheet metal boxes.

F. Wet and Damp Locations: Provide rigid galvanized steel conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

G. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

H. Exposed Dry Locations: Provide rigid galvanized steel conduit below 10ft or where exposed to physical damage. Provide electrical metal tubing at elevations over 10ft above finished floor. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.5 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.6 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit for the following:

1. Flexible metal conduit.
2. Liquid tight flexible metal conduit.
3. Nonmetallic conduit.
4. Raceway fittings.
5. Conduit bodies.
6. Surface raceway.
7. Wireway.
8. Pull and junction boxes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents:

1. Record actual routing of conduits larger than 2 inches.
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.8 DELIVERY, STORAGE AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. Protect PVC conduit from sunlight.

1.9 COORDINATION

A. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

B. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Or approved equal

B. Galvanized Rigid Steel Conduit: ANSI C80.1. Hot-dip galvanized steel.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1; all fittings and couplings for rigid steel conduit shall be galvanized steel and all fittings shall be threaded.

2.2 PVC COATED METAL CONDUIT

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Or approved equal

B. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.

C. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Or approved equal

B. Product Description: Interlocked steel construction.

C. Fittings: NEMA FB 1. Fittings for flexible metal conduit shall be made of steel or malleable iron having and insulated throat.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Or approved equal

B. Product Description: Interlocked steel construction with PVC jacket.

C. Fittings: NEMA FB 1. Fittings for Liquid tight Flexible Metal Conduit shall be made of steel or malleable iron, consisting of a body, gland, locknut and ground cones. The sealing ring shall be thermoplastic. The sealing gasket shall be stainless steel.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Or approved equal

B. Product Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, gland and ring compression type. No set screw fittings will be allowed.

D. No die cast fittings will be allowed.

2.6 NON-METALLIC CONDUIT

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Or approved equal

B. Product Description: NEMA TC 2; Schedule 80 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3. Made of the same material as conduit.

2.7 BUSHINGS

A. Bushings for metallic conduits shall be threaded with insulated throat, manufactured of steel or malleable iron.

B. Bushings for conduit 1-1/4” and larger shall be grounding type with integral ground lug and stainless steel grounding screw.

2.8 WIREWAY

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Or approved equal

B. Product Description: General purpose, Oiltight and dust-tight type wireway as required.

C. Knockouts: Manufacturer's standard.

D. Size: 6 x 6 inch length as indicated on Drawings.

E. Cover: Hinged cover.

F. Connector: Flanged.

G. Fittings: Lay-in type with removable top, bottom, and side; captive screws drip shield.

H. Finish: Rust inhibiting primer coating with gray enamel finish.

2.9 OUTLET BOXES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Or approved equal

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.

C. Nonmetallic Outlet Boxes: NEMA OS 2.

D. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

E. Wall Plates for Finished Areas: As specified in Section 26 27 26.

F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.10 PULL AND JUNCTION BOXES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Or approved equal

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Hinged Enclosures: As specified in Section 26 27 16.

D. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:

1. Material: Cast aluminum.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.3 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.4 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 26 05 29.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit in and under slab from point-to-point.

K. Maximum Size Conduit in Slab Above Grade: 3/4 inch. Do not cross conduits in slab larger than 3/4 inch

L. Maintain clearance between raceway and piping for maintenance purposes.

M. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

N. Cut conduit square using saw or pipe cutter; de-burr cut ends.

O. Bring conduit to shoulder of fittings; fasten securely.

P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

Q. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

R. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate factory elbows for bends in metal conduit larger than 2-inch size.

S. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

T. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

U. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

V. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

W. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

X. Close ends and unused openings in wireway.

Y. Die-cast zinc-alloy fittings shall not be used on any type of raceway.

3.5 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Division 07.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings reflected ceiling plan.

D. Align adjacent wall mounted outlet boxes for switches, thermostats and similar devices.

3.7 ADJUSTING

A. Adjust flush-mounting outlets to be plumb and to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.8 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION 26 05 33

SECTION 26 05 34 FLOOR BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Floor boxes.
2. Floor box service fittings.
3. Poke-through fittings.

B. Related Sections:

1. Division 07 - Firestopping
2. Section 26 05 29 - Hangers and Supports for Electrical Systems: Firestopping for electrical work.
3. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
4. Section 26 27 26 - Wiring Devices: Receptacles for installation in floor boxes.

1.3 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit catalog data for floor boxes service fittings.

C. Samples: Submit one of each service fitting illustrating size, material, configuration and finish.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Closeout procedures.

B. Project Record Documents: Record actual locations of each floor box and poke-through fitting.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 EXTRA MATERIALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 FLOOR BOXES

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Legrand.
2. Hubbell.
3. FSR incorporation.
4. Or approved equal.

B. Floor Boxes: NEMA OS 1, model and sizes as indicated on contract drawings. Provide all required flanges, covers, devices and connectivity plates for complete installation.

C. Adjustability: Fully adjustable.

D. Box material: Stamped steel.

E. Shape: Rectangular.

F. Cover material: Brass

G. Finish as specified by commissioner.

2.2 POKE-THROUGH FITTINGS

A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:

1. Legrand
2. Hubbell.
3. FSR incorporation.
4. Or approved equal.

B. Product Description: Assembly comprising service fitting, poke-through component model and size as indicated on contract drawings, fire stops and smoke barriers, and junction box for

conduit termination. Provide covers, devices, connectivity mounting plates and conduit housing assembly for complete installation.

C. Fire Rating: 2 hours.

D. Service Fitting Type: Flush.

E. Housing: Stamped steel.

F. Cover: Brass – Finish as specified by commissioner.

G. Device Plate: As specified on drawings.

H. Configuration: As specified on drawings.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Coordination

B. Verify locations of floor boxes and outlets in offices, closets and work areas prior to rough-in.

C. Verify openings in access floor are in proper locations.

3.3 INSTALLATION

A. Boxes and fittings are indicated on Drawings in approximate locations. Contractor to field coordinate lay-out of floor boxes with furniture lay-out. Contractor to create drawing indicating lay-out of floor boxes with dimensions and submit for approval.

B. Provide all required fittings, adaptors, covers and mounting plates for power and telecom connectivity devices. Coordinate mounting plate types with IT and AV contractor.

C. Floor Box Requirements: Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

D. Set floor boxes level with the finish floor.

E. Install boxes and fittings to preserve fire resistance rating of slabs and other elements, using materials and methods specified in Section 26 05 29.

F. Install protective rings on active flush cover service fittings and protect floor boxes and poke-through during construction.

3.4 ADJUSTING

A. Refer to DCAS General Conditions - Testing and Inspection.

B. Adjust floor box flush with finish flooring material.

3.5 CLEANING

A. Refer to DCAS General Conditions - Closeout Requirements

B. Clean interior of boxes to remove dust, debris and other material.

END OF SECTION 26 05 34

SECTION 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Stencils.
6. Lockout Devices.

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.3 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data:

1. Submit manufacturer’s catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Samples:

1. Submit two (2) tags, actual size.
2. Submit two (2) labels, actual size.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.4 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with 2014 NYC Building Code.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Accept identification products on site in original containers. Inspect for damage.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.9 EXTRA MATERIALS

A. Refer to DCAS General Conditions - Closeout procedures.

B. Furnish two (2) containers of spray-on adhesive.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Furnish materials in accordance with 2014 NYC Building Code.

B. Product Description: Laminated three-layer plastic with engraved letters.

1. Provide white letters on black contrasting background color for normal power systems.
2. Provide white letters on red contrasting background color for emergency systems.
3. Provide white letters on blue contrasting background color for standby power systems.

C. Letter Size:

1. 1/4 inch high letters.
2. Lettering shall designate the equipment served or the specific equipment designation as shown on the contract drawings.

D. Minimum nameplate thickness: 1/8 inch.

E. Nameplates shall be 3/4 inch by 2 inch or larger in dimension, fastened with counter-sunk, oval head, chrome plated machine screws.

F. Laminated plastic nameplates shall be provided for all electrical equipment, but not limited to, the following: Switchboards, Main and feeder devices in switchboards, Distribution panelboards, Branch circuit panelboards, Individual motor starters, Dry type transformers, Safety switches, Automatic transfer switches, Single pole switches used for motor disconnect switch, Control panels.

2.2 LABELS

A. Furnish materials in accordance with 2014 NYC Building Code.

B. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

2.3 WIRE MARKERS

A. Furnish materials in accordance with 2014 NYC Building Code.

B. Description: Cloth tape type wire markers.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
2. Control Circuits: Control wire number as indicated on [schematic and interconnection diagrams.

2.4 CONDUIT AND RACEWAY MARKERS

A. Furnish materials in accordance with 2014 NYC Building Code.

B. Description: Nameplate fastened with straps.

C. Color:

1. 480 Volt System: Black lettering on orange background.
2. 208 Volt System: Black lettering on white background.

D. Legend:

1. 480 Volt System: 480 Volts.
2. 208 Volt System: 208 Volts.

2.5 STENCILS

A. Furnish materials in accordance with NYCBC.

B. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.

C. Stencil Paint: As specified in Division 09, semi-gloss enamel, colors conforming to the following:

1. White lettering on black background.
2. White lettering on gray background.
3. White lettering on red background.
4. White lettering on blue background.

2.6 LOCKOUT DEVICES

A. Lockout Hasps:

1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 for stencil painting.

3.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:

1. Install nameplate parallel to equipment lines.
2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners as specified above.
3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners as specified above.
4. Secure nameplate to inside surface of door on recessed panelboard in finished locations.

C. Label Installation:

1. Install label parallel to equipment lines.
2. Install label for identification of individual control device stations.
3. Install labels for permanent adhesion and seal with clear lacquer.
4. Label all power receptacles with P-touch labels. Identify panelboard and circuit number for every power receptacle.

D. Wire Marker Installation:

1. Install wire marker for each conductor at panelboard gutters and each load connection.
2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
3. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.

E. Stencil Installation:

1. Apply stencil painting in accordance with Division 09.

END OF SECTION 26 05 53

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SECTION 26 05 73 OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Short circuit analysis and protective device coordination study encompassing new portions of electrical distribution system from normal power source or sources up to and including breakers in service entrance switchboard, main breaker in sub-distribution panels and main breaker in each panelboard. Arc flash analysis for the new components of electrical distribution system based on the available short circuit throughout the distribution system.
2. Contractor to apply to utility company to obtain available short circuit at the point of entry and use provided values in studies described herein.
3. Contractor to obtain all necessary information regarding existing electrical distribution system required to complete studies described herein. If reliable shop drawings are not available, contractor shall provide all necessary means to survey existing installation and obtain required information.

B. Related Sections:

1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
2. Section 26 22 00 - Low-Voltage Transformers.
3. Section 26 24 16 - Panelboards.
4. Section 26 28 13 - Fuses.
5. Section 26 28 19 - Enclosed Switches.
6. Section 26 28 23 - Enclosed Circuit Breakers.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

1.4 DESIGN REQUIREMENTS

A. Complete Short Circuit and Protective Device Coordination Study of the new portion of the electrical distribution to meet requirements of NFPA 70. Study shall include existing utility and service equipment and conductors supplying electricity to the new portion.

B. Complete Arc-flash hazard analysis for all new components of electrical distribution system to meet requirements of NFPA 70E.

C. Report Preparation:

1. Prepare study prior to ordering distribution equipment to verify equipment ratings required.
2. Perform study with aid of computer software program.
3. Obtain actual settings for packaged chiller and motor characteristics and for equipment incorporated into Work.
4. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:
   a. Utility supply cables.
   b. Secondary unit substations.
   c. Automatic transfer switch.
   d. Engine generator.
   e. Low-voltage switchgear.
   f. Switchboards.
   g. Motor control centers.
   h. Distribution panelboards.
   i. Branch circuit panelboards.

D. Each other significant equipment location throughout system.

1. Calculate Incidental Energy Exposure (IEE) available at 18” from the equipment, Flush Hazard Boundary (FHB) and identify minimum requirement for PEE when work to be performed inside FHB by consulting requirements of NFPA 70E. 130.7 (c)(1) to (c)16.
2. Indicate all values in the report for arc-flash hazard analysis and provide equipment specific labels for all electrical distribution equipment (panelboards and switchboards) in accordance with NFPA 70E.

E. Report Contents:

1. Include the following:

F. Calculation methods and assumptions.

G. Base per unit value selected.

H. One-line diagram.

I. Source impedance data including power company system available power and characteristics.

J. Typical calculations.

1. Fault impedance.
2. X to R ratios.
3. Asymmetry factors.
4. Motor fault contribution.
5. Short circuit kVA.
6. Symmetrical and asymmetrical phase-to-phase and phase-to-ground fault currents.
7. Tabulations of calculation quantities and results.

K. One-line diagram revised by adding actual instantaneous short circuits available.

L. State conclusions and recommendations.

1. Prepare time-current device coordination curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms.
2. Prepare with each time-curve sheet complete title and one-line diagram with legend identifying specific portion of system covered by that particular curve sheet.
3. Prepare detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
4. Plot device characteristic curves at point reflecting maximum symmetrical fault current to which device is exposed. Include on curve sheets the following:
    a. Power company relay characteristics.
    b. Power company fuse characteristics.
    c. Medium voltage equipment protective fuse characteristics.
    d. Low voltage equipment circuit breaker trip device characteristics.
    e. Low voltage equipment fuse characteristics.
    f. Cable damage point characteristics.

M. Pertinent transformer characteristics including:

1. Transformer full load current.
2. Transformer magnetizing inrush.
3. ANSI transformer withstand parameters.
4. Significant symmetrical fault current.

N. Pertinent motor characteristics.

O. Generator characteristics including:

1. Phase and ground coordination of generator protective devices.
2. Decrement curve and damage curve.
3. Operating characteristic of protective devices.
4. Actual impedance value.
5. Time constants.

6. Current boost data.
7. Do not use typical values for generator.

P. Transfer switch characteristics.

Q. Other system load protective device characteristics.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Qualifications Data: Submit the following for review prior to starting study.

1. Submit qualifications and background of firm.
2. Submit qualifications of Professional Engineer performing study.

C. Software: Submit for review information on software proposed to be used in performing study.

D. Product Data: Submit the following:

1. Report: Summarize results of study in report format including the following:

E. Descriptions, purpose, basis, and scope of study.

F. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.

G. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection and commentary regarding same.

H. Fault current calculations including definition of terms and guide for interpretation of computer printout.

I. Submit copies of final report signed by a Professional Engineer licensed in the State of New York. Make additions or changes required by review comments.

1.6 QUALITY ASSURANCE

A. Maintain one (1) copy of each document on site.

B. Use commercially available software, designed specifically for short circuit and protective device coordination studies with minimum of five (5) years documented availability approved by the Commissioner.

C. Perform study in accordance with IEEE 242.

1.7 QUALIFICATIONS

A. Study Preparer: Company specializing in performing work of this section with minimum five (5) years documented experience and having completed two (2) projects of similar size and complexity within the past three (3) years.

B. Perform study under direct supervision of a Professional Engineer licensed in the State of New York with minimum of five (5) years' experience in power system analysis.

C. Demonstrate company performing study has capability and experience to provide assistance during system start up.

1.8 SEQUENCING

A. Refer to DCAS General Conditions - Coordination.

B. Complete study within four (4) weeks after pre-installation meeting.

C. Allow two (2) weeks for review of completed study by the Commissioner.

D. Submit short circuit and protective device coordination study to the Commissioner prior to receiving final approval of distribution equipment shop drawings and prior to releasing equipment for manufacturing.

E. When formal completion of study will cause delay in equipment manufacturing, obtain approval from the Commissioner for preliminary submittal of study data sufficient in scope to ensure selection of device ratings and characteristics will be satisfactory.

1.9 SCHEDULING

A. Schedule work to expedite collection of data to ensure completion of study for final approval of distribution equipment shop drawings prior to release of equipment for manufacturing.

1.10 COORDINATION

A. Refer to DCAS General Conditions - Coordination.

B. Coordinate work with local power company.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Quality requirements.

B. Provide assistance to electrical distribution system equipment manufacturer during startup of electrical system and equipment.

C. Select each primary protective device for delta-wye connected transformer so device's characteristic or operating band is within transformer characteristics, including point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection.

D. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by 16 percent current margin to provide proper coordination and protection in event of secondary line-to-line faults.

E. Separate medium-voltage relay characteristic curves from curves for other devices by at least 0.4 second time margin.

3.3 ADJUSTING

A. Refer to DCAS General Conditions - Testing and adjusting.

B. Perform field adjustments of protective devices and modifications to equipment to place equipment in final operating condition. Adjust settings in accordance with approved short circuit and protective device coordination study.

C. All overcurrent protective devices shall be selectively coordinated. Provide adjustments and/or required devices to achieve such coordination based on coordination study with no additional cost to the City of New York.

END OF SECTION 26 05 73

SECTION 26 08 00 – COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including contract conditions and the scope of work document, and other Division 01 specification sections, apply to this section.

B. Owner's Project Requirements and Basis-of-Design documentation, if included, are for reference information only.

C. The following specification sections contain information related to the design, installation, testing, and acceptance of the electrical equipment:

1. Specification Section 01 91 13 – General Commissioning Requirements

1.02 EQUIPMENT SUMMARY

A. This section lists the electrical equipment items that will be commissioned as a part of the project scope:

1. Commissioning of the electrical related items include:

a. Electrical Systems

1) Lighting Control System
2) Occupancy and Vacancy Sensors

2. The detailed list of electrical equipment to be commissioned is specified as part of the Commissioning Plan issued by the commissioning agent

1.03 DEFINITIONS

A. B.A.S. – “Building Automation System”

B. CM – “Construction Manager”

C. CxA – “Commissioning Authority”

D. DOR – “Designer of Record”

E. DDC – “Direct Digital Control”

F. FPT – “Functional Performance Test”

G. HVAC&R – “Heating, Ventilation, Air Conditioning, and Refrigeration”

H. "Systems," "Subsystems," "Equipment," and "Components" – Where these terms are

used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

I. PFC – ”Pre-functional (construction) checklist”

J. T.A.B. – “Testing, Adjusting, and Balancing”

1.04 COMPENSATION

A. Should Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.

1. Failure to provide timely notice of commissioning activities schedule changes.

2. Failure to meet the acceptance criteria for test demonstrations.

1.05 DOCUMENTATION

A. MEP Design Review

1. The CxA will perform a commissioning focused design review of the MEP Drawings and specifications for the project and issue comments to the DOR

2. The DOR is responsible for formally addressing each comment issued by the CxA

B. Informational Equipment Submittal

1. Equipment submittals will be submitted for approval by the CM to the Owner, DOR, and CxA to be reviewed concurrently

2. Each equipment submittal is required to contain (at a minimum) the following information:

a. Manufacturer Name
b. Model Number
c. Quantity
d. Installed Options
e. Unit Dimensions
f. Maximum Heating / Cooling Load
g. Electrical Criteria
h. Installation Requirements
i. Wiring Diagrams
j. Performance / Efficiency Ratings
k. Parts Listing
l. Warranty Information

C. Submittal Review Process

1. The submittal review process begins once the CM submits the equipment

submittals to the Owner, DOR, and CxA for review and approval

a. The CxA will review each submittal within seven (7) days of receipt and provide comments directly to the DOR
b. The DOR will be responsible for deciding whether or not to include the CxA's submittal review comments in their official response to the CM

D. Pre-Functional (Construction) Checklists

1. PFCs are documents that will be developed by the CxA and completed by the appropriate sub-contractor to confirm that the equipment has been installed per the manufacturer's instruction and in accordance with the approved equipment submittal and relevant specification section

2. Completed PFCs will be utilized as confirmation that the installed equipment is ready to be scheduled for functional testing. Any deviations in installation from the contract documents, manufacturer's recommendations, or design specifications will be noted as a deficiency and recorded on the Commissioning Issues Log

3. Checklist criteria should include (but is not limited to) the following:

a. Manufacturer Name
b. Model Number
c. Serial Number
d. Electrical Criteria
e. Location (i.e. floor, room name / number, etc.)
f. Filter presence (if applicable)
g. Exterior disposition (e.g. cracked, dented, damaged)
h. Deficiencies found during installation

4. Start-up reports are to be issued by the equipment manufacturer or responsible subcontractor to the CxA in addition to the PFCs completed by the CM or subcontractor

E. FUNCTIONAL PERFORMANCE TESTS

1. Functional performance tests are documents developed by the CxA and executed by the Electrical contractor

2. The CxA requires the approved equipment submittal, sequence of operations, control submittal and completed PFC prior to scheduling functional testing

3. The purpose of the FPTs is to test the operation of the equipment in its various modes of operation. Some modes that may be tested as a part of the equipment's sequence of operations are:

a. Un-Occupied Mode
b. Occupied Mode
c. Emergency Power Mode (if applicable)
d. Alarms (if applicable)

4. Any deviation in operation from the approved sequence of operations will be recorded as a deficiency and included on the commissioning Deficiency Log which will be issued in its entirety at the culmination of functional testing.

F. ISSUES LOG

1. The commissioning issues log is a spreadsheet constructed by the CxA that details all of the installation and operational deficiencies found during the pre-functional and functional testing stages for each equipment item.

2. A deficiency is defined as follows:

   a. Any deviation in the equipment's installation in comparison to the approved equipment submittal, contract drawings, or relevant design specification
   b. Any deviation in an equipment's operation in comparison to the approved sequence of operations, or relevant design specification

3. Once a deficiency is identified by the CxA, it will be added to the deficiency list and marked "OPEN". The list is distributed to the project team where it becomes the CM's responsibility to rectify the issue. Once the issue is addressed, the CxA will confirm that the CM has corrected the deficiency and mark the deficiency as "CLOSED" on the deficiency list.

4. The Owner will serve as the arbiter in the event that CM and the CxA disagree on a perceived deficiency.

G. Systems Manual

1. Provide operating instructions and maintenance data books for all equipment and materials furnished under this division to the CxA.

2. Submit one (1) copy of operation and maintenance manuals in searchable electronic format (PDF) for review at least ten (10) weeks before Final Review of the project.

3. Operation and maintenance manuals shall include complete periodic maintenance schedules, lubrication, cleaning and servicing data compiled in clearly and easily understandable form. Data shall show serial numbers and model numbers of each piece of equipment, complete lists of replacement parts (including part numbers), motor ratings and actual loads.

4. Include the following information where applicable:

1. Name, location and phone number of nearest service agency and phone number for 24-hour manufacturer service hotline.

2. Narrative describing system operation.

3. Identifying name and mark number.

4. Locations of major equipment (where several similar items are used, provide a list).

5. Complete nameplate data.

6. “Final Reviewed” submittals.

7. Parts lists.

8. Performance curves and data.

9. Wiring diagrams.

10. Lubrication charts.

11. Manufacturers’ recommended operation and maintenance instructions with all non-applicable information deleted.

12. List of spare parts recommended for normal service requirements.

13. Assembly and disassembly instructions with exploded view drawings where available.

14. Troubleshooting diagnostic instructions where available.

15. Description of alarm and trouble codes for software-based systems.

16. Manufacturer recommended and actual set points.

H. FINAL COMMISSIONING REPORT

1. The final commissioning report is developed by the CxA and is a cumulative review of the commissioning process for the project.

2. The results of the functional testing, deficiency resolution, final equipment disposition, and recommendations for on-going systems monitoring and maintenance are included in the report

3. A list of appendices contained in the Final Commissioning Report include:

   a. Table of Contents (With Links)
   b. Executive Summary (Open Issues shall be highlighted at the beginning)
   c. Equipment List
   d. Final Commissioning Plan
   e. Completed and Blank Pre-Functional Checklists
   f. Completed and Blank Functional Performance Tests
   g. Completed Deficiency Log
   h. Field Observation Reports
   i. Start-up Reports
   j. TAB Report
   k. MEP Static Test Results
   l. Training Sign-In Sheets
   m. As-Builts

1.06 QUALITY ASSURANCE

A. Testing Equipment, Instrumentation Quality, and Calibration

1. All test equipment used during the commissioning phase of the project will possess the following:

a. Certificate of calibration certified with the date the test equipment was last calibrated
b. Manufacturer, model number, and serial number

2. All test equipment will be capable of meeting the following criteria:

a. Capable of testing and measuring performance within the specified acceptance criteria
b. Calibrated at the manufacturer’s recommended intervals with current calibration tags permanently affixed to the instrument
c. Maintained in good repair and operating condition throughout the duration of us on the project
d. Recalibrated or repaired if damaged in any way while being used on the project

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 GENERAL EXECUTION REQUIREMENTS

A. Schedule and coordinate commissioning with the construction schedule.

B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.

C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies.

D. Included in the Commissioning Plan is a detailed list of the test demonstrations.

E. Report test data and commissioning issue resolutions.

F. Schedule personnel to participate in and perform the Commissioning Process Work.

G. Installing contractors' commissioning responsibilities include, but are not limited to, the following:

1. Operating the equipment and systems they install during tests.

2. In addition, installing contractors may be required to assist in tests of equipment

and systems with which their work interfaces.

3.02 ELECTRICAL TESTING REQUIREMENTS

A. The commissioning testing schedule will be determined by the CM upon submission of the prerequisite documentation and completion of equipment installation.

1. The CxA must be notified three (3) business days in advance of the proposed testing date

2. The CxA will make the functional test forms available to the CM in advance of testing

3. The CM (and electrical contractor) will be responsible for providing the appropriate test equipment to complete functional testing

B. The following requirements are the sole responsibility of the CM and electrical sub-contractors to complete prior to functional testing by the CxA:

1. Certify in writing that all electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the contract documents, approved shop drawings, and submittals.

2. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (e.g. normal, hand, off, auto, occupied, etc.)

3. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions to verify compliance with acceptance criteria

4. Provide personnel capable of accessing, operating, and making changes (if necessary) to the unit

5. Perform functional performance tests written by CxA

6. Resolve commissioning deficiencies in a timely fashion and notify the CxA once corrective action is completed

C. The sampling method of testing is used when functional testing of large quantities of equipment is required.

1. The sampling method is used on only contractually agreed upon equipment items

2. In the event that 10% of the sample size fails functional testing, the remainder of the sample size will be considered to have failed as well. It will be incumbent upon the CM to resolve the issue and contact the CxA for retesting

D. Retesting of commissioned equipment will be required if:

1. 10% of a sample size of equipment fails functional testing

2. Equipment is not ready to be commissioned at the designated testing date

+ + END OF SECTION + +

SECTION 26 09 43 CENTRAL LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Central lighting control system and components.
2. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Product requirements for raceway and boxes for placement by this section.
3. Section 26 05 53 - Identification for Electrical Systems: Product requirements for electrical identification items for placement by this section.
4. Section 26 27 26 - Wiring Devices: Product requirements for wiring devices for placement by this section.

1.3 REFERENCES

A. Federal Communications Commission:

1. Standard for Radio Frequency Equipment.

B. Government Electronics and Information Technology Association:

1. EIA 709.1 - Control Network Protocol Specification.

C. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.
2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

E. Underwriters Laboratories Inc.:

1. UL 50 - Enclosures for Electrical Equipment.
2. UL 67 - Panelboards.

3. UL 508 - Industrial Control Equipment.
4. UL 916 - Energy Management Equipment.

1.4 SYSTEM DESCRIPTION

A. Provide central lighting control system consisting of components manufactured by single manufacturer:
   1. Lutron Electronics (Basis of design).
   2. Cooper Controls brand of Eaton.
   3. Leviton.
   4. Or approved equal.

B. Provide central lighting control system consisting of:
   1. Programmable switched relay controller with relays and 0-10V dimming in single enclosure.
   2. Programmable, connected to the lighting control system low voltage wallstations, occupancy sensors, vacancy sensors and photo sensors.
   3. Interface devices connected to the lighting control system.

C. Central lighting control system performs lighting control in the following building areas:

   1. Refer to contract drawings for lighting-controlled areas and locations of system equipment

D. Provide connection to Building Management System (BMS).

   1. System shall be integrated to BMS. Refer to Division 23 requirements and requirements specified herein.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.

   1. One Line Diagram: Indicating system configuration indicating panels, number and type of controlled zones, wallstations and interface devices.
   2. Drawings for each panel showing hardware configuration and numbering.
   3. Component locations throughout the building.
   4. Include typical wiring diagrams for each component.

C. Product Data: Submit manufacturer’s standard product data for each system component.

D. Manufacturer's Installation Instructions: Submit for each system component.

E. Manufacturer's Field Reports: Submit system startup report indicating date of completion and acknowledgment of programming completion.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Submittals.

B. Project Record Documents: Record the following information:

1. Wiring diagrams reflecting field installed conditions with identified and numbered, system components and devices.
2. Drawings for each panel showing hardware configuration and numbering.

C. Operation and Maintenance Data:

1. Submit manufacturer's published installation instructions, operating instructions, programming instructions, and operator's guide.
2. Warranty information.
3. System start-up information.
4. System user's guide and programmer's guide.
5. Instruction books and manufacturer's printed materials.
6. Recommended renewal parts list.

1.7 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Comply with NFPA 70 as applicable to electrical wiring work.

C. Comply with NEMA 250 for type of electrical equipment enclosures.

D. Provide panelboards with UL listing in accordance with UL 50, UL 67, and UL 916.

E. Provide equipment complying with FCC emissions' standards in part 15 subpart J for Class A application.

F. Perform Work in accordance with 2014 New York City Building Code.

1.8 QUALIFICATIONS

A. Manufacture: Subject to compliance with requirement, provide products by one of the following:
1. Lutron Electronics (Basis of design).
2. Cooper Controls brand of Eaton.
3. Leviton.
4. Or approved equal.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Material and equipment.

B. Accept system components on site in manufacturer’s packaging. Inspect for damage.

C. Protect components by storing in manufacturer’s containers indoor protected from weather.

1.10 WARRANTY

A. Refer to DCAS General Conditions - Closeout procedures.

B. Furnish five year manufacturer’s warranty for each system component. Warranty shall include system parts including panels, sensors, control devices, interfaces and wiring. Failed system components shall be replaced with new and programed by contractor with no additional cost to the City of New York.

C. Warranty period shall start once system is accepted by the City of New York.

1.11 MAINTENANCE SERVICE

A. Furnish service and maintenance of system for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including checkout and adjustments.

B. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, with maximum 4 hour response time.

C. Perform maintenance work using competent and qualified personnel under supervision of manufacturer or original installer.

D. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of the City of New York.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide networked lighting control system consisting of the following components: programmable digital communication panels, relay and dimming panels, addressable dimming and switching modules, programmable wall stations, occupancy sensors and day light sensors, and capability of integration into building automation system.

B. Designed and tested to withstand electrostatic discharges up to 12,000 V without impairment IEC 801-2.

C. Substitutions: Refer to Division 1 – Requirements for substitutions. Contractor to coordinate all system components including light fixture drivers, devices, sensors, wiring, control panels, software and physical location of all components for fully operational system.

2.2 SYSTEM COMPONETS

A. Programmable Main Quantum Processor Hub: model QP3-1PL-100-240.

B. Programmable digital communication panels: Energi Savr Node QS, model QSN-2ECO-S.

C. Local relay panels with 0-10V dimming: Energi Savr Node QS, model QSN-4T16-S.

D. Addressable full line voltage (120V) circuit dimming module: model C5-BMJ-16A.

E. Addressable full line voltage (120V) circuit switching module: model C5-XPJ-16A.

F. Programmable wall station: One button wallstation with toggle on/off and raise/lower for dimming control: model CC-1BRL-WH.

G. Programmable master control station: Five button wallstation with toggle on/off and raise/lower for dimming control: model QSWS2-5BRLN-WH.

H. Programmable dual technology occupancy sensor: models LOS-CDT-2000-WH and LOS-CDT-500-WH.

I. Programmable daylight sensor: model EC-DIR-WH.

J. QS sensor module for integration of sensors and controls through the Energi Savr Node to the Ecosystem: QSM2-4W-C.

2.3 ENERGY SAVER NODE PANELS

A. EcoSystem Digital Fixture Lighting Control Module

1. Product: QSN-2ECO-S
2. Mechanical:
   a. Listed to UL 508 as industrial control equipment.
   b. Delivered and installed as a UL listed factory assembled panel.

B. Panels passively cooled via free-convection, unaided by fans or other means.

1. Supports two independent links of up to 64 ballasts per link.
2. Connect without interface to wired:
   a. Occupancy sensors
   b. Daylight sensors

C. IR receivers for personal control

1. Connects to Lighting Management Panel via RS485.
2. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
3. Thermal protection reports to Light Management System if module overheats.

4. Contact Closure Input.

D. Directly accept contact closure input from a dry contact closure or solid-state output without interface to:

1. Activate afterhours mode
2. Provide basic load shed functionality
3. Emergency Contact Closure Input

E. Turn all zones to full output during emergency state via direct contact closure input from UL 924 Listed Emergency Lighting Interface, security system or fire alarm system.

F. Disable control operation until emergency signal is cleared.

1. Programming Connection:

G. Provide Ethernet input for wired connection to wireless router.

H. Provide ability for programming from an iPod touch or IPhone via wireless router.

2.4 LOW-VOLTAGE WALL STATIONS

A. Product: Neo Type Decorator programmable wallstation connected to the system over Cat 5 cable.

B. Use CAN wiring for low voltage communication to ensure reliable data communication in high electrical noise environments.

C. Functionality: Upon button press, LEDs to immediately illuminate.

D. Provide color as specified by the Commissioner.

E. Provide faceplates with concealed mounting hardware.

F. Engrave wall stations with appropriate button, zone, and scene descriptions as specified by City of New York.

2.5 WIRED CEILING AND WALL MOUNTED OCCUPANCY SENSORS

A. Wired Ceiling and Wall Mount Occupancy/Vacancy Sensors

1. Product: LOS-CDT-2000-WH, LOS-CDT-500-WH.
2. Sensing mechanism:
   a. Dual technology:
      1) Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
      2) Utilize an operating frequency of 32kHz or 40kHz that shall be crystal controlled to operate within plus or minus 0.005 percent tolerance.

3. Connect directly to EcoSystem ballast and modules without the need of a power pack or other interface
4. Sensors shall turn off or reduce lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space
5. Sensor shall accommodate all conditions of space utilization and all irregular work hours and habits.
6. Sensors shall be UL listed.
7. Sensors shall be fully adaptive and adjust their sensitivity and timing to ensure optimal lighting control for any use of the space
8. Sensors shall have field adjustable controls for time delay and sensitivity to override any adaptive features.
9. Power failure memory:
    a. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and learned parameters saved in protected memory shall not be lost.

10. Provide all necessary mounting hardware and instructions.
11. Sensors shall be Class 2 devices.
12. Indicate viewing directions on mounting bracket for all Ceiling mount sensors.
13. Provide customizable mask to block off unwanted viewing areas for all ceiling mounted sensors using infrared technology.
14. Provide swivel mount base for all wall mount sensors.

B. Interior Daylight Sensors

1. Wired Daylight Sensor
    a. Product: EC-DIR-WH
    b. Use Class 2 wiring for low voltage communication
    c. Can be replaced without reprogramming
    d. Open-loop basis for daylight sensor control scheme
    e. Stable output over temperature from 0 degrees to 40 degrees C
    f. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection
    g. Provide linear response from 0 to 500 foot-candles
    h. Integral IR receiver for programming
    i. Constructed with plastic meeting UL94 HB
    j. Mountable on lighting fixtures or recessed acoustical ceiling tiles
    k. Constructed via sonic welding
    l. Color:
        1) Match NEMA WD1, Section 2 White
        2) Color variation in same product family: Maximum $\Delta E=1$, CIE L*a*b color units.

C. Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request

2.6 LOW VOLTAGE CONTROL INTERFACES

A. Contact closure: The contact closure input device will accept both momentary and maintained contact closures. The contact closure output device can be configured for maintained or pulsed outputs.

B. Contact closure Input Interface: QS seeTouch keypads Model QSWS2. The contact closure input device will accept both momentary and maintained contact closures

C. Automatic load control relays to provide switching or dimming control of emergency lighting in compliance with UL924.

D. Sensor module hub - Communicate sensor information to wired QS link for use by compatible devices model QSM2-4W-C.

E. RS-232/RS-485 converter for connection to BMS network. Provide all required wiring and coordinate work with BMS contractor.

2.7 SOFTWARE

A. Shall include with user-friendly software suitable for operation on computer workstations which serve as central control stations by monitoring the devices in the system, recording events, indicating alarm conditions, logging and displaying system reports.

B. The software shall be configured, not programmed. All software shall be configured by the vendor and delivered ready to use. This configuration shall include preparation of all graphics, and displays required as a part of this project.

C. Configuration shall be to the point that when additional monitoring devices are added, the user shall only need to convey to the software the communications address and type of the new device. The software shall then be able to display all data from that device in a format identical to that used for other devices of the same type.

D. The software shall be a standard product offering with no customization required. The City of New York shall interface with the software via any standard browser application (Internet Explorer, Firefox, Safari, Chrome, etc.) with a Flash plug-in. No additional software application install shall be required for the City of New York communication with the software.

E. Browser based clients shall access server through standard ASP (active server page) interface that is capable of displaying:

1. Historical Reports that can be customized and saved to users PC
2. Graphical displays with real-time data updates
3. Electronic documentation (support of .xls)
4. Setup of display preferences.

F. Shall be able to give real-time dynamic alerts on-screen and via text or email.

G. Web-enabled software shall support the viewing of interactive graphics in a browser.

H. Intuitive display of time-series data with user-selectable time scales and intuitive click-and-drag drill-down capability.

I. Shall be able to display 31 days of 24-hour views of data from any node in the system.

J. Annotation of specific data points to identify anomalies and relate to operational events.

K. Easy comparison of time-series data for up to 9 parameters on a single chart.

L. Shall support multiple utility tariff structures for flat rate, time of day, demand surcharges, and tiered rate for specific calendar periods.

M. Contractor shall work with the City of New York in order to identify timing schedules and all system components assignments for proper programming the system. Contractor shall field coordinate and adjust timing schedules, device sensitivities and system component assignments as directed by City of New York.

N. After programming of system parameters is completed and accepted by the City of New York, system shall allow each user-definable feature such as schedules, wallstations and photo sensors assignments to be field modified without need for configuration software or system integration expertise.

O. Contractor shall integrate lighting control system at Building Management System and provide full graphical interface with all functionality as specified herein and indicated on the drawings.

2.8 NETWORK WIRING

A. Network wire recommended is Belden#1502R in conduit. Refer to wiring notes on contract drawings for sizes and conductor quantities.

B. 64 digital devices (Source Controllers, User Interfaces, etc.) may reside on a single network segment with a network length not to exceed 3000 feet. Additional network segments shall be accomplished by the employment of a network bridge up to 65000 devices. Network segments shall be terminated at the end of each segment.

C. Devices to be connected via Daisy Chain topology.

2.9 STARTUP AND PROGRAMING

A. Provide factory-certified field service engineer to a site visit to ensure proper system installation and operation under following parameters:

1. Qualifications for factory-certified field service engineer:
   a. Minimum experience of 2 years training in the electrical/electronic field.
   b. Certified by the equipment manufacturer on the system installed.

2. Make a visit upon completion of installation of system:

a. Verify connection of power feeds and load circuits.
b. Verify connection and location of controls.
c. Program system data.
d. Verify proper connection of digital control link.
e. Verify proper operation of manufacturers interfacing equipment.
f. Verify system operation control by control, circuit by circuit.
g. Check panel dimming load types and currents and remove by-pass jumpers.
h. Obtain sign-off on system functions.
i. User to be trained on system operation.
j. Verify interface with BMS system.

B. Tech Support

1. Provide factory direct technical support hotline 24 hours per day, 7 days per week.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. Install equipment in accordance with manufacturer's installation instructions.

B. Mount equipment, wallstations and photo sensors as indicated on Drawings and as field coordinated with the City of New York.

C. Define each dimmer's/relay's load type, assign each load to a zone, and set control functions.

D. Label each low voltage wire clearly indicating connecting device or system component. Refer to Section 26 05 53.

E. Use only properly color coded, stranded wire. Install wire sizes as indicated on Drawings and as required for complete and properly operated system.

F. Identify power wiring with circuit breaker number controlling load. When single circuit breaker is feeding into multiple system modules, label wires to clearly indicate originating panel designation.

G. Terminate communication conductors and associated conduits external to factory supplied equipment.

H. Test modules and switches after installation to confirm proper operation.

I. Install wiring schedule directory card affixed to rear of panel cover to identify circuits and loads controlled.

3.3 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Testing and adjusting.

B. Test relays and switches after installation to confirm proper operation and confirm correct loads are recorded on directory card in each panel.

3.4 ADJUSTING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Testing and adjusting.

B. Furnish factory trained technicians to functionally test each system component after installation to verify proper operation.

3.5 DEMONSTRATION

A. Refer to DCAS General Conditions - Closeout procedures.

B. Demonstrate operation of the following system components:

1. Operation of wall stations.
2. Operation of photo censors.
3. Operation of system under timing schedules and under override signals from system devices.
4. Integration with BMS system.

C. Furnish services of manufacturer's technical representative for 8 hours to instruct the City of New York's personnel in operation and maintenance of system. Schedule instructing with the City of New York, provide at least 7 days' notice to the Commissioner of instructing date.

END OF SECTION 26 09 43

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SECTION 26 22 00 LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Two-winding transformers.

B. Related Requirements:

1. Division 03 - Concrete
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
4. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
5. Section 26 05 53 - Identification for Electrical Systems.

1.3 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

1. NEMA ST 1 - Specialty Transformers (Except General Purpose Type).
2. NEMA ST 20 - Dry Type Transformers for General Applications.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

C. Test and Evaluation Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

D. Source Quality Control Submittals: Indicate results of factory tests and inspections.

E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Closeout procedures.

B. Record Documentation: Record actual locations of transformers.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure and finish.

1.8 WARRANTY

A. The Contractor/Installer shall provide a five (5) years written warranty covering every low- voltage transformer. Should any defects due to workmanship or materials occur during the stated period, they shall be corrected immediately, and all damage caused by such defects shall be corrected. All corrective work shall be at the Contractor/Installer’s expense.

B. Warranty period shall start once each transformer is accepted by the City of New York.

PART 2 - PRODUCTS

2.1 TWO-WINDING TRANSFORMERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electrical.
3. Siemens
4. Schneider Electric - Square D – Basis of design.
5. Or approved equal.

B. Substitution Limitations:

1. Refer to DCAS General Conditions - Product Requirements: Requirements for substitutions for other manufacturers and products.

C. Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers, ratings as indicated on Drawings.

D. Transformers shall meet the efficiency levels specified in the Final Rule of the Energy Policy Act of 2016 (EPACT 2016).

E. Operation:

1. Primary Voltage: As indicated on contract drawings.
2. Secondary Voltage: As indicated on contract drawings.
3. Or as indicated on drawings.
4. Insulation system and average winding temperature rise for rated kVA as follows:

a. 1-15 kVA: Class 220 with 115 degrees C rise.
b. 16-500 kVA: Class 220 with 115 degrees C rise.

1) Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.
2) Winding Taps: Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.

c. Transformers 15 kVA and Larger: NEMA ST 20

1) Sound Levels: NEMA ST 20. Maximum sound levels are as follows:

a) 1-5 kVA: 40 dB.
b) 6-25 kVA: 45 dB.
c) 26-150 kVA: 50 dB.

d. 151-225 KVA: 55 dB

1) Basic Impulse Level: 10kV.
2) Mounting:

a) 1-15 kVA: Suitable for wall mounting.
b) 16-75 kVA: Suitable for floor or trapeze mounting.
c) Larger than 75 kVA: Suitable for floor or trapeze mounting.

F. Materials:

1. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.
2. Coil Conductors: Continuous copper windings with terminations brazed or welded.
3. Enclosure: NEMA ST 20, Type 1 ventilated. Furnish lifting eyes or brackets.

G. Fabrication:

1. Isolate core and coil from enclosure using vibration-absorbing mounts.

2. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.3 PREPARATION

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for installation preparation.

B. Provide concrete pads under provisions of Division 03.

3.4 INSTALLATION

A. Set transformer plumb and install level on 4” high concrete housekeeping pad. Transformers shall be secured in place with four bolts min.

B. Use flexible conduit, in accordance with Section 26 05 33, 2 feet (600 mm) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Support transformers in accordance with Section 26 05 29.

1. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer.
2. Mount floor-mounted transformers using vibration isolating pads (on concrete housekeeping pad) suitable for isolating transformer noise from building structure.
3. Mount trapeze-mounted transformers as indicated on Drawings.

D. Provide vibration controls.

E. Install grounding and bonding in accordance with Section 26 05 26.

3.5 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Quality Requirements. Requirements for inspecting and testing.

B. Test transformers in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.2.1.

3.6 ADJUSTING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

3.7 CLEANING

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for cleaning.

END OF SECTION 26 22 00

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SECTION 26 24 16 PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Branch circuit panelboards.

B. Related Requirements:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.
3. Section 26 28 13 - Fuses.

1.3 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers:

1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
5. NEMA PB 1 - Panelboards.
6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories Inc.:

1. UL 50 - Cabinets and Boxes
2. UL 67 - Safety for Panelboards.
3. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
4. UL 1283 - Electromagnetic Interference Filters.
5. UL 1449 - Transient Voltage Surge Suppressors.
6. UL 1699 - Arc-Fault Circuit Interrupters.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit catalog data showing specified features of standard products.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

D. Source Quality control submittals: Indicate results of factory tests and inspections.

E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

B. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Refer to DCAS General Conditions - Closeout Requirements.

B. Extra Stock Materials:

1. Furnish two (2) of each panelboard key. Panelboards keyed alike to the City of New York’s current keying system.

1.7 QUALITY ASSURANCE

A. Qualifications: Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

1.8 WARRANTY

A. The Contractor/Installer shall provide a five (5) years written warranty covering each panelboard. Should any defects due to workmanship or materials occur during the stated period, they shall be corrected immediately, and all damage caused by such defects shall be corrected. All corrective work shall be at the Contractor/Installer's expense.

B. Warranty period shall start once each panelboard is accepted by the City of New York.

PART 2 - PRODUCTS

2.1 GENERAL

A. Dead-front panelboards incorporating the number, rating and type of circuit over-current protection indicated and as shown on the Contract Drawings shall be provided in the enclosure specified for either surface or flush mounting as indicated on the Drawings.

2.2 MANUFACTURERS

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. Eaton
2. General Electric
3. Siemens
4. Schneider Electric/Square D – Basis of design.
5. Or approved equal.

2.3 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE

A. Description: NEMA PB 1, circuit breaker type, fully rated, distribution panelboard.

B. All interiors shall be completely factory assembled with switching and protective devices, connectors, etc. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units, without removing the main bus connectors, and shall be so designed that circuits may be changed without machining, drilling or tapping.

C. Short Circuit Rating:

1. For 208 volt panels - 65,000 amperes RMS symmetrical minimum.
2. For 480 volt panelboards - 42,000 amperes RMS symmetrical minimum.
3. As indicated on the Drawings and as required to comply with short circuit study.
4. Distribution panelboards shall be fully rated.

D. Materials:

1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish isolated copper neutral bus in each 4-wire panelboard. Furnish copper ground bus in each panelboard.
2. Multiple cable lugs for incoming feeder cables shall be furnished where required. Lugs shall be secured to bus by stud bolts. Multiple section panels shall have sub-feed or feed-through lugs with full capacity taps to adjacent panel section.
3. Molded Case Circuit Breakers conforming to UL 489:

E. Main device - NEMA AB 1, fixed mount type circuit breaker with solid-state electronic trip unit and data communication features.

F. Branch devices - circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

1. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits
2. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 65,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
3. Circuit breakers shall be bolted in type, consisting of the number of poles and ampere ratings as noted on the drawings. Two and three pole breakers shall be of the common trip type.
4. Provide circuit breaker accessory trip units and auxiliary switches as indicated.
5. All distribution panelboard circuit breakers shall be equipped with lock-out/tag-out devices.
6. Power meters: Integrated in panelboard, factory mounted power logic meter ION 7650 series by Square D or approved equal. Provide power meter for every distribution panelboard.
7. Surge Suppressers: Integrated in panelboard, factory mounted. Provide surge suppressor for every distribution panelboard.
8. Enclosure: NEMA PB 1, Type 1. Box shall be fabricated from code gauge galvanized sheet steel without pre-punched knockouts.
9. Front covers shall be hinged, fabricated from the same material as the panel trim and shall be door-in-door type. Each set of doors shall be provided with Yale 511S locks with #47 keys. Locks shall be provided as follows:
   a. For doors less than 30 inches – provide one lock at each door.
   b. For doors between 30 to 48 inches – provide two locks at each door.
   c. For doors greater than 48 inches – provide three locks at each door.
   d. Finishes: Manufacturer's standard gray enamel.

2.4 DISTRIBUTION PANELBOARDS – FUSIBLE SWITCH TYPE

A. Product Description: NEMA PB 1, fusible switch type panelboard.

B. Panelboard Bus: Tin/silver plated Copper current carrying components, ratings as indicated on Drawings. Furnish an isolated copper neutral bus in panelboards where a neutral bus is required.

C. Furnish copper ground bus in each panelboard. Ground bus shall be bare, un-insulated and suitably bolted to the cabinet. Provide suitable lugs for each feeder ground conductor and each outgoing feeder or branch circuit.

D. Minimum short circuit rating: As indicated on the drawings and as required to comply with short circuit study.

E. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed switch with externally operable handle. Furnish interlock to prevent opening front cover with switch in ON position. Handle lockable in “Off” position. Fuse clips: Designed to accommodate only NEMA FU 1, UL Class R fuses.

F. Switches shall be of the ampere ratings indicated on the drawings. All switches shall be 3-pole.

G. All interiors shall be completely factory assembled with switching and protective devices, connectors, etc. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units, without removing the main bus connectors, and shall be so designed that circuits may be changed without machining, drilling or tapping.

H. Enclosure: NEMA PB 1, Type 1.

I. Cabinet Front: Four piece bolt on trim without door. Finished in manufacturer's standard enamel.

2.5 BRANCH CIRCUIT PANELBOARDS

A. Description: NEMA PB1, circuit breaker type, fully rated, lighting and appliance branch circuit panelboard.

B. All interiors shall be completely factory assembled with switching and protective devices, connectors, etc. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units, without removing the main bus connectors, and shall be so designed that circuits may be changed without machining, drilling or tapping.

C. Short Circuit Rating:

1. For 208 volt panelboards - 22,000 amperes RMS symmetrical minimum.
2. As indicated on Drawings and as required to comply with short circuit study.
3. Branch circuit panelboards shall be fully rated.

D. Materials:

1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish an insulated copper neutral bus in each panelboard with a neutral.

2. Furnish copper ground bus in each panelboard. Furnish insulated ground bus as indicated on Drawings. Ground bus shall be bare, un-insulated and suitably bolted to the cabinet. Provide suitable lugs for each feeder ground conductor and each outgoing branch or feeder circuit.
3. Multiple cable lugs for incoming feeder cables shall be furnished where required. Lugs shall be secured to bus by stud bolts. Multiple section panels shall have sub-feed or feed-through lugs with full capacity taps to adjacent panel section.
4. Molded Case Circuit Breakers: UL 489, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits; Type HACR for air conditioning equipment circuits; Class A ground fault interrupter circuit breakers as indicated on Drawings. Provide UL Class 760 arc-fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
5. Enclosure: NEMA PB 1, Type.
6. Cabinet Box: 6 inches deep, 20 inches box shall be fabricated from code gauge galvanized sheet steel without pre-punched knockouts.
7. Trim shall be fabricated from code gauge sheet steel and shall cover circuit breakers.
8. Front covers shall be hinged, fabricated from the same material as the panel trim and shall be door-in-door type. Each set of doors shall be provided with Yale 511S locks with #47 keys. Locks shall be provided as follows:

    a. For doors less than 30 inches – provide one lock at each door.
    b. For doors between 30 to 48 inches – provide two locks at each door.
    c. For doors greater than 48 inches – provide three locks at each door.
    d. Finishes: Finish in manufacturer's standard gray enamel.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb.

C. Install recessed panelboards flush with wall finishes.

D. Height: 6-feet 6-inches to operating handle of highest circuit breaker. Install panelboards not less than 6-inches above the floor.

E. Install filler plates for unused spaces in panelboards.

F. Provide type circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads. Identify each circuit as to its clear, evident and specific purpose of use.

G. Install engraved plastic nameplates in accordance with Section 26 05 53.

H. Install three (3) 1" spare conduits out of each recessed panelboard to accessible location above ceiling. Identify each as SPARE.

I. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.3 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Closeout Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.

E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.4 ADJUSTING

A. Refer to DCAS General Conditions - Testing and Inspection.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi- wire branch circuits.

3.5 CLEANING

A. Refer to DCAS General Conditions - Closeout Requirements.

END OF SECTION 26 24 16

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SECTION 26 27 16 ELECTRICALCABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hinged cover enclosures.
2. Cabinets.
3. Terminal blocks.
4. Accessories.

B. Related Requirements
1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
3. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
4. Section 27 17 00 - Telecommunication Cabling System.
5. Section 27 50 00 – Security management and Access Alarm System.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. See General conditions for Submittal Procedures.
B. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.
C. Manufacturer's Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
D. Qualification Statements:
1. Submit fabricator experience qualifications.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. See General Conditions for requirements for maintenance materials.
B. Extra Stock Materials:
1. Furnish two (2) of each key.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five (5) years documented experience.

PART 2 - PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Manufacturers: Subject to the requirements of this specification, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   1. Hoffman Enclosures.
   2. Hammond Manufacturing.
   3. Hubbell-Weigmann
   4. Eaton/B-Line.
   5. Electrotech Service Equipment Corporation.
   6. Or Approved Equal.

B. Description: NEMA 250, Type 1 steel for dry areas, Type 3R for exterior areas or Type 4X stainless steel for wet or exterior areas, where specified.
   1. Covers: Continuous hinge, held closed by flush latch operable by screwdriver, key, or with handle with provisions for a padlock.
   2. Furnish interior metal panel for mounting terminal blocks and electrical components;finish with white enamel.
   3. Enclosure Finish: Manufacturer's standard enamel for Type 1; Manufacturer's standard finish for Type 3R, brushed stainless steel for Type 4X.

2.2 TERMINAL BLOCKS

A. Manufacturers: Subject to the requirements of this specification, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   1. Eaton
   2. General Electric.
   3. Schneider Electric/Square D.
   4. Rockwell Automation/Allen-Bradley.
   5. WAGO Corporation.
   6. Or Approved Equal.

B. Description:
   1. Terminal Blocks: NEMA ICS 4.
   2. All terminal blocks shall be finger safe construction.
   3. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
   4. Signal and Control Terminals: Modular construction type, suitable for DIN rail mounting, with tubular pressure screw connectors, rated 300 volts.
   5. Furnish ground bus terminal block, with each connector bonded to enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosures and boxes plumb. Anchor securely to wall or structural supports at each corner in accordance with Section 26 05 29 and as indicated on drawing details.

B. Install cabinet fronts plumb.

3.2 CLEANING

A. Refer to General Conditions Article 22 – Removal of Rubbish and Surplus Materials and Article 24 – Final Cleaning.

B. Clean existing cabinets and enclosures to remain or to be reinstalled.

C. Clean electrical parts to remove conductive and harmful materials.

D. Remove dirt and debris from enclosure.

E. Clean finishes and touch up damage.

END OF SECTION 262716

SECTION 26 27 26 WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Wall switches.
2. Receptacles.
3. Multi-outlet assembly.
4. Device plates and decorative box covers.

B. Related Sections:

1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.
2. Section 26 05 34 - Floor Boxes for Electrical Systems: Service fittings for receptacles installed on floor boxes.
3. Section 26 05 34 - Floor Boxes for Electrical Systems: Poke-through receptacles.

1.3 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

C. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color and finish.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

1.6 EXTRA MATERIALS

A. Refer to DCAS General Conditions - Closeout Requirements.-

B. Furnish two (2) of each style, size and finish wall plate.

PART 2 - PRODUCTS

2.1 UNIFORMITY OF MANUFACTURER

A. Products provided under this Section shall be from one manufacturer for identical catalog items (i.e., receptacles); wherever possible, provide uniformity of manufacturer for similar types of items.

B. Plugs shall be of same manufacturer and grade as receptacles.

C. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Wiring Devices, Cooper Controls (abbreviated Cooper)
2. Legrand
3. Hubbell
4. Leviton
5. Lutron
6. Pass & Seymour (abbreviated P & S)
7. Or approved equal.

2.2 WALL SWITCHES

A. General Requirements:

1. Heavy-duty, AC only general-use snap switch, quiet operation type.
2. Voltage: 120/277 volts, AC.
3. Current: 20 amperes.
4. Horsepower rating: 1 HP@120V; 2 HP@277V.
5. Body and Handle: Decora style, thermoplastic with a nylon toggle handle. Handle color shall be selected by the Commissioner from the manufacturer’s standard colors.
6. Switch shall be mounted on a plated steel yoke with a grounding screw.

B. Switch Types: Switch types and manufacturer's catalog numbers as follows:

	Manufacturer's Catalog Numbers			
Description	Cooper	Leviton	Hubbell	P&S
Single Pole	7621	5621-2	2121	2621
Double Pole	7622	5622-2	2122	2622
Three-Way	7623	5623-2	2123	2623
Four-Way	7624	5624-2	2124	2624

2.3 POWER RECEPTACLES

A. General Requirements:

1. Wide double blade contacts designed to maintain positive pressure against both sides of plug or cap having flat fingers. Contacts shall be solid brass.
2. Polarized grounding type with grounding contacts bonded to receptacle mounting strap or housing, except isolated ground receptacles. Mounting strap shall be plated steel.
3. Contacts separated by impact resisting molded plastic insulating material.
4. Receptacles shall be back and side wired, provide a green base ground screw terminal and a nylon face.
5. Locking devices, where specified, to "lock" cap in place with simple twisting motion.
6. Receptacles shall be Decora style.
7. Color shall be us follows:

    a. Wall and surface raceway mounted receptacles connected to normal power – as selected by Commissioner;
    b. All receptacles connected to emergency generator - red;
    c. Ceiling mounted receptacles connected to normal power – white.

B. General Receptacle Types: Rating in amperes, number of poles and wires, voltage, NEMA configuration, description and manufacturer's catalog numbers as follows:

			Manufacturer's Catalog Numbers			
Rating	NEMA	Description	Leviton	Cooper	Hubbell	P&S
20A, 2P, 3W, 125V	5-20R	Single	16341	6351		26361
		Duplex	16342	6352	HBL2162	26352
		Duplex Ground Fault	7899	VGF20	GF20L	2095

2.4 COVER PLATES

A. Concealed Work: Screw-less snap on thermoplactic, matching the wiring devices selected. Color shall be as selected by the Commissioner from the manufacturer’s standard colors. Number of gangs and configuration as required to fit the devices used, as manufactured by:

1. Cooper Wiring Devices, Inc.
2. Hubbell, Inc.

3. Leviton
4. Lutron
5. Pass & Seymour, Inc.
6. Or approved equal.

B. Exposed Work: Beveled metal, stainless steel 304.

C. Weatherproof Cover Plate: Gasketed thermoplastic with hinged gasketed device cover. Gaskets shall be provided between the box and the cover mounting surface and between the mounting surface and the hinged cover. Cover shall be capable of being closed with a plug inserted in the receptacle, and shall be UL listed as "Suitable for Wet Locations While in Use". Covers shall be TayMac, Eaton, Intermatic or approved equal.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Coordination.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.3 PREPARATION

A. Clean debris from outlet boxes.

3.4 INSTALLATION

A. Install devices plumb and level.

B. Install switches with “Off” position down.

C. Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on bottom.

F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

G. Install wall plates on flush mounted switches, receptacles, and blank outlets.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

J. Use jumbo size plates for outlets installed in masonry walls.

K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights and as indicated on drawings.

B. Install wall switch 48 inches above finished floor.

C. Install convenience receptacle 18 inches above finished floor.

D. Install convenience receptacle 6 inches above back splash of counter.

E. Install dimmer 48 inches above finished floor.

F. Coordinate installation of wiring devices with underfloor raceway service fittings provided under Section 26 05 39.

G. Coordinate installation of wiring devices with floor box service fittings provided under Section 26 05 34.

3.6 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Closeout Requirements.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

A. Refer to DCAS General Conditions - Testing and inspection.

B. Adjust devices and wall plates to be flush and level.

3.8 CLEANING

A. Refer to DCAS General Conditions - Closeout Requirements.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 26 27 26

SECTION 26 28 13 FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Fuses.

B. Related Sections:

1. Section 26 28 19 - Enclosed Switches.

1.3 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.

B. Underwriter's Laboratories, Inc.

1. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses.
2. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses.
3. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses.
4. UL 248-14 - Low-Voltage Fuses - Part 14: Supplemental Fuses.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Requirements.

B. Project Record Documents: Record actual sizes, ratings and locations of fuses.

1.6 MAINTENANCE MATERIALS

A. Refer to DCAS General Conditions - Closeout Requirements.

B. Extra Materials:

1. Furnish 10% but not less than six spare fuses of each Class, size and rating installed.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

PART 2 - PRODUCTS

2.1 FUSES - GENERAL

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries - Bussmann.
2. Ferraz-Shawmut.
3. Littelfuse.
4. Or approved equal.

B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

C. All fuses shall have an interrupting rating of 200,000 amperes RMS Symmetrical.

D. All fuses shall be UL Listed.

E. All fuses utilized on the project shall be products of one manufacturer.

F. Voltage: Rating suitable for circuit phase-to-phase voltage.

G. Substitution Limitations:

1. Refer to DCAS General Conditions - Product Requirements: Requirements for substitutions for other manufacturers and products.

2.2 CLASS RK1 (TIME DELAY) FUSES

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. Bussmann Type LPN-RK (250V) or Type LPS-RK (600V).
2. Ferraz-Shawmut A2D (250V) or A6D (600V).
3. Littelfuse Type LLN-RK (250V) or Type LLS-RK (600V).
4. Or approved equal

B. Description: Dual-Element, time-delay, current limiting, rejection type.

2.3 CLASS J (TIME DELAY) FUSES

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. Bussmann Type LPJ (600V).
2. Littelfuse Type JTD (600V).
3. Ferraz-Shawmut A4BQ (600V).
4. Or approved equal

B. Description: Dual element, time-delay fuse; current limiting.

2.4 CLASS L (TIME DELAY) FUSES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following

1. Bussmann Type KRP-C (600V).
2. Littelfuse Type KLP-C (600V).
3. Ferraz-Shawmut A4BQ (600V).
4. Or approved equal

B. Description: Time-delay (minimum 4 sec at 500% of rating), current limiting, machined end bells with O-ring inlays, silver plated terminals.

2.5 CLASS CC (TIME DELAY) FUSES

A. Manufacturers:

1. Bussmann Type LP-CC (600V).
2. Ferraz-Shawmut ATDR (600V).
3. Littelfuse Type KLDR (600V).
4. Or approved equal

B. Description: Time-delay fuse; rejection type.

2.6 SPARE FUSE CABINET

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bussmann.
2. Ferraz-Shawmut.
3. Littelfuse.
4. Or approved equal.

B. Product Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.

C. Doors: Hinged with hasp for The City Of New York's padlock.

D. Finish: Manufacturer's standard baked enamel finish.

E. Furnish two fuse pullers in each spare fuse cabinet.

2.7 FUSE PERFORMANCE REQUIREMENTS

A. Motor Load Feeder Switches: UL Class RK1 (time-delay).

B. General Purpose Branch Circuits: UL Class RK1 (time-delay).

C. Motor Branch Circuits: Class RK1 (time delay).

D. Lighting Branch Circuits: UL Class CC (time delay).

E. Motor Control Transformers: UL Class CC (time-delay).

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 INSTALLATION

A. Install fuse with label oriented so manufacturer, type, and size are easily read.

B. Promptly replace all fuses cleared during construction for whatever cause.

3.3 FUSE TYPE

A. The type of fuses required for each application, are given in the Specification Sections where equipment requiring fuses are specified.

B. If the fuse type is not identified, provide UL Class RK-1 fuses.

3.4 SPARE FUSE CABINET

A. Install spare fuse cabinet in the Electric Distribution Equipment Room or as directed.

END OF SECTION 26 28 13

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SECTION 26 28 19 ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Fusible.
2. Non-fusible switches.

B. Related Sections:

1. Section 26 05 29 - Hangers and Supports for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.
3. Section 26 28 13 - Fuses.

1.3 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. Underwriter's Laboratory, Inc.:

1. UL-98 - Enclosed and Dead-Front Switches.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Closeout Requirements.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation.
2. General Electric Company.
3. Schneider Electric/Square D – Basis of design
4. Siemens.
5. Or approved equal.

2.2 FUSIBLE SWITCH ASSEMBLIES

A. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter switch. Handle lockable in OFF position.

B. Fuse clips: Designed to accommodate only NEMA FU 1, Class R fuses.

C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard enamel unless otherwise noted.

1. Interior Dry Locations: NEMA Type 1.
2. Exterior Locations: NEMA Type 3R.

D. Provide auxiliary contact in each switch for connection to variable speed drive control circuit.

E. Switches shall be furnished with copper isolated neutral bus and copper ground bus in each switch.

F. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Provide neutral bonding provisions for service entrance rated switches.

G. Furnish switches with entirely copper current carrying parts.

2.3 NON-FUSIBLE SWITCH ASSEMBLIES

A. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter switch. Handle lockable in OFF position.

B. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard enamel unless otherwise noted.

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

C. Switches shall be furnished with copper isolated neutral bus and copper ground bus in each switch.

D. Provide auxiliary contact in each switch for connection to variable speed drive control circuit.

E. Furnish switches with entirely copper current carrying parts.

2.4 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating:

1. UL Class RK-1 fuses - 200,000 RMS symmetrical amperes.
2. UL Class J fuses - 200,000 RMS symmetrical amperes.
3. UL Class L fuses - 200,000 RMS symmetrical amperes.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 PREPARATION

A. Maintain access to existing enclosed switches and other installations remaining active and requiring access.

3.3 INSTALLATION

A. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.

B. Height: 5 feet to operating handle.

C. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

D. Connect auxiliary contact to control circuit of variable speed drive to turn off drive when switch is opened.

E. Install engraved plastic nameplates in accordance with Section 26 05 53.

F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4 – Division of Responsibility.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1 – Switches, Air, Low-Voltage.

3.5 CLEANING

A. Refer to DCAS General Conditions - Closeout Requirements.

B. Clean existing enclosed switches to remain.

END OF SECTION 26 28 19

SECTION 26 28 23 ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section includes:

1. Molded-case and insulated-case circuit breakers in individual enclosures.

1.3 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit catalog sheets showing ratings, trip units, time current curves, dimensions and enclosure details.

1.5 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Closeout Requirements.

B. Project Record Documents: Record actual locations and continuous current ratings of enclosed circuit breakers.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

1.7 EXTRA MATERIALS

A. Refer to DCAS General Conditions - Closeout Requirements.

B. Furnish three (3) of each size and type of current limiter.

PART 2 - PRODUCTS

2.1 MOLDED CASE CIRCUIT BREAKER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corporation.
2. General Electric Company.
3. Schneider Electric/Square D – Basis of design.
4. Siemens.
5. Or approved equal.

B. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1.

C. Service Conditions:

1. Temperature: 40 degrees F

D. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 225 amperes and larger have mechanism for adjusting long time, short time setting for automatic operation. Range of Adjustment: seconds.

E. Field-Changeable Ampere Rating Circuit Breaker: Circuit breakers with frame sizes 225 amperes and larger have changeable trip units.

F. Current Limiting Circuit Breaker: Circuit breaker indicated as current-limiting have automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.

G. Solid-State Circuit Breaker: Electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip with integral ground fault sensing; instantaneous trip; and adjustable short time trip.

H. Current Limiter: Designed for application with molded case circuit breaker.

1. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.
2. Interlocks trip circuit breaker and prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiter is not in place or has operated.

I. Enclosure: NEMA AB 1, to meet conditions. Fabricate enclosure from [steel finished with manufacturer's standard gray enamel.

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.
3. Industrial Locations: Type 4.

J. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 26 05 29.

B. Height: 5 feet to operating handle.

C. Locate and install engraved plastic nameplates in accordance with Section 26 05 53.

3.2 FIELD QUALITY CONTROL

A. Refer to DCAS General Conditions - Closeout Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1.

3.3 ADJUSTING

A. Refer to DCAS General Conditions: Testing and adjusting.

B. Adjust trip settings to coordinate circuit breakers with other overcurrent protective devices in circuit.

C. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

END OF SECTION 26 28 23

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SECTION 27 17 00 TELECOMMUNICATION CABLING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Should any discrepancy become apparent between the General Conditions and conditions required by this specification, the contractor shall notify the Commissioner in writing, and Commissioner shall interpret and decide such matters in accordance with the provisions of the General Conditions.

B. Comply with all applicable governmental regulations and with all federal, state, city, and other applicable codes and ordinances.

C. Provide all items and work indicated on the drawings and in the specification necessary to provide a complete cabling system.

D. It is the intent of the drawings and specifications to provide a complete workable communications cabling system ready for the City of New York's use. Any item not specifically shown on the drawings or called for in the specifications, but normally required to conform to the intent, are to be considered a part of the contract.

1.3 TERMS AND ABBREVIATIONS

1.	NEC	National Electrical Code
2.	ANSI	American National Standards Institute
3.	NFPA	National Fire Protection Association
4.	IEEE	Institute of Electrical and Electronics Engineers
5.	NEMA	National Electrical Manufacturers Association
6.	UL	Underwriters' Laboratories
7.	ASTM	American Society of Testing Materials
8.	EIA	Electronic Industries Association
9.	FCC	Federal Communications Commission
10.	TIA	Telecommunication Industry Association
11.	TR	Telecommunications (IT/IDF) Room
12.	TSER	Telecommunications Service Entrance Room
13.	MDF	Main Distribution Room

1.4 DEFINITIONS

A. Utilize the following definitions within the drawings and specifications:

1. "Provide" or "furnish" means to supply, purchase, transport, place, erect, install, connect, test warranty and turn over to the City of New York, complete and ready for regular operation, the work referred to.
2. "Supply" means to purchase, procure, acquire and deliver complete with related accessories.
3. "Install" means to move from property line; set in place, join, unit fasten, link attach, set up or otherwise connect together before testing, and turning over to the City of New York or equipment and/or components. Installation is to be complete and ready for regular operation.
4. "Wiring" or "cabling" includes the furnishing of all fittings, conductors, grounding accessories, tape, splices and all other items for such work.
5. "Conduit", "cable tray", and "cable supports" include the furnishing of all fittings, hangers, supports, sleeves, bonding, etc.
6. "As directed" means as directed by the City of New York or Commissioner.
7. "Concealed" means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed within hung ceilings.
8. "Exposed" means not installed underground or "concealed" as defined above.
9. "Telecom Room" means IDF, TSER, MDF/Server rooms.

1.5 WORK INCLUDED

A. The work covered by this specification includes the construction described, including all labor necessary to perform and complete such construction; all materials and equipment incorporated or to be incorporated in such construction; all services, facilities, tools and equipment necessary or used to perform and complete such construction.

B. Provide the following:
1. Provide a complete telecommunications cabling infrastructure.
2. Labeling and documentation of all cables, outlets and hardware installed under this contract.
3. All horizontal telecommunications cabling between individual work area outlet locations and the associated telecommunication room (TR).
4. All fiber and copper backbone telecommunications cabling between TRs and MDF/Server room. All cable trays within Telecom spaces as well as the associated cable support hangers including all necessary mounting and installation hardware,
5. All necessary equipment cabinets, racks, wiring enclosures, cable supports and pathways hardware (including J-hooks), except for those already provided for in other building contracts such as the cable tray within the corridors.
6. Patching into network switches from the horizontal patch panels.
7. Testing and test documentation for all cabling.
8. Preparation and submission of shop drawings, as-built drawings and cable documentation.
9. Fire-stopping of all rated wall and floor penetrations in the TR as well as all openings created by or utilized by the contractor through rated walls and floors.
10. All connections to the telecommunications grounding system provided under the electrical specifications.
11. Provision of manufactures extended warranty.

1.6 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

B. Conduit.

C. Cable tray not in the MDF/Telecom/IT Rooms.

D. Power.

1.7 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Subcontractors:

1. The bidder shall submit proof of their Certified Installer status as part of the submittal process and provide a twenty-five (25) year Extended Product Warranty program for the Copper Cabling and Fiber Cabling Systems.
2. Contractor must be able to provide an onsite project manager who has demonstrated the ability to supervise a project of this magnitude and who shall attend project meetings while the work is in progress.
3. The successful bidder shall submit in writing a list of qualified technicians assigned to this project, including relevant manufacturers training programs completed by each, and years of related experience of each.
4. The successful bidder shall maintain an office or competent technical presence with appropriate testing equipment and replacement parts within 2 hours drive time from this project.

C. Product Data:

1. Submit manufacturer’s product data sheets for all materials and equipment proposed for use on the project. Material and equipment requiring shop drawing submittals shall include, but not be limited to the following telecommunication components:
2. Faceplates:
   a. Data modular inserts (Category 6)
   b. Data & Voice horizontal cable (Category 6)
   c. Data & Voice patch panels/termination blocks (Category 6)
   d. Voice Backbone cable
   e. Fiber optic building backbone cable
   f. Fiber optic connector closet housings
   g. Fiber optic connectors
   h. Equipment racks
   i. Work shall not proceed without the approval of the submitted items.
   j. Submit manufacturer's product data sheets for all fire stopping materials proposed for use on the project.
   k. Mark each product data sheet to show applicable choices and options. Where product data includes information on several products, some of which are not required, mark to indicate the applicable information.

D. Shop Drawings:

1. Submit shop drawings ten (10) business days prior to required approval.
2. Drawings shall show evidence of coordination with other trades.
3. Any work performed without prior approval shall be subject to changes without charge or penalty to the City of New York if found unacceptable by the Commissioner.

E. Test Reports:

1. Prior to testing, submit for review and approval copies of test report forms proposed for use.
2. Each test report form shall contain the following general information: date of preparation, date of test, project name, contractor(s) name(s), media type, make, model and serial number of test equipment used, dated of last calibration and names of test crew. Refer to the Test Result Section of this specification for further details.

F. As-Built Documents:

1. Keep an accurate record of all deviations between the work as shown on the document drawings and that actually installed. Provide record of these deviations to the City of New York as a set of as-built documents.
2. The as-built drawing set shall consist of one (1) set of reproducible and one (1) set of electronic drawing files in accordance with the contract documents.

1.8 MATERIALS HANDLING

A. All products and materials are to be new, manufactured within six (6) months of delivery to the site, clean free of defects and free of damage and corrosion.

B. Contractor shall assume all risk of loss until final acceptance by the City of New York.

C. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in an indoor locations protected from vandalism and weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location prior to installation. If necessary, cable shall be stored off site at the contractor's expense.

1.9 ORGANIZATION OF WORK

A. The work called for under contract shall be carried on simultaneously with the work of other trades in a manner so as not to delay the overall progress of the work. Promptly furnish all information and measurements relating to the work as required to other trades involved at the project. Cooperate with them in order to secure the harmony necessary in the interest of the project as a whole.

B. Provide all work necessary to meet all construction schedules.

C. All work shall remain accessible so as to permit the City of New York observation of the work during the course of construction.

1.10 COORDINATION OF THE WORK

A. Carefully check space requirements with other trades and the physical confines of the area of work to ensure that all material can be installed in the allotted spaces including finished suspended ceilings. Make modifications as required and approved.

B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.

C. Coordinate all work with other trades and work under the direction of the General Contractor. Transmit to other trades in a timely manner all information required for work to be provided under their respective sections in ample time for installation.

D. Attend all construction meetings, at the project site or other locations, as requested by the City of New York or General Contractor.

E. Prior to actual installation, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper compliance with the design intent.

F. The cabling contractor is responsible for communicating all conduit requirements, core drilling requirements, and pathway requirements and block-out requirements the general contractor at the time of bid submission.

1.11 CODES, REGULATIONS AND STANDARDS

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.

B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

C. All modular jacks, patch cords, and patch cords performance shall be verified (not just tested) by a third party to be category 6 component and channel compliant.

D. The cabling system described in this project is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:

1. ANSI/TIA-568-C.0-2009, Generic Telecommunications Cabling for Customer Premises, March, 2009
2. ANSI/TIA-568-C.I-2009, Commercial Building Telecommunications Cabling Standard, March, 2009
3. ANSI/TIA-568-C.2-2009, Balanced Twisted-Pair Telecommunications Cabling and Components Standards, August, 2009
4. ANSI/TIA-568-C.3-2008, Optical Fiber Cabling Components Standard, June, 2008
5. ANSI/TIA-1152-2009, Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling, September, 2009

6. ANSI/TIA/EIA-526-7-1998, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, August 1998
7. ANSI/TIA-526-14-B-2010, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 edition 2, Fiber-Optic Communications Subsystem Test Procedure- Part 4-1: Installed cable plant- Multimode attenuation measurement, August 2010
8. ANSI/TIA-569-B-2004, Commercial Building Standard for Telecommunications Pathways and Spaces, October, 2004
9. ANSI/TIA-570-B-2004, Residential Telecommunications Infrastructure Standard, April, 2004
10. ANSI/TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure, May, 2002
11. J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements For Telecommunications, October, 2002
12. ANSI/TIA-758-A, Customer-owned Outside Plant Telecommunications Infrastructure Standard, August 2004
13. National Fire Protection Agency (NFPA-70), National Electrical Code (NEC)

E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

1.12 FEES AND PERMITS

A. Pay all local fees and obtain all permits and services of inspection authorities. Be present to coordinate inspections with inspection authorities. Cooperate fully with local utility companies with respect to their services.

1.13 WARRANTY

A. Submit a single warranty from the Fiber and Copper Cabling manufacture stating that all portions of the work are in accordance with contract requirements. Fiber and copper shall have separate warranties.

B. The Application Assurance Warranty shall cover the failure of the cabling system to support the applications that are designed for the link/channel specifications of the applicable standards. These applications include, but are not limited to, l0BASE-T, l00BASE-T, l000BASE-T and 155 Mb/s ATM.

C. Correct any deficiencies to the City of New York’s satisfaction, during the warranty period within 24 hours after notification by the City of New York, at no additional cost. Obtain similar warranty from the sub-contractors, manufacturers, suppliers and sub-trade specialists.

1.14 ACCEPTANCE

A. The cabling installer shall deliver the cabling system warranty (e.g., copper and fiber) to the City of New York, from the cabling system manufacturer, before the City of New York will extend to the cabling installer, the City of New York's acceptance of the work performed.

B. Once the testing has been completed, and all as-built and testing documentation has been delivered to the City of New York, and the City of New York is satisfied that all work is in accordance with the contract documents, and to the complete satisfaction of the cabling system manufacturer, the City of New York shall notify the contractor in writing of the acceptance of the work performed. The date of this acceptance shall constitute the start date of the warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: The following specific components represent the standards which the client has adopted. Provide cable and equipment from the following manufacturers:

1. 4-Pair Cable
   a. Commscope
   b. General
   c. Siemon
   d. Approved equal

2. Optical Fiber Cable and Connectors
   a. Commscope
   b. Panduit
   c. Siemon
   d. Approved equal

3. Patch Cables
   a. Commscope
   b. Panduit
   c. Siemon
   d. Approved equal

4. Termination Blocks
   a. Commscope
   b. Panduit
   c. Siemon
   d. Approved equal

5. UTP Modular Connectors/Outlets/Patch Panels
   a. Commscope
   b. Panduit
   c. Siemon
   d. Approved equal

6. Optical Fiber Patch Panels

a. Commscope
b. Panduit
c. Siemon
d. Approved equal

7. Wire Management Hardware
   a. Chatsworth
   b. Commscope
   c. Siemon
   d. Great Lakes
   e. Approved equal

8. Equipment Racks/Cabinets
   a. Chatsworth
   b. Siemon
   c. Great Lakes
   d. Approved equal

9. Cable Tray/Ladder Rack
   a. Chatsworth (Ladder Type)
   b. Hubbell
   c. B-line
   d. Approved equal

10. Labels
    a. Brady USA Inc.
    b. Panduit Corporation
    c. Approved equal

2.2 PART NUMBERS

A. Part numbers provided in this Specification have been coordinated with the manufacturer's latest available product literature. Part numbers are subject to change without notice by the manufacturers. Where a specific part number is invalid, provide product meeting component description.

2.3 MATERIALS

A. Where specific items are called out in the specification or indicated on the drawings or a specific application, use those products or materials, or approved substitutes. Where no specific call outs are made use premium products and materials.

2.4 CABLE MEDIA

1. Physical Specifications: 4pr twisted pair - 23 AWG, solid copper conductors, 100 ohms nominal impedance +/-15%.
2. Electrical characteristics: Superior to the individual characteristics established in the ANSI/TIA-568-C.2 standards for Category 6 cable performance specifications.

3. Cable Construction: insulated conductors under a common plenum rated sheath. Gray in color.
   a. Manufacturer: Commscope
      1) Type: CS37P (gray)
      2) Approved equal

B. Multi-Mode Optical Fiber Cable

1. Physical Specifications: 12-Strand Multimode 50 micron/125 micron, armored.
2. Performance Characteristics: OM4 Fiber. Fiber attenuation shall not exceed 3.0dB/km @850nm wavelength or 1.0dB/km @1300nm. Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of 1000m/600m for 850nm and 1300nm respectively. Optical fiber shall guarantee a 10 Gigabit Ethernet distance of 550m at 850nm.
3. Cable Construction: Tight buffered, individually insulated conductors, reinforced with a fiber type strength member under a common plenum rated sheath, with no metallic components.
   a. Manufacturer: Commscope
      1) Type: Lazrspeed 550 type 5K 50/125 micron fiber
      2) Approved equal

C. 8-Pin Modular Patch Cables

1. Physical Specifications: 4 twisted pair - 23 AWG, stranded copper conductors, 100 ohms nominal impedance +/-15%, with 8-pin modular plugs.
2. Electrical characteristics: Equal to or better than individual characteristics established in ANSI/TIA-568-C.2 for category 6 cable performance specifications.
3. Cable Construction: 4-pair cables, individually insulated conductors under a with 8-pin modular plug at each end.
   a. Manufacturer: COMMSCOPE
      1) Type: CPCSSX2-04FXXX (XXX for Length)
      2) Approved equal

D. Multi-Mode Duplex Optical Fiber Patch Cables

1. Physical Specifications: Multi-mode 50micron/125 micron.
2. Performance Characteristics: Fiber cable attenuation shall not exceed 3.4dB/km @850nm wavelength or 1.0dB/km @1300nm. The terminated connectors shall exhibit a maximum insertion loss of 0.75dB when tested at either 850nm or 1300nm wavelengths.
3. Cable Construction: Duplex cables under a common aqua jacket, terminated with LC to LC connectors at each end. The cords shall be factory assembled, 100% tested for transmission and continuity.
   a. Manufacturer: COMMSCOPE
      1) Type: FEXLCLC42-MXFXXX (XXX=length)
      2) Approved equal

2.5 TERMINATION HARDWARE

A. Termination Blocks

1. Rack mount 8-pin modular patch panel. Complies with ANSI/TIA-568-C.2 Category 6 performance specifications. Patch Panels shall be High Density 48 port and shall fit onto 19" type equipment racks.
   a. Manufacturer: COMMSCOPE
      1) Type: M4800-1U-GS plus (48) MGS600-003(black)
      2) Approved equal

B. Optical Fiber Patch Panel

1. 19-inch rack mounted patch panel with hinged front door, with slide out shelf, mounting guides and designation panels. Populate panels complete with coupler panels and LC couplers required for a complete installation.
   a. Manufacturer: COMMSCOPE
      1) Type: HD-2U-SP
      2) HD-1U-SP (for all other cabinets and racks)
      3) 360DPis-24LC-LS (24 fiber LC/LC adapter plate)
      4) Approved equal

C. Modular Connectors/Outlets

1. 8-pin modular outlet, non-keyed. Complies with ANSI/TIA-568-C.2 Category 6, performance specifications. Outlet wired with standards compliant T568B pinning. Provide different color jacks blue, orange, green brown for the workstation cabling
   a. Manufacturer: COMMSCOPE
      1) Type: MGS400-XX (XX=color) (for wall outlets)
      2) MGS400-XX (keystone style for poke-thrus)
      3) Approved equal

2. Wall mounted 8-conductor outlet and faceplate, mounted over a standard electrical j-box. Stainless steel faceplate with two mounting studs to support wall mounted type telephones. Complies with ANSI/TIA-568-C.2 Category 6, performance specifications.
   a. Manufacturer: COMMSCOPE
      1) Type: M10LW4SP WITH MGS600-XXX(XXX=COLOR)
      2) Approved equal

D. Outlet Faceplate/Mounting Plate
1. Outlet faceplate suitable to be installed in a standard NEMA electrical junction box, capable of mounting a minimum of four approved 8-pin modular outlets complete with "106" mounting frame (for poke-throughs and/or floor boxes). Provide blanks and colored icons as required.
   a. Manufacturer: COMMSCOPE
      1) Type: M12L
         a) Modular Furniture Bezels – M4CA-XXX(XXX=color)
         b) Furniture Mounted Outlet Box – M204ASMB-262
         c) Approved equal

E. Optical Fiber Connectors

1. Multi-mode OM4 LC connectors, non-optical disconnect, Factory Polished, suitable for use with specified and supplied optical fiber cables. .2db loss.
   a. Manufacturer: COMMSCOPE
      1) Type: MFC-LCF-09-5X
      2) Approved equal

2.6 EQUIPMENT RACKING

A. Equipment Racks/Cabinets with vertical cable management

1. 19-inch double-sided wire-management 2-post equipment rack, 84-inch high, with vertical wire management panels attached to each side of the racks and shall have a 23.75" OD width with standard EIA spacing. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.
   a. Manufacturer: Siemon
      1) Type: Refer to drawings for part numbers of rack/cabinets and wire management panels.

B. Wire Management Hardware
1. Wall mounted, lightweight, self-extinguishing molded, polycarbonate, split front, distribution (D) rings.
   a. Manufacturer: Chatsworth
      1) Part Number: D-rings
2. Rack mounted, patch cord wire management panel using #10-32 screws.
   a. Manufacturer: Chatsworth
      1) Type: 2U Horizontal Wire Management Panel with Cover.
3. Cable support split mesh grip, with double support eyes, suitable for support of vertically installed backbone cables.
   a. Manufacturer: COMMSCOPE
      1) Part Number: HTK-19-SS-2U

C. Cable Tray (Telecom Room only)
1. Open rung ladder type cable tray with runway radius drop outs, 8-inch cable retaining post and end cap, complete with heavy duty butt-splice hardware, junction splice hardware, end feet hardware, protective end caps and 5/8-inch ceiling support hardware. Constructed of steel tubing with 12-inch rung spacing.
   a. Manufacturer: Chatsworth Products Inc.
      1) Type:
         a) 10250-724 (24-inch ladder rack)
         b) 10506-706 (elevation kit)
         c) 10596-712 (runway mounting plate)
         d) 10595-712 (cable retaining posts)
         e) 12100-712 (runway radius drops)

D. Labels

1. Pre-printed or machine printed, self-adhesive smudge resistant labels for cables and face-plates. Labels shall be appropriately sized for cable diameter. Labels shall be appropriately colored for faceplate contrast.
   a. Manufacturer: Brady Labeling System
      1) Type: Contractors option meeting specification. Or
         Approved Equivalent
         Submit sample labels for approval.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 GENERAL

A. Installation: Follow manufacturers' instructions for installing, connecting, and adjusting all equipment and communications cabling. Where no instructions are included or available, follow industry standards.

B. Examine and compare the communications cabling drawings and specifications with the drawings and specifications of other trades; report any discrepancies between them to the Commissioner, and obtain from him written instructions for changes necessary in the work. The most stringent requirements shall be included in the bid.

C. The contractor shall assume responsibility for the protection of any finished work during installation of the cabling system set forth in this specification and its associated plans and documents, and remedy any such injury or damages as required.

D. Exercise particular caution with reference to the location of patch panels, termination blocks, outlets, etc. Have precise and definite locations of all outlets accepted by the Commissioner before proceeding with the installation.

E. Keep all items protected before and after installation, with dust and moisture proof barrier materials. It shall be the contractor's responsibility to ensure the integrity of these protective measures throughout the life of the project.

F. Clean up all debris generated by installation activities. Transport all debris to a pickup location designated by the General Contractor or Commissioner. Ensure that safe ingress and egress from all work sites is maintained during movement and installation of materials.

G. Maintain a current copy of this bid specification at the job site at all times.

3.3 CABLE DISTRIBUTION

A. Follow room boundaries when pulling cables through ceilings for distribution into walls, conduits, wiring channels, outlets, etc.

B. Horizontal distribution cables shall be bundled in groups of no more than 50 cables.

C. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

D. Where a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch intervals. At no point bottom cables within the bundle and degrade cable performance.

E. J-hooks shall be furnished and installed under this contract shall use saddle type J –hooks.

F. J-hooks shall be dedicated for data/voice communications cabling only.

G. Cables shall not be attached to the ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

H. At no time shall plastic ty-wraps be utilized.

3.4 EMI/RFI AVOIDANCE

A. To avoid electromagnetic interference (EMI), Co-installation of telecommunications cable and power cable is governed by applicable electrical code for safety. For minimum separation requirements of electrically conductive telecommunications cable from typical branch circuits (120/240 V, 20 A), Article 800.52 of ANSI/NFPA 70 shall be applied, for example:

1. separation from power conductors;
2. separation and barriers within raceways; and
3. separation within outlet boxes or compartments.

B. Telecommunication cables which must cross electrical cables/conduits shall do so only at 90° angles.

3.5 STAFFING

A. Keep a qualified foreman in charge of the work at all times. The foreman shall be present in the field at all times during the performance of the work. Such foreman shall be replaced if unsatisfactory to the Commissioner.

B. Use only skilled, experienced and reliable work force. Discontinue the services of anyone employed on this project upon written request of the City of New York or Commissioner.

C. Craft personnel shall be qualified with 30% approved Certified installers (at minimum) to perform the work activities and be knowledgeable of the following:

1. Color coding of American Standard Telephone cables.
2. Bonding and grounding of communication wiring, pathways and equipment.
3. Testing conductors for electrical continuity.
4. Testing conductor insulation.
5. Installation, termination, connectorization, and testing of unshielded twisted pair cable, connectors, and terminal blocks.
6. Other testing, as set forth in this specification.

D. Craft personnel shall be required to provide and use the proper tools in the performance of each activity. The tools must be in good working order. The Commissioner reserves the right to review the tools and tool maintenance procedures of the contractor and require replacements to be obtained.

E. Telephone and data industry cable installation standards, EIA/TIA standards, and manufacturer's instructions shall be used for in-process quality control and final acceptance of the work installation.

3.6 INSTALLATION

A. Equipment Racks/Cabinets

1. Provide 19-inch wide, 4-post 84-inch high equipment racks in the Telecom room as shown on the Telecommunications Room Details Drawings. Racks are to be used for the mounting of UTP workstation termination blocks, optical fiber backbone cable patch panels and City of New York provided equipment.
2. Provide vertical management channels between racks. Utilize rear rings for routing of horizontal cabling.
3. Provide cable runway radius drop cross member or stringer with 3 – 1 1/2" cable spools installed for each Global Vertical Cable Manager and cable drop locations (cross member product # 12100-712).
4. Ground each rack and cable tray section to the telecom grounding busbar located within the room.

B. Termination Blocks

1. Provide 24/48-Port 8-pin angled modular patch panels in the Telecom room for the termination of all UTP 4-pair Category-6 workstation cables in the Telecommunications Room. Mount the termination panels on the equipment racks as shown on the Drawings. All blocks to be provided complete with designation strips. Provide patch panels in quantities as required for a complete installation.
2. Provide wire management panels in the Telecom rooms. Mount the panels onto the equipment racks alternating between termination blocks and/or patch panels as shown on the Detail Drawings. Provide wire management panels in quantities as required for a complete installation.
3. Provide rack-mounted optical fiber patch panels in the MDF and each IDF room for the termination of optical fiber backbone cables. Mount the patch panels onto 19" equipment racks/cabinets. Provide patch panels complete with coupler panels, couplers and cable designation strips. Provide fiber panels in quantities as required for a complete installation.
4. Provide mounting brackets to support the patch panels in the cabinets.

C. Cable Media

1. Install workstation and backbone cables in accordance with these Specifications, the Cable Termination Schedules, the manufacturer's recommendations, and the Telecommunications Distribution Plan Drawings.

2. All cabling outside the telecom room shall be installed in J-hooks or conduit for the main runs as shown on the drawings, branches within rooms to the final stub-up locations are to be supported via j-hooks.
3. After dressing the cable to its final location the sheath shall be removed to a point that allows the conductor to be splayed and terminated in a neat and uniform fashion. Every effort will be made to maintain sheath integrity by removing only as much sheath as is practical, to accomplish termination. For UTP cables, maintain the manufacturers twisting of the wire pairs through to the point of termination.
4. There shall be no splices or mechanical couplers installed between the cable points of origin and termination for the intra-building cable.
5. When routing cables in the Telecom rooms, cables are to transition from the conduit sleeves to the cable tray within the room via vertical ladder rack. When cables enter racks from the horizontal cable tray mounted above, they are to be run in an approved “waterfall” bracket that attaches to the ladder rack. Do not use plastic tie-wraps. If tie- wraps are to be used, provide Velcro-type, and ensure that the tie-wraps can be able to be twisted around the cable bundle with no stress.

6. 4-Pair Cables
   a. Provide 4-pair Category 6 cable from the telecommunications outlet location shown on the IT Distribution plan Drawings in quantities shown on the telecommunications drawings, to the respective serving IT/Telecom Rooms. Terminate all cables onto 8-pin modular connectors at the outlet location and onto rack-mounted modular patch panel for all Category 6 cables in the IT Closets as shown on the IT Closets Detail.
   b. Provide Category 6 cables from the IDF to the MDF. Terminate all cables on 24-port Category 6 patch panels at both ends.
   c. Provide an allowance for (5) 4-Pair Category 6 cables to support Wireless Local Area Network Access points in addition to what is shown on the drawings. Terminate all cables on 8-pin connectors at the Access Point and on Modular Patch Panels in the IDF/IT Closets. Exact location of Wireless Access Points shall be determined during the RF survey. Allow 200’ run from the IDF/ IT Closet to the Access Point. The wireless data jack shall:
      1) Hold one (1) modular jack.
      2) Utilize a single gang box.
      3) Be located a minimum of six (6) inches above ceilings and mounted to the nearest wall in relation to supplied drawings depicting wireless access point locations.
      4) Be located exactly as directed in areas without ceilings.

7. Optical Fiber OFNP Fiber Cables:
   a. Provide 50-Micron multi-mode fiber cable from the IDF room to the Computer room as shown as shown on IT/Telecom drawings. Terminate all cables with the appropriate fiber connectors and mount in optical fiber patch panels.

D. Connectors:

1. Dry Wall, Wall Mounted/Furniture Mounted Telecommunications Outlet:
   a. Provide Category 6 style 8-pin modular connectors for all Category 6 cables installed under this work. Provide an accompanying faceplate and/or furniture mounting plate at the appropriate outlet location as shown on the IT Distribution

plan Drawings. Install faceplates level and align to adjacent outlet faceplates. Coordinate the color of the connectors with the corresponding cable, and be consistent throughout. Coordinate the color of the wall plate with the Commissioner.

2. Fiber Connectors:
   a. Provide LC connectors for Multi-Mode optical fiber cabling.

E. Ladder Rack Cable Tray:

1. Provide ladder type cable tray (provided under this scope of work) in the IDF and Computer rooms to support cabling entering the rooms. Mount cable trays overhead as described on the Drawings. Coordinate with mechanical and electrical trades. Follow manufacturer installation instructions. Provide heavy-duty butt-splice-kits where cable tray lengths require the joining of two sections. Provide threaded-rod-ceiling-kits, spaced 5-feet on center, and/or end-foot-kits to support the cable tray overhead. Provide extension horns/retaining post for the ladder type tray, spaced at every other rung two feet. Ground each cable tray section to the next where butt splice kits are required. Ground each cable tray to the nearest grounding bus bar located with the respective room. Coordinate exact dimensions to be determined during the shop drawing process.
2. Ladder rack shall be attached to all data racks installed in the TR's using Chatsworth cable runway elevation kit up to 15cm high black (product # 10506-706) and Chatsworth cable runway mounting plate (product # 10595-712.)
3. Provide ladder type cable tray vertically on the main wall, in the Telecom room, which cables "waterfall down". Use cable tray to support cables between wall mounted termination blocks and the ceiling and from the ceiling to the horizontal cable tray. When supporting cables on the wall use VELCRO tie wraps only.

F. Patching/Patch Cords:

1. The contractor shall furnish and install all patching for horizontal Category 6 cabling into the City of New York provided network switch. Patching shall be installed in a neat and organized manner going from the patch panel port to the network switch port top to bottom not utilizing the vertical wire or horizontal wire management panels.
2. Furnish and Install under the Commissioner's supervision two (2) Category 6 patch cords per each Category 6 cable installed in the following lengths:
   a. 25% 3-foot, 50% 6-foot and 25% 12-foot 4pr Category 6RJ45 to RJ45 blue patch cords. Exact color and length to be determined by DCAS +/- 1-2 feet. Confirm lengths of patch cords as well as patching scheme with City of New York prior to patching.
   b. Furnish and Install (12) LC to LC multi-mode fiber optic patch cords 25% 4-foot, 50% 8-foot and 25% 15-foot.

G. Cut-Over Support

1. Provide (40) hours of cutover support with manpower familiar with the project to assist DCAS with mounting active equipment, patching etc.

3.7 GROUNDING

A. In addition to the normal electrical ground system, a Telecommunications Main Ground Busbar (TMGB) and a Telecommunications Ground Busbar (TGB) system are required per ANSI/TIA-STD-J-607-A. These grounding systems shall be installed to support the telecommunication infrastructure only.

B. A TMGB shall be located in the Computer Room. The TMGB is to be bonded to the Main Building Grounding System and to building steel or ground rod by conventional welds, exothermic welds clamp-and-braze method, or UL approved compression type connectors where practical. TMGB shall be bonded to both building steel and ground rod if Main Building Grounding System does not have a sufficient ground rod. The connection between the TMGB and the bonding point shall be 6 AWG copper ground wire, or larger as required. Exothermic welds are the preferred method.

C. In the IDF room, a TGB shall be installed. The TGB shall be bonded to the electrical panel serving the rooms where the TGB is installed, bonded to building steel, and bonded in series to the main TMGB.

D. All TMGB and TGB's shall be labeled in accordance with TIA/EIA 606-A.

E. Communications bonding relies on short direct paths that have minimum resistive and inductive impedance:

F. Bonding conductors shall be routed with minimum bends or changes in direction.

G. Bonding connectors shall be made directly to the points being bonded, avoiding unnecessary connections or splices.

H. All ground attachments shall be properly tagged and labeled in accordance with TIA/EIA-606-A. Do Not Disconnect tags shall be attached to each ground attachment.

3.8 FIRESTOP

A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, ladder racks, etc. entering or residing in the TR's shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape.

3.9 CABLE TESTING

A. Pre-Installation Testing:

1. Visually inspect all cables, cable reels and shipping cartons to detect any damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
2. When post-manufacture test data has been provided by the manufacturer on the reel or shipping carton, submit copies to the Commissioner prior to installing the cables.
3. Mark reels as tested/inspected and submit associated test results to Commissioner.
4. Coordinate cable terminations, hardware, and testing with the Telecommunications project management team and their contractors.

B. Post-Installation Testing:

1. Conduct cable testing as described below upon completion of installation. Fully test completed systems. Partial or statistically sampled testing is not acceptable.
2. For 4-pair UTP cabling, in addition to the end-to-end test for continuity, ground fault proper cross connection, shorts and crossed pairs for each cable pair/conductor, test for length, capacitance, attenuation, noise, resistance, and next with injected standard signals. Utilize automated test equipment (see below) for all 4-pair UTP cable testing to allow for single-pass testing of all measured auto-test parameters. Test all horizontal, 4- pair cables bi-directionally, in accordance with the requirements of ANSI/TIA-1152 for Level III testing.
3. All 4-pair Category 6 UTP cabling not cross connected or patched within the closet shall be auto-tested as a basic (permanent) link recording all of the auto-test measurements:
    a. Wire Map
    b. Length
    c. Attenuation
    d. NEXT (Near end crosstalk)
    e. Return Loss
    f. ELFEXT Loss
    g. Propagation Delay
    h. Delay skew
    i. PSNEXT (Power sum near-end crosstalk loss)
    j. PSELFEXT (Power sum equal level far-end crosstalk loss)
    k. Remove all defective cables from the cable pathways. Do not abandon cables in place.
    l. The City of New York reserves the right to observe the conduct of any or all portions of the testing process.
4. The City of New York further reserves the right to conduct using contractor equipment and labor, a random re-test of up to five (5) percent of the cable plant to confirm documented test results.
5. All test results and corrective procedures are to be documented and submitted to the City of New York within ten (10) working days of test completion.

6. Be prepared to conduct on-the-spot cable tests and effect cable plant repairs, as necessary. Successful equipment performance tests do not relieve the Contractor from the specified testing, repair, and documentation requirements.

C. All UTP cables. Provide test reports created by automated cable tester for each tested cable.

D. Fiber Testing shall be in conformance with the following:

1. All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless clearly defined in the specifications. Testing shall consist of an end to end power meter test performed per FOTP61 - Measurement of Fiber Cable Attenuation (ANSI/TIA/EIA-455-61-2000). The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
2. Backbone fiber cabling shall be tested at 850 nm and 1300 nm for multimode and or 1310 and 1550 nm for single-mode in both directions.
3. Test set-up and performance shall be conducted in accordance with ANSI/TIA-526-14-B Multimode Standard, Method B or ANSI/TIA/EIA-526-7 Single-Mode Standard, Method A.1.
4. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. ONLY LINK TEST IS REQUIRED. The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the Standards listed above.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.
6. All twisted-pair, multimode and single-mode field testing shall be done in accordance with the applicable cabling system manufacturers requirements.

3.10 SYSTEM DOCUMENTATION

A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets for approval. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the IT Staff, the telecommunications contractor shall provide copies of the original test results.

1. OCA may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary, including a 100% re-test. This re-test shall be at no additional cost.

3.11 TEST RESULTS

A. Test documentation shall be provided on disk within 30 days after the completion of the project. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test docllil1ent shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

B. The field test equipment shall meet the requirements of ANSI/TIA-1152 including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.

C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form (CD or DVD).

D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

E. Marginal (PASS*) test results will not be accepted.

3.12 CABLE IDENTIFICATION SYSTEM

A. Use color coding in accordance with the ANS/TIA-606-A standards.

B. All horizontal cabling shall be labeled with machine generated black uppercase lettering printed on three (3) rows on a permanent self-laminating adhesive label stock.

C. Labels shall be placed on both ends of the cable within 12 inches from the point at which the cable jacket is opened to expose individual copper pairs or fiber strands, or from the connector, outlet boxes or terminal block. All labels shall be visually and physically accessible at work locations, and when cables are mounted to frames, blocks, racks, etc. where the proper mounting procedure allows ready access to individual cables.

D. The cable identification numbers will be developed and will be related to the termination location within the TR’s. Each cable number indicates the floor, the block or panel and the termination sequence or port number. This number will be the cable ID.

E. After pulling and testing cables, place the appropriate cable label. Temporary tags are acceptable for use during construction. All temporary tags must be removed and replaced with permanent machine generated labels prior to acceptance.

F. If at any time during the job of permanent cable label becomes illegible or is defaced or removed, immediately replace it with a duplicate pre-printed cable label.

END OF SECTION 27 17 00

SECTION 27 41 00 COMMON WORK RESULTS FOR AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract)

1.2 SCOPE OF WORK

A. General: Provide audio visual systems design, engineering, and installation within all phases and spaces of the project, as defined by the related documents. Systems shall include all devices, equipment, installation, programming and commissioning in accordance with requirements of the contract documents and drawings.

1. The Work detailed within the Contract Documents has been specified to meet certain requirements for performance, appearance, and costs. It shall be the responsibility of the Contractor to implement the guidelines and requirements contained in the Contract Documents and translate them into a complete design package containing all elements necessary for a complete, operational, and functionally integrated Audio-Visual System(s).
2. Provide all work as detailed in the Contract Documents as a turnkey installation including all material, labor, warranties, taxes, freight, and permits. Only items and requirements specifically stated to be provided by others shall not be a requirement for this Section of the Work.

B. Work Included:

1. Refer to Sections contained in 27 41 16.01 for Scope Requirement and System Descriptions

C. Work Specified Elsewhere

1. Installation of raceway, pull-boxes, plywood backboards and floor-boxes (provided under electrical Work). Coordination is required within the design to verify the appropriate raceways are in place.
2. Installation and termination of network systems.
3. Cutting, patching and painting of walls, unless damaged performing the work described herein.

D. Coordinated Work

1. Coordinate with related trades to schedule the Work and ensure a complete installation in accordance with the schedule outlined by the City of New York.
2. Coordinate all IP device requirements with the Data vendor, City of New York, and Contractor.

3. Coordinate all network connectivity requirements with the low voltage cabling contractor and the City of New York.

1.3 SUPPLEMENTAL CONDITIONS

A. The City of New York's General Conditions shall be considered as forming an integral part of the Specification, and shall be carefully examined before proposals for any work are submitted. Unless this section contains statements that are more definitive or more restrictive than those contained in the City of New York's General Conditions, this Specification shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions. These conditions shall be considered supplementary.

B. The Contractor shall be responsible for delivering a turnkey system to the City of New York.

C. The Contractor represents that they are familiar with, and has expertise in the Work of this nature and scope. The Contractor further agrees that he/she shall provide all Work as may be required to make a complete job of that which may not be fully defined in the Contract documents. The NIC ("Not in Contract") and OFE ("Owner Furnished Equipment") equipment and materials are specifically exempt from this requirement.

D. The Contractor shall comply with all of the legal regulations, including OSHA safety regulations and regulations of municipal, city, local, and other government agencies having jurisdiction concerning the Work of the Contractor. The Contractor shall give all notices and comply with all laws, ordinances, codes, rules, and regulations bearing on the conduct of the Work. If the Contractor performs any Work, which is contrary to such laws, ordinances, codes, rules and regulations, he/she shall make all changes to comply therewith and bear all costs arising there from.

E. Because drawings are, in general, diagrammatic, the Contractor shall coordinate all installations with the Commissioner, based on the field conditions.

F. All permits required for any part of the Contractor's Work shall be procured and paid for by the Contractor. The Contractor shall determine all permits required and transmit this information to the Commissioner.

G. The Contractor warrants that he and his/her subcontractors are licensed by the State and as required by local ordinances.

H. The Contractor must state if he intends to utilize a sub-contractor, and provide the sub-contractor's name and address. The sub-contractor shall comply with all the same rules, regulations, laws, codes, licenses, etc. as required by the Contractor and as specified herein. The Commissioner reserves the right to approve or disapprove any sub-contractor proposed by Contractor.

I. Prior to ordering equipment, the Contractor shall field verify all conditions, with respect to dimensions and placement of equipment. Any and all discrepancies from the contract documents shall be brought to the attention of the Commissioner.

J. The Contractor shall furnish software necessary to operate software controlled audiovisual sub-systems e.g. remote control system. This software shall, in every case, be provided by the

manufacturer(s) of the sub-system, and shall be installed and tested prior to delivery of equipment at site.

K. All of the Contractor's Work shall be tested and inspected by all authorities having jurisdiction and in accordance with all Specifications. The Contractor shall coordinate and cooperate fully and shall provide at no additional cost to the City of New York, manpower, blueprints, facilities, scaffolds, etc. to reasonably assist the inspectors.

L. The project documentation is, in general, diagrammatic, and/or been developed to communicate design intent. The Contractor shall coordinate the installation of all devices and/or equipment with the City of New York prior to installation based on the existing field conditions.

M. The Contractor shall examine the site and the Contract Documents and review with the City of New York the designated areas of access, delivery, and storage for the Contractor's use. The Contractor agrees that such areas are satisfactory and sufficient for his/her needs in the prosecution of his Work in conformance with the terms of this Contract.

N. The Contractor, upon receiving notice from City of New York that the Contractor has furnished inferior, improper or unsound work or materials (including equipment), or work or materials at variance with that which is specified, will, within 24 hours, proceed to remove such work or materials and make good all other work or materials damaged thereby, and, at the option of the City of New York, the Contractor shall immediately replace such work or materials with work or materials as specified. The removal, replacement, and repair shall be performed at such times and with manpower sufficient, in the judgment of the City of New York, so as to avoid disturbance to occupants, or other ongoing work for the Project.

1. If the Contractor does not remove such unsound Work within a reasonable time, the City of New York may remove it and may store the material at the expense of the Contractor. If the Contractor does not pay the expenses of such removal within ten (10) days' time thereafter, the City of New York may, upon written notice, sell such materials at auction or at private sale and shall account for the net proceeds thereof, after deducting all the costs and expenses that should have been borne by the Contractor and all expenses of the sale.
2. The City of New York shall have the authority at all times, until final completion and acceptance of the Work, to inspect and reject work and materials which in its judgment are not in conformity with the Drawings, Details and Specifications, and its decision in regard to character and value of Work shall be final and conclusive on both contracting parties. If the City of New York permits said Work or materials to remain, the City of New York shall be allowed the difference in value or shall at its election have the right to have said Work or materials repaired or replaced, as well as the damage caused thereby, at the expense of the Contractor, at any time within one (1) year after the completion of the entire project, or within such longer period as may be covered by any guarantee; and neither payments made to the Contractor, nor any other acts of the City of New York, shall be construed as evidence of acceptance or waiver.
3. Any expense incurred by the City of New York in connection with the foregoing, shall be borne by the Contractor, and the City of New York may withhold money due to the Contractor or recover money already paid to the Contractor, to the extent of such expense.

O. The City of New York reserves the right to furnish any materials necessary for the Project.

P. It shall be understood that the Specifications and Drawings are complementary. Where there are conflicts within the documents, the Commissioner shall be notified.

Q. To the extent that they govern the Work, the Program documents, Specifications and Drawings also govern change order Work, if any.

R. Certain details appear on the Drawings for the Work that are specified with regard to the dimensioning and positioning of the Work. These are intended only for general information purposes. They do not obviate field coordination for individual items of the indicated Work.

S. Information as to general construction and architectural general construction and architectural features and finishes shall be derived from the structural and architectural drawings and specifications, are may require ongoing coordination with the Commissioner.

T. Ratings of devices, materials, and equipment specified without reference to specific performance criteria shall be understood to be nominal or nameplate ratings established by means of industry standard procedures.

U. It is the intent of the Room Data Sheets, Drawings and Specifications to provide complete operating Audio Visual Systems. All Work necessary to provide such a System shall be performed. Any discrepancies shall be brought to the attention of the Commissioner.

V. Include in the Work all necessary supervision and issuing of all coordination information to any other trades who are supplying work to accommodate the Audio Visual Systems installation.

W. For items of equipment which are to be installed but not purchased as part of the Work, the Work shall include:

1. Coordination of delivery
2. Unloading from delivery trucks
3. Safe handling and field storage up to the time of permanent placement in the project
4. Correction of any damage to the item(s)
5. Mounting in place and connection(s) as specified

X. Items which are to be installed, but not purchased as part of the Work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the Work will be considered only if presented in writing within one (1) week of the date of delivery to the project of the items in question. The Work includes all procedures necessary to put in satisfactory operation all items for which no claims have been submitted as outlined above.

Y. Structured cabling is specified to be provided by the low voltage cable contractor, the Audiovisual Systems Contractor shall identify the cable types, quantities, lengths, and final locations to be terminated and provide them to the City of New York and the low voltage cable contractor to be provided and installed. It is the Contractor's responsibility to ensure that the information is complete and accurate. Any errors or omissions in the ordering information will be the responsibility of the Contractor.

1.4 QUALIFICATIONS OF BIDDERS

A. Work specified herein shall be the responsibility of a single Audiovisual Systems Integration Contractor. Tenders shall document a minimum of five years' experience in the fabrication, assembly and installation of systems of similar complexity as specified herein. This requirement shall apply equally to suppliers and manufacturers of the audiovisual subsystems and major components to be used on this Project.

B. The documentation shall include the names, locations, and points of contact for at least three installations of the type and complexity specified herein. Tenders shall indicate the type of each referenced system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 24 months.

C. The Bidder must have a substantial presence within 50 miles of the jobsite. That presence shall include a fully equipped shop and no fewer than six qualified engineers/service technicians in full-time, permanent employment at that location.

D. In that it is our intention that no Bidder shall be awarded contracts totaling more than 15% of the value of that Bidder's annual gross receipts from the sale of integrated audiovisual systems. The bidders shall submit proof of their gross receipts from integrated audiovisual systems for the past three years. The bidders should exclude the value of service contracts, rental services and sales of un-integrated equipment. In arriving at this figure, we shall consider the average receipts for all wholly owned offices for any two of the previous three years.

E. Each bidder shall have at least one supervisory employee possessing a certificate, from either ICIA or another recognized organization or institution, providing formal training in audiovisual engineering or installation. Proof of this shall be supplied with bid.

F. Each bidder shall have at least one supervisory employee possessing a Bachelor or Master's degree in Electrical Engineering. Proof of this shall be supplied with bid. Trade school degrees are not acceptable.

G. All employees used by the Contractor to install this system must be competent technicians who are experienced in the installation and interconnection of professional audiovisual systems.

H. The Contractor shall have local in-house engineering and project management capabilities consistent with the requirements of the Work.

I. The Contractor shall provide a full-time project manager who is to be present on site at all times that Work is actively in progress. This person shall be the same individual throughout the course of the Project and shall be the person responsible for system programming, preparation of Operation and Maintenance Manuals, training programs and schedules, test protocols, documentation of system testing, maintenance of Record Documentation and coordination and scheduling of all subcontract labor (as applicable). The Commissioner reserves the right to approve the Contractor's Project Manager.

J. Each bidder shall be currently authorized by the manufacturer of the major components of the system to sell their products and initiate warranty service on the same items. Major components of the system shall include, but not be limited to, data/video projectors, video processing equipment, audio processing equipment, power amplifiers, speakers, etc. Proof of this may be

requested during the bidding process. Proof of franchise shall be in the form of a letter from the appropriate manufacturer addressed to the consultant stating that the Contractor is currently authorized to sell their products. Letters from the sales representative (rep) shall not be accepted as proof.

K. All programmers of DSP-based audio systems must be factory certified to program the DSP, and has passed the manufacturer's training course. Proof of this shall be supplied with bid. Note that it is insufficient for the Audiovisual Contractor to be certified company-wide; the individual programmers must be certified.

L. By submitting a Tender, the Contractor thereby certifies that it is qualified in all areas pertaining to the Work, either directly or indirectly. In the event the Contractor becomes unable to complete the Work in accordance with the Contract Documents, or the satisfaction of the City of New York or its representatives, due to a lack of understanding of equipment, systems or services required by the Contract Documents, it shall be the responsibility of the Contractor to retain the services of the applicable manufacturers' representatives to expeditiously complete the Work in accordance with the Commissioner's construction schedule with no additional cost to the City of New York.

M. The Contractor shall maintain, or establish and maintain, a fully staffed local office including a service center capable of providing comprehensive maintenance and service to the Audiovisual Systems in this scope of work. The Contractor shall staff the service center with factory trained technicians and adequately equip the office to provide service, whether or not the City of New York elects to purchase a maintenance contract from the Contractor.

N. The Contractor shall provide factory-certified technicians to install, commission, and maintain the Work. All installing personnel shall be licensed as required by local and/or state jurisdictions.

O. The Contractor shall ensure compliance with, and have a thorough understanding of, all local codes and contract conditions pertaining to this Project.

P. The Contractor shall maintain an inventory of spare parts and other items critical to system operation and as necessary to meet the emergency service requirements of this Project within the local service center.

1.5 DEFINITIONS

A. "Contractor" as used in this section refers to the contractor responsible for providing (furnishing and installing) the systems and devices described herein.

B. "Bidder" as used in this section refers to an Audiovisual Systems Contracting firm submitting a bid response to this specification.

C. "Contractor" or "Audiovisual Contractor" as used in this section refers to the contractor responsible for providing (furnishing and installing) the systems and devices described herein.

D. "Supply" as used in this section means "to supply, complete with instructions, for installation by others.

E. "Provide" as used in this section means "to furnish, install and make operable".

F. "NIC" as used in this section and on the contract drawings means "not included in this section, not to be supplied".

G. "By Others" as used in this section and on the contract drawings means "not included in this section, supplied as part of another section".

H. "Or as Approved" as used in this section and on the contract drawings means "substitution only after written approval by the Consultant".

1.6 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Refer to the following Sections for specifications related to the Work:

1. Section 27 41 16.01 – Integrated Audiovisual Systems

1.7 RELATED WORK

A. Audiovisual Contractor shall coordinate with Electrical Contractor on raceway/junction box locations for audio visual equipment and routing of audio, video, control, and power cables/raceway from equipment, terminal and pull boxes to system equipment racks.

B. Related Work: Equipment and materials provided and installed by others, unless otherwise shown in this Section or the Drawings.

C. Coordinate work of this section with installation of wall and ceiling finishes.

1.8 INFORMATION TO BE SUBMITTED WITH THE BID RETURN

A. Equipment Costs

1. The bid return shall include detailed schedules of all equipment to be supplied. Unit pricing will be established for each piece of equipment on the Equipment Schedule. Equipment Schedules are provided herein under the Detailed Specifications. Copies of these schedules shall be used, with the appropriate price information added.
2. The Commissioner is not responsible for any formulas that may be resident in the schedule. The results of any calculations in the schedule are the sole responsibility of the Bidder.
3. The design intent of the system may require equipment not listed in the attached schedule, but are indicated elsewhere in the contract documents, in either the drawings or the written specification. It is the sole responsibility of the Bidder to reconcile the contract documents with the equipment and labor required for this project.
4. No claims for additional equipment required will be allowed, if the sole reason for such claims is that the equipment was not listed in the attached schedule. It is the sole responsibility of the Bidder to verify the completeness of the Equipment Schedule.
   a. If there is a conflict between the plans and quantities listed on any document, the Bidder shall propose the larger quantity.

b. It is the sole responsibility of the Bidder to verify the completeness of the Equipment Schedule.
c. The Bidder shall notify the Commissioner of all discrepancies in the documents. Any discrepancies not identified during the bidding process shall be the sole responsibility of the Contractor.

5. Equipment costs shall reflect all required modifications and accessories. All substitutions for specified equipment shall be listed and individually priced on a separate page.
6. It is possible that device quantities may change over the course of this project. In the event that quantities of certain devices should change over the course of the project the following shall be observed:
   a. The Bidder shall certify that the unit price shown shall be the guaranteed maximum price for that device over the duration of the project.
   b. Any deductions for equipment reductions, prior to taking delivery of the equipment, shall be at the unit price shown on the return provided by the Bidder.

B. Non-Equipment Costs

1. Non-equipment costs shall be furnished separately on the Master Recapitulation of Costs form. These non-equipment costs shall be detailed for each of the following categories:
   a. Engineering: Including all required designs, drawings, run sheets, instruction manuals, etc. Samples of acceptable drawings will be made available by the Consultant, if requested by the Bidders.
   b. Project Management: Includes all responsibilities as outlined in Section 1.12. (Project Management), as well as all meetings, scheduling of personnel, coordination with trades, etc.
   c. Pre-installation: Including all fabrication, modification, assembly, rack wiring, etc., performed on the Contractor's premises.
   d. Electrical Installation: Including all costs and materials associated with the installation of the low-voltage audiovisual cabling and devices.
   e. Installation: Including all on-site installation and wiring, coordination and supervision, testing, checkout, instructing, etc. performed on the City of New York's premises.
   f. General and Administrative: Including all G & A expenses, shipping, insurance, and guarantees.
2. Taxes: Bidders shall verify with the administering agency the tax requirement of the project.

C. General Information on Your Firm

1. The number of years in business.
2. Resumes of key personnel. Resumes must reflect skills relating to audio, video, teleconferencing (audio and video), integrated control systems, programming, project management, etc.
3. Locations of all currently staffed and operational offices, complete with the number of technical support personnel in each office.

D. Project References

1. End User contact name, with current telephone number and e-mail address.

2. Functional description of the project.
3. Project scope and approximate dollar amount
4. Completion date.
5. All projects identified must be verifiable, and have been completed within the last twelve
6. (12) months.

E. List of products for which the firm is a direct dealer, including the duration of the dealership and the extent of any factory training. This list should include, but not limited to:

1. Large screen display systems, including LCD, LED, DLP and DMD based systems.
2. Computer controlled audio systems.
3. Integrated control systems.
4. Video Teleconference Systems
5. List of technical products that the firm has installed and serviced, but are not a direct dealer for.

F. Warranty Statement

1. To maintain certain manufacturer's warranties, said equipment must be installed, aligned and serviced by those installers authorized by said manufacturer to perform those duties. If the Contractor is not authorized by said manufacturer, it is his sole responsibility to make the appropriate arrangements and bear all cost and consequences thereof.
2. The Bidder shall include a statement of warranty on the entire system and on the individual pieces of equipment. The system warranty shall be for a minimum of 365 days from the date of system acceptance by the City of New York. This warranty shall obligate the Contractor to provide all equipment, material, and labor at no charge to the City of New York, during the warranty period, in the event of a system or equipment malfunction.
3. In cases where the manufacturer's warranty period is greater than twelve months, the Contractor must be prepared to honor that warranty for the full extent of the manufacturer's warranty period. This shall exclude any labor costs incurred by the Contractor removing and re-installing the defective items for the full duration of the manufacturer's warranty period.
4. In cases where the manufacturer's warranty period is less than 12 months, the Contractor is liable for defects in the item up to, but not exceeding, the twelve-month warranty period on any Contractor provided items.
5. The system warranty shall include a minimum of four (4) preventative maintenance visits, to perform operation checks of the equipment, review generated log files, to clean screens, projector lenses and other critical surfaces, to lubricate moving parts as recommended by the respective manufacturers and to adjust and align projector to maintain optimum registration and focus.
6. All manufacturers' equipment warranties shall be activated in the City of New York's name and shall commence on the date of system acceptance. In the case of Contractor- modified equipment, the manufacturer's warranty is normally voided. In such cases, the Contractor shall provide the City of New York with a warranty equivalent to that of the original manufacturer.
7. The Audiovisual Contractor shall respond via telephone within two (2) hours to any request for service. This first contact should outline the nature of the problem or functional anomaly. The Contractor shall make available an individual knowledgeable

with the installed system, and who can address specific system issues described by the system operators.

8. The system warranty shall be an “on-site” warranty, with a twenty-four (24) hour response time. The Bidder shall include alternate pricing for a four (4) hour response time. Telephone support shall be available between normal business hours, Monday through Friday.

G. Service Contract

1. The Bidder shall offer a separate annual service contract by pricing for five (5) years on a year-to-year basis, covering all installed systems. This service contract shall cover a minimum of four (4) visits per year, at regular intervals, to perform operation checks of the equipment, to clean screens, projector lenses and other critical surfaces, to lubricate moving parts as recommended by the respective manufacturers and to adjust and align projector to maintain optimum registration and focus. The service contract shall commence immediately after expiration of the warranty period. (A per item price for the service contract shall be submitted with the bid).
2. The Bidder shall also submit separate costs for other emergency “on-call” service visits and an “in-shop” hourly rate for repair and maintenance work.
3. The costs for this service contract shall not be commingled with the costs for the systems base bid.
4. All repairs required following Substantial Completion of the rooms shall be scheduled at the User’s convenience. In no case will the User allow such repairs to interrupt or delay a regularly scheduled event. Notwithstanding the above, all repairs within the regular period of usage must be completed within 24 hours of notification of a failure; 2nd and /or 3rd shift warranty repair activity should be anticipated.

H. Schedule of Implementation

1. The Bidder shall obtain from the Construction Manager projected dates when the relevant areas will be available for the on-site installation.
2. The Bidder shall submit a scheduling plan with the bid return, indicating the various pertinent terminal dates after award of contract for completion of design, pre-installation work, on-site installation work, and testing and acceptance on a “per phase” basis. This shall be in the form of a Gantt chart, and be consistent with the project schedule.

I. Alternate Equipment

1. All bids shall be submitted based on the specified equipment. The Bidder may propose alternate equipment. However, all such proposals shall be submitted separately and will be identified as “alternates” with equipment costs shown separate and apart from the costs of the equipment “as specified”.
2. Proposals for alternate equipment will receive careful and equitable consideration if the differences do not depart from the overall intent of the design and operation of the system, and are in the best interests of the City of New York. All proposed alternate equipment shall work with the existing infrastructure.
3. All such proposals for alternate equipment shall be accompanied by full technical information, “cuts” and specifications for the equipment so proposed. The Bidder shall identify the substantive differences between the alternate and the specified equipment.

J. Exceptions and Proposed Modifications

1. Should the Bidder have recommendations, which will enhance the performance of the system, or reduce costs without loss of performance, reliability and durability, such recommendations shall be include with the bid submission. All suggestions that are of value to the City of New York will be taken into consideration in the evaluation of the bid returns. All such proposals shall be made as “alternates”, with the appropriate cost modifications shown separate and apart from the costs of the system “as specified”. Pricing shall be on a line-item basis.
2. Any and all exceptions to these specifications and related drawings must be made with the bid submission. In the absence of exceptions, these specifications and related drawings shall be binding in letter and intent on the successful Bidder. It will further be assumed that the Bidder has examined the design and specifications in detail, and is prepared to take full responsibility for the performance of the complete installation as designed and specified.

K. Sub-Contract Information

1. If the Bidder proposes to sub-contract portions of the work, such sub-contractors shall be identified and their responsibilities and qualifications detailed in the Bidder’s bid submission. The work as performed by a sub-contractor shall be considered as part of the Contractor’s responsibility, with that work as part of the Contractor’s statement. Any contract arising as a direct result of these proceedings shall be binding on the successful bidder.
2. The Contractor must identify the Electrical Contractor who will be performing the Electrical Installation, and their union affiliation. Typical installation labor will include:
   a. Receiving a loading-dock delivery (from a union driver) and setting equipment in place.
   b. Cable pulls and installation.
   c. Equipment that is permanently attached to the building.

L. Sub-Contract Information

1. If the Bidder proposes to sub-contract the installation and wiring, or other portions of the work, the Bidder shall provide direct supervision of the sub-contracted work.
2. Because of the complexity of the systems, the supervision of such sub-contracted work cannot be intermittent, but shall be continuous during the installation.
3. If it is the intention of the Bidder to “joint-venture” with one or more other Contractors, then this must be clearly identified in the bid return.
   a. The Contractor returning the bid will be considered as the prime in respect of this, and will hold full responsibility for the performance of the members of their team, including themselves and all other sub-contractors engaged in the performance of this contract.
   b. In the case of joint ventures of multiple firms, the firms must demonstrate that the joint venture has existed prior to this project, and has performed as a joint venture on at least one or more projects similar in size and scope to this project.

4. No sub-contract will be permitted for the Contractor’s responsibilities, as herein defined, unless specifically identified in the bid submission and approved by the City of New York.

5. The Contractor shall have sole responsibility for the satisfactory implementation of each system, even though the Contractor may have sub-contracted a portion of the installation or had certain manufacturers install their own equipment.

1.9 REVIEW AND INTERPRETATION DURING BIDDING

A. Notify the Commissioner of any omissions, discrepancies or ambiguities in the documents so a clarification may be issued. Notify the Commissioner if exception is taken to any statement, indication or criterion in the contract documents.

B. Obtain all other contract documents, including architectural, structural, mechanical and electrical, and check to ensure there are no conflicts with work of this section. Notify the Commissioner of all such conflicts, with any suggested alteration to resolve conflicts.

C. Submit all above notification in writing to the Commissioner no less than 14 days prior to bid opening date. Lack of notification shall be understood to indicate acceptance of all requirements of the contract documents, and any future clams shall be rejected.

D. Interpretations or correction to the contract documents shall be issued by Addendum. Interpretations or corrections given by any other method shall not be binding.

1.10 QUALITY ASSURANCE - LABOR

A. Work shall be done by persons skilled in this trade in strict accordance with the requirements and/or specifications of the manufacturers of the material being used.

B. Obtain each type of screen required from a single manufacturer as a complete unit, including motor, controls, limit switches, necessary mounting hardware frames and any accessories required.

C. Coordinate work with that of all other trades affecting, or affected by, work of this Section. Cooperate with such trades to assure steady progress of all work under Contract.

D. All permits required for any part of the Contractor's Work shall be procured and paid for by the Contractor. The Contractor shall determine all permits required and transmit this information to the City of New York.

E. The Contractor warrants that he/she is licensed by the State and/or as required by local ordinances.

F. The Contractor must state if he/she intends to utilize a subcontractor, and provide the subcontractor's name and address. The subcontractor shall comply with all the same rules, regulations, laws, codes, licenses, etc. as required by the Contractor and as specified herein. The City of New York reserves the right to approve or disapprove any subcontractor proposed by Contractor.

1.11 QUALITY ASSURANCE - MATERIAL

A. All electrical equipment and materials shall have the listing of the Underwriters' Laboratories, Inc., and shall bear the labels attesting to UL listing, and types approved by the Municipal Departments having jurisdiction.

B. All equipment shall be equal to or exceed the minimum requirements of TIA/EIA, IEEE, ASME, ANSI and Underwriters' Laboratories.

C. The Contractor shall supply the latest model available at the time of order placement for each piece of equipment.

D. The Contractor, upon receiving notice from City of New York that the Contractor has furnished inferior, improper or unsound Work or materials (including equipment) (whether worked or unworked), or Work or materials at variance with that which is specified, shall, within twenty-four (24) hours, proceed to remove such Work or materials and make good all other Work or materials damaged thereby, and, at the option of the City of New York, the Contractor shall immediately replace such Work or materials with Work or materials as specified. The removal, replacement and repair shall be performed at such times and with manpower sufficient, in the judgment of the City of New York, so as not to avoid disturbance to occupants, or other ongoing work.

E. If the Contractor does not remove such unsound Work within a reasonable time, the City of New York may remove it and may store the material at the expense of the Contractor. If the Contractor does not pay the expenses of such removal within ten (10) days' time thereafter, the City of New York may, upon ten (10) days' written notice, sell such materials at auction or at private sale and shall account for the net proceeds thereof, after deducting all the costs and expenses that should have been borne by the Contractor and all expenses of the sale.

F. The Commissioner shall have the authority at all times, until Final Completion and acceptance of the Work, to inspect and reject Work and materials which in its judgment are not in conformity with the Drawings and Specifications, and its decision in regard to character and value of Wor k shall be final and conclusive on both contracting parties. If the City of New York permits said Work or materials to remain, the City of New York shall be allowed the difference in value or shall at its election have the right to have said Work or materials repaired or replaced, as well as the damage caused thereby, at the expense of the Contractor, at any time within one year after the completion of the entire project, or within such longer period as may be covered by any guaranty; and neither payments made to the Contractor, nor any other acts of the City of New York, shall be construed as evidence of acceptance or waiver.

G. Any expense incurred by the City of New York in connection with the foregoing shall be borne by the Contractor, and the City of New York may withhold money due to the Contractor or recover money already paid to the Contractor, to the extent of such expense.

1.12 SOFTWARE DOCUMENTATION AND OBLIGATIONS

A. Title to, and exclusive ownership of, any software commissioned under this contract shall at all times remain with the City of New York. All source code becomes the exclusive property of the City of New York.

B. At the time of submitting the System to the Acceptance Tests, the Contractor will furnish media which will contain:

1. All source code pertaining to the System, where there is custom code.
2. Instructions and full description of equipment required which will enable the City of New York to create executable programs from source code.
3. All executable programs.
4. Instructions and full description of equipment required which will enable the City of New York to prepare operating systems and other third-party Software as licensed hereunder for use.
5. All source files for Web pages.
6. Graphic files for all interface screens, if any.
7. For any Software as purchased hereunder not developed by the Contractor all information, data, codes and documentation distributed to the Contractor and otherwise available to the Contractor.
    a. When a third-party software developer has been employed and sub-contracted by the Contractor, the Contractor must demonstrate best effort in fulfilling these requirements. This best effort will be demonstrated to the Commissioner by copies of correspondence between the Contractor and the third party stating the Contractor's request and giving the third-party statement of compliance or otherwise.
        1) One copy of the above documentation will be retained by the Commissioner.
        2) One copy shall be delivered to the Consultant prior to the System Acceptance Tests. This copy will be retained by the Consultant.

C. An acceptance test will be performed for a ten (10) day period, during which this changed or additional code must perform accurately and error free. During this acceptance test, if the City of New York discovers an error in the coding or the logic of the software as supplied under the terms of this Agreement to the City of New York, which prevents the system from performing in accordance with the performance requirements of this Specification, the City of New York shall notify the Contractor of the error and upon request the Contractor will deliver to the City of New York its analysis thereof accompanied by complete program, module, data listings and sample runs exhibiting and rectifying the error.

D. In the event that adjustments are required, no program resident in a system shall be overwritten until a back-up of the resident program is made.

E. The Commissioner shall assist the Contractor in its performance under the terms of this Specification by allowing the Contractor to use the City of New York's System, data listings and sample runs to reproduce and/or correct the reported error and to install and check updated versions of the delivered Software licensed hereunder.

F. The Contractor represents and warrants that it is the City of New York or Licensee of the supplied Software as licensed hereunder and has the right to permit the City of New York to use the same. The City of New York shall not be liable for any incidental or consequential damages, whether foreseeable or not, even if the City of New York has been advised of the possibility of such damages, resulting from or in any way connected with the use of the supplied Software as licensed hereunder.

G. Subsequent to system acceptance, source code changes and/or additional programming, whether requested by the client or performed by the vendor, will be warranted by the vendor for a period of one (1) year, with the vendor responsible for the diagnosis and repair. The vendor shall ensure that the current program is saved to a compact disc or flash drive, and stored as outlined.

H. The Contractor shall defend any suit or proceeding brought against the City of New York, and shall pay any adverse judgment entered therein, so far as such suit or proceeding is based upon a claim that the use of the Software as provided hereunder and furnished by the Contractor under this Agreement constitutes infringement of any copyright or patent, provided the City of New York is promptly notified in writing and given authority, information and assistance (at the Contractor's expense) for the defense of same. The Contractor shall, at its own expense and at its option, procure for the City of New York the right to continue to use the said Software as licensed hereunder, or to replace the same with a non-infringing release. The foregoing shall not be construed to include any agreement by the City of New York to accept any liability whatsoever in respect to copyrights or patents for inventions including more than the Software as purchased and furnished hereunder, or in respect of copyrights or patents for methods and processes to be carried out with the aid of said Software as licensed hereunder, except those which are inherent in said System as furnished.

I. The foregoing states the entire liability of the Contractor with regard to copyright and patent infringement as related to the delivered Software as licensed hereunder.

J. Provided that the City of New York has obtained, under the terms of this Specification or subsequent agreements, all items, such as but not limited to source code and compilers, required to modify the Software, the Contractor hereby grants the City of New York the right to modify and to enhance the Software as supplied and licensed under the terms of this Agreement at its own risks and expense and further agrees such modifications and enhancements developed by the City of New York to be the property of the City of New York without prejudice to the rights of the Contractor to the basic Software. The City of New York furthermore is under no obligation to notify the Contractor of any such modifications and enhancements.

K. Any new version of Software as provided hereunder and delivered to the City of New York by the Contractor during the warranty period, under the terms of this Specification which is deemed, and advised so by the Contractor, to rectify a failure which occurred during the operations of an event, will cause the warranty period for the Software as provided hereunder to restart.

L. The Contractor warrants that all contracts, contacts and arrangements between the Contractor and all third-party Software suppliers providing Software as licensed hereunder will transfer to the City of New York with the successful completion of the Final Acceptance. The Commissioner will inform the Contractor of all its dealings with third party Software suppliers supplying software as licensed hereunder for the duration of the warranty period.

M. The Contractor warrants that at no charge to the City of New York it will reply to verbal queries from the City of New York provided that:

1. The queries relate to the System provided by the Contractor pursuant to this Specification.

2. The query is raised by City of New York's staff or the Commissioner.
3. The query is during the Contractor's normal business hours.
4. The Commissioner has attended training in the use of the System as provided by the Contractor, or is otherwise qualified.

N. The Bidder shall also offer an annual “Software Maintenance” contract. This shall cover all software provided as part of this system and/or written for this system, and shall include both routine upgrades to applications and operating systems, as well as any modifications to software that may be required by the City of New York. The Software Maintenance contract shall commence immediately after expiration of the warranty period, and continue for three (3) years.

1.13 PROJECT MANAGEMENT

A. The Contractor shall provide a Project Manager to oversee and coordinate all activities on the Project

B. Project Manager’s Duties and Responsibilities:

1. The Contractor shall provide to the City of New York, as a part of the prefabrication submittal, the name of the Project Manager that will provide all duties and responsibilities as specified herein, during the term of the project.
2. The Project Manager shall maintain the ability of making all managerial decisions on behalf of the Contractor on a day-to-day basis, and shall retain the authority of accepting notices of deduction, inspection reports, payment schedules and any other project related correspondence on behalf of the City of New York.
3. The Project Manager shall schedule and attend project management meetings during which time all System related issues are discussed, scheduled, confirmed, and/or resolved.
4. The Project Manager shall be available during normal business hours within two (2) hours by telephone during the term of the project.
    a. After normal business hours, the Project Manager shall be available within four (4) hours by telephone during the term of the project.
    b. In the event that the Project Manager is not available within the allotted time frame, the Contractor may designate another employee to temporarily act as the Project Manager in all correspondence with the City of New York.
    c. The Contractor shall ensure that any individual temporarily assuming the duties of the Project Manager is at equal or higher level in the Contractor’s managerial chain of command.

C. Upon notification by the City of New York, of any project related installation issue, or issue that may contradict the Specifications as stated herein, the Project Manager shall respond to such issue, verbally and/or in writing within an eight (8) hour period.

1. Responses to such issues as stated above shall include a clear understanding of the issue, along with a tentative plan of action, reflecting milestones and/or deadlines to resolve the issue.
2. Where appropriate, the Project Manager shall follow-up their initial response with a written response to the issue within 24 hours of identification of the issue.

D. Prior to the initiation of the Work, the Project Manager shall submit a schedule reflecting key milestones of the Work, including but not limited to the following:

1. Bid award
2. Kick-off meeting
3. Master Plan submittal
4. Prefabrication submittal
5. Ordering, delivery, and installation of head-end System equipment
6. Field equipment delivery
7. Project management schedule
8. Payment schedule
9. Installation completion date
10. System training
11. Delivery of As-Built documentation
12. Delivery of Operations & Maintenance Manuals
13. Final System test
14. Acceptance of System

E. The Project Manager shall update the schedule on a weekly basis to reflect the status of each key milestone as the Work progresses.

F. As the System installation progresses, the Project Manager shall be capable of discussing any/or all of the above mentioned items at the request of the City of New York, and shall address each item, as it relates to the current status of the Work.

1.14 REGULATORY AGENCIES

A. Work shall be carried out in conformance with applicable Building codes, the requirements of OSHA and the applicable provisions of American Institute of Architects, American National Standards Institute, Construction Specifications Institute, National Electrical Manufacturers Association, National Fire Protection Association and Underwriter’s Laboratories.

1.15 DESCRIPTION OF SYSTEMS

A. It is the intent of these specifications to provide a complete working audio visual system ready for the City of New York's use. System acceptance shall be judged on the successful adherence to the installation instructions of this Specification.

B. Any item not specifically shown on the drawings or called for in the specifications, but normally required to conform to the intent, are to be considered as part of the Work.

C. Any given item of equipment or material shall be the product of one manufacturer throughout the facility. Multiple manufacturers of any one item will not be permitted, unless specifically noted otherwise.

D. These specifications are equipment and performance specifications and are considered to be one all-encompassing package with the drawings. Actual installation shall be as engineered by the Contractor with prior approval by the Commissioner.

E. Provide audio visual devices and equipment with performance levels and capacities as noted herein.

1.16 SUBMITTALS

A. Furnish submittals in accordance with the General Requirements specified in Division 1, Submittal Procedures.

B. Prefabrication Submittals

1. Submit pre-fabrication submittals in accordance with the City of New York's construction schedule.
2. Pre-fabrication submittals shall consist of product data, shop drawings, samples, and a detailed completion schedule. Partial submittals will not be accepted without prior written approval from the Commissioner.
3. Pre-fabrication submittals shall be furnished in electronic formats as defined by the General Conditions under Part 1 of the Project Specifications.
4. No portion of the Work shall commence nor shall any equipment be procured until the Commissioner has approved the pre-fabrication submittals in writing.
5. A letter of transmittal identifying the name of the Project, Contractor's name, date submitted for review, shall accompany pre-fabrication submittals and a list of items transmitted.

C. Product data required as part of the pre-fabrication submittal shall include the following:

1. Submit manufacturer's product data sheets for all materials and equipment proposed for use on the project sorted by room and indexed.
2. Submit manufacturer's product data sheets for all fire stopping materials proposed for use on the project.
3. Equipment schedules listing all System components, manufacturer, model number and the quantity of each
4. General functional descriptions for each System.
5. Manufacturer's data specification sheets for all System components, including any warranty information.
    a. Mark each product data sheet to show applicable choices and options (sheets containing more than one device or component model number shall be clearly marked to delineate items included in the Work)
    b. Manufacturer's Data: For each manufactured device, submit manufacturers' specifications and print photograph of the proposed device. Include engineering descriptions, principle of operation, application, and proposed model, style or size clearly indicated.
6. A complete list of cable and wiring types, sizes, manufacturer, and model number
7. A complete list of finishes and sample graphics, including custom art work and custom graphics (if applicable)
8. List of parts inventory to provide manufacturer recommended service and maintenance of the Work

D. Shop Drawings shall include the following:

1. Detailed plan views and elevations of Audiovisual Control and/or Head-End rooms (in addition to relevant telecommunications rooms) showing raceway, sleeves, cable tray, cable paths, equipment racks, equipment cabinets, termination blocks, power receptacles and grounding bus bars.
2. Drawings to show evidence of coordination with other trades.
3. Cable run sheets denoting cable type, signal type, termination type, cable number designation, start point and end point.
4. Cable termination schedules showing cable transmission and device location. Provide schedules in printed and electronic format.
5. Floor plan drawings indicating device locations with device legends
6. System riser diagram with all devices, wire runs, and wire designations
7. Schematic block diagrams for each System showing all equipment, interconnects, data flow, etc.
8. Wiring diagrams for each subsystem defining the interconnection of all inputs and outputs for all equipment
9. Fabrication shop drawings for all custom equipment (if applicable)
10. Plans and elevations of the Audiovisual equipment racks and/or custom furniture (including consoles, desks, and lecterns) quantifying all equipment to be mounted therein
11. The Contractor shall submit samples of any equipment components upon request of the City of New York.
12. Samples submitted shall be the latest version of equipment.
13. It is the responsibility of the Contractor to confirm all dimensions, quantities, and the coordination of materials and products supplied by the Contractor with other trades. Approval of shop drawings containing errors does not relieve the Contractor from making corrections at their expense.

E. Record Documentation shall include all information required in the Pre-fabrication Submittals but revised to reflect “as installed” conditions.

F. General Description and Requirements

1. Submit Record Documentation in accordance with the Commissioner’s construction schedule.
2. Record Documentation shall consist of Record Drawings and Operation and Maintenance Manuals.
3. Provide a letter of transmittal with Record Documentation identifying the name of the Project, Contractor’s name, date submitted for review, and a list of items transmitted.
4. Prior to the final acceptance of the Work, submit two draft sets of the Record Drawings portion of Record Documentation to the Commissioner. The draft copy shall be used during the final acceptance testing by the Commissioner.
5. Update all record documentation to reflect changes or modifications made during final acceptance testing as required and submit three blue/black lines and one reproducible set.
6. Provide cable test results for all cables installed under this Work, tested and documented as described herein.
7. Provide City of New York with Operation and Maintenance Manuals including wiring diagrams, parts lists, shop drawings and manufacturers' information on all equipment and cables provided by the Contractor. Manuals shall be provided in a high quality, 3-ring binder and completely indexed.

8. Provide City of New York with all systems programming on electronic media. All programming and source code is to be considered as a work for hire and will be the property of the City of New York upon completion of the project.

G. Record Drawings

1. Produce all Record "as-built" Drawings using the latest version of AutoCAD. Record drawings shall, at a minimum, include the following:
   a. Floor plan drawings indicating device locations, with device legends indicating manufacturers and model numbers for each device
   b. Floor plan drawings indicating wire routing, wire routing shall be delineated in straight line runs and be tagged with cable identification and terminal strip numbers to coincide with the installation
   c. Mounting details for all equipment and hardware
   d. Functional block diagrams for each subsystem
   e. Wiring details showing rack elevations, equipment wiring and terminations, and inter- rack wiring
   f. Wiring diagrams for all custom circuitry including interfaces to various control output controlled devices, lighting control interfaces, projections screens, operable window treatments, motorized doors/partitions, etc.
   g. Wiring diagrams for each System, wiring diagrams shall be identical to those laminated and located within the door of
   h. Typical point-to-point wiring diagrams for each piece of equipment and groups of equipment within the System
   i. Layout details for each riser location, including Audiovisual panels, power supplies, junction boxes, conduit, and any other Audiovisual related equipment

H. Operation and Maintenance Manuals

1. Operation and Maintenance Manuals shall apply to all Audio Visual related devices, equipment and software modules.
2. Operation and Maintenance Manuals shall be formatted as follows:
   a. Bind each manual in a hard-back loose-leaf binder.
   b. Identify each manual's contents on the cover.
   c. Provide a table of contents and tabulated sheets for each manual. Place tab sheets at the beginning of each chapter or section and at the beginning of each appendix if applicable.
   d. Any hardware manual demonstrating more than one model number of device on any one page shall be clearly marked as to delineate which model has been implemented in the Work.

3. Operation and Maintenance Manuals shall include, at a minimum, the following:
   a. Operational description of each subsystem
   b. Detailed programming descriptions for each subsystem
   c. Explanations of subsystem interrelationships
   d. Electrical schematics for each piece of equipment specified
   e. Power-up and power-down procedures for each subsystem
   f. Description of all diagnostic procedures
   g. A menu tree for each subsystem

h. Setup procedures for each component of the subsystems
i. A list of manufacturers, their local representatives, and subcontractors that have performed Work on the Project
j. Installation and service manuals for each piece of equipment
k. Maintenance schedules for all installed components

4. Operation and Maintenance Manuals shall include a separate section for each software program incorporated into the Project. The software section shall include, at a minimum, the following information:
   a. Definitions of all software related terms and functions
   b. Description of required sequences
   c. Directory of all disk files
   d. Description of all communications protocols, including data formats, command characters, and a sample of each type of data transfer
   e. Instructions for manufacturer supplied report generation
   f. Instructions for custom report generation
   g. Database format and data entry requirements

I. Procedure for Resubmitting

1. All comments by the Commissioner, whether they require a resubmission or not, need to be responded to by the Contractor.
2. Make corrections or changes in O & M and/or Record Drawings as required by the Commissioner and resubmit when the Commissioner's stamp requires re-submittal.
3. Clearly identify changes made other than those specifically requested by the Commissioner when resubmitting Record Drawings. Changes shall be clouded or similarly highlighted as coordinated with the Commissioner. Only changes that have been specifically requested by the Commissioner or have been clouded by the Contractor will be reviewed on resubmittals.
4. Any drawing sheets added to the resubmittal shall be clearly identified and clouded, and shall not change the sheet numbering scheme for previously issued Record Drawings.
5. The Contractor shall be responsible for any delays caused by the re-submittal process.
6. Re-submittal Review Fees
   a. If the Commissioner rejects the Contractor's Record Submittal (Rejected, Revise, and Resubmit) more than two times, the Commissioner will be compensated for all subsequent reviews, whether partial or comprehensive. The amount of such compensation will be incorporated by Change Order and withheld from the Contractor's Application for Payment.

1.17 DELIVERY, STORAGE AND HANDLING

A. Protect product from damage. Comply with all manufacturers' recommendations for handling, storage and protection.

B. At all times, take all precautions to protect the work from damage.

1.18 WARRANTIES

A. Systems Contractor shall provide a one (1) year warranty for the Work. The warranty shall cover all Work, Systems, and subsystems against defects in materials and workmanship. The Work as specified herein, including all materials and labor, but excepting any existing devices and equipment which are incorporated in the completed Work, shall be warranted to be free from defects in design, workmanship, and materials. Further, the Contractor shall warrant that the completed Systems, including all components (except those, which are existing or provided by others), are of sufficient size and capacity to fulfill the requirements of the Specifications.

B. The warranty shall be valid for a period of one (1) year following the date of System acceptance by the City of New York. System acceptance shall commence when all parts, components, sub-Systems, and Systems have been tested, shown to be working in accordance with the Specification, and approved by the City of New York

C. Warranty Service:

1. In the event that defects in the materials and/or workmanship are identified during the warranty period, the Contractor shall provide all labor and materials as may be required for prompt correction of the defect.

D. Provide written notice to the City of New York documenting any Work performed during the warranty period, including any preventative maintenance Work performed.

E. Provide loaner equipment that is fully compatible with the Audiovisual Systems for any equipment not field repairable.

F. Loaner equipment for components that must be shipped to/from the manufacturer or distributor shall be on site and operational within 48 hours of the component failure. Furnish lists of equipment that will require shipment from the manufacturer or distributor and lead times associated with that equipment.

G. Contractor shall warrant equipment to be free of defective components, faulty workmanship or improper adjustment for a period of one year from the date of Final Acceptance.

1.19 BID SUBMISSION

A. All bids are to be submitted as described in the covering documentation.

B. By returning a bid response, it is assumed that the Bidder has read, understood and will abide by all the provisions of this specification and all complementary documentation.

C. No extensions will be granted for any reason.

1.20 AWARD OF CONTRACT

A. A single award of contract will be made for all systems as detailed in this specification. The quoted prices shall remain firm for a minimum of ninety (90) days.

B. The bid reviewers reserve the right to reject any or all bids for any reason. Some of the reasons for rejection might include:

1. Insufficient experience of the Contractor.
2. Failure to meet one or more of the requirements in Part 1, Section 1.3 (Qualifications of Bidders).
3. An unreasonably high or low bid in relation to the estimated cost of the audiovisuals system.

C. Failure of the Contractor to provide sufficient documentation with his bid to prove that he is capable of installing a complete and functional system in keeping with the intent of these specifications.

PART 2 - PRODUCTS; COMMON TO ALL SYSTEMS

2.1 GENERAL REQUIREMENTS

A. All materials and components shall be new and of manufacturer's finest quality as appropriate to the application. Uniform materials and components shall be used throughout, and wherever possible, shall be field replaceable and commonly available.

B. Products shall conform to applicable UL standards and to general electrical requirements.

2.2 WIRE AND CABLE

A. General

1. Audio Applications
   a. Microphone/Line Level; fixed installation
      1) Miniature PVC insulated, AWG 22 stranded copper wire twisted pair with 100% foil shield and drain wire, in PVC jacket, 3.51 mm nominal overall diameter.
      2) Belden 8451
      3) Plenum Equivalent - Belden 88761
      4) Or Approved Equal
   b. Speaker Level; fixed installation; 18 Gauge (70 Volt distribution only)
      1) PVC insulated AWG 18 high strand count copper twisted pair, individually PVC insulated with Black & White jackets, in an overall PVC insulated Jacket, 4.67 mm nominal overall diameter.
      2) Belden 5300UP Or Equal
      3) Plenum Equivalent - Belden 82740
      4) Or Approved Equal
   c. Speaker Level; fixed installation; 16 Gauge
      1) PVC insulated AWG 16 high strand count copper twisted pair, individually PVC insulated with Black & White jackets, in an overall PVC insulated Jacket, 5.28 mm nominal overall diameter.
      2) Belden 5200UP Or Equal
      3) Plenum Equivalent - Belden 6200UE
      4) Or Approved Equal

d. Speaker Level; fixed installation; 14 Gauge
   1) PVC insulated AWG 14 high strand count copper twisted pair, individually PVC insulated with Black & White jackets, in an overall PVC insulated Jacket, 6.6 mm nominal overall diameter.
   2) Belden 5100UP
   3) Plenum Equivalent - Belden 6100UE
   4) Or Approved Equal

e. Speaker Level; fixed installation; 12 Gauge
   1) PVC insulated AWG 12 high strand count copper twisted pair, individually PVC insulated with Black & White jackets, in an overall PVC insulated Jacket, 7.67 mm nominal overall diameter.
   2) Belden 5000UP Or Equal
   3) Plenum Equivalent - Belden 6000UE
   4) Or Approved Equal

f. Speaker Level; fixed installation; 10 Gauge
   1) PVC insulated AWG 10 high strand count copper twisted pair, individually PVC insulated with Black & White jackets, in an overall PVC insulated Jacket, 9.04 mm nominal overall diameter.
   2) Belden 5T00UP Or Equal
   3) Plenum Equivalent - Belden 6T00UP
   4) Or Approved Equal

g. Antenna Cable-Wireless Microphone/Assistive Listening Emitter
   1) Coaxial cable, RG-8U, 50 Ohm, maximum VSWR 1.43:1 from 5MHz to 2,250MHz.; equal to or better in high frequency attenuation performance at 2,250MHz (-8.0dB, 100') as specified, with braided shield for minimum 95% coverage and foil shielding for minimum 100% coverage, in an overall PVC insulated jacket, 11 mm nominal overall diameter.
   2) Belden 9913F7 Or Equal
   3) Plenum Equivalent - Belden 88913
   4) Or Approved Equal

2. Remote Control System Applications
   a. Device Interconnection; Relay Systems
      1) Two twisted pair stranded AWG 22 copper wire, individually jacketed, in an overall PVC jacket, 6.20 mm nominal overall diameter.
      2) Belden 9744 Or Equal
      3) Plenum Equivalent - Belden 88741
      4) Or Approved Equal
   b. Device Interconnection; RS-232/RS-422/RS-485
      1) Two twisted pair stranded AWG 22 copper wire, individually jacketed with individual shielding of pairs, in an overall PVC jacket, 4.39 mm nominal overall diameter.
      2) Belden 8723 Or Equal
      3) Plenum Equivalent - Belden 88723
      4) Or Approved Equal
   c. Device Interconnection; with Power
      1) One twisted pair stranded AWG 22 copper wire with shield; one AWG 18 TC unshielded power pair in an overall PVC jacket, 6.35 mm nominal overall diameter.
      2) Belden 1502R Or Equal
      3) Plenum Equivalent: Belden 1502P
      4) Or Approved Equal

3. Some specific equipment and systems may require dedicated proprietary cabling produced by the equipment manufacturer. If these systems are specified, no substitutions are permitted.

4. Note that these cable types are cited to illustrate the type and quality of cable required. Unless otherwise noted, cables from other manufacturers, i.e. West Penn, Comm-Scope, Liberty Cable, etc. will be considered acceptable if data sheets are submitted prior to installation.

5. The Contractor shall only use plugs and jacks specifically manufactured and designed for the cable used. Unless otherwise noted, third-party connectors from other manufacturers, i.e. Kings, Switchcraft, AMP, Amphenol, Lemo, etc. will be considered acceptable if data sheets are submitted prior to installation.

PART 3 - EXECUTION

3.1 INSPECTION

A. Investigate the nature and location of the Work, the general and local conditions, particularly those bearing upon the Work required such as transportation, disposal, handling and storage of materials, availability of labor, electrical power and physical conditions at the site and character of equipment and facilities needed during the execution of the Work. Obtain all information that can affect the Work, or cost thereof under the Contract.

B. Verify substrate surfaces and installation conditions are acceptable for the audiovisual systems installation to commence.

C. Examine all work prepared by others to receive work of this Section and report any defects affecting installation to the Commissioner prior to commencement of work.

D. Ensure that the structural members can support a redundant weight factor of the combined total weight of the audiovisual equipment and all associated hardware and components. The redundant weight factor shall be determined by the Authority having Jurisdiction.

E. Beginning of installation means acceptance of existing conditions.

3.2 GENERAL REQUIREMENTS

A. Verify locations of outlets and switches in finished rooms with architectural drawings of interior details.

B. Follow manufacturers' wiring diagrams for all electrical terminations and carefully follow all installation procedures provided by the manufacturer.

C. Follow architectural drawings for locations of all equipment specified herein.

3.3 WORKMANSHIP

A. The installation of all work shall be neat. All boxes, equipment, etc., shall be plumb and square.

B. Following installation, all soiled, abraded or discolored surfaces of work installed herein shall be cleaned and left free from blemishes or defects.

C. Work that is damaged or improperly installed shall be removed and replaced and the entire installation left in satisfactory condition. Any damage brought about by Contractor's work shall be repaired by the Contractor at no cost to the City of New York.

D. It shall be the responsibility of the Contractor to cooperate with other trades, in order to achieve well-coordinated progress and satisfactory final results.

1. The Contractor shall watch for conflicts with work of other contractors on the job and execute, without claim for extra payment, moderate moves or changes as are necessary to accommodate other equipment or preserve symmetry and pleasing appearance.
2. The Contractor is responsible for all coordination of the Work with other trades.
3. Should any questions of union jurisdiction arise, the Contractor shall immediately take steps to settle such disputes and shall use such labor as may be determined to have jurisdiction, at no additional cost to the City of New York.
4. Should he/she fail to take expeditious action, he/she shall be responsible for any time lost because of delays arising from such a dispute.

E. The Contractor shall be responsible to provide and maintain his/her own storage facility. If this storage facility is required to be on-site it shall be the Contractor's responsibility to coordinate the size and spatial requirements with the City of New York and/or their representatives. The Contractor shall assume full responsibility for both their storage facility and all contents therein, unless otherwise indicated by the City of New York.

F. The Contractor shall provide protection necessary to safeguard his/her own Work from damage by his/her own operations and others. Unless the Contractor proves to the City of New York's satisfaction that their Work has been damaged by others, the Contractor shall, at his/her own cost and expense, promptly repair, adjust and clean all defective installations as shown on the punch list prepared by the City of New York.

G. The Contractor shall remove from the job site all rubbish and refuse at the end of each day and shall keep his work area clean.

3.4 INSTALLATION PRACTICES

A. General

1. Installation shall include the delivery to the installation site, unloading, setting in place, fastening to walls, floors, ceilings, counters, or other structures where required, interconnecting wiring of the system components, equipment alignment and adjustment, and all other work whether or not expressly required herein which is necessary to result in complete and fully operational systems.
2. Prior to ordering equipment, the Contractor shall coordinate the frequencies of all wireless devices to prevent unwanted interaction between devices and rooms. This includes, but is not limited to, wireless microphones, assisted listening system devices, wireless control panels, etc.
3. All accessories, including rack mounting hardware, power supplies, etc., shall be obtained from the original equipment manufacturer. Unless otherwise noted or specified, third party accessories shall not be used.
4. All audiovisual equipment racks shall be wired at the Contractor's facility, and fully tested.

5. All installation practices shall be in accordance with, but not limited to, these specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements, and recommendations of National, State, City, County, Municipal, and other authorities having jurisdiction.
6. If, in the opinion of the Contractor, an installation practice is desired or required, which is contrary to these specifications or drawings, a written request for modification shall be made to the Commissioner. Modifications shall not commence without written approval from the Consultant.
7. During the installation, and up to the date of final acceptance, the Contractor shall be under obligation to protect his finished and unfinished work against damage and loss. In the event of such damage or loss, he shall replace or repair such work at no cost to the City of New York.

B. Physical Installation

1. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise.
2. All equipment shall have an engraved plaque permanently affixed, denoting its function.
3. Fastenings and supports shall be adequate to support their loads with a safety factor as determined by the Authority having Jurisdiction.
4. All boxes, equipment, etc., shall be secured plumb and square.
5. In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

C. Trim and Escutcheon Components

1. To insure a proper finished appearance, the Contractor shall furnish and install trim/escutcheon components at all conditions where audiovisual components penetrate a finished surface. This would include but not be limited to video projector supports, television monitor/receiver supports and any other component which is not specifically supplied with integral flanges/trim components; i.e. speaker mounts, assistive listening devices, etc.
2. The visible component of any trim should be a minimum in size, preferably no wider than 1/2”. All trim components at the ceiling plane shall be finished to match the approved ceiling system and grid system components. The Contractor should obtain a sample from the General Contractor, including any custom color information, or standard color numbers. All trim components shall be submitted to the Commissioner for review and approval prior to fabrication.

D. Speaker Rigging Notes and Guidelines

1. No single rigging fitting should ever be subjected to a load that is greater than the fittings stated working load limit; refer to the manufacturers’ documentation to obtain this information.
2. It is the responsibility of the Audiovisual Contractor to provide the rigging systems for the speakers. It is strongly recommended that the Audiovisual Contractor, unless he has a proven track record in rigging, subcontract this portion of the work to a certified specialist.
3. These speakers are designed to be mounted from structural hang-points. The Audiovisual Contractor shall provide (furnish and install) all necessary rigging components to the structural steel, as well as any and all components to physically

connect and mount multiple speakers as clusters. The speakers, and all mounting hardware, are by the Audiovisual Contractor. The locations are by the Commissioner.

4. Provide a safety cables to structural mounting points on each speaker.
5. All applicable building codes must be observed.
6. The design of the loudspeaker suspension rigging must be reviewed and approved by a licensed structural Commissioner. The Audiovisual Contractor is responsible for all fees and costs associated with the approval and certification process.
7. The installation of this product must be carried out in conformity with local building codes and standards. If necessary, consult the local safety standards officer before installing any product. Alternatively, check any laws or bylaws. No member of the Commissioner or the manufacturer shall be held responsible for any damages caused by the improper installation of loudspeaker.

E. Cable Installation

1. All wire bundles are to be neat and combed free of cable crossovers.
2. All cables, regardless of length, shall be marked with a permanent, self-laminating wrap-around number or letter cable marker at both ends, similar to the Panduit “Pan-Code” system. Labels must be computer-generated for legibility. Wire labels done by hand in the field must be replaced with computer generated labels. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall correspond to codes shown on drawings and or run sheets.
3. All cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cable families:
   a. Power cables – 120VAC or greater.
   b. Control cables.
   c. Video cables.
   d. Audio cables carrying signals less than – 20 dBm.
   e. Audio cables carrying signals between – 20 dBm and +20 dBm.
   f. Audio cables carrying signals above +20 dBm.
4. As a general practice, all power cables, control cables, and high level cables shall be run on the left side of an equipment rack as viewed from the rear. All other cables shall be run on the right side of an equipment rack, as viewed from the rear.
5. Cables ties shall be placed at appropriate intervals of no greater than six inches for vertical bundles, two inches for horizontal bundles.
6. All vertical cable bundles shall be attached to the rack frame.
7. All cables shall be continuous lengths without splices. All system wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. Except where noted otherwise in the specifications, no bare wire terminations will be accepted. Heat-shrink tubing shall be used to insulate the ground or drain wire. Unused wires at the end of a cable shall remain unstripped and shall be laid back and held in place with wire ties.
8. All solder connections shall be made with rosin-core solder using temperature-controlled solder stations. Care shall be taken to avoid cold or cracked solder joints. Any connections that do not appear to be clean and shiny, or which show signs of cracking, shall be resoldered by the Contractor before final acceptance of the system.
9. Mechanical connections using insulated, crimp-type connectors shall be bonded to the connector by soldering the wire to the metal part of the connector.

10. Connections made with screw actuated pressure type terminal strips shall be made by stripping approximately 1/4 inch of insulation from the stranded conductor. Then the un-tinned wire shall be inserted into the terminal and the screw tightened using a secure fitting precision screwdriver.
11. Terminal blocks, boards, strips or connectors shall be furnished for all cables that interface with racks, cabinets, consoles, or equipment modules.
    a. No audio or control cables shall run directly to permanently rack-mounted equipment.
    b. All unused audio inputs and outputs will terminate at the terminal blocks.
    c. All audio patch panels and patch bays shall be furnished with a dedicated audio terminal block. All audio cables to and from the audio patch panels shall terminate on this block.
12. All wire markers shall face a common direction.
13. All cables shall have proper connector housing.
14. Cables shall not protrude from the back of racks.
15. All cable entry shall be through the tops of racks or through entrance holes in the base of the rack. No cable shall enter racks through front, rear or side panel openings.
16. Unless otherwise noted, all video and computer video cables are to be terminated using seventy-five ohm (75Ω) connectors, with a captive center pin.
17. Cables running in plenum areas without conduit shall be plenum rated cable, and match the specified cable.
18. It is the responsibility of the Bidder to inspect the Electrical Commissioner drawings, and verify in what spaces plenum cable shall be used. No claims for additional monies, based on the use of plenum cable, will be allowed.
19. All cables (except video and pulse cables, which must be cut to an electrical length) shall be cut to the length dictated by the run. No splices shall be permitted in any pull boxes without prior permission of the Consultant. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.
20. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer.
21. Where cables are installed in architectural niches, ensure that the cables are black, unless otherwise directed, to reduce visibility from the audience.

F. Patch Panel Assignments

1. All patch panels shall be wired so that signal “sources” (outputs from) appear on the upper row of a row pair; and all “loads” (inputs to) appear on the lower row of a row pair.
2. All audio and video patch panel designation strips shall utilize alphanumeric identifications and descriptive information. The jack position in each horizontal row shall be numbered sequentially from left to right. The horizontal jack rows shall be lettered sequentially from top to bottom. The alphanumeric identification of each jack shall be included on the functional block drawings, as well as on reproductions of these drawings, which shall be mounted in an appropriate location near the patch bays.

G. Grounding Procedures

1. In order to minimize problems resulting from improper grounding, and to achieve maximum signal-to-noise ratios, the following grounding procedures shall be adhered to:

2. System Ground
   a. A single primary “system ground” shall be established for the systems in each particular area. All grounding conductors in that area shall connect to this primary system ground.
   b. The system ground shall be provided in the audio equipment rack for the area, and shall consist of a copper bar of sufficient size to accommodate all secondary ground conductors. A copper conductor having a maximum of 0.1 Ohms total resistance shall connect the primary system ground bar to the nearest approved electrical ground. The Contractor shall be responsible for determining if the metallic conduit is properly electrically bonded to the building ground system.
   c. Secondary system grounding conductors shall be provided from all racks, audio consoles, and grounding point for the area. Each of these grounding conductors shall have a maximum of 0.1 Ohms total resistance.
   d. Under no conditions shall the AC neutral conductor, either in the power panel or in a receptacle outlet, be used for a system ground.
   e. Under no conditions shall the technical ground be connected to non-technical ground conductors.

3. Audio Cable Shields
   a. All audio cable shields shall be grounded at one point only. There are no exceptions. For inter and intra-rack wiring, this requires that the shield be connected at one end only. For ungrounded portable equipment, such as microphones, the shield shall be connected at both ends but grounded at only one end.
   b. The Contractor shall submit for approval a detail showing standard wiring procedures indicating the following:
      1) Audio connection methodology for balanced to balanced line level interfaces.
      2) Audio connection methodology for balanced to unbalanced line level interfaces.
      3) Audio connection methodology for unbalanced to balanced line level interfaces.
      4) Audio Receptacles
   c. All audio receptacles that are provided and installed by the Contractor shall be insulated from the mounting panel, outlet box, or wireway.
   d. Unless otherwise detailed herein, this shall be accomplished by using insulated-from- panel type receptacles.

4. Video Receptacles
   a. All video receptacles that are provided and installed by the Contractor shall be insulated from the mounting panel, outlet box, or wireway.
   b. Unless otherwise detailed herein, this shall be accomplished by using insulated-from- panel type receptacles.

5. General
   a. Because of the great number of possible variations in grounding systems, it shall be the responsibility of the Contractor to follow good engineering practice, as outlined above, and to deviate from these practices only when necessary to minimize crosstalk and to maximize signal-to-noise ratios in the audio, video, and control systems.

H. Performance Standards

1. At the maximum distance as designated by the Consultant this system shall be capable of supplying 80 dB SPL program level plus 10 dB peaking factor over a bandwidth of 250 Hz to 4 kHz without deformation of the waveform as observed on an oscilloscope connected to the output of a SLM in every zone unless noted otherwise.
2. Distribution of sound in the listening area from 250 Hz to 4 kHz shall vary not more than
3. +/-2.0 dB at any location, as measured in octaves with an ANSI SLM.
4. The system shall provide adequate dynamic range at an acoustic distortion level sufficiently low to ensure minimum listening fatigue and intelligibility acceptable to the City of New York. The intelligibility is based on listeners not familiar with the message, or talker; no visual cues; normal activity; and moving position both within and between zones.
5. Unless restricted by the published specifications of a particular piece of equipment, or unless otherwise required under the Detailed Specifications, the following performance standards shall be met by each system:
   a. Audio – General Conditions
      1) All performance standards, unless otherwise noted, should be verified under the following conditions:
      2) Frequency bandwidth measured should be 20 Hz to 20 kHz.
      3) All levels should be referenced to +4 dBu.
      4) Gain settings should be “Unity Gain” for line level signals and maximum for microphone preamplifiers.
   b. Audio – Electrical
      1) S/N (including crosstalk and hum) shall be 75dB minimum (ref. 0dBU)
      2) Total Harmonic Distortion shall be 0.1% maximum (30Hz to 15kHz)
      3) Frequency Response shall be +/-1.0 dB (30Hz to 16kHz)
   c. Audio – Acoustical
      1) S/N (including crosstalk and hum) shall be 65dB minimum
      2) Frequency Response: shall be +/-3.0 dB (80Hz to 15kHz, loudspeaker direct field as measured via time-based analyzer, displayed with moderate smoothing.)
   d. Video (signal)
      1) Frequency Response shall be within plus or minus 0.5dB, DC to 4.2 MHz.
      2) Signal to Noise Ratio shall be 55 dB minimum (peak to RMS) unweighted, DC to 4.2 MHz
      3) Crosstalk shall be 45 dB minimum unweighted DC to 4.2 MHz
      4) Line and Field Tilt shall be 2% maximum.
      5) Differential Gain shall be 3% maximum.
      6) Differential Gain shall be 2 degrees maximum.
   e. Performance Test Signal Paths
      1) Audio
         a) From all source inputs (for microphones, media players, etc.) through all mixers, switchers, etc., to all signal destinations.
      2) Video Signals
         a) From all sources of the above signal paths.

b) This shall not exempt the Contractor from the responsibility of checking all paths and outlets for appropriate compliance with the Performance Standards; see section below for detailed requirements.

f. Display Systems
1) All displays shall be solidly mounted and braced, so that there will be no observable movement in the image induced by motor vibration or other mechanical operations.
2) All displays shall be calibrated to a common standard; there shall be no observable chrominance (saturation and tint) or luminance (black and white levels) differences between displays.
3) The total averaged light output from a projector, in lumens, shall be within plus- or-minus 15% of that specified by the projector manufacturer.
4) The “corner” location shall be defined as the four points determined by intersecting lines drawn 5% of the distance in from the focused edges of the image.
5) The light meter used for the above measurements shall be a properly calibrated foot-candle (or lux) meter and shall be cosine-corrected.
6) Projectors, lenses, and mirrors shall be solidly mounted and braced, so that there will be no observable movement in the image induced by motor vibration or other mechanical operations.

3.5 SYSTEM TESTS

A. Contractor Systems Test

1. Before Acceptance Tests are scheduled, the Contractor shall perform his own system tests. He shall furnish all required test equipment and shall perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification. This work shall include the following:
a. Provide documentation that all matrix switching cross-points have been tested and verified.
b. Test all audio and video systems for compliance with the Performance Standards.

2. Video Systems
a. Video Test Equipment:
1) Multi-Format Video signal generator, Quantum Data 804 series, with HDMI and DVI support.
2) Combined waveform monitor/vectorscope, Leader 5872A.
3) Calibrated content for all media players that are part of the system.
4) Blank media for all media recorders that are part of the system.
5) All miscellaneous equipment, cables and terminations necessary for testing.
6)
b. Signal Paths; Video
1) Connect the output of the video signal generator to each source input point (floor box/table/rack panel, etc.) and select the “Full Field Color Bar” signal.
2) Ensure that the test signal is routed to the selected output.
3) Check that the image is filling the screen and is properly centered at all resolutions and timings that are industry standard and in use by the City of New York.

4) Change test pattern to Pluge pattern and ensure that there is no ringing in the image.
5) Change test pattern to a full-field cross-hatch pattern and ensure consistent focus throughout the image.

3. Audio Systems
   a. Audio Test Equipment:
      1) Signal generator, Leader LAG-120B
      2) Time-based acoustic analyzer, Goldline TEF, SIA Smaart, Meyer SIM System II or approved equivalent, with all required accessories.
      3) AC millivoltmeter, Leader LMZ-181A.
      4) Audio test set, Audio Precision P1PLUS.
      5) Pink noise generator IVIE IE-20B.
      6) Spectrum analyzer IVIE-IE30A.
      7) Harmonic and intermodulation distortion analyzer Leader LDM-171.
      8) Loudspeaker and Microphone polarity checker,
      9) Calibrated content for all media players that are part of the system.
      10) Blank media for all media recorders that are part of the system.
      11) All miscellaneous equipment, microphones, cables and terminations necessary for testing.
   b. Gain Setting
      1) Adjust all components (starting at source equipment and ending at the power amplifiers or active loudspeaker inputs), for maximum signal-to-noise ratio per conventions outlined in Sound System Engineering, Second Edition (Don and Carolyn Davis, Howard W. Sams & Co. 1987).
      2) Provide a Gain Structure chart showing measured levels at each and every gain point through the system. This will be submitted as the reference setup for the system.
      3) At the conclusion of audio system gain structure setting no hiss or noise should be audible through any loudspeaker, and ample electronic headroom should be available throughout the signal chain.
      4) At the conclusion of the tests, return all equipment settings to previously calibrated positions. All component settings are to be labeled, identified and documented.
      5) Provide written records of all test results in spreadsheet form.
   c. Signal Paths; Audio
      1) Measure and record the impedance of each active device operating as a source to any passive device or series of passive devices. Record the dc resistance of any build-out resistors used.
      2) Measure and record the input impedance of any active device used to terminate passive devices, and record the total impedance of all such devices. Record the dc resistance of any terminating resistor used.
      3) Measure the absolute polarity of all devices, including all loudspeakers in the signal path, correct and record any reversals.
      4) Adjust the gain of all devices in the signal path for optimum signal-to-noise ratio and maximum crest factor.
      5) Without changing gain, terminate microphone and line-level inputs, with shielded resistors of 150 and 600 ohms respectively.

6) Measure and record the overall hum and noise level at each power amplifier output. Level shall be at least 75 dB below rated power output of amplifier over a bandwidth of 40-16,000 Hz.
7) Measure and record the impedance of each loudspeaker line at 250, 1000, and 4000 Hz before connecting it to the output of its respective amplifier.
8) Load power amplifiers with resistors matching nominal impedance of output terminals used in system in place of actual loudspeaker loads.
9) Adjust gain of system as for hum and noise level tests above.
10) Apply a 1,000 Hz. sine-wave signal to each microphone and line-level input at level required to produce measured full amplifier output.
11) THD shall measure less than 1.0%.
12) Set up system for each specified mode of operation.
13) Use wide-bandwidth oscilloscope and loudspeaker monitoring.
14) Check to ensure that system is free of spurious oscillation and RF pickup in the absence of any input signal and also with the system momentarily driven to full output at 400 Hz.
15) Feed full/wide-dynamic range music to the system. Adjust the system for frequent peaks at its specified maximum sound pressure level.
16) Listen carefully for noise, rattle, or other extraneous sounds, and objectionable distortion.
17) Correct all causes of such defects. If cause is outside system, promptly notify the Construction Manager, and the Consultant, indicating cause and suggested corrective procedures.
18) Measure and record the acoustic distribution of the loudspeakers of this system at locations as designated by the Consultant, one (1) in every zone. Record the location of all position where any 1/3 octave band, deviates more than +/-3 dB from 500 Hz to 4 kHz, weighted by –5 at 8,00 Hz re: 2500 Hz.

4. Loudspeaker Assemblies and Associated Systems
   a. Provide loudspeaker assemblies as shown on the drawings. Unless otherwise noted: the speaker types and quantities are as shown on the equipment schedule.
      1) Unless otherwise noted, the Contractor shall provide complete assemblies, including back boxes (enclosures) where applicable, grilles, mounting hardware, etc.
      2) Unless otherwise noted, the speakers shall be finished as directed by the Commissioner.
      3) Should the design of the speakers make repainting the speaker, or otherwise refinishing the speaker impractical, the Contractor shall provide the Commissioner with the factory-available finishes for selection.
      4) All speakers shall be tested at the Contractor's facility prior to delivery to the job site for installation.
         a) Testing of speakers shall be in the installed condition; speakers that will be installed in a back box shall be tested installed in the back box.
         b) All tests shall be performed with a dedicated loudspeaker measurement system, equivalent to the LinearX LMS system.
         c) Frequency sweeps shall be at the usable frequency response of the speaker. Testing shall include:
            (1) SPL Response (SPL versus Frequency).
            (2) Impedance Response (Impedance versus Frequency).

(3) Time Domain Response (Voltage versus Time).
(4) Mechanical Testing (Voltage versus Frequency).

5) All testing shall be documented and stored on media, as defined in Article 1.16, Part F.
6) Testing shall be performed on all speakers, including spares.

5. General
   a. Check all control functions, from all controlling devices to all controlled devices, for proper operations.
   b. Adjust, balance, and align all equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for all level controls, and record these settings in the "System Operation and Maintenance Manual".
   c. Check all optical projection images for average light level, light fall-off, and image alignment and size to comply with the Performance Standards and specifications drawings. Check to determine that all projectors, projector bases, carts, tables, and mirrors are rigid and vibration-less in operation.
   d. Maintain documentation of all performance tests for reference by the Commissioner during the System Acceptance Tests.

6. DSP-Based Audio Systems
   a. The digital signal processor, or DSP, provides all system-specific mixing, routing, equalization, delay, and other signal processing functions for the various modes of operation. This functionality is achieved through software programmed into the audio DSP. Multiple modes of operation are to be defined in this software, each selected by the user via a control touch-panel.
   b. Each room is required to undergo certification by the manufacturer. This certification process will include:
      1) On-line testing of all required functions, including, but not limited to, speech reinforcement, program audio systems, audio teleconferencing, audio support for video teleconferencing, Voice Lift, etc.
      2) Verification of final matrix routing presets.
      3) Verification of correct input and output gains.
      4) Verification of gating adjustments and parameters.
      5) Number of open microphones (NOM).
      6) Priority microphones and mode of operation.
      7) Verification of adjustment of all software components, including, but not limited to:
         a) Automatic gain controls (AGC).
         b) Automatic microphone mixers.
         c) Limiters, compressors and equalizers.
         d) Acoustic echo cancellation (AEC) and references.
         e) Crossovers.
         f) Delays.
         g) Expanders.
         h) Filters.

7. The Contractor will arrange to have a technical representative from the Manufacturer on-site to review the DSP settings and assist in performing any final adjustments. The manufacturer's representative will then certify in writing that the system is operating

correctly, and all the required adjustments have been made. All attendant costs shall be borne by the Contractor, and shall be included in your Engineering costs.

a. All final configurations and settings should be stored in the native file format of the device(s) on finalized CD's, to be used as the "base" configuration in the event that further adjustments are required.
b. This certification will be included in the documentation delivered to the Consultant prior to the System Acceptance Testing.

B. Offsite System Checkout

1. Before onsite installation, the Contractor shall be prepared to perform system checkout under the supervision of the Commissioner at his shop. He shall furnish all required test equipment and shall perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification.
2. This inspection shall include the following:
   a. All racks being reviewed should be in an isolated area of the shop, and arranged in a manner to expedite testing and review. A work table and chairs shall be provided for use of the Commissioner.
   b. All racks shall have temporary labels, indicating building, floor and room where the rack shall be installed. Alternatively, the temporary labeling should indicate system type.
   c. Racks shall be clean, and free of all debris (cut cable ties, insulation from stripped wires, etc.) and dust.
   d. Full-size approved shop drawings and preliminary as-built drawings.
   e. All equipment shall be installed in the racks, with peripheral and ancillary equipment installed and ready to test.
   f. Blank panels, vent panels and engravings may be omitted at this point, but should be on-hand for final assembly prior to shipping to the field.
3. The Commissioner will review the following:
   a. Equipment inventory, referenced to the Equipment Schedule and all change orders to- date.
   b. Review of Contractors in-house testing.
   c. Review of conformance with the specifications.
   d. Review of internal cabling.
   e. Cabling shall be as stated above; Section III.R.4.
   f. All internal cabling shall be neatly dressed, with all wire markers clearly visible.
   g. Tension of wire ties on bundled cable shall not bulge the cable.
   h. Review of terminal-block assemblies; Section III.R.4.j.
   i. Review of control system panels and operation.
   j. Review of heat path through the rack.
   k. Review of overall build quality.
   l. Review of general shop conditions.
   m. Review of repair area.

3.6 ACCEPTANCE TESTING

A. Upon completion of installation and initial tests of the equipment, notify the City of New York that equipment is ready for acceptance testing.

B. System Acceptance Tests will not be performed until the Contractor's System Checkout has been completed and the test results have been reviewed.

C. The System Acceptance Tests will be supervised by the Consultant and will consist of the following:

1. A physical inventory will be taken of all equipment on site and will be compared to equipment lists in the contract documents.
2. The operation of all system equipment shall be demonstrated by the Contractor. The individual performing the demonstration shall be fully knowledgeable of all operating and service aspects of the equipment and systems.
3. Both subjective and objective tests will be required by the Consultant to determine compliance with the specifications. The Contractor shall be responsible for providing test equipment for these tests.
4. Familiarize the City of New York on planned operation and maintenance, including periodic preventative maintenance measures required. Include explanation of service requirements and simple onsite service procedures, as well as information concerning name, address and phone number of qualified local source of service.
5. All final, "as-built" drawings, run sheets, manuals, and other required documents, shall be on hand. Two complete sets of these documents shall be delivered to the City of New York at this time. (One complete set shall have been delivered to the Consultant prior to the scheduling of Acceptance Tests).
6. In the event further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the Consultant.
7. Any charge for additional time incurred by the Consultant required to over-see the system tests, due to improper system installation or previous failed systems, shall be the responsibility of, and charged directly to the Contractor.
8. When final testing has concluded to the City of New York's satisfaction, Contractor shall submit a written request for Final Acceptance. Guarantees, warranties and service contracts shall commence upon written notification Final Acceptance by the City of New York.

3.7 INSTRUCTING

A. The Subcontractor shall provide on-the-job training by a suitably qualified instructor, to personnel designated by the City of New York, to instruct them in the operation and maintenance of the systems.

1. All training personnel shall be full-time employees of the Subcontractor.
   a. In the event the Subcontractor does not have qualified instructors on staff for certain sophisticated equipment, a manufacturer's representative for such instruction will be provided by the Subcontractor, at no additional cost to the City of New York.
   b. This representative must be a manufacturer's technical representative; training by a local sales representative is not acceptable.
2. All training shall take place after the systems are operational, but before the acceptance tests.
3. All training personnel shall hold certificates from either ICIA or another recognized organization or institution, providing formal training in audiovisual engineering or installation.

4. All instructing personnel should have been part of the installation team, where feasible.
5. The Subcontractor shall have qualified trainers on-site for a designated one (1) week period.
    a. A trainer will be available during normal operating hours.
    b. A trainer will be available by appointment for non-operating hours.

B. The cost to instruct the City of New York's personnel to service the equipment shall be listed separately by item of equipment.

C. Follow-up instructions within ninety (90) days, at the request of the Commissioner, shall also be provided at no additional charge.

D. Additional on-site support shall be provided for the first major event held at the facility, whether or not these events occur during normal hours of operation.

3.8 POST COMPLETION DOCUMENTATION

A. During usage and maintenance of the system, the Commissioner may request changes and modifications to the system configuration. In order to maintain current and accurate system documentation, the following guidelines shall be followed:

B. All system changes shall be redlined on the existing documentation. This documentation shall be copied and returned to the Contractor's office for modification in CAD.

C. All system changes shall be "bubbled" with a revision number attached. This revision number shall also be in the revision block of the drawing, with the date and reason for the revision.

D. This finished documentation shall be burned onto a CD, or other approved media, and send to the Commissioner, with a copy to the Consultant.

E. At the earliest opportunity, but no later than the next preventative maintenance visit, a hard- copy of the revised drawing shall be placed in the appropriate place in the drawing set. The drawing it is replacing shall remain in the set, and be stamped "Superseded" with the date.

F. The procedures outlined above shall also be followed for all other documentation, and for the duration of their maintaining the system.

END OF SECTION 27 41 00

SECTION 27 41 16.01 INTEGRATED AUDIOVISUAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMAMRY

A. Scope of Work:
   1. The audio-visual systems within this space are intended to provide the audio-visual capabilities required for effective communications. The systems include the following.
      a. Display Systems.
      b. Video Presentation Systems.
      c. Program Audio/Speech Reinforcement Systems.
      d. Control Systems
   2. The spaces and/or facility systems are as follows:
      a. Boardroom
      b. Conference Rooms
      c. Waiting Area

1.3 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Provide in accordance with Section 27 41 00, Common Work Results for Audiovisual Systems. Provide product data for:
   1. Display Equipment and Systems
      a. Projection Systems.
      b. Flat Panel Displays.
      c. Safety certifications (UL, TUV, CE etc.).
   2. Video Equipment and Systems
      a. Signal switching and processing equipment.
      b. All source equipment.
      c. Signal transmission.
      d. All cable types required for video and/or audiovisual signal transmission.
      e. Safety certifications (UL, TUV, CE etc.).
   3. Program Audio/Speech Reinforcement Equipment and Systems
      a. Signal switching and processing equipment.
      b. All source equipment.
      c. Signal transmission.
      d. Loudspeakers.
      e. Microphones.

f. All cable types required for audio signal transmission.
g. Safety certifications (UL, TUV, CE etc.).

4. Control System Equipment and Systems
   a. Wired button control panels.
   b. Digital control system processors.
   c. Control system interfaces.
   d. All cable types required for control signal transmission.
   e. Safety certifications (UL, TUV, CE etc.).
5. Miscellaneous Equipment and Systems
   a. Audiovisual racks and rack accessories.
   b. Wall plates, table plates and floor box plates and inserts
   c. Materials
   d. Finishes (for selection by Commissioner).
   e. Dimensions
   f. Safety certifications (UL, TUV, CE etc.)

C. Drawings & Documentation
   1. Provide in accordance with Section 27 41 00, Common Work Results for Audiovisual Systems.

D. Software Documentation
   1. Provide in accordance with Section 27 41 00, Common Work Results for Audiovisual Systems.

1.4 INSTALLATION AND COMMISSIONING

A. Provide in accordance with Section 27 41 00, Common Work Results for Audiovisual Systems.

1.5 PERFORMANCE TEST

A. Provide in accordance with Section 27 41 00, Common Work Results for Audiovisual Systems.

1.6 EQUIPMENT NAMEPLATES

A. Provide in accordance with Section 27 41 00, Common Work Results for Audiovisual Systems.

1.7 QUALITY ASSURANCE

A. Provide in accordance with Section 27 41 00, Common Work Results for Audiovisual Systems.

1.8 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 27 41 00, Common Work Results for Audiovisual Systems.

1.9 WARRANTY

A. Refer to DCAS General Conditions: Product warranties and product bonds.

B. The system warranty shall be for a minimum of 365 days from the date of system acceptance by the City of New York.

PART 2 - PRODUCTS

2.1 ALL ELECTRONIC PRODUCTS

A. Shall operate on 120VAC at 60 Hz.

B. Shall be capable of operating continuously for 12 hours over the external ambient temperature range of +10°C (+50ºF) to +40°C (+100ºF) (20% to 95% humidity, non-condensing) without permanent damage.

2.2 SUBSTITUTIONS

A. Refer to contract drawings for an equipment schedule with manufacturers and models.

B. Provide in accordance with Section 27 41 00, Common Work Results for Audiovisual Systems.

2.3 FUNCTIONAL DETAILS – CONFERENCE ROOMS/MEETING/Flex ROOMS

A. Narrative Description
1. This large meeting space is acting as an executive boardroom. A wall mounted control system will manage the audiovisual capabilities of the space. Other meeting/Flex spaces are standard conference rooms with intergraded Video Conferencing Kits

B. Display Equipment and Systems
1. Provide wall mounted LED display. The system shall include:
   a. Minimum of 120 Hz refresh rate
   b. Minimum of (2) HDMI inputs
   c. Minimum native resolution of 3840 x 2160

C. Video Equipment and Systems
1. Provide connectivity from the table/floor positions.
2. PTZ Video Cameras
3. Provide all loose cables, connectors, etc. required to complete a full working system.

D. Control System Equipment and Systems
1. Provide modular control system for control of all installed audiovisual and room systems.
2. Provide all system programming.

E. Miscellaneous Equipment and Systems
1. Provide audiovisual equipment rack. This rack will be located in a credenza.
2. Unless otherwise noted:
   a. Ensure that the equipment racks have a clear opening (between rack and cabinet mounting rails) that conforms to EIA standards of 17-3/4”; +1/16”, -0”.

b. Provide blank and vent panels, as required. There are not to be any open areas on the front of the racks.
c. Provide lockable drawer in audiovisual rack for storage of loose items, such as patch cords, equipment remote controls, wireless microphones, and other equipment dedicated to a specific room.
d. All equipment shall be installed with “rack ears” or custom rack-mounts/face- plates, using security screws. There shall not be any shelf-mounted components in the audiovisual racks.

3. Cabling and Accessories
a. Provide custom plates for mounted devices. Confirm fit and finish with the Design Team prior to fabrication.
b. Provide custom floor plates with all required connectivity.
c. Provide coordination with other disciplines for shared connectivity locations.
d. Provide all loose cables, connectors, etc. required to complete a full working system.

2.4 FUNCTIONAL DETAILS – OPEN AREA

A. Narrative Description
1. This space is acting as a collaborative space.

B. Display Equipment and Systems
1. Wall mounted LED displays
a. Minimum of 120 Hz refresh rate
b. Minimum of (1) HDMI input
c. Minimum native resolution of 3840 x 2160

C. Video Equipment and Systems
1. As part of the signage system, the displays will be connected to the headend for independent visual annunciation.
2. Provide all loose cables, connectors, etc. required to complete a full working system.

D. Program Audio/Speech Reinforcement Equipment and Systems
1. As part of the system, provide a mixer amplifier
a. Inputs with acoustic echo-cancellation for microphones both wired and wireless.
b. Line-level inputs for non-microphone inputs.
c. Line-level outputs.
2. Provide ceiling-mounted speakers.
a. Speakers shall be ceiling-mounted from the structural ceiling, or other structurally-suitable support, to be flush with the ceiling grid.
b. Speakers shall include safety chain, in addition to primary support cable.
c. Confirm speaker color prior to ordering the speakers.
3. Provide amplification for the ceiling speakers.
4. Provide all loose cables, connectors, etc. required to complete a full working system.

E. Control System Equipment and Systems
1. A simple easy to use control system (IPAD) will be utilized.

F. Miscellaneous Equipment and Systems
   1. Provide audiovisual equipment rack. This rack will be located the IDF room.
   2. Unless otherwise noted:
      a. Ensure that the equipment racks have a clear opening (between rack and cabinet mounting rails) that conforms to EIA standards of 17-3/4"; +1/16", -0".
      b. Provide blank and vent panels, as required. There are not to be any open areas on the front of the racks.
      c. Provide lockable drawer in audiovisual rack for storage of loose items, such as patch cords, equipment remote controls, wireless microphones, and other equipment dedicated to a specific room.
      d. All equipment shall be installed with "rack ears" or custom rack-mounts/face- plates, using security screws. There shall not be any shelf-mounted components in the audiovisual racks.
   3. Cabling and Accessories
      a. Provide custom plates for mounted devices. Confirm fit and finish with the Commissioner prior to fabrication.
      b. Provide custom floor plates with all required connectivity.
      c. Provide coordination with other disciplines for shared connectivity locations.
      d. Provide all loose cables, connectors, etc. required to complete a full working system.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work

3.2 INSTALLATION

A. Refer to Section 27 41 00 – Common Work Results for Audiovisual Systems.

3.3 MOUNTING HEIGHTS

A. Refer to Section 27 41 00 – Common Work Results for Audiovisual Systems.

B. Coordinate locations of the following with mounting heights as indicated on drawings and details.
   1. Technical wall plates
      a. AV input/output connections
      b. Flat panel display panel connections
   2. Pull boxes.

C. Install all technical panels plumb.

D. Arrange for adequate ventilation and access.

3.4 CABLE SUPPORT

A. Refer to Section 27 41 00 – Common Work Results for Audiovisual Systems.

B. Supporting method in accordance with Section 26 05 00
   1. Individual runs throughout building
      a. Support cable at 24” on center and 3” at any change in direction.
      b. Support from building structure only.
         1) Cables on top of ceiling tiles will be rejected.
         2) Cable supported by ceiling grid support wires will be rejected.
   2. Cable Bundles
      a. Where multiple cables combine, support at 12” on center and 3” at any change in direction.
      b. Support from building structure.
         1) Cables on top of ceiling tiles will be rejected.
         2) Cable supported by ceiling grid support wires will be rejected.

3.5 CABLE SEPARATION

A. Refer to Section 27 41 00 – Common Work Results for Audiovisual Systems.

B. Cable separation of cables for runs greater than 7.5 m.
   1. Microphone Level – 12” from all other circuits.
   2. Line Level and Control – 12” from any circuit with signal of 20dB or greater than Line Level and Control cables.
   3. Speaker level circuits – 12” from other circuits.
   4. Video and Data – 12” from any circuit with signal of 20dB or greater than Video and Data.
   5. AC Power Circuits – 12” from all other circuits.

3.6 APPROVED WIRE TERMINATION MEANS

A. Refer to Section 27 41 00 – Common Work Results for Audiovisual Systems.
   1. Solder Connections – For connectors utilizing Solder Cups
   2. Terminal strip Connectors – For termination of blunt cut cables, cable to be tinned prior to termination
   3. Multi Pin connectors – Utilize connector manufacturers crimper
   4. Crimp Cap Terminations – For Loudspeaker circuits at individual devices. Distribution cable termination to utilize terminal strip connectors.

3.7 CONTRACTORS’ FINAL CHECKOUT

A. Refer to Section 27 41 00 – Common Work Results for Audiovisual Systems.

B. Products shall conform to applicable UL standards and to general electrical requirements.

END OF SECTION 27 41 16.01

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SECTION 27 50 00 SECURITY MANAGEMENT AND ACCESS ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. General description, functional requirements, operational characteristics, and criteria for the Security Management System (SMS).

B. Related Sections:

1. Electrical: Electrical and Telecommunications systems and components.
2. Electronic Safety and Security.

1.3 DEFINITIONS

A. API: Application Programming Interface.

B. LDAP: Lightweight Directory Access Protocol.

C. NTSC: National Television Standards Committee.

D. PAL: Phase Alternating Line. PAL is the color video standard used in Europe and many other countries.

E. SMS: Security Management System.

1.4 REFERENCE STANDARDS

A. Where more than one (1) reference standard, code, or regulation applies, the more stringent one shall govern.

B. Electronic Industries Alliance (EIA):

1. EIA RS-170 - Standard for Composite Video Signals.

C. Federal Communications Commission (FCC).

1. FCC Part 15 - Unlicensed RF Devices.

2. FCC Part 68 - Requirements for Connecting to the U.S. Phone Network.

D. Institute of Electrical and Electronics Engineers, Inc. (IEEE).

E. International Organization for Standardization (ISO).

F. International Radio Consultive Committee (CCIR).

G. Microsoft® Open Database Connectivity (ODBC) Interface.

H. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.

I. National Institute of Standards and Technology (NIST):

1. Federal Information Processing Standards Publication (FIP PUBS 197) - Specification for the Advanced Encryption Standard (AES).

J. National Television Standards Committee (NTSC):

1. Color Camera Broadcast Standard.

K. Underwriters Laboratories Inc. (UL):

1. UL 294 - Standard for Access Control System Units.
2. UL 1076 - Standard for Proprietary Burglar Alarm Units and Systems.
3. UL 1981 - Standard for Central-Station Automation Systems.

1.5 SECURITY MANAGEMENT SYSTEM (SMS) DESCRIPTION

A. The Security Management System (SMS) outlined in this section and detailed in Part 2 of this section is the key central component for managing physical security and the bridge between physical and logical security for a project. The system shall provide a variety of integral functions including: regulation of access and egress; provision of identification credentials; monitor, track and interface alarms and; view, record and store digital surveillance video linked to SMS events.

B. The Security Integrator is responsible for coordinating the selection and installation of the security door hardware. The security door hardware will be installed by the electrical contractor. As part of the submittal process, the Security Integrator shall generate a spreadsheet identifying all the doors to receive electronic security devices and validate that the door hardware submittal and doors submittal shall support the required security functions. Should a conflict in function be identified, the security contractor shall alert the Commissioner. The security contractor shall be responsible to ensure that required security functions are met for each door location.

C. The Security Contractor shall be responsible for coordinating the installation with all other trades and shall provide final termination of all conductors, except as provided by the Electrical Contractor.

D. The Security Integrator shall provide complete initialization of the integrated Access Control and Alarm Management System (ACAMS) hardware and software. Security Integrator shall consult with the City of New York to determine its requirements prior to initialization. Security Integrator shall transfer and/or enter all data into the system databases, including complete hardware and software configuration, alarm point database, time zone database, employee cardholder database, reports configuration, device database, I/O database, guard tours, and any other required set-up.

E. The Security Integrator shall be responsible for coordinating the security requirements of this Section with all other trades.

F. The SMS shall utilize a single seamlessly integrated relational database for all functions utilizing a fully multi-tasking multi-threading Microsoft Windows 7 or 2008 or XP or 2003 Operating System. The SMS shall be written so that all system modules (access control, alarm monitoring, ID or credential management, visitor management, asset management and digital video management) are developed and built from a unified single 32-bit source code set. Separate source code bases for individual modules of the SMS are not acceptable.

G. Upgrades or expansion of the SMS to a larger size system in scale shall not require installation of a different and/or new SMS application or require the administrator or operator to learn a different and or new interface from the previous version.

H. The SMS shall be written using Unicode format. Unicode enables a single software product to be targeted across multiple platforms and languages without re-engineering and allows for data to be transported through different systems without corruption. The SMS graphical user interface shall be available in the following single-byte languages: Arabic (ARA), Croatian (HRV), Czech (CSY), Dutch (NLD), English (ENU), Finnish (FIN), French (FRA), German (DEU), Hebrew (HEB), Italian (ITA), Polish (PLK), Portuguese Brazil (PTB), Russian (RUS), Spanish (ESP), and Swedish (SVE). The SMS graphical user interface shall be available in the following double-byte languages: Chinese Simplified (CHS), Chinese Traditional (CHT), Korean (KOR), and Japanese (JPN). Language Accessory Add-ons shall require a special language- specific license bit in order for the Language Pack to be used.

I. The SMS software developer shall be a Microsoft Silver Certified Partner.

J. The SMS shall be Microsoft Windows XP Certified.

K. The SMS shall be compatible with Microsoft Windows 7, and shall have passed Microsoft-designed tests for compatibility and reliability on Windows 7.

L. The SMS shall be UL 1076 Listed.

M. The SMS shall have FIPS 140-2 certification.

N. The SMS shall only require a single license key to be present on the database server for the SMS to operate. The license key shall either be a physical device or a software license key. The SMS shall allow the SMS USER the ability to activate, return, or repair the software license key. The software license shall only be used on a physical computer or in a VMware virtual environment. License keys shall not be required at the client workstations. The license key on the database server shall determine the number of client workstations that shall be able to

connect to the SMS as well as all SMS functionality. An alarm shall be generated in the SMS's Alarm Monitoring application as the license expiration date approaches.

O. The License Administration login and password shall be encrypted when they are passed to the License Server. The hash shall not be the same data even with the same logon credentials on different systems. This is a requirement for U.S. government DIACAP certification.

P. The SMS shall support concurrent licensing with respect to client licenses. CUSTOMER shall purchase a fixed number of client workstation licenses (or connections) that shall be programmed into the database server license file. The SMS shall be installed on any number of client workstations in the CUSTOMER facility. Then, any of the client workstations that have the SMS software installed shall have the ability to connect to the database server as long as the maximum number of concurrent connections purchased has not been reached. Connections shall be licensed on a per module basis. This shall provide CUSTOMER with great flexibility in system design and layout.

Q. The SMS shall provide support for single sign-on capability. Single sign-on shall allow System Administrators or System Operators to authenticate into SMS applications using their Windows domain account.

R. Single sign-on shall support the following scenarios:

1. Allow System Administrators or System Operators to interactively run SMS applications without having to enter a username or password. This shall make administration of the SMS easier since maintenance of separate SMS usernames and passwords is not required.
2. Allow SMS API scripts to authenticate. These scripts shall be run using a Windows account allowing a seamless and secure way to authenticate the account and restricting the script to those actions that the user is permitted to perform.

S. The SMS shall be able to communicate with intelligent system controllers via RS-485, RS-232, TCP/IP or Ethernet, and dialup via modem.

T. Tasks shall be accessible from any compatible client workstation on the network utilizing one (1) or all of the following:

1. Traditional client-server architecture.
2. N-tier architecture where the SMS supports the expansion of the system architecture and allows for user deployment based upon their system architectural needs. The SMS shall allow for, but not require, the separation of the database, application server, Web server, and client interface. The system shall require that all connections to the database be performed through a trusted link from the client or internet browser interface.
3. Centralized distribution (publishing) of applications using Windows Terminal Server and Citrix® on Windows, UNIX, Linux or Apple Macintosh based systems through any compatible internet browser application and/or by means of a mobile computing platform using a wearable computer, Tablet PC, or PDA device.

U. Utilize an open architecture where all data must reside on a single database and must be accessible in real time to SMS workstation or Web-based client connected to the network. The system shall be configurable to support all of the following databases: Microsoft SQL Server

2008, Microsoft SQL Server 2005, Oracle Server 11g, and Oracle Server 10g. Oracle data may reside on Windows or UNIX platforms.

V. Transparent data encryption (TDE) shall be supported. TDE shall perform real-time I/O encryption and decryption of the database and database log files. (Standard SMS log files shall not be encrypted, and TDE shall not provide encryption across communication channels.)

W. The system architecture shall support Microsoft Windows Clustering, Hot Standby, Fault Tolerant Servers and Fault Tolerant Hot Standby Servers.

X. The SMS shall be able to connect to and interface bi-directionally with external data sources utilizing all of the following methods:

1. ASCII with support for XML formatted text exchange of data activated both manually and automatically.
2. ASCII with support for XML formatted text exchange of data using a direct table interface activated both manually and automatically.
3. Real-time exchange of data via Active Directory or LDAP utilizing an API (Application Programming Interface) written by the SMS manufacturer. The live exchange of data shall expose SMS events and transactions to other data sources in real-time and allow for receipt of data into the SMS where this data may be acted upon and trigger linked events in the SMS in real-time.

Y. The SMS shall support:

1. ISONAS PureIP series: unlimited access control readers, unlimited number of inputs or outputs, minimum of (5) concurrent client workstations.

1.6 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings.

1. Manufacturer's technical data for all material and equipment at the system and sub system level to be provided as part of the SMS.
2. A system description including analysis and calculations used in sizing equipment required by the SMS. The description shall show how the equipment will operate as a system to meet the performance requirements of the SMS. The following information shall be supplied as a minimum:
   a. Server(s) processor(s), disk space and memory size.
   b. Description of site equipment and its configuration.
   c. Network bandwidth, latency and reliability requirements.
   d. Backup or archive system size and configuration.
   e. Start up operations.
   f. System expansion capability and method of implementation.
   g. System power requirements and UPS sizing.

h. Device or component environmental requirements (cooling and or heating parameters).
i. A description of the operating system and application software.

C. Shop Drawings: Submit plans, elevations, sections, details, and attachments to other work.

1. Indicate all system device locations on architectural floor plans. No other system(s) shall be included on these plans.
2. Include full schematic wiring information on these drawings for all devices. Wiring information shall include cable type, conductor routings, quantities, and connection details at device.
3. Include a complete SMS one-line, block diagram.
4. Include a statement of the system sequence of operation.

D. Operation and Maintenance Data: For electronic security system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23, include the following:

1. Provide sets electronic format manuals including operating instructions, maintenance recommendations and parts list including wiring and connection diagrams modified to reflect as-built conditions.
2. Manuals: Deliver final copies of the manuals within 14 days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the Contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following:
   a. Functional Design Manual: Identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Include a description of hardware and software functions, interfaces, and requirements.
   b. Hardware Manual: Describe equipment furnished including:
      1) General description and specifications.
      2) Installation and check out procedures.
      3) Equipment layout and electrical schematics to the component level.
      4) System layout drawings and schematics.
      5) Alignment and calibration procedures.
      6) Manufacturer's repair parts list indicating sources of supply.
      7) Software Manuals: Describe the functions of software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
      8) Definition of terms and functions.
      9) System use and application software.
      10) Initialization, startup, and exit.
      11) Reports generation.
      12) Details on forms customization and field parameters.

3. As-Built Drawings: During system installation, the Contractor shall maintain a separate hard copy set of drawings, elementary diagrams, and wiring diagrams of the SMS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the SMS. Copies of the final as-built drawings shall be provided to the end user in DWG and PDF format.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. SMS manufacturer shall be an established organization with referenced and documented experience delivering and maintaining SMS of equal or higher sophistication and complexity as compared to the system detailed in this specification.
2. SMS manufacturer shall employ at a minimum the following methods for quality assurance of component and assembly devices.
   a. Perform visual inspection of devices to verify assembly according to defined procedures. Perform end of line operational tests to ensure product functionality has been correctly configured.

3. Perform individual functionality and system level regression testing to ensure compliance with product specifications. Perform single and multiple unit system tests to mimic end-user installation configurations. Utilize automated hardware and software testing to evaluate system performance under published operational loads and compare to published system capabilities.

B. Bidder Qualifications:

1. At the time of the bid, the bidder shall have satisfactorily completed projects of a similar size, scope and complexity as the system detailed in this specification. The bidder shall furnish written proof of experience from three (3) references and proof of current accreditation or certification by the manufacturer for required training for sales or installation or service of the SMS and associated devices.
2. The bidder shall also be a factory authorized local service organization that shall carry a complete stock of parts and provide maintenance for the SMS and related systems under this contract. Local shall be defined as an area in a (70) mile radius of installed location.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.

B. Store components and equipment in temperature and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 degrees Fahrenheit (10 and 29.4 degrees Celsius), and not more than 80 percent relative humidity, non-condensing.

C. Open each package; verify contents against packing list; and file copy of packing list, complete with package identification, for inclusion in operation and maintenance data.

D. Mark packing list with the same designations assigned to materials, components, and equipment for recording in the system labeling schedules that are generated by software.

E. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.9 WARRANTY

A. SMS, Third-party, and Access Control and Digital Video Warranty:

1. SMS manufacturer warrants that the product and hardware key shall be free from defects in material and workmanship and that SMS software product will function in substantial accordance to SMS manufacturer's specifications. Any defective media will be replaced at no charge provided that the system is currently on a supported version of SMS software.
2. All SMS manufacturer branded access control hardware, are provided with a three (3) year warranty from the date of shipment to the Reseller. SMS manufacturer warrants that such products will be free from defects in material and workmanship and that they will operate in general accordance with their product specifications. The parts will be repaired or replaced at the manufacturer's option. Reseller shall follow SMS manufacturer's procedures for RMA with these products. SMS manufacturer provides repair or replacement of SMS manufacturer branded components for up to five years from the product discontinuance date.
3. Transfer SMS third-party device warranties from the manufacturer to the Contractor, which may then transfer third-party warranties to the City of New York. Specific third- party warranty details, terms and conditions, remedies and procedures, are either expressly stated on, or packaged with, or accompany such products. The warranty period may vary from product to product. These products include but are not limited to devices that are directly interconnected to the SMS field hardware or computers and are purchased directly from the SMS manufacturer. Examples may include but not be limited to: credential printers, reader heads, biometric devices, computers, etc.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: The security management system is based on products of ISONAS, 4750 Walnut Street – Suite 110 Boulder, CO 80301; Telephone: 303-567-6516; Web site: www.isonas.com

B. Substitutions will be considered under provisions of Section 01 60 00.

2.2 SMS SOFTWARE

A. Security Management System (SMS) Software: Isonas Pure Access Cloud or Manager or Approved Equal.

2.3 SMS FIELD HARDWARE

A. Security Management System (SMS) Hardware: The SMS shall be equipped with the access control field hardware required to receive alarms and administer all access granted or denied decisions. All field hardware must be designed to meet UL 294 requirements. The SMS must be able to retrieve device serial numbers from all field hardware, excluding card readers, biometric readers, and keypads. Depending upon the configuration, the SMS field hardware must be able to include any or all of the following components:

1. Pure IP Reader-Controller (RC-04) or Approved Equal
2. IP Bridge
3. Network Adapters
4. PoE+ Managed Network Switches
5. Power supplies and enclosures
6. UL, CUL, and CE listed power supplies and enclosures

2.4 SERVER REQUIREMENTS

A. Database Servers

1. Furnish and Install (1) Server for Windows Access Control, Alarm Monitoring and Credential Management Systems
   a. Dell PowerEdge or Approved Equal
   b. Intel® i5 Processor (or Approved Equal) or better
   c. 8GB Memory DDR4 RAM
   d. 24X IDE CD-RW/DVD ROM Drive
   e. 500GB SSD 2.5" for Operating System
   f. 500GB SSD 2.5" for Database
   g. Four 10/100/1000 Ethernet Network Ports
   h. 22 in. Flat LED Monitor
   i. Onboard HDMI and VGA
   j. 4 USB 3.0 ports
   k. Speakers
   l. USB Keyboard
   m. USB Optical Mouse
   n. Surge Suppression Strip
   o. Microsoft Windows Server 2012R2 or newer
   p. Pure Access Manager or Cloud software or Approved Equal

2.5 COMPONENTS

A. SMS Software Capabilities: Support an unlimited number of card readers, input points, intrusion detection points, and relay outputs. The SMS database server shall support an unlimited number of cardholders, visitors, and assets limited only by the available memory on the controller. The database server shall also support an unlimited number of system events and System Operator transactions in the history file limited only by available hard disk space. Client Workstations shall be limited only by the limitations of the operating system server software. The SMS functions are categorized into “system modules” which shall include:

1. Access Control
2. Alarm Monitoring
3. Credential Management
4. Intrusion Detection Management
5. Badge Layout Creation
6. Screen or Forms Creation
7. Graphical Map Creation
8. Application Programming Interfaces
9. Data Import
10. SMS to Controller Encryption
11. Controller to Reader Interface and I/O Module Encryption
12. Area Control: Provide eight (8) area control features: Global Hard Anti-passback, Global Soft Anti-passback, Timed Anti-passback, Two Person Control, Designated One Person Control, Designated Two Person Control, Tail Gate Control, and Occupancy Limit. Area control shall be a security method of preventing a person from passing their badge to another person for dual entry into a single location utilizing one (1) card.
13. Elevator Control
14. Pre-Alarm
15. Alarm or Event Logging
16. Scheduling Utility
17. Multiple Card Formats
18. Card Reader Cipher Mode.
19. Denied Access Attempts Counter
20. Card Reader Timezone Overrides:
    a. Online Context-Sensitive Help: Provide online context-sensitive help files to guide System Administrators and System Operators in the configuration and operation of the SMS. The help menu shall be available from any window in the SMS by pressing the F1 function key or clicking on the Help icon in the toolbar. Help windows shall be context-sensitive so System Administrators can move from form to form without leaving the help window. The SMS shall also come with complete online documentation on the product media.

21. Monitor Zones:
    a. Advanced Field Device Control

22. Alarm or Event Routing:
    a. Text Instructions

23. Customizable Voice Instructions
24. Customizable Voice Annunciation
25. Alarm Attributes: The System Administrator shall have the ability to configure how the SMS handles the annunciation of alarms on an individual basis.
26. Alarm-Event Mappings: Provide the following options:
    a. Alarm Masking: The ability to mask the alarm input on a timezone basis.
    b. Local Linkage: The ability to locally link outputs with inputs that are attached to the same controller.
    c. Activate Output: The ability to activate an output tied to the controller on a time zone basis.
    d. Activate Output Always: The ability to activate an output always.

e. Configuration of Debounce Times: The ability to control the amount of time that an input state change must remain consistent in order for it to be considered a real change of state.
f. Configuration of Hold Times: When configuring an Alarm Input, a hold time setting shall be settable from 0-15 seconds.
g. Checkpoint: The ability to configure an input as a designated stop on one or more guard tours.
h. Supervised Input: The ability to specify if a specific alarm contact on the controller is a supervised or unsupervised contact.

27. Entry or Exit Delay: The ability to set up entry or exit delays for inputs that are attached to any controller. System Administrators shall have three options for entry or exit delay:
    a. Non-Latched Entry: When an input activates, the alarm will not be reported until the Entry delay expires. If the input is still active when the entry delay expires, the alarm will be reported. If the input is not active when the entry delay expires, then the alarm will not report.
    b. Latched Entry: When an input activates, the alarm will not be reported until the Entry delay expires. If the input is still active when the entry delay expires AND the alarm has NOT BEEN MASKED, the alarm will be reported. If the input has been masked when the entry delay expires, then the alarm will not report.
    c. Exit Delay: When an input activates, the alarm will not be reported (operates as if masked) until the Exit delay expires. If the input is still active when the exit delay expires, the alarm will be reported. If the input is not active when the exit delay expires, the alarm will not be reported.

28. Controller Options: System Administrators shall have the ability to group add, modify, and delete controllers in the SMS. The SMS shall have a copy command, allowing System Administrators to easily and efficiently add controllers. The copy command will copy all information configured for a controller selected and apply those same characteristics to the new controller being added. System Administrators shall also have the ability mark controllers as ‘online’ or ‘offline’ depending on whether those panels are online. The SMS shall also prompt the System Administrator if the System Administrator attempts to configure the number of cardholders (and assets, if applicable) that will be downloaded to a controller to a number greater than that which the controller’s memory can handle.
29. Basic Integrated Intrusion Functionality: System Administrators shall have the ability to define Alarm Mask Groups for sets of points. These sets of points can then be treated as an intrusion area. Indication of events from these points can be masked (disarmed) or unmasked (armed) through the Alarm Monitoring application. The SMS shall support Intrusion Mask Groups. The Intrusion Mask Group shall contain intrusion points. These intrusion points shall be individually configured in the SMS. Once intrusion points are assigned to an intrusion mask group it shall be monitored by the SMS to determine the current state of the intrusion mask group. Alarms shall be reported for the intrusion mask group by the SMS based on the current arming mode and state of the intrusion mask group. The System Administrator shall be able to define which Integrated Intrusion commands (Arm or Disarm or Force Arm or View Faulted points) are allowed and whether a credential is required to execute each of them. The System Administrator shall also be able to assign each Integrated Intrusion command to a function key (if supported by the device), and define up to eight 16-character ASCII strings to be continuously scrolled on the device display (if so equipped).
30. The Alarm monitoring application shall have the option of providing at least the following capabilities:

a. Visual and Audible indication of entry and exit delays
b. Current status of any faulted points in the group
c. Audible and visual indication that an alarm has occurred
d. After an alarm occurs, a list of points faulted during the previous armed period leading up to the alarm
e. When disarmed, an audible chime when programmed point in the group change state
f. Alarm Monitoring - Alarms Monitored: When the SMS is configured, the System Administrator shall assign a default monitor zone to be monitored. The monitor zone shall include default alarm types with default timezones of which the alarm type will be monitored. These monitor zones will then be assigned to an alarm monitoring client workstation. The SMS shall allow for the monitoring of a combination of one or more controllers, alarm inputs, alarm outputs, and card readers. If applicable, the SMS shall also allow the monitoring of a combination of fire alarm panels, intrusion detection devices, central station alarm receivers, intercom exchanges, intercom stations, and personal safety panels. System Administrators shall have the option to define monitor zones to include all sub devices of a controller or to choose which sub devices of an ISC and/or digital video recorder belong to that monitor zone. Alarm monitoring client workstations shall be configured to annunciate any or all of the following types of alarms: access granted alarms, access denied alarms, system alarms, emergency alarms, and/or area control alarms.
g. The SMS shall allow for automatic update of the list of hardware devices as they are added, modified or deleted from the SMS. Newly configured devices and changes to existing devices shall be reflected in the hardware list automatically. The SMS shall indicate a deleted device by changing the icon and text associated with the device. Upon the next login, the SMS shall remove the device from the hardware tree.
h. Alarm Annunciation Configuration: The System Administrator shall have the capability to configure how the SMS handles the annunciation of alarms on an individual alarm or event basis.
i. Alarm Handling
j. Current Status Indication
k. Alarm Monitoring on Multiple Windows
l. Device Group Support: Support device grouping for uniform command and control of groups of devices within the system. Four types of homogeneous device groups shall be supported:
    1) Card Reader Groups
    2) Input Groups
    3) Relay Output Groups
    4) Video Camera GroupColor

31. Cardholder Record Call-up: From the alarm monitoring window, the System Operator must be able to display a cardholder record with the stored cardholder's image. This feature shall be user configurable to be automatic meaning that the Cardholder Window will automatically appear on the Alarm Monitoring client workstation on cardholder activity and will display the current cardholder's information with photo. The Cardholder Window will automatically update with updated cardholder information as additional cardholder activity is generated. This feature shall be provided at all alarm monitoring client workstations to assist the System Operator in determining the access rights of an

employee who may have forgotten his or her badge or to verify that the individual presenting the card is the correct individual cardholder. Utilizing a database search via the input of the cardholder's name or other key search field, or by selecting a cardholder record call-up from the main monitoring window on a cardholder alarm, the SMS must access the employee's personnel file, containing pertinent information and the employee's image for identification by the System Operator. The System Operator shall not be required to exit alarm monitoring to view this information and this operation must not restrict the operation of monitoring alarms. In the event of an access denied or access granted card reader alarm signal to the alarm monitoring client workstation, this function shall be available as a menu or mouse selection, based on the alarm event. Data input by the System Operator shall not be required.

32. Inactive Badge Alarm: The SMS shall provide an alarm, indicating current badge status, if an attempt to gain access is made with a badge that has a status set to any value other than “Active” in the cardholder record. Typical inactive badge status values include “Lost” and “Terminated”. Access shall be denied for this attempt. By default, the SMS shall come with this feature disabled; the System Administrator shall have the ability to enable this functionality.
33. Request to Exit Event: The SMS shall provide an event when a Request to Exit (REX) is used. By default, the SMS shall come with this feature disabled; the System Administrator has the ability to enable this on a reader by reader basis.
34. Real-Time, Live Video User Verification: Have the capability to interface with a CCTV system and display a live video image next to a stored cardholder image record. This feature shall be system configurable.
35. Cardholder Photo Verification: From the alarm monitoring window, the SMS shall optionally display the stored cardholder photo for each credential presented at the user- specified reader(s). This function shall allow an operator to verify that the person using the credential matches the stored photo. The system operator shall be able to select from a list of readers. As the cardholder badges through the selected reader their photo shall appear in the Cardholder Verification window. The system operator shall be able to open multiple Cardholder Verification windows to cover multiple readers at the same time. If the Cardholder Verification window is open when the Alarm Monitoring application is closed then the Cardholder Verification window shall open automatically next time the application is launched.
36. Cardholder, Card Reader, or any Field Hardware Device Trace: From the alarm monitoring window, the System Operator must be able to initiate several traces of cardholders, assets, and/or field hardware devices while monitoring alarms. This information shall be continuously accumulated in the dedicated trace window until the trace is stopped. The trace operations must not interfere with the operation of the alarm monitoring, and be continuous while alarms are monitored. The results of each trace shall be printable on the report printer or displayed on the screen. The traces shall operate independently, such that one trace may stop and start without interfering with another. Trace windows operate independently of each other and the Main Alarm Monitoring Window. Thus, different Alarm Filter sets shall be settable for each alarm window (Main Window and Trace Windows) open in Alarm Monitoring. For example, the Main Alarm Monitoring Window may not monitor Access Grants Events, while one or more of the trace windows are monitoring Access Grants Events. The operator of the SMS’s Alarm Monitoring application shall be able to acknowledge alarms from any alarm view window (even if they are no longer present in the Main Alarm Window). The alarm view windows shall include Main Alarm Monitor, Trace Monitors, Pending Alarms, and Video Verification. The SMS shall allow for individual alarm acknowledgement and fast or group acknowledgement. The SMS shall support historical traces. Historical traces shall allow

System Operators to specify the date and time range that they would like displayed for the particular device that is being traced. For example, a System Operator may perform a historical trace that shows the last seven days activity at a particular card reader. Events are then added in real-time during and after the database has been searched for historical events. Historical traces shall also have the ability to be run against restored (previously archived) data. The SMS shall allow System Operators to filter alarm types from the history trace window. Alarms that shall be filtered from the trace window are access granted alarms, access denied alarms, system alarms, duress alarms, and area control alarms. If applicable, alarms that shall also be filtered are asset alarms, fire alarms, intercom alarms, central station receiver alarms, video clips, and transmitter alarms. The SMS shall allow for a trace on any controller, Alarm Input, Credential, Intrusion Detection Device, Monitor Zone, or card reader to be performed. If applicable, the SMS shall allow for a trace on any asset, intercom, or camera to be performed.

37. Auto Exit to Windows 7 or 2008 or 2003 or XP Login Window: Configurable to automatically exit the Alarm Monitoring application and log the System Operator out of the Windows 7 or 2008 or 2003 or XP Operating System when a System Operator logs off an alarm monitoring client workstation. The SMS shall then bring the System Operator to the Windows Login Window for the next System Operator to log on.
38. Grant or Deny Popup Window: The SMS shall have the ability to launch a pop-up window when a request for access is made through global input or output activity, such as when an intercom station is linked to a door. Upon activating the intercom, the pop-up window shall be displayed in the Main Alarm Monitoring Window and the System Operator shall then have the ability to issue a grant or a deny for the open-door request.
39. Alarm Monitoring – Column Display and Configuration: Allow System Administrators and System Operators to define which columns are displayed in the Main Alarm Monitoring Window and in which order. System Administrators and System Operators shall also be able to determine the column order.
40. Test Mode: Support a Test Mode for Alarm Inputs, Door Forced Open, Access Grants. Tests on Input Device Groups shall be available to verify that all inputs within the group are operational. Upon entering into Test Mode and for the duration of the test, alarms from members of the group shall either be displayed in a separate window or view on test alarm monitoring client workstations or on all Alarm Monitoring client workstations in which the alarms are usually routed. During the test (the duration of the test shall be set by the System Operator), all inputs within the group are manually activated in the field. At the end of the time duration, a report shall be generated flagging any inputs for alarms that were not received. During the Test Mode, all alarm operations carry on as programmed (that is, Global I/O functions, CCTV commands, printer activity, etc.) so that all functions are tested.
41. Manual Control: Provide the System Operator the option to manually control over all output points or input points connected to the SMS. Control points are defined as any door strike, auxiliary card reader output, or any other relay output.
42. Destination Assurance: Provide the ability to alert the system operator when a cardholder does not reach a required location and present their credential after entering at a designated checkpoint in a designated period of time.
43. CCTV Interface Option: Capable of passing alarm information with any CCTV Matrix System that utilizes ASCII commands. When the SMS receives an alarm from any monitoring point on the SMS, a minimum of three (3) ASCII control commands of up to 32 characters each relating to that alarm point may be sent to a CCTV matrix switcher per alarm input or card access alarm. The three (3) commands are sent based upon the following condition:
    a. Upon arrival of the alarm at the SMS

b. Upon “selecting” or reviewing of the alarm
c. Upon alarm acknowledgment or clearing the alarm

44. Real-Time, Dynamic Graphical Maps:
    a. Support graphical maps that display device or group status, function lists and video cameras dynamically in real-time. The maps may be configured to appear on command or when specified alarms are selected for acknowledgment. Map device icons shall have the ability to dynamically change shape and/or color to reflect the current state of the device. The SMS shall indicate if the field hardware is not operating with the most current version of firmware.
    b. Support all map formats
    c. Support map hierarchies or maps within maps. There shall be no limit to the number of maps that shall be nested hierarchically with each other. Multiple maps may be displayed simultaneously.
    d. Support user-defined icons for field hardware devices. The SMS shall also give System Operators the ability to affect the mode of card readers, open doors, start a trace on a device, mask or unmask alarm inputs, and activate or deactivate or pulse an output from the map icons.
    e. The graphical maps shall have the ability to be printed to a local printer.

45. Real-Time Graphical System Status Tree and List Window. The SMS shall give System Operators the ability to acknowledge alarms from the real-time graphical system status tree or list window without going back into the Main Alarm Monitoring Window. The SMS shall also allow System Operators to affect the access mode of card readers, open doors, start a trace on a device, mask or unmask alarm inputs, and activate or deactivate or pulse an output from the tree icons. The system hardware status tree or list window shall have the ability to be printed to a local printer. The SMS shall also allow System Operators to launch a video player to view live video at the video camera selected.
    a. Function List icons shall be able to be placed onto the System Status Tree and thus, System Operators shall have the ability to control and activate function lists from the tree.
    b. Alarm Masking Group icons shall be able to be placed onto the System Status Tree and thus, System Operators shall have the ability to view the status of the alarm masking groups and control the groups from the System Status Tree.
    c. Anti-passback area icons shall be able to be placed onto the System Status Tree and thus, System Operators shall have the ability to control area status (open or closed) from the tree.

46. Automatic Credential Deactivation by Lack of Use: Have an automatic credential
47. E-mail Interface Option: Support an e-mail interface seamlessly integrated within the SMS Alarm Monitoring application. System Operators shall have the ability to manually or automatically send ASCII text e-mail messages from the Alarm Monitoring application on demand regarding any alarm currently displayed in the Main alarm monitoring window. E-mails shall have to ability to be sent to multiple e-mail accounts if desired. Integrate with Microsoft Exchange Server.
48. Modify Existing Field Names of SMS Cardholder Form: The SMS shall provide a method of defining basic user-defined fields. It shall allow System Administrators to rename the standard database fields in the cardholder form of the SMS and move the fields to different locations on the form. Additional functionality shall be available in the advanced Forms Designing and Editing Module.

49. Cardholder Active Badges: A cardholder may possess one or many badges at any one time.
50. If a badge is updated or re-issued, the SMS shall guide the System Operator to first change the existing badge's status to the appropriate classification (de-activate) before a re-issue of the new badge occurs.
51. By utilizing the previously captured image and employee record, the SMS must allow for fast and efficient re-issuance of a badge. As this re-issued badge is printed, the SMS shall update its database to remove access rights from the old badge number and activate the new badge number.
52. Each cardholder record shall offer a user-definable activation and expiration date field. The activation date shall be changed by a System Operator to establish a future activation date. A System Operator shall be able to re-activate a card that has been previously de-activated.
53. When issuing a new badge to a cardholder, System Operators shall be able to assign the pre-existing badge deactivation date and time to the badge instead of the default deactivation date and time for new badges. The deactivation date and time may be assigned on a per badge type basis.
54. A badge form will keep a complete history of every badge that was assigned to the cardholder's record. The history shall be complete with cardholder badge ID, issue code, badge type, badge status, activation and deactivation dates and times, PIN numbers, embossed numbers, and anti-passback information.
55. Badge status deactivate
56. All active badges can be configured to change to another badge status when the deactivate date has passed. It is possible to configure this system-wide or per badge type. The badge status shall change 24-48 hours after the deactivate date.
57. Multiple Active Badges: The SMS shall support a user configurable Multiple Active Badge feature. This shall allow cardholders in the System to have up to a user-defined pre-determined number of badges active in the SMS at any one time. System Administrators shall have the ability to set the maximum number of active badges allowed in the SMS.
58. Assign Access Levels: At the time a badge is created it shall be possible to have up to 128 access levels assigned to the cardholder's badge plus any precision access groups. For convenience, the System Administrator must be able to define default access levels to be assigned for given badge types. If a System Operator has proper authorization, cardholder access levels shall be modified. When a badge is created with access rights, or modified, that change shall be downloaded to all controllers immediately upon completion of the change. Record changes for access rights shall affect only the modified record, and shall not require a download of the entire cardholder database. The access changes shall be downloaded to the field hardware as soon as the employee record change is complete. This badge record download shall not affect field hardware operations. When a badge reaches its deactivation date or time the SMS shall automatically deactivate the access rights associated with the badge. All access rights of a badge shall be eliminated after the expiration date. Should the cardholder become authorized for access again, new access rights shall be applicable to the same badge, and re-issue shall not be required. Should an expired cardholder swipe his badge after his card has expired, access shall be denied and an "invalid credential" alarm event shall be generated to the alarm monitoring client workstation. All cardholder information shall be stored for future retrieval or reporting. An access level form shall show System Operators all access levels configured in the SMS and the associated access levels that are assigned to the cardholder's current badge. The SMS shall allow the System Operator to double-click the mouse on any access level to view all of the card reader and

timezone combinations that are assigned to that access level. The SMS shall also support access groups, which shall be assigned to cardholders. Access groups will consist of up to thirty-two access levels of which shall be viewed by System Operators by clicking on the desired access group.

59. Bulk Assignment or Modification or Deletion of Access Levels: System Administrators or System Operators shall have the option for Bulk Assignment, Modification, and/or Deletion of Access Levels to active badges for a group of cardholders. This feature shall allow System Operators to perform a search of the cardholder database and then apply any additions, modifications, or deletions of access level assignments to all active badges for that group of cardholders.
60. Search Records: The SMS must allow the System Operator to search for records and images using search criteria on any field(s) in the database. The System Operator must be able to enter the search criteria for one or a combination of fields. In addition, partial searches shall be performed. For example, a partial last name search on “Fitz” might return “Fitzpatrick,” “Fitzgerald,” or “Fitzerbauch.” Using a partial name or letter shall return every record in the database that contains that information in its last name field. The SMS shall support basic Boolean logic searches (greater than, greater than or equal to, less than, less than or equal to, equal to). For example, a last name Boolean Search “>B<F” will return to the System Operator all records whose last name begins with the letter C, D, and E. These records shall be viewable sequentially using search keys. The SMS shall allow for the System Administrator the ability to limit the ability of a System Operator to search the database. This shall prevent the System Operator from searching through records when viewing a cardholder screen from an event when using Alarm Monitoring. In a query with no matching records, the SMS must display a message within three (3) seconds indicating that there is no match for the key field information supplied.
61. Credentials: Support the following credential types and allow for direct Thermal Dye Sublimation printing onto the credential surface.
    a. Composite Credentials - 3.375 in. x 2.125 in., UPVC Composite credentials with an ISO standard 30 mil thickness.
    b. Proximity credentials: Proximity shall be an access control or identification technology that utilizes radio frequency (RF) circuits in microchip form. The microchips are encoded and transmit the encoded information when activated. The proximity card shall be used with its associated proximity card readers. The SMS shall be provided with the following proximity card design options:
        1) The proximity card shall be a polycarbonate-based card that cannot be run through direct card printers. This card shall offer a clip slot pre-punched.
        2) The proximity card shall be a PVC dual technology card that employs both proximity and magnetic stripe technology. It shall comply with ISO standard for thickness (30 mil). This card shall allow the printing of cardholder record fields including photo directly on the card.
    c. Smart Cards – Contact and Contactless:
        1) Contact smart cards shall be utilized for access control or identity verification technology. Through use of an embedded memory chip, protected electronic data shall be stored on the smart card. Standard card configuration shall include cardholder, biometric, and access information. Contact cards shall require insertion into a card reader which interrogates the card via physical contacts. When coupled with a smart card reader, the smart card shall have the processing power to serve as an access control device, for use in network security and physical access control. The SMS must possess the ability to integrate with the ActivIdentity Card Management System. This integration must allow the System Operator the

ability to personalize contact smart cards during the badge issuance process. The integration also must allow for communication during such events as badge encoding, activation, deactivation, and deletion.

62. Enrollment and Credential Creation - Enrollment:
    a. System Operators shall be able to enroll cardholders on a one by one basis. System Operators will fill in all required fields including name and badge type. The SMS shall determine a number of attributes based on the cardholder's badge type. These attributes shall be:
        1) Default Deactivation Date or Time - The deactivation date or time shall have the ability be set for a pre-determined number of days, months, or years; or for an exact specified date.
        2) Default Access Levels
        3) Badge Design Layout
        4) Which Printer will Produce the Badge
        5) Information and Encoding Format to be Encoded onto the Magnetic Stripe

63. Based on the badge type selected, additional fields shall be required for data entry above and beyond the standard required fields. For example, a Contractor badge may require the field "Company Representing" to be filled in before the badge can be saved and printed.
    a. System Operators shall also enter a Badge ID of up to 18 digits for the cardholder. The cardholder Badge ID shall be determined in one of the following manners:
        1) Manually entered by the System Operator
        2) Automatically generated by the SMS
        3) Use of the Social Security Number as the Badge ID number
        4) Use of EMPID as the Badge ID number

64. Badge ID ranges shall be able to be pre-defined, if desired, by the System Administrator based on Badge Type. For example, the Employee Badge Type may allow Badge IDs to range from 1-49,999 while the Visitor Badge Type Badge IDs range from 50,000-50,999. Multiple Badge ID ranges may be configured for each Badge Type. System Administrators shall have the option of determining how Badge IDs are generated for each Badge Type. For example, the Employee Badge Type shall generate Badge IDs automatically while Visitor Badge IDs must be manually entered into the system at the time of enrollment. Badge ID ranges may be system wide. For example, all Badge IDs (regardless of Badge Type) must fall within a specific range.
65. System Operators shall have the option of utilizing PIN Codes of up to nine digits, embossed numbers, and anti-passback exemptions for each cardholder who is enrolled in the SMS. System Operators shall also assign any temporary access levels for each cardholder that is enrolled.
66. The SMS shall allow for fast and efficient re-assignment of Badge IDs for use for Temporary badges through use of Re-Assignment Wizards. Re-assignment shall be such that the Badge ID shall be stored in the Audit Trail and reported with the cardholder that was assigned to that Badge ID for the specified period of time.
67. Cardholder Image Capture:
    a. Compatible with flash lighting, RGB video cameras, composite input cameras, S-Video input sources, USB sources and digital cameras and allow the capturing of the cardholder image at a minimum resolution of 1024 x 968.

b. SMS image capture, storage, and hardware compression techniques must be in compliance with the ANSI standard or JPEG. Cardholder images must be stored as Binary Large Objects (BLOB) within the cardholder record.
c. Provide the ability to capture a cardholder's image through the use of any industry standard scanner or digital camera that utilizes a TWAIN interface. Images shall be able to be scanned in at up to 16.7 million colors for a true color scanned image. When using a digital camera that supports multiple resolutions, the system shall allow the operator to select the desired resolution.

68. Intrusion Detection: The SMS shall support an intrusion detection solution allowing for the detection of, and differentiation between, humans, vehicles, and small animals. The intrusion detection solution shall be capable of being used in both interior and exterior situations. The intrusion detection solution shall contain advanced mechanics that distinguish between moving trees or other inanimate objects so as to avoid false alarms.
69. Integrated Intrusion Detection Interface:
    a. Provide seamless integration with intrusion detection panels. This shall allow for the ability to monitor intrusion detection alarms in real time inside the SMS Alarm Monitoring application and allow for command and control of supported intrusion detection. Once alarms are brought into SMS, they shall have the ability to be linked to digital video and/or global I/O, and they shall be stored in the SMS database.
    b. Communication with the intrusion detection panel shall be achieved through a direct wired RS-232 or a LAN connection.
    c. Intrusion detection panel devices (zones, relays) shall be definable and added to the SMS database.
    d. Allow for the configuration of Intrusion Detection Zones, Areas, Relays and Doors. Operators shall have the ability to mark intrusion detection Zones, Areas, Relays and Doors as 'enabled' or 'disabled'.

70. Asset Management System (AMS):
    a. A system that is seamlessly integrated with the SMS and all integrated SMS systems. Store asset data in the SMS database and incorporate related functions and features of the SMS into the AMS.
    b. Employ a distributed architecture so that all access or asset decisions are only made locally at the controller. Store assets locally at the ISC and make decisions to grant asset access by the local ISC. Decisions made at the HOST or Database Server PC shall not be allowed.
    c. Employ asset technology independence. Support multiple asset technologies including Radio Frequency Identification (RFID) and bar code.
    d. Support multiple card reader technologies. Support any card reader that outputs a standard Wiegand communications protocol including proximity and bar code readers.
    e. Allow specified readers to require an authorized asset before granting access.
    f. A record for each asset shall be created in the Asset Management System by entering the required data into the appropriate data fields.
    g. The AMS must allow the System Operator to search for assets and images using search criteria on any field(s) in the database.
    h. System Administrators shall be able to divide corporate assets into subdivisions called classes.
    i. System Operators shall be able to enroll assets on a one by one basis.

j. System Operators shall be able to assign or re-assign the asset to the current cardholder record selected with a single-click of the mouse.
k. System Administrators shall be able to define how assets are handled in the AMS. The AMS shall either be set to Asset Tracking Mode or Automatic Assignment Mode.
l. From the Main Alarm Monitoring Window, the System Operator must be able to initiate several traces of assets or asset hardware devices while monitoring alarms.
m. System Operators shall be able to perform a search of cardholder records and be able to view all assets that are currently assigned to that cardholder.
n. There shall be a minimum of six (6) standard AMS reports. All reports MUST be stored in the SMS database and MUST be able to be viewed from any AMS client workstation with proper permissions. The standard reports that shall be included with the AMS are described below:
    1) Assets Events
    2) The Assets Events Report shall provide information on all asset events that occurred in the AMS.
    3) Assets by Scan ID
    4) The Assets by Scan ID Report shall provide information on all assets defined in the AMS grouped by Scan ID.
    5) Assets by Type
    6) The Assets by Type Report shall provide information on all assets defined in the AMS grouped by type and subtype.
    7) Assigned Assets by Cardholder
    8) The Assigned Assets by Cardholder Report shall provide information on all currently assigned assets, sorted by cardholder.
    9) Assigned Assets by Scan ID
    10) The Assigned Assets by Scan ID Report shall provide information on all currently assigned assets, sorted by Scan ID.
    11) Assigned Assets by Type, Scan ID
    12) The Assigned Assets by Type, Scan ID Report shall provide information on all currently assigned assets, sorted by type and then Scan ID.
o. The AMS shall have a copy command allowing System Operators to easily and efficiently add assets.
p. System Operators shall be able to view an asset's assignment history for a specific period of days from the time of the search. The time period shall be in one day increments.

71. The ACAMS shall utilize the building issued proximity identification (ID) cards.

2.6 ACCESS CONTROLLERS

A. General

1. The access controllers shall be a self-contained, microprocessor-controlled field device. The device shall serve as the data collection and communications interface between the Host and the various field devices such as card readers, alarm inputs and control outputs.
2. The controller shall operate in either a host controlled or local decision mode. Configuration information (i.e. card records, time commands, door/monitor point/control

point configuration, etc.) shall be downloaded from the host computer. Local programming at the controller or the use of EPROMs shall not be required.

3. The system access control field hardware shall provide network-based access control. The network interface on the controller shall be a 10/100/1000 MB Ethernet based input/output that has the capability to reside on a local area network (LAN) or wide area network (WAN) without connectivity to a PC serial port. The controller shall utilize an off the shelf network connectivity device to deliver this functionality. The Network based controller shall be able to communicate back with the database server through industry standard switches and routers and shall not have to be on the same subnet.
4. The controller is required to continue to function normally (stand-alone) in the event that it loses communication with the system software. While in this off-line state, the controller is required to make access granted/denied decisions and maintain a log of the events that have occurred. Events shall be stored in local memory, and then uploaded automatically to the system database after communication has been restored.

B. Construction

1. The controller shall be housed in a single-gang device, suitable for wall mounting.
2. Tamper alarms shall automatically report to the host computer when activated. The controller shall be suitably sized to allow installation of all expansion modules and associated field wiring.
3. Field wiring shall be connected to the controller through the use of screw clamp type connectors, which can be removed from the controller. These connectors shall allow the replacement of modules without requiring the connection of field wiring. The contact pins on the controller shall be spaced in such a manner as to prevent cross wiring of neighboring connections.
4. The Class A supervised alarm inputs shall utilize end-of-line resistors, providing four (4) states of the alarm circuit (normal, alarm, open circuit, shorted circuit). The same end-of-line resistor values shall be used by all supervised alarm inputs connected to the controller or any expansion module.
5. The controller shall operate in a temperature range of minus forty (-40) to one hundred thirty five (135) degrees Fahrenheit.

C. PureIP Reader-Controller

1. The reader-controller shall operate with any authentication device that produces a standard Wiegand with the use of an ISONAS IP Bridge.
2. The reader-controller shall incorporate the following features:
   a. 64,0000 cardholders, 5,000 event transaction buffer
   b. 12 VAC or 12 VDC power supply
   c. Reader communications via IP, Clock/Data or Wiegand Data1/Data0 - more than 150 different readers approved for use
   d. Up to 16 different formats (8 card and 8 asset)
   e. Issue code support for Magnetic and Wiegand formats
   f. Door contact supervision (Open/Closed)
   g. REX monitor
   h. Strike Control output
   i. Bi-color status LED support and 2-wire LED support
   j. Beeper control
   k. Dedicated tamper and power failure circuits

l. Support for offline reader access mode
m. Onboard jumpers for termination
n. Onboard jumpers for 12 VDC reader support
o. Elevator control
p. UL 294 listed and CE approved
q. Device shall be IP addressable and PoE+ compliant

3. Provide ISONAS Pure IP Reader-Controller (RC-04) or Approved Equal

2.7 CARD READERS

A. Multi-Class Card Readers

1. A wall switch reader assembly consisting of a reader antenna which may be mounted directly on any standard metal or plastic single-gang electrical box or on a flat wall, and a remote electronics module (all readers shall be flush mounted, where applicable, with the gang box recessed within the wall). The unitized reader with a read antenna and necessary electronics for transmission of the card code to the system all contained in a single package.
2. A proximity type card is brought close to the reader so that the unique coding of the card is sensed without requiring insertion or swiping of card through sensing devices. Reader system equipment shall have provisions to operate as specified in environments of, electromagnetic interference, radio frequency interference and spurious electrical power line interference.
3. The reader shall operate within the temperature range of minus 40 degrees to plus 57 degrees centigrade with relative humidity of 95 percent non-condensing. Reader shall be designed to operate on power-over-ethernet or low voltage AC or DC. An alarm signal shall be provided to indicate failure of any portion of this internal power supply equipment
4. A LED on the front surface of the reader shall indicate to the user that the card or tag presented to the reader has been read. An audio beep tone to indicate that the card has been read. Visual indication that a card has been decoded and deemed valid or invalid shall be provided at each reader location by green and red LED's respectively.
5. Power for the reader module shall be supplied by a network switch or dedicated power supply. All data and power wiring shall be in accordance with manufacturer specification.
6. A standard reader housing shall be available. The Commissioner shall determine manufacturer standard color only. The reader housing shall be secured to the mounting plate with tamper resistant screws
7. Card reader shall support 125 kHz proximity and 13.56 MHz iClass.
8. Average proximity card read range shall be 3" for a card based proximity card.
9. Provide ISONAS Pure IP RC-04 card reader or Approved Equal in standard sized locations.

2.8 POWER SUPPLIES

A. Lock/Access Control Power Supply

1. The lock power supply shall be UL Listed Fire and Access Control Power Supply (UL1481, UL294). It shall be Class 2 rated and NFPA 72 compliant.
2. The lock power supply shall have a 115VAC / 60Hz, 1.9 amps input, 6 amps continuous supply current and be field selectable 12VDC or 24VDC. The unit shall contain five individual power limited outputs. The unit shall have sufficient batteries as to operate

either magnetic locks or electrified strikes for at least four (4) hours from the time of power failure to the lock power supply.

3. The lock power supply shall provide a dry contact interface to the fire alarm system. The intent of the interface is to connect the primary power to the supply when a fire alarm signal is sent from the fire system to automatically unlock electrified locked fail-safe doors.

B. Provide Altronix Model 600 ULACM lock power supply or Approved Equal.

2.9 REMOTE DOOR RELEASE/INTERCOM DEVICE

A. Remote Door Release

1. Provide Aiphone Door Release(s) (Intercom) at locations shown on the drawings and a Master Station at reception the desk to remotely release the entrance doors.

2.10 INTRUSION DETECTION DEVICES

A. Magnetic Contact Switch:

1. The contact contains a hermetically sealed magnetic reed switch. Switches shall be reed switches, epoxied and/or potted in the switch housing. Magnets shall be permanent Alnico type, finish to match door jam. Rare Earth Magnet shall be made of neodymium iron boron.
2. Switches shall be rated at 30 VDC (50 mA) for 1,000,000 cycles, minimum.
3. Housings shall be molded of flame retardant ABS plastic. Magnetic contact switches shall be protected to deter sticking or freezing.
4. The gap distance for wood shall be 1” and steel up to ½”.
5. The unit shall have a 1” diameter, with open or closed loop operation with an electrical configuration of double pole-double throw (DPDT).
6. Provide GE Security Model (R)1076d recessed DPDT magnetic contact switch or Approved Equal.

2.11 REQUEST TO EXIT DEVICES

A. Motion Detector

1. The unit shall be UL and CE listed.
2. Shall have internal vertical pointability, wrap-around coverage. Unit shall contain two detection elements and require both detection elements to shunt the alarm.
3. The unit shall allow for wall or ceiling mounting and can be used for either a single or double door application.
4. The unit shall run on either a 12 or 24 VDC.
5. The unit shall have a selectable relay trigger mode.
6. The unit shall have dual IR and radar detection system. Both sensors are to trigger to send an alarm to the ACAMS.
7. Provide GE Security Model RCR-REX-W request to exit motion detector or Approved Equal.

B. Push Button

1. The unit shall provide a 1-¼" diameter stainless steel mushroom switch mounted onto a single-gang 11 gauge stainless steel plate. Switch shall be momentary pushbutton type and shall be engraved in 1/4" high letters to read, "PUSH TO EXIT."
2. Provide Dortronics Systems W5287 xUS26DxE1 push button request to exit or Approved Equal.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of electronic security system.

B. Examine rough-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before electronic security system installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SYSTEM INTEGRATION

A. Integrate electronic security system with the following systems and equipment:

1. Electronic door hardware.
2. Elevators.
3. Network lighting controls.
4. Intercommunications and program systems.
5. Public address and mass notification systems.
6. Access control.
7. Fire-alarm system.
8. Perimeter security system.
9. Video surveillance.

3.4 INSTALLATION

A. Install electronic security system in accordance with manufacturer's written instructions.

B. Wiring Method: Install wiring in metal raceways. Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4-inch. Control and data transmission wiring shall not share conduit with other building wiring systems. Install wiring in metal raceways, except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where plenum cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 3/4-inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

C. All AC power feeds to the system shall be installed in conduit separate from the data bus communication and low voltage control cables. The 120 VAC input power shall be furnished and installed by the Electrical Contractor, specified elsewhere in Division 16. The Security Integrator shall be responsible for coordinating his requirements with the Electrical Contractor.

D. The electrical contractor shall furnish and install, in accordance with the manufacturer's instructions, all interconnect wiring, and equipment necessary for the erection of a complete system as described herein and shown on the drawings. All wiring termination, except 120 VAC power inputs and above door hardware device inputs, shall be the responsibility of the Security Contractor.

3.5 IDENTIFICATION

A. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA-606

B. Using cable and asset management software specified in Part 2, develop Cable Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.

C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

D. At completion, cable and asset management software shall reflect as-built conditions.

3.6 SYSTEM SOFTWARE

A. Develop, install, and test software and databases for the complete and proper operation of systems involved. Assign software license to the Commissioner.

3.7 TESTING

A. The following reflects the minimum testing requirements for the ACAM system: Monitored Door (Door Position Switch Only)

1. Open door to the full 90-degree and release. Door should close and secure under the action of the door closer.
2. Verify when the door is opened that the door breach is displayed on the access control workstation and the local horn/strobe activates.
3. Confirm that the identified camera alarm call-up function is activated and displayed on the call-up monitor.

4. Re-secure the door, acknowledge the alarm. Ensure the alarm is cleared on the access control workstation.
5. Verify door name/number references on access control system is correct.

B. Access Controlled Door

1. Open door to the full 90-degree and release. Door should close and secure under the action of the door closer.
2. Present valid/authorized ID card to the reader. Ensure that access is granted and no alarm is received on access control system.
3. Present invalid/unauthorized ID card to the reader. Ensure that access is not granted and an unauthorized card alarm is received on access control system.
4. From secure side of door, turn handle/depress panic hardware and ensure that the REX provides non-alarm egress for doors with just single sided card readers. For doors with card readers on both sides, repeat steps 3 and 4.
5. Hold door open for xx seconds and verify door held open alarm noted on access control workstation. “xx” seconds to be confirmed based upon the door location and security requirements.
6. Force door opened and verify door breach is noted within 2 seconds on the access control workstation. For electric lockset doors, a plastic card will be inserted between the lock and the strike plate so that the door can be closed, but not “locked” the door will then be pushed open to simulate the forced breach
7. Confirm that the identified camera alarm call-up function is activated and displayed on the call-up monitor.
8. Re-secure the door, acknowledge the alarm. Ensure the alarm is cleared on the access control workstation.
9. For fail-secure doors, activate the fire alarm system and ensure that the electronic lockset provides immediate egress.
10. Verify door name/number references on access control system is correct.
11. Verify from the access control system that the door can be remotely released from the mapping interface.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct the City of New York's maintenance personnel to adjust, operate, and maintain security access system.

B. Develop separate training modules for the following:

1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
3. Security personnel.
4. Hardware maintenance personnel.
5. Corporate management.

END OF SECTION 27 50 00

SECTION 28 31 00 FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract (City of New York Standard Construction Contract).

1.2 SUMMARY

A. Section Includes:

1. Remote data gathering panel (DGP).
2. Addressable manual fire-alarm stations.
3. Addressable smoke and heat detectors.
4. Addressable duct mounted smoke detectors.
5. Audible alarm notification appliances (Speakers).
6. Visual alarm notification appliances (strobe lights).
7. Combination audible/visual alarm notification appliances (speaker/strobe light).
8. Magnetic lock/card access release over-ride control.
9. Air handling system shutdown.
10. Sprinkler/standpipe valve supervisory (tamper) switches.
11. Sprinkler flow switches.
12. Auxiliary fire-alarm equipment.
13. Standby battery.
14. Power and signal wire and cable.
15. NYC Department of Building (DOB) and Fire Department of New York City (FDNY) requirements shall be complied with to obtain a fully functional portion of system, inspected by the FDNY and provided with an FDNY Letter of Approval and sign-off of the new portion of the system at the DOB.

B. Related Sections:

1. Section 21 12 00 - Fire Suppression Standpipes.
2. Section 21 13 13 - Wet-Pipe Sprinkler Systems.
3. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
4. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
5. Section 26 05 33 - Raceways and Boxes for Electrical Systems.
6. Section 26 05 53 - Identification for Electrical Systems.

1.3 REFERENCE STANDARDS

A. National Fire Protection Association (NFPA):

1. NFPA 70 - The National Electrical Code.
2. NFPA 72 - National Fire Alarm and Signaling Code.
3. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

B. New York City:

1. NYCBC - New York City Building Code
2. NYCEC - New York City Electrical Code.
3. NYCFC - New York City Fire Code.
4. EPP- New York City's Environmental Preferable Purchasing.
5. Requirements of the New York City Department of Building and the Fire Department of New York (FDNY) shall be complied with to file, inspect and obtain a FDNY Letter of Approval for the Fire Alarm System.
6. Local Law No. 5 - 1973.
7. Local Law No. 16 - 1984.
8. Local Law No. 58 - 2009.

C. Underwriters' Laboratories, Inc.:

1. UL 38 - Manually Activated Signaling Boxes.
2. UL 228 - Door Holders for Fire Protective Signaling Systems.
3. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
4. UL 268A - Smoke Detectors for Duct Applications.
5. UL 464 - Audible Signaling Appliances.
6. UL 521 - Heat Detectors for Fire Protective Signaling Systems.
7. UL 864 - Control Units for Fire Protective Signaling Systems.
8. UL 1481 - Power Supplies for Fire Protective Signaling Systems.
9. UL 1638 - Visual Signaling Appliances.
10. UL 1711 - Amplifiers for Fire Protective Signaling Systems.
11. UL 1971 - Standard for Signaling Devices for the Hearing Impaired.

1.4 COORDINATION

A. Refer to DCAS General Conditions - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with Work of other Sections. Coordination shall include the installation and/or testing of sprinkler flow and valve tamper switches, the installation and testing of duct mounted smoke detectors, testing of control and monitor modules for proper operation of fan shutdown, smoke purge, and damper control and position indication.

1.5 SUBMITTAL PROCEDURES

A. Refer to General Conditions Article 4.

B. Product Data: Submit manufacturer's catalog information showing electrical characteristics and connection requirements.

C. Shop Drawings:

1. Floor Plans showing the location of all devices, routing of fire alarm cables and conduits, and riser conduits.
2. Riser diagram showing all devices on each floor, including alarm initiating and alarm indicating devices, control devices, monitoring devices, power supplies, amplifiers and DGP's.
3. Indicate system wiring diagram showing each device and wiring connections.
4. Panel interior drawings, showing the interior of each panel, interconnecting wiring and wiring from field devices.
5. Battery calculations for each set of batteries to document compliance with battery back-up requirements.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for fire-alarm system.

F. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Manufacturer Reports:

1. Certify that equipment has been installed according to manufacturer instructions.
2. Indicate activities on Site, adverse findings, and recommendations.

I. Qualifications Statements:

1. Submit qualifications for installer, including Manufacturer's approval of Vendor to provide installation, programming, service and maintenance of the proposed fire alarm system.

1.6 CLOSEOUT SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of fire-alarm equipment.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Spare Parts:

1. Furnish five (5) automatic smoke detectors, without base, of each type provided.
2. Furnish two (2) spare smoke/heat detector bases.

3. Furnish one (1) visual (strobes) alarm indicating devices of each type provided.
4. Furnish one (1) combination audible/visual (speaker/strobe) alarm indicating devices of each type provided.
5. Furnish two (2) addressable control modules.
6. Furnish two (2) multi-voltage relays.
7. Furnish two (2) of each type addressable monitor modules provided.

1.8 QUALIFICATIONS

A. System Vendor: Company specializing in performing Work of this Section with minimum three (3) years documented experience and approved by manufacturer.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to DCAS General Conditions - Product Requirements: Requirements for transporting, handling, storing and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.10 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: The existing Fire Alarm system is an Edwards EST-3 System, which has been accepted by the FDNY. All fire alarm system components shall be manufactured by Edwards or shall be approved for use with the Edwards system by Underwriters Laboratories, Inc. (UL).

B. No substitutions for the specified manufacturer will be allowed, as the devices are required to be compatible with the Edwards Fire Alarm System.

2.2 SYSTEM DESCRIPTION

A. Fire-Alarm System:

1. The existing system is a manual and automatic fire-alarm system with voice evacuation and connection to a NYC approved central station for alarm reporting.
2. The system consists of the Fire Command Station (FCS), located in the main building lobby, remote data gathering panels (DGPs), area smoke detectors, area heat detectors, duct mounted smoke detectors, addressable manual pull stations, addressable monitor and control modules, multi-voltage control relays; audible, visual and combinations audible/visual alarm indicating devices, and warden telephones.
3. Comply with NFPA 72, as amended by Appendix Q of the New York City Building Code.

B. All products and components of the Fire Alarm System shall be provided by Edwards, or shall be UL Listed as compatible with the existing fire alarm system. The Fire Alarm System Manufacturer shall assume all warranty requirements and responsibility for all fire alarm system devices and components supplied for this project. Warranty obligations assumed by multiple manufacturers are not acceptable.

2.3 CONTROL PANELS

A. Description: Modular fire-alarm control panel, with surface, wall-mounted enclosure.

B. The fire alarm system consists of a Fire Command Station and remote data gathering panels.

C. Data Gathering Panels (DGPs) consists of a modular fire alarm panel with the following items:

1. Power supplies:
   a. Adequate to serve control panel modules, remote detectors, remote annunciators, addressable control modules and multi-voltage interface relays for control of starters and dampers and alarm signaling devices.

D. Furnish battery-operated emergency power supply with capacity for operating system in standby mode for 24 (twenty-four) hours, followed by alarm mode for twenty (20) minutes.

1. Modular frame for cards to provide communication to data gathering panels, signaling line circuits (for addressable initiating and control devices), amplifiers for speaker circuits, and cards for visual alarm indicating circuits. The cards shall, in addition to providing the connectivity, shall also provide supervision of the circuit for shorts, grounds and opens on the circuit.
2. Door Tamper switch, connected to an addressable monitor module, to indicate and record when the door is opened as a supervisory alarm.

E. System Supervision: Failure of component or power supply places system in trouble mode.

F. Initiating Device Circuits:

1. Furnish supervised signaling line circuit cards to provide connection to addressable alarm initiating and addressable control modules. The cards shall provide both supervision of the circuit for shorts, grounds and opens.

2. Occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from initiating alarm.

G. Indicating Appliance Circuits:

1. Provide alarm indicating circuit cards as required to support a minimum of two alarm indicating circuits per floor.
2. The occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from signaling alarm.

2.4 INITIATING DEVICES

A. Manual Pull Stations:

1. Manual Pull stations shall be intelligent, addressable type. The station shall have a metal case with an internal switch. The finish of the station shall be red with white lettering indicating “Pull in Case of Fire”. The station shall be capable of mounting on a 2-1/2” deep outlet box with a single gang plaster ring. LED indicator(s) green LED shall flash to indicated communication with the control panel; Red LED shall be flash to indicated alarm (either two LEDs or a single multi-color LED shall be acceptable). Manual Stations shall be suitable for operation in temperatures of 32 deg. F to 120 deg. F, 0 to 93% relative humidity (non-condensing).
   a. Manual pull stations shall be: SIGA-278 with Cat 45 key.

B. Addressable Area Smoke Detectors:

1. Addressable photoelectric analog smoke detectors shall be utilize light scattering type detectors to sense changes in air samples from the surrounding. The detectors shall contain an integral microprocessor analyze the environment and initiate an alarm. The detector shall continuously monitor changes in sensitivity due to dirt, smoke, temperature, aging and humidity. Smoke obscuration per foot alarm set points shall be field selectable from 1.0% to 3.5%. Temperature range shall be 32 deg. F to 120 deg. F; 0 to 93% relative humidity, non-condensing.

C. Smoke detectors shall be: SIGA-PS.

1. Provide Remote Alarm LED Indicators SIGA-LED and/or remote test station model SD-TRK for all duct detectors located above hung ceilings and as indicated on the plans.

D. Addressable Duct Detector Housing:

1. Addressable duct detector shall be a low-profile unit with air sampling and exhaust tubes that extend into the duct air stream up to 10-feet. The duct housing shall be suitable for extreme environments, including a temperature range of -20 deg. F to 158 deg. F and a harsh environment gasket option. The housing shall accept a remote LED alarm indicator light or a remote alarm indicator light/remote test station where indicated on the plans.
   a. Duct detector housing shall be: SIGA-SD.

E. Addressable Area Heat Detectors:

1. Addressable heat detectors shall be combination fixed temperature/rate of rise heat detectors. The detector shall continuously monitor the temperature of its surroundings to minimize thermal lag time. The detector shall have an internal microprocessor to determine if an alarm condition exists and initiate an alarm. The nominal fixed temperature set point shall be 135 deg. F and a rate-of-rise alarm point of 15 deg. F per minute. Heat detectors shall be designed for ceiling installation at a minimum of 70 feet on center.
   a. Heat detectors shall be: SIGA-HRS.

F. Standard Detector Mounting Bases:

1. Provide detector mounting bases suitable for mounting on 3-1/2" or 4" octagonal box or 4" square box. The base shall contain no electronics, shall support all smoke and heat detectors. The base shall allow the removal of the detectors without affecting communication to other detectors. Terminals shall be on the room side of the base and shall be capable of supporting a remote LED alarm indicator, where required.
   a. Mounting bases shall be: SIGA-SB / SIGA-SB4.

G. Addressable Input Modules:

1. Addressable input modules shall be utilized to connect and supervise non-intelligent contact devices (valve tamper switches, water flow switches, etc.). The input module shall connect to the fire alarm system signaling line circuit for supervision of the device, monitor the state of the contact and provide supervision of the wiring, for open and ground fault, between the input module and the contact device. Modules shall provide either one or two Class B input circuits for monitoring contacts. Each module shall be provided with LED(s); flashing green to indicated communication, flashing red to indicate alarm. Addressable input modules shall mount on a standard 1-1/2 deep, 4-inch square box with a single gang plaster ring. Input modules shall support normally-open, latching contacts (manual stations, heat detectors, etc.), normally-open delayed latching (waterflow switches), normally-open active non-latching (monitor, fans, dampers, doors, etc.), and normally-open active latching (supervisory, tamper switches). Temperature range shall be 32 deg. F to 120 deg. F; 0 to 93% relative humidity, non-condensing.

2.5 CONTROL DEVICES

A. Addressable Relay Module:

1. Addressable relay module shall provide control of multi-voltage relays to interface with line voltage controlled equipment. The relay module shall have one form "R" dry relay contact rated 2 amperes at 24VDC. The relay shall be rated for pilot duty and releasing systems. The position of the relay shall be confirmed by the system firmware. The relay module shall mount on a 1-1/2" deep, 4-inch square outlet box with a single gang plaster ring.
   a. Control module shall be: SIGA-CR.

B. Addressable Input Signal Module:

1. Addressable single input module shall provide one (1) Class B output circuit. The signal module shall operate as a telephone power selector, capable of generating a “ring tone”. The module shall also be capable of providing 24VDC to operate audible/visual alarm indicating devices. The module shall mount on a 1-1/2” deep, 4-inch square outlet box with a single gang plaster ring.
   a. Input signal module shall be: SIGA-CT1/SIGA-CT2.

C. Multi-Voltage Relays:

1. Multi-voltage relays shall be utilized to interface line-voltage control system with addressable relay modules to provide control of dampers, motor starters, etc. Relays shall be DPDT and shall be rated at 10 amperes, 115 VAC. A single relay shall be energized from a source of 24 VDC, 24 VAC, 115 VAC or 230 VAC. A red LED shall indicated the relay is energized. The relay shall be mounted in a metal enclosure.
   a. Multi-voltage relay shall be: MR-200.

2.6 ALARM INDICATING DEVICES

A. All visual alarm indicating devices shall be UL 1971 Listed and shall be installed in accordance with NFPA 72, as modified by Appendix Q of the New York City Building Code.

B. Alarm indicating devices (visual, audible and combination visual/audible) shall be of the same manufacture as the Fire Alarm System or shall be UL Listed as compatible with the fire alarm system.

C. Visual alarm indicating devices shall be strobe lights, white in color with a red faceplate or housing, labeled “FIRE” in white letters, oriented for wall mounting. Screw terminals shall be provided for terminating wiring. Strobes shall mount on a standard 4-inch square box, with or without a single gang plaster ring. The light output (candela rating) shall be as indicated on the drawings. Strobe units with a switch to set the candela output of the strobe unit are acceptable. All strobe lights shall be synchronized.

D. Audible alarm indicating devices shall be speakers with a red housing, labeled “FIRE” in white letters, oriented for wall mounting. Screw terminals shall be provided for wiring. Speakers shall be provided for use with 70V systems and shall provide power taps at 1/4w, 1/2w, 1w, and 2w. Speakers shall provide UL confirmed 90 dBA sound output at 2w. Speakers shall mount on a 4-inch square, 1-1/2-inch deep outlet box.

E. Combination visual/audible alarm indication units shall combine the horn and strobe light into a common housing. The combination unit shall have the same technical requirements as the individual devices indicated above. Wiring terminals shall allow the horn and strobe to be wired separately or on a common circuit. All strobe lights shall be synchronized.

F. Strobe devices:

1. Provide EST Series G1RF-VM series low profile wall mounted strobes at the locations shown on the drawings. Strobes shall provide synchronized flash outputs. Strobe output

shall be field selectable as indicated on the drawings in one of the following intensity levels; 15/75, 15cd, 30cd, 75cd or 110cd. Low profile strobes shall mount in a North American 1-gang box or surface mounted on a matching back box provided by the manufacturer, as directed in the field.

2. The fire alarm vendor may select below 75 candela where allowed by the appropriate release of ADA. 15/75 strobes may be used in corridors and in locations where 15 candela is required per NFPA wall and ceiling tables (see NFPA 72).

G. Speaker/strobe devices:

1. Provide speakers with a 4” cone as manufactured by EST, Cat. No. G4-S7 Genesis Series. The rear of the speaker shall be completely sealed protecting the cone during and after installation. Screw terminals shall be provided for wiring and the speaker housings shall be red and include "FIRE" labeling. Speakers shall be provided for use with 70V systems and shall provide power taps at 1/4w, 1/2w, 1w, and 2w. Speakers shall provide UL confirmed 90 dBA sound output at 2w. Speakers shall mount in a North American 4” electrical box with extension ring using the 2 screws provided with ring. It must not be necessary to completely remove the screws to facilitate mounting.
2. Provide speaker/strobes with a 4” cone as manufactured by EST, Cat. No. G4-S7 Series. The rear of the speaker shall be completely sealed protecting the cone during and after installation and screw terminals shall be provided for wiring. Speaker/strobe housings shall be red and include "FIRE" labeling. Speakers shall be provided for use with 70V systems and shall provide power taps at 1/4w, 1/2w, 1w, and 2w. Speaker/strobes shall provide UL confirmed 90 dBA sound output at 2w. Strobes shall provide 15/75, 30, 75 cd 110 candela synchronized flash outputs. The strobe shall have lens markings oriented for wall mounting. Ceiling mounted Speaker/Strobes shall have lens markings with correctly oriented lettering. Speaker/strobes shall mount in a North American 4” electrical box with extension ring using the 2 screws provided with ring.
3. The fire alarm vendor may select below 75 candela where allowed by the appropriate release of ADA. 15/75 strobes may be used in corridors and in locations where 15 candela is required per NFPA wall and ceiling tables (see NFPA 72).

2.7 WIRE AND CABLE

A. Description: All fire alarm wiring shall be Teflon rated, red, solid copper, NYC approved fire alarm cable in conduit. Cables specified below are minimum sizes and shall be increased to meet proper system operation and field conditions:

1. Data for addressable devices – Twisted, 2 conductor #16 AWG fire alarm cable.
2. Fire alarm strobes - Twisted, 2 conductor #14 AWG fire alarm cable.
3. Fire alarm speakers - Twisted, shielded, 2 conductor #14 AWG fire alarm cable.
4. Power for modules and interface devices - 2 conductor #14 AWG fire alarm cable.
5. Control wiring between interface modules and air handling system and dampers #12 type THHN in conduit.
6. Other wiring and power circuits: THHN in conduit, size as required and as indicated on contract drawings.

PART 3 - EXECUTION

3.1 EXECUTION REQUIREMENTS

A. Refer to DCAS General Conditions for requirements related to the execution of the work.

3.2 EXAMINATION

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that products and systems receiving devices are ready for installation.

3.3 PREPARATION

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for installation preparation.

B. Existing Work:

1. Remove exposed abandoned fire-alarm wiring, including abandoned wiring above accessible ceiling finishes.
2. Cut cable flush with walls and floors, and patch surfaces.
3. Disconnect and remove abandoned fire-alarm equipment.
4. Access:

C. Maintain access to existing fire-alarm equipment and other installations remaining active and requiring access.

D. Modify installation or provide access panel.

1. Extend existing fire-alarm installations using materials and methods compatible with existing installations, or as specified.
2. Clean and repair existing fire-alarm equipment that is to remain or to be reinstalled.

3.4 INSTALLATION

A. The system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagram. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type required by the Code, recommended by the manufacturer, approved by the local Fire Department and specified within.

B. All penetration of floor slabs and fire rated walls shall be sleeved and fire stopped in accordance with all local fire codes.

C. End of Line Resistors shall be furnished as required for mounting as directed by the manufacturer. Devices containing end-of-line resistors shall be appropriately labeled. Devices should be labeled so removal of the device is not required to identify the EOL device.

D. All manual pull stations shall be mounted 48 inches above the finished floor, as measured to the handle.

E. All audio/visual devices shall be mounted 80 inches above the finished floor, as measured to the device bottom. Devices shall be mounted no less than 6 inches from the ceiling (whichever is lower).

F. Conduit utilization schedule for fire alarm wiring:

1. Minimum conduit size – 3\4" conduit.
2. In mechanical spaces, boiler rooms exposed below 8ft and in locations where wiring will be exposed to physical damage - in Rigid Galvanized Steel (RGS) conduit.
3. In open spaces with no ceilings above 8ft – in EMT conduit.
4. In spaces with ceilings below 8ft – in EMT conduit.
5. In accessible ceilings above 8ft in free air on threaded bridal rings.
6. Raceways in finished areas shall be concealed in partitions. When raceways are concealed in partitions EMT conduit shall be utilized.

G. All box covers contains fire alarm system wiring must be painted red and labeled "INTERIOR FIRE ALARM".

H. All addressable modules shall be mounted within 36 inches of the monitored or controlled equipment or circuit. This shall include, but is not necessarily limited to, fan shutdown, elevator recall, sprinkler status points, or door release. Label all addressable modules as to their function.

I. All wiring shall be color-coded throughout, to NYC Electrical Code standards.

J. All junction box covers shall be painted red.

K. Fire alarm system wiring shall not co-mingle with any other system wiring in the facility. Conduits shall not be shared under any circumstance. Only when fire alarm wiring enters the enclosure of a monitored or controlled system will co-habitation be permitted (i.e. at fan starters or elevator controllers).

L. All fire alarm wiring shall be continuous and unspliced. Terminations shall only occur at fire alarm devices or control panel enclosures under terminal screws. All other splicing methods are specifically disallowed (i.e. plastic wirenuts).

M. All fire alarm conduit system shall be installed using a dedicated system of supports.

N. All fire alarm wiring shall be sleeved when passing through any wall, and fire stopped in accordance with applicable Code.

O. The system shall be arranged to receive power from three wire 120 Vac, 20 A supply. All low voltage operation shall be provided from the fire command center and associated equipment.

P. All fire alarm devices shall be accessible for periodic maintenance. Should a device location indicated on the Contract Drawings not meet this requirement, it shall be the responsibility of the installing contractor to bring it, in writing, to the attention of the Engineer. Failure to bring such issues to the attention of the Engineer shall be the exclusive liability of the installing Electrical Contractor.

Q. The existing fire alarm system shall remain in operation for all time. Contractor to coordinate switch over to the new fire command center with building operations. Contractor to provide fire watch each time building fire alarm system is taken offline.

R. The installing Electrical Contractor shall be responsible for the removal of existing fire alarm system components and controls as indicated on contract drawings upon approval of the AHJ and the building fire safety director.

3.5 FIELD QUALITY CONTROL

A. Certificate of Compliance: Complete and submit to the Project Engineer in accordance with NFPA 72, Paragraph 1.07 and Paragraph 1.08.

B. Field – Testing General:

1. New portion of fire alarm system shall be tested upon completion of installation which includes individual testing of all initiating devices and visual inspection of all notification devices.
2. Each addressable analog smoke detector shall be individually field tested prior to installing the device at its designated location to ensure reliability after shipment and storage conditions. A dated log indicating correct address, type of device, sensitivity and initials of the technician performing test – using test equipment specifically designed for that purpose – shall be prepared and kept for final acceptance documentation. After testing, the detection devices and base shall be labeled with the system address, date and initials of installing technician. Labeling shall not be visible after installation is complete.
3. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
    a. A systematic record shall be maintained of all readings using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.
    b. The acceptance inspector shall be notified before the start of any required tests. All items found at variance with the drawings or this Specification during testing or inspection by the acceptance inspector shall be corrected.
    c. Test reports shall be delivered to the acceptance inspector as completed.

4. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing Contractor. The following equipment shall be a minimum for conducting the tests:
    a. Ladders and scaffolds as required to access all installed equipment.

b. Multimeter for reading voltage, current and resistance.
c. Intelligent device programmer-tester.
d. Laptop computer with programming software for any required program revisions.
e. Two-way radios, flashlights, smoke generation devices and supplies.
f. An approved device for measuring air flow through air duct smoke detector sampling assemblies.
g. Decibel meter.
h. Testing documentation.

5. In addition to the testing specified to be performed by the installing Contractor, the installation shall be subject to test by the acceptance inspector.

C. Final Acceptance Testing:

1. The contractor shall prepare a written “Acceptance Test Procedure” (ATP) for testing the fire alarm system components in accordance with NFPA 72 and this Specification. ATP shall be submitted to the engineer prior to acceptance testing for approval. Once ATP is approved, the contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components (new and existing to remain), circuits and programming.
2. The acceptance test of the fire alarm system shall be conducted by the contractor and the fire alarm equipment vendor as directed by the City of New York after the fire alarm equipment vendor has performed a 100% test of the system.
3. The acceptance test cannot be conducted during regular business hours. These tests must be scheduled for evening hours (exact time to be agreed upon) or weekends. Additional approvals may be required by other agencies in the building. Contractor shall include in his price all necessary overtime and/or premium time.
4. A final “as-built” function matrix shall be prepared by the installing Contractor referencing each alarm input to every output function affected as a result of an alarm, trouble or supervisory condition on that input. In the case of outputs programmed using more complex logic functions involving “any”, “or”, “not”, “count”, “time”, and “timer” statements, the complete output equation shall be referenced in the matrix.
5. A complete listing of all device labels for alphanumeric annunciator displays and logging printer shall be prepared by the installing Contractor prior to the ATP.
6. The acceptance inspector shall use the system record drawings during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
   a. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
      1) Open, short and grounded intelligent analog signaling circuit.
      2) Open, shorted and grounded network signaling circuit.
      3) Open, shorted and grounded conventional zone circuits.
      4) Open, shorted and grounded speaker, telephone circuits.
      5) Intelligent device removal.
      6) Primary power or battery disconnected.
      7) Incorrect device at address.
      8) Printer trouble, off line or out of paper.
      9) Loss of data communications between system control panels.

10) Loss of data communications between system annunciators.

b. System evacuation alarm indicating appliances shall be demonstrated as follows:
   1) All alarm notification appliances actuate as programmed.
   2) Audibility and visibility at required levels.

c. System indications shall be demonstrated as follows:
   1) Correct message display for each alarm input at the control panel, each remote alphanumeric LCD display.
   2) Correct annunciator light for each alarm input, at each annunciator and color graphic terminal.
   3) Correct printer logging for all system activity.

d. System on-site and/or off-site reporting functions shall be demonstrated as follows:
   1) Correct alarm custom message display, address, device type, date and time transmitted for each alarm input.
   2) Correct trouble custom message display, address, device type, date and time transmitted for each alarm input.
   3) Trouble signals received for disconnect.

e. Secondary power capabilities shall be demonstrated as follows:
   1) System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
   2) System primary power shall be restored for forty-eight (48) hours and system charging current shall be normal trickle charge for a fully charged battery bank.
   3) System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.

7. In the event of system failure to perform as specified and programmed during the ATP procedure, at the discretion of the acceptance inspector, the test shall be terminated.
   a. The installing Contractor shall retest the system, correcting all deficiencies and providing test documentation to the acceptance inspector.
   b. In the event that software changes are required during the ATP, a utility program shall be furnished by the system manufacturer to compare the edited program with the original. This utility shall yield a printed list of the changes and all system functions, inputs and outputs affected by the changes. The items listed by this program shall be the minimum acceptable to be retested before calling for resumption of the ATP. The printed list and the printer log of the retesting shall be submitted before scheduling of the ATP.
   c. The acceptance inspector may elect to require the complete ATP to be performed again if, in his opinion, modifications to the system hardware or software warrant complete retesting.

8. The Contractor is responsible for arranging FDNY inspection of the additional and modified existing fire alarm systems, and obtaining all required approvals and permits.

D. Documentation:

1. System documentation shall be furnished to the City of New York and shall include but not be limited to the following:

a. System record drawings and wiring details including one set of reproducible masters and drawings on CD in PDF format and suitable for use in a CAD drafting program.
b. System operation, installation and maintenance manuals.
c. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
d. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.
e. System program "hard copy" showing system functions, controls and labeling of equipment and devices shall be kept in the CD from at fire command center.
f. Signed and sealed riser diagram including system operation matrix.

E. Test Equipment:

1. The Contractor shall furnish to the City of New York all test equipment as required to program the field analog devices, specifically an intelligent device programmer-tester or a calibrated smoke generator with power source.

F. Warranty/Services:

1. The Contractor shall warrant the entire system against system hardware and electrical defects including programming software defects, for a period described in the Contract General Conditions. This period shall begin upon satisfactory completion and certification of final acceptance testing of the system and recipient of FDNY letter of approval.
2. Substation completion nor beneficial use shall not be used as a start date for warranty services.
3. Contractor shall provide to the City of New York a letter stating the start-date of warranty period. In addition, the Contractor shall also provide an updated list of name(s) and phone number(s) for normal and off-hours contacts necessary to respond to warranty issues. Response to warranty notification shall require a reply within 24 hours of initial contact.

G. Instructing:

1. The Fire Alarm Contractor shall furnish instructing as follows for a minimum of four (4) employees of the system user:
   a. Instructing in the receipt, handling and acknowledgment of alarms.
   b. Instructing on system operation including manual control of output functions from the Fire Command Center.
   c. Instructing in the testing of the system including logging of detector sensitivity, field test of devices and response to common troubles.
   d. The total instructing requirement shall be a minimum of two 4- hour sessions, but shall be sufficient to cover all items specified. Each session shall be conducted on different days.

H. Contractor shall maintain installed fire alarm system (or portions of the system) until entire building system is completed, tested, approved and FDNY letter of approval is received.

Contractor shall cover all cost associated with maintenance including repairs, programming, troubleshooting, visits of fire alarm vendor, parts, etc.

I. The manufacturers shall provide a written schedule of instructing dates for factory instructing of The City of New York's representatives. Include all fees, dates, times, phone numbers and contact individual.

J. The Fire Alarm Turnover for the New Fire Alarm Systems document must be completed prior to turn over the system to DCAS. The system will not be accepted without the completion of all items in this document

3.6 MAINTENANCE

A. Refer to DCAS General Conditions - Execution and Closeout Requirements: Requirements for maintenance service.

B. Provide service and maintenance of fire-alarm equipment for one year from date of Substantial Completion.

END OF SECTION 28 31 00q