DIVISION 23

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Special requirements For HVAC Work.
2. Submittals
3. Incidental Work
4. HVAC Demolition
5. Permits And Fees
6. Training of NYCHA Operations and maintenance Staff
7. Control Circuits, Control Wiring and Power Wiring for Control Panels and control Devices.
8. Piping materials and installation instructions common to most piping systems.
9. Dielectric fittings.
10. Mechanical sleeve seals.
11. Sleeves.
12. Escutcheons.
13. Grout.
14. Equipment installation requirements common to equipment sections.
15. Concrete bases.
16. Supplemental supports and anchorages.
17. Service Aisles, Walkways and Access Space.
18. Cutting, Patching and Incidental Work.
19. Cleaning.
20. Miscellaneous Appurtenances.
21. Final and Acceptance Tests for HVAC Systems.

B. Provide the Work and perform Inspections in accordance with the 2014 Mechanical Code of the City of New York.

C. For requirements for provision of specific “Allowances”, refer to the “Summary Scope of Work” specified under Section 01 11 16 of the Contract Specifications, and refer to the Scope of Work specified on Architectural Contract Drawings.

D. Related Sections:

1. Section 01 51 23 - Temporary Heating
2. Section 23 05 00 – Common Work Results For HVAC
3. Section 23 05 13 - Common Motor Requirements For HVAC Equipment
4. Section 23 05 23 - General Duty Valves For HVAC Piping
5. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
6. Section 23 05 53 - Identification for HVAC Piping and Equipment
7. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC
8. Section 23 07 00 - HVAC Insulation

9. Section 23 09 13 - Instrumentation and Control for HVAC
10. Section 23 09 14 - Natural Gas and CO Gas Leak Detection Equipment
11. Section 23 09 23 - Control Dampers
12. Section 23 09 24 - Steam Flow Meters
13. Section 23 22 13 - Steam and Condensate Heating Piping
14. Section 23 25 19 - Water Treatment for Steam System Feedwater
15. Section 23 31 13 - Metal Ducts
16. Section 23 33 00 - Air Duct Accessories
17. Section 23 34 16 - Boiler Room Combustion Air Makeup And Ventilation System
18. Section 23 51 00 - Chimney Liner
19. Section 23 51 16 - Prefabricated Breechings and Accessories
20. Section 23 51 23 - Gas Vents
21. Section 23 52 39 - Firetube Boilers
22. Section 23 53 12 - Vacuum Condensate Pumps
23. Section 23 53 13 - Boiler Feedwater Pumps

1.02 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. Piping: Pipe, tube, fittings, unions, hangers, supports, traps, drains, insulation and related items, for air conditioning unit condensate drainage.

G. Wiring: Raceway, fittings, wire, boxes and related items.

H. Concealed: Embedded in masonry or other construction, installed in furred spaces, within double portions or hung ceilings, in trenches, in crawl spaces, or in enclosures.

I. Exposed: Not installed underground or "concealed" as defined above.

J. Motor Controllers: Manual or magnetic starters, individual push buttons or hand-off-automatic (HOA) switches controlling the operation of the motors.

K. Control or Actuating Devices: Automatic sensing and switching devices such as thermostats, and pressure switches and electrodes controlling operation of equipment.

1.03 SUBMITTALS

A. Submissions Required: Include drawings and specifications, shop drawings, manufacturer's descriptive literature and published details with performance/capacity rating schedules or charts as applicable in submission, letters of certification, Welding Certificates, samples, photographs, test reports, balancing reports, and other engineering information. Product shop drawings shall indicate fabrication details and proposed layouts for shop and field fabrications.

B. Submit shop drawings certified for construction by the Contractor and reviewed by the Engineer that include location of electrical connections, point-to-point wiring diagrams, all automatic temperature control diagrams, ladder diagrams, anchor bolt layout, details indicating construction and materials of construction, performance of equipment, dimensions and rated horsepower of all motors, gear and bearing ratings, service factors and weights of principal parts and completely assembled equipment. Submit shop drawings of all ductwork and piping standards and details. Each ductwork shop drawing shall indicate type construction and its pressure class. Ductwork shop drawings shall be drawn to 3/8" = 1'-0" scale.

C. The Design Drawings are not intended to be shop or working drawings.

D. Prepare accurate and complete shop drawings covering all parts of the work where shop drawings are called for in the Specifications or as directed by the Engineer.

E. Drawings shall not be scaled. Only written dimensions shall be used.

F. Shop drawings shall be completely checked by the Vendor and the Contractor, prior to submission to the Engineer. Checking of drawings shall be confirmed by the checker's signature and Contractor’s approval stamp on each sheet. Failure to attest to checking of the shop drawings as herein required will be cause for their return without examination.

G. Include graphic scales and grid marks.

H. The review of submittals by the Engineer is for general conformance with the project requirements. Markings or comments shall not be construed as relieving the Contractor from compliance with the Contract Documents, nor departures therefrom. The Contractor shall remain responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of assembly, and for performing his work in a safe manner.

I. Review by the Engineer of submittals, shall not relieve the Contractor from furnishing material of proper dimensions, quantity and quality, nor will such approval relieve the Contractor from responsibility for errors of any sort in the submittals.

J. Submit shop drawings and controls coordination shop drawings for all equipment specified and shown to be provided under Division 23, in accordance with the specified requirements of each Division 23 Section. The Contractor’s special attention is alerted to the specified requirements for integration of the new boiler-burners plant controls systems with the existing Computerized Housing Automation System (CHAS). Controls coordination shop drawings, including both point-to-point wiring diagrams and schematic

ladder type control diagrams with numbered and key-coded terminal junctions and narrative control sequences, shall be fully complete, unified and coherent, combining all boiler plant controls into a single coordinated system, including identification of all existing controls systems and new controls systems, clearly delineating factory provided wiring and control devices from field installed control wiring and control devices, and the junctions of “new” to “existing” controls work.

K. Catalogs, pamphlets, or other documents submitted to describe items on which review is being requested, shall be specific and identification in catalog or pamphlet of item submitted shall be clearly made in ink. Data of a general nature will not be accepted.

1.04 QUALITY ASSURANCE

A. Work shall be executed in strict accordance with the best practice of the trades in a thorough, workmanlike manner by competent workmen.

B. NYCHA's Insurance Company recommendations governing or relating to any portion of the Work are hereby incorporated into and made a part of this Specification.

C. The Heating, Ventilating and Air Conditioning trade is required to supply all necessary supervision and coordination information to all other trades who are to supply work to accommodate the Heating, Ventilating and Air Conditioning installation.

D. Where a manufacturer's field representative is specified to be enlisted for field supervision, observation and reports, submit qualifications of manufacturer's representative to the Engineer 30 days in advance of required field services and observations. Representative shall be subject to approval of the Engineer.

E. When specified in individual sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and to initiate instructions when necessary.

F. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

G. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

H. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.05 INCIDENTAL WORK:

A. Coordinate location and proper dimensions of openings in floors and walls with other trades. Cut, patch, and repair walls, floors, etc., where holes have been incorrectly located or sized. The Engineer's approval is required before cutting any part where strength of appearance or finished work is involved. Finish in a neat manner to match existing work.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Before installation, store materials and equipment on the Site as follows:

1. On dry base, at least 6" above ground or floor.
2. In an orderly manner to prevent interference with access to buildings or facilities.
3. With waterproof covering to prevent damage from wind and rain.
4. For protection against theft or damage and replace items stolen or damaged, at no cost to NYCHA.
5. Store items subject to moisture damage, i.e., burners, controls, electrical devices, motors, starters and switches, in an approved dry area.

1.07 OPERATION OF STEAM BOILER PLANT SYSTEMS PRIOR TO COMPLETION:

A. The Engineer may require operation of parts or all of the steam boiler-burners systems installation prior to final completion and acceptance of the Work. The operation shall not be construed to mean acceptance of the work by NYCHA.

1.08 HVAC DEMOLITION:

A. Provide labor, materials, tools, equipment, and services necessary for removal, dismantling, relocation and disposal of HVAC equipment, ductwork and piping.

B. Existing conditions, removals and adjustments of all mechanical work, including ductwork, piping and equipment for the alteration, are not detailed on the Drawings. Contractor shall survey the site and make necessary changes as required based on existing conditions for proper installation of new work.

C. The work also includes repair or replacement of existing mechanical systems, wherever such systems are disturbed or otherwise damaged during the execution of the work.

D. Submit drawings for removal and dismantling of ductwork, piping and equipment including:

1. Locations and sizes of ductwork, piping and equipment to be removed.
2. Location of disassembly points, termination, and capping.
3. Methods and scheduling of disassembly.
4. List of equipment to be used.

5. Safety precautions and protection procedures to be followed.

E. All demolition and removal work shall be performed in strict accordance with the rules and regulations of the Construction Safety, and Health Regulations of the Department of Labor occupational Safety and Health Administration (OSHA).

F. Temporary Shutdowns:

1. When removal or dismantling of existing piping requires the temporary shutdown of an existing operating system, perform the removal or dismantling at time designated by NYCHA.

2. Notify NYCHA in writing of the estimated duration of the shutdown period at least 10 days in advance of the date on which the work is to be performed, and obtain written approval. Prepare a schedule of removal, dismantling, and planned new work, listing approximate completion dates that the Contractor expects to accomplish each phase of the work. Coordinate this schedule with NYCHA and the other trades involved.

3. Arrange for continuous performance of the work to ensure that existing operating services are shutdown only for the least time possible to perform necessary removals and dismantling.

4. Provide a detailed sequence of demolition and removal work to ensure uninterrupted service of NYCHA's on -site operations.

G. Provide temporary piping supports and bracing when piping systems are to be demolished and anchor or brace at the point of removal. Temporary supports or bracing shall be put in place until final removing or capping and new supports or bracing are installed. Temporary support spacing shall not exceed the maximum suggested support spacing as defined in ANSI B 31.1, Part 5.

H. Protection: Provide temporary protection so that the interiors of existing structures are protected from dust and weather inclemency, and that interior heat is conserved. The Contractor shall be responsible for damage to the existing structure or its contents by reason of the insufficiency of such protection. Barriers shall be consist of plywood panels reinforced by 2 inch x 4 inch stringers and sealed by heavy gage polyethylene sheeting, secured by high pressure, silver faced duct tape. Finished floors and roofing shall be protected by plywood or wooden planking laid over areas subject to removal loads.

I. Cutting and Capping:

1. Cut and cap existing piping, including but not limited to removal of equipment power and control wiring to source, and removal of equipment drain connections, where applicable. Where work of this Contract renders existing piping and ductwork useless, dismantle such piping and ductwork. Properly cap or plug branch connections to such piping where abandoned piping is to remain hidden in construction.

2. Where existing piping systems, at points of connection to new work or in rerouting are found defective, remove such defective portions. Perform replacement work as specified under other Sections of the specification.

3. Where existing piping insulation of piping to remain is damaged by requirements of the work, replace such damaged insulation to match existing.

J. Upon the completion of each day's work, the premises shall be swept broom clean. All finished surfaces shall be mopped to remove dust.

K. NYCHA assumes no responsibility for actual conditions of items to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by NYCHA insofar as practicable.

L. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

1. Do not interrupt existing utilities until authorized in writing by authorities having jurisdiction and a schedule of removals shall be established. Provide temporary services during interruption to existing utilities, as acceptable to NYCHA.

2. NYCHA will shut off utilities. Disconnecting and sealing indicated utilities before starting demolition operations is part of this work.

3. Protect all remaining utility lines, utility lines to be modified, appurtenances and openings form dirt, foreign objects and damage during the demolition period.

M. Provide temporary supports where required.

N. Where alterations reveal concealed piping and accessories that must necessarily remain in service, such piping and accessories shall be rerouted, replaced or altered to conceal such piping in the new work.

O. Cutting and patching in the existing buildings shall be provided under this Section.

P. The Contractor shall be responsible for any damage that may be caused to any part of existing structures as a result of work. Promptly repair damages caused to adjacent facilities by demolition operations.

Q. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed as directed by NYCHA.

R. Notify NYCHA of the estimated duration of any shutdown period at least 10 days in advance of the days on which the work is to be performed, and obtain NYCHA's written permission before initiating the interruption.

S. Where existing electrical disconnect switches, and motor starters are to be removed, relocated and/or replaced, ensure that equipment to be relocated or replaced is not damaged and that all control and power connections are restored to equipment as required to return equipment to its original operating condition.

1.09 PERMITS AND FEES:

A. The Contractor shall determine the applicability of air pollution permitting regulations and operating requirements in accordance with the 6NYCRR, Part 201, and shall prepare and file the permit application.

B. The Contractor shall give all necessary notices, obtain all permits and pay all governmental taxes, fees, and other costs in connection with the work; file all necessary plans, prepare all documents, and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required Certificates of Inspection for the work and deliver same to NYCHA before request for granting of Substantial Completion and Acceptance and Approval of the Work by NYCHA, and receipt of final payment for the Work.

C. The Contractor shall provide all permits and filings required by the agencies having jurisdiction, such as, DOB, DEC, BAR, etc. BAR filing shall include all required drawings and calculations and shall be signed and sealed by the Contractor's licensed Professional Engineer.

1.10 TRAINING OF NYCHA OPERATIONS AND MAINTENANCE STAFF:

A. Upon completion of the Work, including all the multivariate HVAC systems and the successful performance of their specified associated testing, adjusting, balancing and commissioning procedures and after the completion, submittal and approval of all commissioning test reports the Contractor shall provide a thorough and complete HVAC Systems Operation and Maintenance Training Program for the designated NYCHA engineering and maintenance staff of each of the three daily work shifts.

B. The HVAC Systems Operation and Maintenance Training Program shall consist of at least 8 hours of Training, including 8 hours for the personnel staff of each of the three daily work shifts. For each personnel shift, the Training Program shall include at least 4 hours of Classroom Lectures, and at least 4 hours of "Hands-On" Demonstrations, with maintenance and operational instructions performed on the actual HVAC equipment installations provided under this Contract.

C. The Contractor shall enlist the services of each of the various HVAC equipment and systems manufacturer's authorized and factory trained expert representatives, to assist in the preparation of the training instruction, in the delivery of the lectures, and to assist in the performance of the instructional demonstrations for the HVAC equipment and systems with which they are associated, and to distribute copies of their respective manufacturer's associated technical and instructional literature to all designated personnel staff trainees in attendance for each of the three daily shifts. Copies and excerpts from the Facility's approved Operations and Maintenance Manuals that are relevant to the specific maintenance and operations training requirements of the various specialized disciplines represented by the designated staff trainees, shall also be distributed to all of the designated respective specialized personnel staff trainees in attendance.

D. Upon the request of NYCHA for limited additional Training and Instruction, the Contractor shall be required to provide such limited additional specialized Training and Instruction to designated NYCHA engineering and maintenance operations staff personnel, at a compensation rate to be established by the Contractor as a contingency, to be included in the Contractor's Contract Proposal.

E. All Training and Instruction lectures and hands-on demonstrations shall be video-taped by the Contractor, and after completion of all Training and Instruction, three (3) sets of copies of all of the video-taped Training and Instruction seminars shall be delivered to the NYCHA Maintenance and Operations Chief Engineer.

PART 2 - PRODUCTS

2.01 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.02 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12.

2.03 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.04 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Stainless steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.06 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

2.07 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and non-metallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.08 CONTROL CIRCUITS, CONTROL WIRING AND POWER WIRING FOR CONTROL PANELS AND CONTROL DEVICES:

A. All control circuits shall be 120 volt AC, 24 volt AC, 0 to 10 volt DC, or 4 to 20 milliamps, 2 wire or 3 wire, provided as specified under Section 23 52 39.

B. Provide 120 volt-single phase, 24 volt and/or 0 to 10 volt DC power supplies and power wiring for HVAC equipment control panels and control devices and for boiler-burner control panels and control devices. Power wiring for control panels and control devices shall be provided as specified under Sections 23 09 13, 23 09 14, 23 09 24 and 23 52 39, and in accordance with the specified requirements of Division 26. All 120 volt-single phase power sources for control panels and control devices shall be provided through coordination with and approval of, Division 26, from the nearest local electrical power panel designated for this purpose. Provide any necessary and required AC and/or DC power transformers for control panels, devices and instrumentation, enclosed within appropriate NEMA rated lockable enclosures, field mounted in close proximity of the control panels and devices that they serve.

C. All 120 volt or 24 volt electrical control wiring, control power wiring, and wiring connections for equipment interlocks, control panels, control instrumentation and other devices required for the specified work, shall be provided by the Contractor as specified under Sections 23 09 13, 23 09 14, 23 09 24 and 23 52 39.

D. Install and connect any control components and control panels furnished as part of packaged HVAC equipment, but not installed at the factory.

E. All control-power wiring and control wiring to be provided as specified under Sections 23 09 13, 23 09 14, 23 09 24 and 23 52 39, shall be installed within 0.75-inch minimum diameter, rigid, galvanized steel conduit. All conduit accessories and junction boxes shall be of galvanized steel construction, intended for use with rigid galvanized steel conduit.

2.09 SUPPLEMENTAL SUPPORTS:

A. Furnish and install all necessary supports required for HVAC equipment. Submit drawings for review before purchase of the equipment, or fabrication or construction of the supports, and other work required at equipment installation locations.

B. Where overhead construction does not permit fastening of supports for equipment that requires overhead supports, provide supplemental framing, rigidly attached to the building structural framing, subject to approval of the Engineer. No structural member shall be overloaded or overstressed for either permanent installation or during installation for hoisting or temporary support.

C. All supplemental support members and bolts shall be galvanized steel.

2.10 SERVICE AISLES, WALKWAY AND ACCESS SPACE:

A. In locating equipment, pay particular attention to furnishing easy access to the equipment.

B. Piping, conduit and equipment shall be kept above head level where it will not interfere with passage. In service aisles and walkways no piping or conduit shall be run on the floor. Piping, conduit and control assemblies shall be racked against the wall or to one side.

C. Disassemble and relocate any piping, conduit, supports or assemblies that interfere with freedom of passage. Where any doubt exists as to the adequacy and width of such a passageway, verify the condition with the Engineer before proceeding.

D. Except as may be otherwise indicated or specified in the Contract Documents for particular or special locations within the Scope Of Work, such as for the minimum required headroom clearance requirements above the boiler maintenance platforms and catwalks, the typical minimum dimensions provided for clearance envelopes of service aisles, walkways and maintenance access space, throughout the Scope Of Work, shall be at least 6’-0” height by 3’-0” width.

2.11 CUTTING AND PATCHING:

A. Furnish and locate all lintels, sleeves and inserts required before the floors and walls are built. Cutting and patching shall be kept to a minimum.

B. Cutting shall be neatly done to exact size required. Excessive cutting is prohibited. If

such takes place, the Contractor shall be responsible for all damages and for all extra patching required.

2.12 CLEANING:

A. Apparatus, accessories and piping, after installation, shall be thoroughly cleaned of all dirt, grease and foreign matter, and left in a condition satisfactory to the Engineer.

B. Surfaces to be painted shall be thoroughly cleaned ready to receive paint.

2.13 MISCELLANEOUS APPURTENANCES:

A. Each appurtenance, whether included in the Specifications or not, is assumed to be part of the complete installation to be provided.

B. Furnish a 6-month supply of disposable items for all equipment installed, including replaceable air filters. The following list is meant to categorize the essentials and shall not to be considered a complete list:

1. Lubricants (2 gallons)

2. Pilot Light Lamps (2 dozen)

2.14 FINAL AND ACCEPTANCE TESTS FOR HVAC SYSTEMS:

A. Every part of the mechanical installation shall be tested and/or operated and left in proper working order. Testing, adjusting and balancing of all HVAC systems shall be performed in accordance with the specified requirements of Section 23 05 93.

B. Before applications for Final Acceptance and Substantial Completion of the work will be considered, all tests specified to be performed under Division 23 and/or as deemed necessary to show proper execution of the work, shall have been performed and completed in the presence of NYCHA, and all associated Testing and Balancing Reports shall have been submitted to NYCHA for review and approval by the Engineer, in accordance with the specified Submittals requirements.

C. All systems, equipment and devices and related controls shall be tested under their respective associated Section of the Specification, except as otherwise specified. Where such an item is connected to building facilities that were installed under another Section of the Specification, and is dependent upon these sources of service for operation and testing, all concerned Sections of the Specification shall be present at test in order to demonstrate all aspects of the installation.

D. All testing equipment necessary to satisfactorily conduct any required test shall be provided under the Section of the Specification performing the test, and at no additional cost to NYCHA.

E. Tests required to be performed by a manufacturer's representative or agent shall be arranged for under this Section of the Specification. Where required, the Contractor shall obtain from the manufacturer's representative or agent a letter of compliance with

Specifications after the successful completion of testing, and shall submit such letter to the Engineer.

F. After all partial and completed tests, demonstrate to the satisfaction of NYCHA that the entire installation is in proper working order. Proceed through a prescribed and orderly scheduled demonstration that will operate the system in a manner typical of a normal daily routine.

G. Scheduling of all testing procedures shall be arranged to suit the convenience of NYCHA, and shall be coordinated with all other parties concerned.

H. Any defects or deficiencies discovered in any of the work during testing shall be corrected in an approved manner without additional cost.

I. Results of all laboratory tests shall be submitted to the Engineer as soon as available but not later than 5 days after completion of testing. Include date of test and name and address of organization performing the tests.

J. Results of all field tests and instrument readings shall be submitted to the Engineer as soon as available, and shall be assembled and recorded in reports to be submitted to the Engineer in a form to be approved by the Engineer.

2.15 TEST EQUIPMENT:

A. All test equipment shall be verified to be in calibration, with the calibration certified, at the time of each test.

PART 3 - EXECUTION

3.01 HVAC DEMOLITION

A. Refer to the specified requirements of this Section, and of Division 01 Section "Cutting and Patching", and of Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.

6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to NYCHA.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install escutcheons for penetrations of walls, ceilings, and floors.

K. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

L. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble

mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

M. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.03 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.04 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.05 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.06 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.

1. Construct concrete bases of dimensions indicated, but not less than 6 inches (100 mm) larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.07 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.08 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.09 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION