

SECTION 23 0510
GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Definitions.
- B. Quality Assurance Requirements and Installer Qualifications.
- C. General Product Delivery and Storage.
- D. Installer Warranty.
- E. Submittal Procedures Supplementing Section 01 3000.
- F. Mechanical Shop Drawing Requirements.
- G. Operating and Maintenance Manuals.
- H. Execution Requirements common to Division 23 systems.
- I. Mechanical sleeve seals.
- J. Manufactured roof curbs(not specified with equipment) and equipment rails.
- K. Existing HVAC systems.
- L. Existing HVAC Equipment.
- M. Pipe Sleeves within building.
- N. Pipe Sleeves in footings and foundations.
- O. Space Conditioning during Construction.
- P. Equipment backboards.
- Q. Starting equipment and Systems-General Requirements.
- R. Training Requirements.
- S. Cleaning Requirements.
- T. Finishing Requirements.

1.02 RELATED SECTIONS

- A. Section 01 3300 - Submittal Procedures, for submittal procedures.
- B. Section 01 7000 - Execution Requirements, for additional submittal and warranty requirements.
- C. Section 07 8413 - Penetration Firestopping.
- D. Section 9200 - Joint Sealants.
- E. Section 09900 - Painting and Coatings.

1.03 DEFINITIONS

- A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.
- B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.
- C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.
- D. Provide: Furnish and install.

- E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the item of equipment.
- F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switches by starters, the primary control device will be that ONE thermostat, time clock, manual switch, aquastat, P.E. switch, or relay performing the primary switching.
- G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.
- H. Readily Accessible: Items requiring maintenance shall be available for close approach for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling through an access point by maintenance staff safely standing on a ladder no taller than the ceiling.
- I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.
- J. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.
- K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.
- L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that Architect shall be the instructor or shall be notified, as the case exists.
- M. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.
- N. Flow Diagram: A single-line, two-dimension, non-scaled drawing depicting arrangement and sequence of equipment, valves, controls, thermometers, gauges, and other specialty devices in a pipe or duct system.

1.04 REGULATORY REQUIREMENTS

- A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.
- B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.
- C. Permits and Codes: Refer to the General Conditions.
- D. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2012 Edition, with all Georgia State Amendments, for all work involving cutting and welding.
- E. HVAC: Conform to the Georgia State Minimum Standard Mechanical Code, International Mechanical Code, 2012 Edition with all Georgia State Amendments.
- F. Energy: Conform to the Georgia State Energy Code for Buildings, International Energy Conservation Code, 2009 Edition, with all Georgia State Amendments.
- G. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, January 30, 2014", and ADA.
- H. Electrical: Refer to Division 26. Conform to the National Electrical Code, NFPA 70, 2020 Edition.

- I. Building Code: Conform to the Georgia State Minimum Standard Building Code, International Building Code, 2012 Edition with all Georgia State Amendments.

1.05 DESIGN REQUIREMENTS

- A. Board of Regents Design Guidelines

1.06 SUBMITTALS

- A. Supplementing Division 1 Administrative Requirements; Contractor shall:
 1. Identify all submittals by a cover sheet showing project name, specification section, drawing or detail number, room number, date, revision date, contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and Preparer's phone number.
 2. Prepare a master list of all items proposed to be submitted on the project and submit all items in a single package. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format of the master list shall contain a Specification Section, Section Title, Item Description, Item Status and any comment.
 3. Long lead/early submittals shall be identified in a list minimum two weeks prior to being submitted, all long lead/early submittals shall be included in a single submittal package.
 4. Review the submittal data and check to ensure compliance with specifications prior to submitting.
 - a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Design Professional are not Change Orders. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.
 - b. The Contractor shall conform to the requirements of the Contract Documents unless a change order is issued. The Contractor shall identify on each submittal that the submittal contains no deviations or the Contractor shall identify any proposed deviations.
 - c. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (the contractor acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.
 - d. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.
 5. Provide a Letter from the HVAC Contractor stating that they have checked all submittals for compliance with specifications.
 6. Product Data:
 - a. Provide data specific to the product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.
 - b. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.
- B. Deliver submittals to Architect at the business address.
- C. Digital Delivery of Submittals:
 1. Submittal data may be posted to the NBP Engineers FTP site when agreed upon by Architect and Owner during the preconstruction phase. The Contractor will be provided with a project folder and a password.
 2. Prepare the submittals as described above. Take steps to reduce submittal file size.
 3. Do not scan in color or high resolution unless required for clarity.

4. Optimize any scans to help control file size.
 5. Ensure any reproductions are legible.
 6. Organize Submittal files individually by specification section with file name format as Follows; "CS/Section# - Section Title - any further identifier required such as *control drawings*"
 7. Send an email to submittal@nbpengineers.com with a copy to the HVAC Design Professional and any Architectural Design Professional identified during the preconstruction phase.
 8. Identify the submittal using the official project title, specification section and submitted item. i.e. Project No. G-xxx, Addition to Administrative Building-Section 230548-Vibration and Seismic Controls. Include drawing or detail number, room number, date, revision date(s), contractor and subcontractor's organization as applicable
 9. Include the project manager's and manufacturers' representatives, salesman's (or a preparer who can answer questions) contact information, email and phone number.
 10. Identify the submittal in the email subject line using the same information listed above.
 11. Provide a submittal index.
 12. Ensure any submittal posted to NBP's or other FTP site has the same identification.
 13. NBP Design Professionals will not process or react to submittals which are not properly transmitted, indexed, and identified.
- D. Shop Drawings:
1. General: Furnish shop drawings of each of the following systems:
 - a. Ductwork
 - b. HVAC and Plumbing Piping
 - c. Equipment Rooms
 - 1) HVAC Equipment, Ductwork, and Piping
 2. Format and Content:
 - a. Shop drawings shall be complete and shall accurately show all items of equipment and material. The number of drawings, and the views contained therein, shall be as needed to show the actual and final routing, construction, and final assembly of each system.
 - b. All drawings shall be electronically produced in a BIM compatible format. Free-hand drawings are not acceptable.
 - c. All lettering shall be legible without use or aid of magnifying device. Title-block lettering shall be minimum 1/8".
 - d. Drawings shall be printed (or plotted) at either 24" high by 36" wide, or the same size as the Contract Drawings for the same trade, whichever is greater. Each drawing sheet shall be formatted the same as the Contract documents (i.e., border width, title block, etc.). With the exception of Isometric drawings, all other drawings shall be drawn in two-dimension and at the same scale as the Contract Drawing of the same area, or as follows, whichever is the larger scale:
 - e. Scale of drawings shall be as follows:
 - 1) Floor Plans 1/8" per foot
 - 2) Roof Plans 1/8" per foot
 - 3) Elevations 1/4" per foot
 - 4) Details 1/4" per foot
 - 5) Equipment Room Layouts 1/4" per foot
 - 6) Isometrics No scale
 - 7) Riser Diagrams 1/4" per foot
 - 8) Equipment Room Pad Layout 1/4" per foot
 - f. Three-dimensional views may be produced and used to provide supplemental information to that which is given on two dimensional drawings. Three-dimensional drawings shall be drawn from a 30-deg. perspective.
 - g. Each individual shop drawing sheet shall contain a single format (two-dimensional or three-dimensional).

- h. In addition to the information called for in the Contract Documents provide all additional data and notations needed to show conformance with Contract Documents (i.e., air flow and volume from/to air devices).
 - i. For all drawings drawn in two-dimensions, all characteristics of the equipment, systems and components, shall be drawn to scale to designate actual size. Use of dimensions alone to designate width, height, length, or depth is not acceptable. Drawings shall not require that they be "scale" to determine sizes or location.
 - j. In the event either the project as a whole, or the specific area covered by a particular drawing, does not contain columns, floors and/or walls to which dimension reference can be made in the location of items, alternate fixed points of reference may be used.
 - k. Shop Drawings drawn at the same scale as the contract Drawings, shall incorporate the same floor plan or ceiling plan areas, and shall be arranged and be "broken" along the same lines as the Contract Drawings.
 - l. Duct and piping systems which have the following maximum width on one side shall be drawn in the following manner:
 - 1) Drawing Scale
 - 2) 1/4" per ft. =>4" Double-line
 - 3) 1/4" per ft. <4" Single-line
 - 4) Flexible Duct Single-line to diffusers
3. Ductwork Shop Drawings:
- a. Background information shall be redrawn scaled versions of the Architectural floor or Reflected Ceiling Plans of the Contract Drawings and shall show all partitions, openings, and structural features. Drawings from the Contract Documents shall not be copied for use as backgrounds nor will reproducible drawings be made available from the Architect for this purpose.
 - b. Show fitting joints, fittings, equipment, required maintenance, removal and safe working clearances, elevations, location and sizes of access panels, net sizes (size of system less insulation), dimension from finished floor and/or overhead structure, horizontal dimension from centerline of columns, direction of flow, changes in size, changes in external covering, system material, construction classification, system name, internal liner, unique situations, equipment designation.
 - c. Show floor plan location of all space control and sensing devices (thermostat, humidistats, CO2 sensors etc.) complete with the designation of the piece of equipment or component which device controls. Lines drawn between the sensing device to the controlled equipment or component, to designate their interaction, are not acceptable.
 - d. Sheet metal work shall be drawn using symbols and designations in accordance to the latest edition of "SMACNA" Duct Construction Standards - Metal and Flexible".
4. Piping Shop Drawings:
- a. Background shall be the Ductwork Shop Drawings called for elsewhere in this Section except that notes and details pertinent to only ductwork may be omitted.
 - b. Show flanges, fittings, equipment, locations and sizes of access panels, required maintenance, removal and safe working clearances, elevations, net size (size of system less thermal or acoustical coverings), dimension from finished floor and/or overhead structure, horizontal dimension from centerline of columns, grade, percent of slope and/or rate of change, direction of flow, changes in size, changes in external covering, system material, construction classification, system name or symbol, unique situations, equipment designation.
 - c. Show floor plan location of all space control and sensing devices (thermostats, humidistats, CO2 sensors) complete with the designation of the piece of equipment or component which device controls. Lines drawn between the sensing device to the controlled equipment or component, to designate their interaction, are not acceptable.
 - d. Piping shall be drawn utilizing the symbols and designations of the controls standards, providing those standards are in general compliance with Industry

- Standards (i.e. ASHRAE, ANSI, etc.). Provide piping symbol legend on shop drawing.
- e. Each piece of equipment or manufactured product shall bear the same designation as indicated on the contract documents.
5. Equipment Room Shop Drawings:
- a. Background shall be redrawn scaled versions of the Architectural Floor Plan showing all partitions, openings, and structural features.
 - b. Show actual size and location of equipment in both plan and vertical section, laid out on center line of equipment shown.
 - c. Equipment and equipment pads shall be drawn to scale and dimensioned. Dimensions shall conform to actual manufacturer's dimensions for product used.
 - d. Show dimensions of equipment placing relative to partitions, columns, beams, and underside of structural deck.
 - e. Show and dimension all service clearances, access door swings, vertical clearances.
 - f. Show all piping, ducts, and equipment to provide full information for coordination.
 - g. Show electrical panels to scale including control panels and disconnect switches.
- E. Tabulation of Power Wiring Requirements: Within 60 Days of the Notice to Proceed, provide a Tabulation of Power Wiring Requirements of all proposed equipment, including H.P., amps, voltage, phase and KW, tabulated on a separate sheet. A copy of the tabulation shall be transmitted independently to the Contractor, Architect and to all affected trades. (Refer to Electrical Drawings for electrical provisions for equipment.)
- F. Warranty: Submit the HVAC installer's warranty letter addressed to Owner stating the correct project name and number, if applicable, the warranty period and ensure that form has the correct date of the Material Completion.

1.07 OPERATING AND MAINTENANCE MANUALS

- A. Operating and Maintenance Manuals shall be prepared by Contractor for all equipment and be submitted for review a minimum of two months prior to the request for Material Completion.
- B. Digital delivery of Operating and Maintenance Manuals:
 - 1. Operating and Maintenance Manuals may be delivered digitally and posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and password.
 - 2. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size.
 - 3. Do not scan in color or high resolution unless required for clarity.
 - 4. Ensure any reproductions are legible.
 - 5. Send an email to submittal@nbpengineers.com with a copy to the HVAC Design Professional and the Architectural Design Professional identified during the preconstruction phase.
 - 6. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.
 - 7. Table of Contents(Index) sheets shall be included in the order listed with identifications typed in capital letters.
 - 8. Ensure the manuals posted to the FTP site has the same identification.
 - 9. NBP Design Professionals will not process or react to manuals which are not properly transmitted, indexed, and identified.
- C. Physical delivery of Operating and Maintenance Manuals:
 - 1. Three (3) bound and indexed Operating and Maintenance Manuals shall be submitted for review. Two (2) approved copies shall be delivered to the operating personnel .
 - 2. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered with waterproof glue.

3. Notebooks shall have 9-1/2-inch by 11-1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1-1/2-inch back width.
 4. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.
 5. Data sheets and diagrams shall be 8-1/2-inch x 11-inch or be mounted on 8-1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edges. Drawings and diagrams larger than 8-1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11-inches and folded to the left to form a width of 8-1/2-inches.
 6. Table of Contents(Index) sheets shall be provided in the order listed with identifications typed in capital letters.
- D. Each Manual shall contain the following information, data and drawings:
1. Copies of submittals (with Design Professional's review comments and stamp), equipment and materials.
 2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one year of facility operation.
 3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
 4. Control diagrams, electrical interlock diagrams, and control valve lists.
 5. Copies of as-built shop drawings showing layouts and construction details.
 6. Copies of Test and Balance Reports including list of instruments and description of methods employed.

1.08 QUALITY ASSURANCE

- A. HVAC Installer Qualifications:
1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean the contractor/subcontractor of record for the installations used for proficiency qualification.
 2. Refer to the individual sections within this division for additional installer qualification requirements.
 3. The Contractor expressly warrants that the company performing the installation of the air conditioning systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least three commercial or institutional buildings, each containing minimum of 100 tons capacity or greater with ducted air distribution and chilled water, PTAC or wall hung units excluded.
 4. The Contractor further warrants that the aforesaid subcontractor, if any, has trained personnel, instruments, tools, and equipment to perform the installation, start-up, instruction and maintenance service specified.
 5. The Contractor also warrants that the aforesaid installer, if any, has been in business performing services of the nature specified herein for at least five years.
- B. Testing and Balancing Qualifications:
1. The Contractor expressly warrants that the company performing the HVAC Testing and Balancing of the mechanical systems has demonstrated proficiency in the testing, balancing, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least Twenty (20) institutional buildings, each containing minimum of 100 tons capacity or greater with ducted air distribution and chilled water, incremental units excluded; a minimum of three (3) buildings shall include performance of TAB work for laboratory HVAC systems. The contractor further warrants that the proposed subcontractor has trained personnel, instruments, tools, and equipment to perform the testing and balancing specified. The contractor also warrants that the aforesaid installer has been in business performing services of the nature specified herein for at least five years.
 2. Affidavits:

- a. As a condition for acceptance and approval of the proposed Test and Balance subcontractor; The Construction Manager shall file with the Architect within 30 days after Notice to Proceed, affidavits reading exactly as follows with nothing added, nothing subtracted, and nothing modified.
 - b. Failure to file the affidavits as required, time being of the essence, shall be deemed to be and shall be acknowledgement on the part of the contractor that there has been a breach of warranty, pursuant to which breach an order of non-compliance will be issued by the Architect for breach of warranty and for breach of an essential condition of the contract as to qualifications of the party or parties performing subcontracted work.
3. Test and Balance Agency Affidavit:
- a. THIS IS TO CERTIFY pursuant to the General Conditions that [insert name of firm], Testing and Balancing subcontractor of the undersigned, has demonstrated proficiency in the testing, balancing, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least Twenty (20) institutional buildings.
 - b. List at least twenty showing name and address of each:
1) - 20)
 - c. Provide a complete set of the Test and Balance report forms to be used for the project, with a complete listing of all equipment to be tested, adjusted and balanced; and provide a listing of all air flow, water flow, system capacity and efficiency measurements to be performed.
 - d. THE CERTIFICATIONS of the affiant are not mere declarations but are in consideration of and in fulfillment of express contractual requirements established in the bidding documents for construction of Project No. _____.
THIS AFFIDAVIT applies to Project No. _____.
This _____ day of _____, 2014.
1) NAME OF COMPANY:
2) By:
3) Title:
CERTIFICATE OF NOTARY PUBLIC Sworn and subscribed to before me, an officer authorized to administer oaths. This _____ day of _____, 2014.
_____, Notary Public
My commission expires on:
_____.

1.09 PRODUCT DELIVERY, STORAGE, AND PROTECTION

- A. Accept all products on site in factory-fabricated protective containers. Inspect for damage.
- B. Store products in a clean dry place and protect from weather and construction traffic.
- C. Handle products carefully to avoid damage to components, enclosures, and finish.
- D. After placement, protect products from damage during construction, by all trade contractors.
- E. Protect equipment nameplates and labels from damage, being painted, scaring, etc.

1.10 WARRANTY

- A. Refer to Section 01 7000 - Contract Closeout, for additional warranty requirements.
- B. Submit manufacturers' warranties prior to final inspection. Refer to the General Conditions.
- C. Correct any defective Work within a one year period after Date of Material Completion. Provide HVAC Installer's warranty letter dated the date of the Material Completion
- D. Where warranties beyond Contractor's one (1) year warranty are specified, the additional warranty time shall start on the same date as Contractor's warranty.

PART 2 PRODUCTS

2.01 MECHANICAL SLEEVE SEALS

- A. Manufacturers: Link-Seal series 300M as manufactured by Thunderline Corporation, Metraseal by Metraflex or Advance Products and Systems Innerlynx.

- B. Synthetic rubber elements linked together to form a watertight seal between pipe and opening for penetrations.
- C. Openings in new construction shall be provided with schedule 40 pipe sleeves having 10 gauge leak plate, 4-inch larger than sleeve O.D., welded thereto and poured in place.

2.02 MANUFACTURED CURBS, EQUIPMENT RAILS and OTHER ROOF ASSEMBLIES

- A. Manufactured Curbs:
 - 1. The Pate CompanyPC-*: www.patecurbs.com.
 - 2. ThyCurb TC-*: www.thybar.com.
- B. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.
 - 1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A 653/A 653M, SS Grade 33 ; G60 coating designation; 18 gage, 0.048 inch thick.
 - 2. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing insulation; 1/4 inch/12 inch slope; minimum cant height 3 inches.
 - 3. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
 - 4. Provide the layouts and configurations shown on the drawings.
- C. Curbs Adjacent to Roof Openings: Provide curb on all sides of opening, with top of curb horizontal for equipment mounting.
 - 1. Provide preservative treated wood nailers along top of curb.
 - 2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
 - 3. Height Above Finished Roof Surface: 8 inches, minimum.
 - 4. Height Above Roof Deck: 14 inches, minimum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify Architect for clarification in the event of conflict.
- B. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.02 PREPARATION

- A. Drawings are diagrammatic and show the general proximity of the equipment, ducts, and pipes, etc., are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at Contractor's risk. Refer to Architectural plans for exact building dimensions and details.
- B. Space Conditions:
 - 1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.
 - 2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to Owner and shall be subject to approval.
 - 3. All equipment requiring service shall be made accessible. Coordinate piping and ductwork installation to avoid conflict with other trades.

3.03 EXISTING HVAC SYSTEMS

- A. The existing mechanical equipment and systems shall remain "as-is" except as otherwise indicated or specified. Perform all work necessary to properly tie in new work with existing

conditions and to adapt existing conditions to conform to the changes in the building and systems.

- B. Remove exposed and accessible piping, ductwork, and other materials rendered useless due to changes or modifications. Cap outlets in piping. Blank-off or patch openings in ductwork and duct insulation. Repair insulation damaged during construction.
- C. Remove concealed piping which is exposed by the removal of walls, partitions, etc., and reconnect and re-route as required to maintain system continuity.
- D. Sleeves left open by removal of piping shall be cut flush with the finished slab or wall, filled with non-shrinking cement grout and/or fire rated foam flush with both sides of slab or wall to maintain slab or wall fire rating and finished to match the space finishes.
- E. Openings left by removal of ductwork shall be patched matching existing construction.
- F. Where existing piping, duct and/or equipment is shown on the Drawings to be reused, its identity, size, flow direction and location shall be verified prior to performing any work. Notify Architect of any discrepancies.

3.04 EXISTING HVAC EQUIPMENT

- A. This project makes extensive use of owner furnished equipment for contractor installation (OFCI).
- B. The documents specify the testing of this equipment recording the condition of the equipment.
- C. The documents specify checking and documenting the control interlocks for the OFCI equipment and systems to be installed.
- D. Include these activities in the overall construction schedule. Ensure that the schedule leaves time for any deficiencies to be identified and corrected before occupancy.

3.05 INSTALLATION

- A. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by mechanical systems so that no mechanical ducts, pipes, vents or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.
- B. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.
- C. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.
- D. Equipment, valves and other items installed under this division requiring service shall be installed to be readily accessible. Refer to definitions in this section.
- E. Coordinate with Contractor and monitor the progress of the work so that other trades do not obstruct items requiring access for service.
- F. After final balancing, equipment with belt drives shall have their belts operating in the mid-80% position of the adjustable sheave.
- G. Provide equipment belt and coupling guards shielding the perimeter and face of all new belt drives, shafts and couplings. Provide openings opposite drive and driven shafts to permit use of revolution counter. Guards for fans shall be supported from the fan and mounting base, independent of the floor or housekeeping pad.
- H. Route piping and ductwork to avoid skylights, translucent, and transparent ceilings.
- I. Pipe Sleeves in Slabs, Masonry Walls and Partitions:
 - 1. Provide sleeves in all slabs and walls/partitions unless otherwise noted.
 - 2. Omit sleeves on cast iron pipe through slabs on grade.

3. Provide sleeve seals where pipe passes thru building wall to a below grade location.
 4. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab.
 5. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.
 6. Omit sleeves in openings core drilled in masonry partitions.
 7. Rated Drywall Partitions: Twenty gage galvanized steel. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.
 8. Non-Rated Drywall Partitions: Omit sleeves.
- J. Pipe sleeves in footings and foundation walls:
1. Schedule 40 black steel pipe.
 2. Chilled water, heating water, condenser water, refrigerant, or process piping passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.
 3. Sleeves in walls to spaces below grade shall be provided with 10 gauge leak plates.
- K. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400
- L. Seal sleeves and openings in exterior walls vaportight or watertight as applicable.
- M. Provide sleeve seals at all exterior pipe penetrations, above and below grade. Comply with manufacturer's sizing recommendations for size of pipes penetrating wall.
- N. Concrete Work: Refer to section 23 0548 for concrete bases and other supports required for HVAC equipment and systems. Coordinate with the Contractor.
- O. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.
- P. Saw cut or core drill openings in existing work for the installation of the mechanical system. Patching shall be performed by the trade whose work is cut. Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

3.06 SPACE CONDITIONING DURING CONSTRUCTION

- A. Coordinate with Contractor regarding the limits of space conditions specified or requested by other trade sections.
- B. Assist Contractor in the preparation of the construction schedule and determine to what extent the project's HVAC system can be operated within the restrictions listed below to help maintain those conditions.
- C. Ducted air handling systems shall not be placed into operation for testing or for temporary space conditioning until all walls in areas served by the system have been prepared for painting and the building is broom clean.
- D. The building's HVAC system shall be kept clean during the entire construction process. Protect equipment, motor, ducts, pipes from dirt and debris.
- E. Filters during construction:
 1. Provide and maintain filters on all air handling equipment and terminal units used for space conditioning during construction.

2. Provide and maintain filters on all return air grilles once ceilings are installed when air handling equipment or terminal units are used for space conditioning during construction.
 3. Provide filters with a minimum MERV rating of 8.
- F. Heating Terminal units such as unit heaters, cabinet heaters and finned radiation may be used for temporary heat during construction. Clean to new condition.

3.07 EQUIPMENT BACKBOARDS

- A. General: Provide wood backboards for installation of surface mounted control panels, enclosed motor controllers, variable frequency controllers, and where shown.
- B. Type: 3/4-inch thick grade 1 fire retardant treated plywood supported by 3/4" x 3/4" x 1/8" aluminum angle frame attached to wall with 1/4-inch toggle bolts for hollow masonry, expansion shields for solid masonry.
- C. Finish: Frame and board with two coats light gray enamel paint.

3.08 STARTING EQUIPMENT AND SYSTEMS

- A. Adjust equipment for proper operation within manufacturers' published tolerances.
- B. Start no equipment or systems until all prefunctional checklists have been completed, signed, and sent to the CxA for approval.
- C. Provide manufacturer's field representative to prepare and start equipment and submit factory certified report.
- D. Demonstrate proper operation of systems and equipment to Owner 's designated representative.

3.09 DEMONSTRATION, TRAINING AND INSTRUCTIONS

- A. A minimum of 40 total hours of training shall be provided for mechanical, electrical, plumbing, and fire protection systems. Training shall occur in 3 hour sessions in the afternoon.
- B. Training shall include a minimum of 24 hours of training dedicated to building controls; of which at least 4 hours shall be field training and at least 20 hours for classroom instruction.
- C. A manufacturer's service representative shall provide the instructions for each piece of equipment on system when specified in other Sections of this Division. A manufacturer's sales representative is not acceptable. (The instructor shall not be a sales person, but shall have service experience on a continuing basis and be knowledgeable about the subject equipment.)
- D. The Contractor shall request the instruction date not less than 15 days of the desired date for coordination with the Using Agency. Operating manuals for the equipment/systems on which instructions are being given shall be in the possession of the operating personnel not less than 30 days prior to the date of instruction.
- E. An Owner Training Video shall be made by the contractor(s) separate from training sessions and professionally recorded. The video shall cover all equipment and systems addressed in the owner training sessions.
- F. The Contractor shall develop not less than three (3) copies of the instructions with an index for easy retrieval of information.

3.10 CLEANING and PROTECTION

- A. All materials, equipment and mechanical rooms shall be cleaned prior to Material Completion.
- B. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.
- C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.
- D. All air handling equipment shall be cleaned internally prior to Material Completion. Clean unit casing externally and internally. Seal/replace all damaged duct liner.
- E. Chipped or scraped paint shall be retouched to match original finish.

- F. Clean and polish all equipment nameplates. All nameplate information shall be legible.
- G. All dents and sags in ductwork and equipment casings shall be straightened.
- H. All ductwork, insulation, equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Material Completion.
- I. Additional cleaning due to contractor use of building systems during construction:
 - 1. Contractor shall have all associated duct work, coils, heat exchangers, and piping professionally cleaned prior to turn over of the building to the owner.

3.11 FINISHING EQUIPMENT AND MATERIAL

- A. Use paint systems specified in Division 9 for the substrates to be finished.
- B. Paint shop-primed equipment.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Finish equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color coding scheme indicated.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
- F. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish and exposed to outside conditions or in mechanical rooms shall be painted to prevent rust.
- G. Paint all exposed un-insulated ferrous metals, flat black.
- H. Concrete Equipment pads: Clean concrete and paint pad safety yellow.

END OF SECTION