

SECTION 15050 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.1 PROVISIONS INCLUDED

- A. Include General Conditions, Supplementary General Conditions Division 0 and applicable parts of Division 1 for conditions and requirements which may affect the work of this Section.
- B. Examine all other Sections of the specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other Trades affecting, or affected by work of this Section. Cooperate with such Trades to ensure the steady progress of all work under the Contract.

1.2 DEFINITIONS

- A. Words in the singular shall also mean and include the plural, wherever the context so indicates and words in the plural shall mean the singular, wherever the context so indicates.
- B. Wherever the terms "shown on drawings" are used in the specifications, they shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.
- C. Wherever the term "provide" is used in the specifications it will mean "furnish" and "install", "connect", "apply", "erect", "construct", or similar terms, unless otherwise indicated in the specifications.
- D. Wherever the term "material" is used in the specifications it will mean any product", "equipment", "device", "assembly", or "item" required under the Contract, as indicated by trade or brand name, manufacturer's name, standard specification reference or other description.
- E. The terms "approved", or "approval" shall mean the written approval of the Architect.
- F. The term "Contract Documents" shall mean the entire set of Drawings and Specifications as listed in the Table of Contents of the General Conditions including all bound and unbound material and all items officially issued to date such as addenda, bulletins, job modifications, etc.
- G. The term "specification" shall mean all information contained in the bound or unbound volume, including all "Contract Documents" defined therein, except for the drawings.

- H. The terms "directed", "required", "permitted", "ordered", "designated", "prescribed" and similar words shall mean the direction, requirement, permission, order, designation or prescription of the Architect. The terms "approved", "acceptable", "satisfactory" and similar words shall mean approved by, acceptable or satisfactory to the Architect. The terms "necessary", "reasonable", "proper", "correct" and similar words shall mean necessary, reasonable, proper or correct in the judgment of the Architect.
- I. "Accessible" indicates ease of access with or without the use of ladders and without requiring extensive removal of other equipment, such as ductwork, piping, etc. to gain access. "Accessible ceiling" indicates acoustic tile type hung ceilings. Concealed spline or sheetrock ceilings with access panels shall not be considered accessible ceilings.
- J. "Piping" includes in addition to pipe or mains, all fittings, flanges, unions, valves, strainers, drains, hangers and other accessories relative to such piping.
- K. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction or in crawl spaces.
- L. "Exposed" means not installed underground or "concealed" as defined above.
- M. "Invert Elevation" means the elevation of the inside bottom of the pipe.
- N. "HVAC, ATC, Plumbing, and/or Fire Protection Contractor" shall refer to the Contractor or his Subcontractors responsible for furnishing and installation of all work indicated on the HVAC, Plumbing, and/or Fire Protection drawings and specifications, as applicable and or referenced to each Trade in the Architectural and/or Structural documents.
- O. "Mechanical Contractor" shall refer to the Fire Protection, Plumbing, HVAC and ATC Contractors, as applicable.
- P. "Architect" shall refer to the Architect "Francis, Cauffman, Foley, Hoffmann (FCFH)" and/or Engineer "Bard, Rao + Athanas Consulting Engineers, LLC" and/or Owner.
- Q. "Owner" shall refer to the designated representatives of the Project Owner, Mercy Health System of Maine (MHSM).
- R. "General Contractor" shall refer to the Contractor(s) performing work under other sections of the Contract Specifications.
- S. "Construction Manager" shall refer to the Construction Manager (CM) "Gilbane" for this project.

1.3 CODES, STANDARDS AND REFERENCES

- A. All materials and workmanship shall comply with all applicable Codes, Specifications, Local and State Ordinances, Industry Standards and Utility Company Regulations, latest editions.

- B. In case of difference between Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations and the Contract Documents, the Mechanical Contractor, as applicable, shall promptly notify the Architect in writing of any such difference.
- C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern for budgetary purposes. However, no work will proceed until the Architect determines the correct method of installation.
- D. Should any Contractor, as applicable, perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect.
- E. Products utilized in the construction/operation of the Fore River Hospital shall be mercury free in accordance with the threshold limit established by the Ohio Guidelines, Ohio EPA and U.S. EPA.
- F. Applicable Codes and Standards shall include all State Laws, Local Ordinances, Utility Company Regulations and the applicable requirements of the following accepted Codes and Standards, without limiting the number, as follows:
 - 1. National Electrical Code (NEC)
 - 2. Environmental Protection Agency (EPA)
 - 3. Maine Environmental Air Quality Protection Agency
 - 4. Maine Energy Code
 - 5. Maine Building Code/IBC (Latest Adopted Edition), including all adopted Maine Supplements
 - 6. Maine Fire Prevention Regulations and Elevator Regulations
 - 7. Local Ordinances, Regulations of the Local Building Department and Fire Department
 - 8. Guidelines for Construction and Equipment of hospital and Medical Facilities 2006 Edition, as published by A.I.A. Press, ISBN 1-57165-013-X, U.S. Dept. of Health and Human Services
 - 9. Occupational Safety and Health Standard (OSHA)
 - 10. Plumbing Code – Maine Plumbing Code/IPC (Latest Adopted Edition), including all Adopted City of Portland Amendments
 - 11. Mechanical Code – Maine Building Code/IMC (Latest Adopted Edition), including all Adopted City of Portland Supplements
 - 12. Recommendations of the National Fire Protection Association (NFPA), latest applicable edition adopted, in general and in particular:
 - a. Life Safety, NFPA 101
 - b. HVAC, NFPA 90A, 90B
 - c. Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment, NFPA 96
 - d. Hospitals, NFPA 99

13. Recommendations of ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers), including:
 - a. ANSI/ASHRAE/IESNA 90.1 – 2004 Energy Efficient Design
 - b. ANSI/ASHRAE 62 - 2004-Ventilation for Acceptable Indoor Air Quality
 - c. ANSI/ASHRAE 15 - 2004-Safety Code for Mechanical Refrigeration
 - d. ANSI/ASHRAE 110 - 1995-Method of Testing Performance of Laboratory Fume Hoods
 - e. ANSI/ASHRAE 55 - 2004-Thermal Environmental Conditions for Human Occupancy
14. Americans with Disabilities Act, ADA
15. In addition to the above Codes and Standards, the medical laboratory systems will also be based on the specific requirements and/or recommendations of the following as they relate to laboratory systems:
 - a. Occupational Safety and Health Administration (OSHA) S29 CFR Part 1910, Health and Safety Standards; Occupational Exposures to Toxic Substances in Laboratories; Proposed Rule. Federal Register July 24, 1986
 - b. ANSI/AIHA Z9.5 American National Standard for Laboratory Ventilation
 - c. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals, Chapters, 9-2.8, 9-2.9
 - d. NFPA 56 - Safety Standard for Laboratories in Health-Related Institutions, Chapter 3-3.5
 - e. Scientific Apparatus Makers Association (SAMA)
 - f. National Cancer Institute - Safety Standards for Research Involving Chemical Carcinogens
 - g. National Research Council - Prudent Practices of Handling Hazardous Chemicals in Laboratories
 - h. National Safety Council - Fundamentals of Industrial Hygiene
 - i. National Institute of Health

G. In these specifications, references made to the following Industry Standards and Code Bodies are intended to indicate the accepted volume or publication of the Standard. All equipment, materials and details of installation shall comply with the requirements and latest revisions of the following Bodies, as applicable:

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| 1. | AMCA | Air Moving and Conditioning Association |
| 2. | ANSI | American National Standards Institute |
| 3. | ARI | American Refrigeration Institute |
| 4. | ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| 5. | ASME | American Society of Mechanical Engineers |
| 6. | ASTM | American Society of Testing Materials |
| 7. | AWS | American Welding Society |
| 8. | CS | Commercial Standards, U.S. Department of Commerce |
| 9. | FM | Factory Mutual |
| 10. | FS | Federal Specification, U.S. Government |

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| 11. | MSS | Manufacturers Standardization Society of the Valve and Fittings Industry |
| 12. | NEMA | National Electrical Manufacturers Association |
| 13. | SMACNA | Sheet Metal and Air Conditioning Contractor's National Association |
| 14. | UL | Underwriters' Laboratories, Inc. |
| 15. | IRI | Industrial Risk Insurer's |
| 16. | CDA | Copper Development Association |
| 17. | CISPI | Cast Iron Soil Pipe Institute |
| 18. | NSF | National Sanitation Foundation |
| 19. | CGA | Compressed Gas Association |
| 20. | OSHA | Occupational Safety and Health Act |

- H. Each Contractor for the work under his charge, shall give all necessary notices, obtain and pay for all permits, pay all governmental taxes, fees and other costs in connection with his work; file for necessary approvals with the jurisdiction under which the work is to be performed. Each Contractor shall obtain all required Certificates of Inspection for his work and deliver same to the Architect before request for acceptance of his portion of work and before final payment is made.
- I. All equipment shall be installed per manufacturer's recommendations and requirements. The Contractor shall notify the engineer in writing when they intend to deviate from manufacturer's installation guidelines. The engineer shall advise if the installation is acceptable prior to installation.

1.4 SUBMITTALS

- A. Prepare and submit shop drawings in accordance with the requirements of Division 1, plus additional requirements noted hereinafter.
- B. All shop drawings shall have clearly marked the appropriate specification number or drawing designation, for identification of the submittal.
- C. Disposition of shop drawings shall not relieve the Mechanical Contractor from the responsibility for compliance with drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Mechanical Contractor from responsibility for errors in shop drawings or schedules.
- D. Documents submitted shall show the following:
1. Principal dimensions and details of construction.
 2. Operating and maintenance clearances.
 3. Weights of principal parts and total weights with information required for the design of supports and foundations.
 4. Sizes and location of piping and connections.

5. Performance data, including pump and fan curves; sound data including sound power dB levels in 1/3 octave bands.
 6. Data on electric motors, including brake horsepower of driven equipment, nameplate ratings and classes, sound data, starting and running full load currents, required starter size and recommended overload heater ratings.
 7. Approval stamp of Underwriters' and other authorities having jurisdiction of Contract Drawings requiring such approval.
 8. Certified performance guarantees.
 9. Calculations and details for refrigeration for field assembled systems including description of specialties and pressure drops, layout of piping with lengths fittings, and refrigerant specialties, and capacity curves for evaporator and compressor showing balance points.
 10. Minimum scale for sheet metal plans and piping plans shall be ¼ inch equal 1 foot.
- E. Submit brochures that contain only that information which is relative to the particular equipment or materials to be furnished. Do not submit catalogs that describe several different items other than those items to be used unless irrelevant information is marked out and relevant material is clearly marked.
- F. Specifications Compliance Statement
1. The manufacturer shall submit a point by point statement of compliance with the specifications.
 2. The statement of compliance shall consist of a list of all paragraphs (line by line).
 3. Where the proposed system complies fully, such shall be indicated by placing the word "comply: opposite the paragraph number.
 4. Where the proposed system does not comply, or accomplishes the stated function in a manner different from that described, a full description of the deviation shall be provided.
 5. Where a full description of a deviation is not provided, it shall be assumed that the proposed system does not comply with the paragraph in question.
 6. Submissions which do not include a point by point statement of compliance as specified shall be disqualified.
- G. Shop drawing data shall include, but not be limited to, the following:
1. Manufacturer's model and catalog data.
 2. Complete connection diagrams for all Trades.
 3. Dimensions, capacities, ratings, materials, finishes, etc.
- H. Each shop drawing is required to bear the review stamp of the Mechanical Contractor associated with installing the equipment and/or processing the document, as well as the Construction Manager's review stamp.
- I. Shop drawings shall include, but shall not be limited to, the following:
1. Air handling units complete with all components, controls, accessories and installation details. Fan curves, coil selections, and other component selections.

2. All types of air distribution devices including frames, fasteners and support details.
3. Humidifiers.
4. Sheet metal accessories and ductwork construction standards. Method of sealing of all ductwork.
5. Variable/constant volume air boxes and valves.
6. Fire dampers, smoke dampers, combination automatic/smoke dampers, automatic dampers.
7. All types of fans, roof curbs and other accessories as applicable. Fan curves.
8. Automatic temperature control system complete with catalogue cuts and bill of materials, wiring and piping diagrams, system schematics, and detailed written description of sequences of operation. Hardware and software including interfaces with all Mechanical/Electrical systems.
9. Sound attenuators, vibration isolators, flexible connectors, seismic restraints, including calculations by a Maine Licensed Professional Engineer bearing his seal.
10. Hangers, supports, expansion compensators, guides, anchor details.
11. All types of heaters and radiation. Induct heating coils.
12. Pumps with individual curves for each pump.
13. Chemical treatment equipment and chemicals, as well as description of operation and maintenance procedures.
14. Thermal insulation for piping, ductwork and equipment.
15. Valves, thermometers, gauges, strainers, steam traps. Pressure reducing valves. Safety relief valves.
16. Heat exchangers.
17. Additional samples and shop drawing submittals, as requested by the Architect.
18. Pressure reducing valves and accessories.
19. Shell-and-tube heat exchangers.
20. Air separators, hydronic accessories, expansion and compression tanks. Condensate pumps and receivers. Individual pump curves for each pump.
21. Link seals.
22. Air and hydronic balancing reports.
23. Valve and pipe identification charts, tags, markers.
24. Nameplates.
25. Coordination drawings and record "as-built" drawings by CAD.
26. Variable speed drives.
27. Computer room air conditioning units.
28. Chillers, cooling towers, complete with all components, installation details and controls.
29. Oil piping and accessories, and detailed drawings of boiler accessories installation. Fuel oil leak detection system. Oil tank, tank accessories, tank gauge, fuel oil tank installation.
30. Steam boiler, dearator, surge tank, including all components installation details, controls, etc.
31. Boiler, breeching and stack, including all fittings, supports, penetration and installation details, etc.
32. Hydronic snow melting system.

1.5 GUARANTEE

- A. Attention is directed to provisions of the General Conditions and Supplementary General Conditions regarding guarantees and warranties for work under this Contract.
- B. Manufacturers shall provide their standard guarantees for work under this Contract, unless specified otherwise. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer and CM may have by Law or by other provisions of the Contract Documents. In any case, such guarantees and warranties shall commence when the Owner accepts the various systems, as applicable and as determined by the Architect. The guarantees and warranties will remain in effect for a minimum period of (1) year thereafter except where longer periods are specifically stated and specified.
- C. All materials, items of equipment and workmanship furnished under each HVAC, Plumbing and Fire Protection shall carry the warranty against all defects in material and workmanship. Any fault due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Contractor responsible, including all other damage done to areas, materials and other systems resulting from this failure.
- D. Each Contractor shall guarantee that all elements of the systems provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated on the drawings.
- E. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the guarantee period, the affected part or parts shall be replaced by the responsible Contractor.
- F. Each Contractor shall furnish, before the final payment is made, a written guarantee covering the above requirements.

1.6 THE CONTRACTOR

- A. Each Contractor shall base his bid on site examinations performed by him. This requirement is mandatory. Each Contractor shall visit the proposed site where work is scheduled to be performed and ascertain for himself the amount of work required to fulfill the intent of his Contract and the complexity of the installation. Each Contractor shall not hold the Architect, his Consultants, agents or employees responsible for or bound by, any schedule, estimate or for any plan thereof. Each Contractor shall study all Contract Documents (HVAC, ATC, Plumbing, Fire Protection, Electrical, Architectural, Structural), etc., included under each Contract, to determine exactly the extent of work to be provided under each Section, and in installing new equipment and systems and coordinating the work with the other Trades and existing conditions.
- B. Each Contractor shall faithfully execute his work according to the terms and conditions of the Contract and specifications and shall take all responsibility for and bear all losses resulting to him in the execution of his work.

- C. Each Contractor shall be responsible for the location and performance of work provided under his Contract as indicated on the Contract Documents. All parties employed directly or indirectly by each Contractor shall perform their work according to all the conditions as set forth in these specifications.
- D. Each Contractor shall furnish all materials and perform all work in accordance with the project specifications and any supplementary documents provided by the Architect. The work shall include every item shown on the drawings and/or required by the specifications as interpreted by the Architect. All work and materials furnished and installed shall be new and of the best quality and workmanship. Each Contractor shall cooperate with the Architect so that no error or discrepancy in the Contract Documents shall cause defective materials to be used or poor workmanship to be performed.

1.7 COORDINATION OF WORK

- A. Each Contractor shall compare his drawings and specifications with those of other Trades and report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the mechanical or electrical work, to ensure that all work is installed in coordination and cooperation with other Trades installing interrelated work. Before installation, each Contractor shall make proper provisions to avoid interferences in a manner approved by the Architect. All changes required in the work of each Contractor caused by his negligence, shall be corrected by him at his own expense, to the Architect's satisfaction.
- B. Locations of piping, ductwork, conduits and equipment shall be adjusted to accommodate the new work with interferences anticipated and encountered during installation. Each Contractor shall determine the exact routing and location of his systems prior to fabrication or installation of any system component. Accurate measurements and coordination drawings will have to be completed to verify dimensions and characteristics of the various systems' installations.
- C. Lines which pitch shall have the right-of-way over those which do not pitch. For example, waste piping shall normally have the right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.
- D. Offsets, transitions and changes of direction in all systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. Each Contractor shall provide manual air vents and drains as required for his work to effect these offsets, transitions and changes in direction, as applicable.
- E. All work shall be installed in a way to permit removal (without damage to other parts) of coils, filters, control appurtenances, fan shafts and wheels, filters, belt guards, sheaves and drives and all other system components provided under this Contract requiring periodic replacement or maintenance. All piping shall be arranged in a manner to clear the openings of swinging overhead access doors, ceiling tiles and cleaning access doors in ductwork.
 - 1. Access to any and all components requiring servicing, adjustment, calibration, maintenance or periodic replacement shall be provided so that the Owner's operations personnel can freely gain access without removal of any materials other than the

Access panel or ceiling tile. Access shall be understood to mean free, clear and unobstructed from the floor up to the device and/or component being serviced. Access panels for VAV/CV boxes shall be 24" x 24" minimum.

2. Fire rated access doors with closers shall be provided for all rated assemblies.
- F. The Contract Drawings are diagrammatic only intending to show general runs and locations of piping, ductwork, equipment, terminals and specialties and not necessarily showing all required offsets, details and accessories and equipment to be connected. All work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation which will afford maximum accessibility for operation, maintenance and headroom.
- G. Where discrepancies in scope of work as to what Trade provides items, such as starters, disconnects, flow switches, electric control components, etc., exist, such conflicts shall be reported to the Architect prior to signing of the Contract. If such action is not taken, each Contractor, as applicable, shall furnish such items as part of his work, for complete and operable systems and equipment, as determined by the Architect.
- H. Where drawing details, plans and/or specification requirements are in conflict and where pipe or duct sizes of same pipe or duct run are shown to be different between plans and/or between plans and sections or details, the most stringent requirement will be included in the Contract. HVAC systems and equipment called for in the specification and/or shown on the drawings shall be provided under this Contract as if it were required by both the drawings and specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to Architect's attention for direction as to what is to be provided.
- I. Final location of all air distribution devices, thermostats, heaters, control devices, sprinkler heads, etc., shall be coordinated with the Architectural reflected ceiling plans and/or other Architectural details, as applicable. (**Note:** Sprinkler head locations shall provide the specified coverage rating and water flow density, and shall be in accordance with all applicable Codes and in full compliance with the requirements of the Owner's insurance carrier.) Offsets of ductwork, added sheet metal, fittings, elbows, flexible connections, etc., shall be provided as required to comply with the Architectural reflected ceiling plans and/or installation details. Obtain approval of locations of all devices from Architect in the field, prior to installation.
- J. Medical equipment, kitchen equipment and/or hoods, dishwashers, fume hoods, glasswashers, sterilizers, stills, etc., or other type of equipment shown on the Plumbing, Fire Protection, HVAC and/or Architectural drawings to be provided with services, such as exhaust ductwork, piping, traps, drains, valves, etc., shall be included under this Contract as applicable, including all piping or ductwork connections to systems, to make equipment completely operable. Additional sheet metal, flexible fittings, etc., shall be provided to accomplish the above requirement, as required, all as part of this Contract, at no additional cost to the Owner.

1.8 COORDINATION DRAWINGS

- A. Before materials are purchased, fabricated or work is begun, each Contractor shall prepare coordination drawings for all floors/areas, including buried systems/services (all-Trade-composite at ¼" scale), showing the size and location of his equipment and lines, in the manner described herein under General Requirements.
- B. Coordination drawings are for the CM and Architect's use during construction and shall not be construed as shop drawings or as replacing any shop drawings. The coordination drawings, when corrected for actual "as-built" conditions, will be reviewed by the Architect, corrected and become the Record Drawings to be submitted to the Owner for his use.
- C. The cost of producing and reproducing the drawings will be included under the Contract of each Trade, including the cost or preparation of the Architectural building outlines. The HVAC Contractor shall take the lead to produce the Architectural backgrounds, show all ductwork, piping, etc., and circulate the drawings to any of his Subcontractors and the other Trades (Plumbing, Fire Protection, Electrical), so that they can indicate all their work as directed by the CM and Architect as required, to result in a fully coordinated installation.
- D. In addition to the regular coordination drawing review, the mechanical work will also be reviewed by the Architect/Engineer to ensure that the system and equipment arrangements are suitable to provide maintenance access and service as follows:
 - 1. Valves and instrumentation should be grouped where possible and positioned in accessible locations.
 - 2. Valves on pipes of 6" and larger, positioned above 7'-0" in height from the operating level, will be provided with chain operated valve wheels and be located where chains will not interfere with primary access through the mechanical room.
 - 3. Location of control/diagnostic panels shall be shown and identified on the mechanical room coordination drawings.
- E. Prepare a complete set of computer based AutoCad (Latest Version) drawings at scale not less than ¼" scale equals 1'-0", showing basic layout for the structure and other information as needed for preparation of Coordination Drawings. The drawings shall indicate the layout of all specialty tradework as indicated herein and shall be designated as Coordination Drawings. The Contractors may obtain a copy of the floor plans on disk from the Engineer to assist in the preparation of Coordination Drawings. The Contractor shall provide a minimum of two (2) weeks notice to the Engineer for preparation of the disk. A signed liability release form will be required from the Contractor prior to the release of the disk from the Engineer.
- F. Highlight all fire rated partitions on the Coordination Drawings for appropriate coordination.
- G. The main paths for the installation or removal of equipment from mechanical and electrical rooms shall be clearly indicated on the Coordination Drawings.

- H. Each of the specialty trades shall add its work to the base drawings with appropriate elevations and grid dimensions. Specialty trade information shall be required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers and for spaces in the above ceilings where congestion of work may occur such as corridors and, where required, entire floors. Drawings shall indicate horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions and other services. Indicate elevations relative to finish floor for bottom of ductwork and piping and conduit 6" greater in diameter.
1. Specialty Trade shall include:
- a. Plumbing system.
 - b. HVAC piping and associated control systems.
 - c. Electrical.
 - d. Sheet Metal Work.
 - e. Fire Protection system.
 - f. Automatic Temperature Control
 - g. Fire Alarm
 - h. Security
 - i. Telecommunications
 - j. Pneumatic Tube
- I. Upon completing their portion of the Coordination Drawings, each specialty trade shall sign, date and return Coordination Drawings to the Contractor.
- J. Where conflicts occur with placement of materials of various trades, the Construction Manager shall be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the affected specialty trade Subcontractor. The Construction Manager shall then final date and sign each drawing.
- K. Fabrication shall not start until Coordinate Drawings have been distributed to all parties as indicated herein.
- L. Distribution of Coordination Drawings:
1. The Construction Manager shall provide one print of each Coordination Drawing to:
- a. Each specialty trade Subcontractor.
 - b. Owner.
 - c. Engineer.
 - d. Architect (for record purposes).
- M. After distribution:
1. The method used to resolve interference's not previously identified shall be as in paragraph J. above. Distribute revised Coordination Drawings to all parties listed above.

N. Coordination Drawings include but are not necessarily limited to:

1. Structure.
2. Partition/room layout, including indication of smoke and fire resistance rated partitions.
3. Ceiling layout and heights.
4. Light fixtures.
5. Access panels.
6. Sheet metal, heating coils, heat pumps, grilles, diffusers, etc.
7. All heating piping and valves.
8. Smoke and fire dampers.
9. Soil, waste and vent piping.
10. Major water and gases.
11. Major electrical conduit runs, panelboards, feeder conduit and racks of branch conduit. Motor control centers, starters and disconnects.
12. Sprinkler piping and heads.
13. All equipment, including items in the Contract as well as O.F.C.I. and O.F.I. items.
14. Equipment located above finished ceiling requiring access for maintenance and service. In locations where acoustical lay-in ceilings occur indicate areas in which the required access area may be greater than the suspected grid systems.
15. Rainwater Piping.
16. Existing conditions, including, but not limited to, Mechanical, Plumbing, Fire Protection and Electrical items.

O. The Architect's response to all requests for information (RFI's) generated by the trade contractors shall be distributed to all other affected trades as if this information was contained in the original contract documents. In other words, the party that issues an RFI is responsible for distributing the information to all affected parties.

1.9 RECORD DRAWINGS

- A. Each Contractor shall maintain, current at the site, a set of Contract Drawings for his portion of the work on which he shall accurately show the actual installation of all work provided under his Contract indicating any variation from the Contract Drawings, in accordance with the General Conditions and Supplementary General Conditions. Changes whether resulting from formal change orders, requests for information, or other instructions issued by the Architect shall be recorded. Include changes in sizes, location and dimensions of piping, ducts, equipment, etc.
- B. Each Contractor shall indicate progress by coloring-in various pipes, ducts and associated appurtenances exactly as they are erected. This process shall incorporate both the changes noted above and all other deviations from the original drawings whether resulting from job conditions encountered or from any other causes.
- C. The marked-up and colored-up prints will be used as a guide for determining the progress of the work installed. They shall be inspected periodically by the Architect and Owner's

representatives and they shall be corrected if found either inaccurate or incomplete. This procedure is mandatory. Marked up drawings shall include all flow diagrams, schedules, details and control diagrams.

- D. Each Contractor shall meet at a minimum on a monthly basis, with the Owner's representative to transfer the information from his HVAC, Plumbing, Fire Protection, etc., marked-up and colored-up prints to a set which will become the basis for preparation of as-built drawings. Refer to the preceding paragraph "Coordination Drawings".
- E. Upon completion of the project, each Contractor shall submit his marked-up drawings to the Architect for review and comment. After the Architect reviews and comments on this set of documents, each Contractor shall prepare as-built drawings on CAD using AutoCad (Latest Version). When the work is completed, each Contractor shall provide 2 hard copies to the Architect for submittal to the Owner and disks with all documentation and a set of reproducible drawing plots marked "As-Built" drawings. The Contractor shall bear all costs of producing the CAD "As-Built" drawings, providing all necessary drawing changes and printing the reproducible drawings for the work under his charge.

1.10 GIVING INFORMATION

- A. Each Contractor shall keep himself fully informed as to the shape, size and position of all openings required for his apparatus and shall give information to the Architect and other Contractors [or Subcontractors] sufficiently in advance of the work so that all openings may be built in advance.
- B. The manufacturers listed within this specification have been preselected for use on this project. No submittal will be accepted from a manufacturer other than those specified. Should any Contractor wish to propose a substitution during the bid period, such request shall be made in writing to the Architect, at least (15) working days, prior to bid date. If substitutions are deemed acceptable, such items shall be issued as an Addendum, prior to bid due date. The above requirement is mandatory.

1.11 EQUIPMENT AND MATERIALS

- A. Equipment and materials shall be delivered to the site and stored in original sealed containers, suitably sheltered from the elements, but readily accessible for inspection by the Architect until installed. All items subject to moisture damage such as controls, filters, etc., shall be stored in dry, heated spaces.
- B. Each Contractor shall have his equipment tightly covered and protected against dirt, water and chemical or mechanical injury and theft. At the completion of the work, equipment and materials shall be cleaned, polished thoroughly and turned over the Owner in a condition satisfactory to the Architect. Damage or defects developing before acceptance of the work shall be made good at each Contractor's [or Subcontractor's] expense as applicable.

- C. Each Contractor shall make necessary field measurements to ascertain space requirements, for equipment and connections to be provided under his Trade and shall furnish and install such sizes and shapes of equipment to allow for the final installation to conform to the drawings and specifications.
- D. Manufacturers' directions shall be followed completely in the delivery, storage, protection and installation of any equipment. Promptly notify the Architect in writing of any conflict between any requirements of the Contract Documents and the manufacturer's directions and obtain the Architect's written instructions before proceeding with the work. Should any Contractor perform any work that does not comply with the manufacturer's directions or written instructions from the Architect, he shall bear all costs arising in correcting any deficiencies that should arise.
- E. Each Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work under his Contract for use, occupancy and operation by the Owner.
- F. Where equipment of the acceptable manufacturers requires different arrangement or connections from those shown, it shall be the responsibility of each Contractor to install the equipment to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, each Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, each Contractor shall make all necessary changes in all effected related work provided under other Sections including location of roughing-in connections by other Trades, electrical requirements, piping, supports, insulation, etc. All changes shall be made at no increase in the Contract amount or additional cost to the other Trades and/or Owner.
- G. All equipment and materials required for installation under these specifications shall be new and without blemish or defect. Equipment and materials shall be products which will meet with the acceptance of the Authorities having jurisdiction over the work and as specified hereinbefore. Where such acceptance is contingent upon having the products listed or labeled by FM, UL or other testing laboratories, the products shall be so listed or labeled. Where no specific indication as to the type or quality of material or equipment is indicated, a first class standard article shall be provided.
- H. All equipment of one type (such as valves, sprinkler heads, fans, air handling units [packaged or custom built], air terminals, plumbing fixtures, etc.), shall be the product of one manufacturer.
- I. Equipment prepurchased on behalf of the Owner or by the Owner himself, if assigned to any of the Contractors, shall be received, inspected, installed, etc., as if it was purchased by the Contractors as applicable. All guarantees, service contracts, etc., shall be the same as for all other equipment provided under this Contract.

1.12 CUTTING AND PATCHING

- A. Each Contractor shall be responsible for all core drilling, as required for work under his Contract, but in no case shall he cut into any structural elements without the written approval of the Architect.
- B. All cutting, rough patching and finish patching, shall be provided under this Contract.
- C. All concrete and masonry equipment bases and housekeeping pads, curbs, chases, pockets and openings required for the proper installation of the work under this Contract shall be provided by the General Trades Contractor, as assigned by the Construction Manager in accordance with Section 03300 Cast-in-Place Concrete, using dimensions, templates, bolts, anchors, as shown on the drawings and/or as required and as furnished by the Contractor installing the equipment. At a minimum, concrete bases (housekeeping) pads shall be 4" high and extending 3" on all sides beyond equipment (for all base mounted equipment), support or isolation base and shall be provided by the General Trades Contractor.
 - 1. Coordinate housekeeping pads for:
 - a. All equipment indoors or outdoors.
 - b. All floor supports or braces.

1.13 USE OF PREMISES

- A. Each Contractor shall confine all of his apparatus, storage of materials and construction to the limits indicated on the drawings and directed by the Architect and he shall not encumber the premises with his materials.
- B. In storing materials within areas (structure or ground), or when used as a shop, each Contractor shall consult with the Construction Manager and shall restrict his storage to space designated for such purposes. Each Contractor will be held responsible for repairs, patching or cleaning arising from any unauthorized use of premises.
- C. Notwithstanding any approvals or instructions which must be obtained by each Contractor from the Architect in connection with use of premises, the responsibility for the safe working conditions at the site shall remain each Contractor's. The Architect or Owner shall not be deemed to have any responsibility or liability in connection therewith.
- D. Air handling unit or cooling tower sections shall not be used for storage of materials. The HVAC Contractor will be responsible for securing, and maintaining the equipment clean. The above requirement is mandatory.
- E. Cleaning
 - 1. Each Contractor shall clean up all debris resulting from its activities daily. Each Contractor shall remove all cartons, containers, crates, etc., under its control as soon

as their contents have been removed. Waste shall be collected and placed in a designated location.

2. At the completion of work in any area, each Contractor shall clean all of its work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
3. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

1.14 PROTECTION/CLEANLINESS

- A. All materials such as valves, fittings, piping, ductwork, plenums, grilles, registers, diffusers, etc., shall be properly protected from the accumulation of dirt, dust, debris or any other contaminants. All ductwork and piping openings shall be temporarily closed by each Contractor [or Subcontractor] installing same, so to prevent obstruction and damage, as a minimum at the end of each working day or more often if required by job conditions. Each Contractor shall take precautions to protect his materials from damage and theft.
- B. Each Contractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or electrical systems provided under his Contract.

1.15 DAMAGE CORRECTION AND EXTRA WORK

- A. Each Contractor shall be held responsible and shall pay for all damages caused by his work to the new and existing building structures and new and existing equipment, piping, duct systems, etc., and all work and finishes installed under this Contract in the new or in existing building. Repair of such damage shall be done as herein before specified, at the expense of each Contractor and to the Architect's satisfaction.
- B. Each Contractor shall promptly correct all work provided under his Contract and rejected by the Architect as defective or as failing to conform to the Contract Documents whether observed before or after completion of work and whether or not fabricated, installed or completed. Each Contractor shall bear all costs of correcting such rejected work.
- C. No claim for extra work will be allowed unless it is authorized by the Architect in writing before commencement of the extra said work.

1.16 TOUCH-UP PAINTING

- A. Each Contractor shall thoroughly clean all equipment and systems provided under this Contract from rust, splatters and other foreign matter or discoloration, leaving every part of each system in an acceptable prime condition. Each Contractor, for the work under his

Contract, shall refinish and restore to the original condition all equipment and piping which has sustained damage to the manufacturer's prime and finish coats of paint and/or enamel.

1.17 DUCT AND PIPE SLEEVES, PLATES AND ESCUTCHEONS, FIRESTOPPING AND SMOKEPROOFING

- A. Where piping and/or ductwork pass through masonry or concrete walls or drywall partitions or floors, each Contractor shall provide and set individual sleeves for each pipe or duct and all other work under his charge, as necessary for passage of all pipes and/or ducts. Sleeves shall be of sufficient size to provide 1/2" air space around the pipe or duct passing through (including insulation where pipes or ducts are externally insulated). All openings shall be sealed, smokeproofed and made tight. Each Contractor shall be responsible for the exact location of sleeves provided under his Contract and shall coordinate all requirements for piping and ductwork sleeves.
- B. Each Contractor, for work under his charge, shall determine the required inside diameter of each individual wall opening or sleeve before ordering, fabrication or installation.
- C. Sleeves and inserts shall not be used in any portions of the building, where their use would impair the strength or construction features of the building. Elimination of sleeves must be approved by the Architect.
- D. Provide chrome plated brass escutcheons with set screw for exposed piping, in all areas except in mechanical rooms. In this area use plain brass or cast iron escutcheons suitable for painting. All escutcheons shall be sized to fit the bare pipe or insulation in a snug and neat manner. They shall be of sufficient size to cover sleeved openings for the pipes and of sufficient depth to cover sleeves projecting above floors. Escutcheons shall be as manufactured by Beaton & Caldwell, Dearborn Brass, or Grinnell.
- E. Pipe or duct sleeves shall be made of Schedule 40 pipe, 20 gauge galvanized steel or 16 gauge steel as follows:
 - 1. Sleeves on pipes passing through masonry or concrete construction shall be Schedule 40 pipe.
 - 2. Sleeves on ducts passing through concrete construction shall be 20 gauge steel unless required otherwise by item 3. below.
 - 3. Sleeves on pipes or ducts passing through fire rated partitions shall be 16 gauge steel.
 - 4. Sleeves on pipes or ducts passing through non-rated drywall construction shall be 20 gauge galvanized steel.
- F. Pipe or duct sleeves shall be set as follows:
 - 1. Set sleeves 1" above finish floor, (except set sleeves, 6" above finish floor at penthouses or mechanical rooms and 6" above finished roof) and flush on each side of walls. Coordinate roof penetrations with roof Subcontractor. Roofing Contractor shall provide flashing/counter flashing to the Mechanical pipes.

2. Sleeves shall be set securely in place before concrete is poured when placed in concrete construction.
 3. Provide sheet metal sleeves for all duct penetrations and cover with sheet metal plates all penetrations after ductwork has been installed through walls/floors.
- G. Each Contractor shall fire stop, smoke stop, and/or acoustically seal the space between the sleeves provided under his Contract and piping or ductwork as applicable, as follows:
1. See specification Section 07841 – Through-Penetration Firestop Systems.
- H. Except as otherwise specified, underground piping passing through exterior walls or foundation slabs on grade, shall have penetration closures of the modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous belt around the pipe and with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and wall, reducing chances of cathodic reaction between these members. Each Contractor for work under his charge shall determine the required inside diameter of each individual wall opening or sleeve before ordering, fabrication or installation. The inside diameter of the wall opening shall be sized to fit the pipe and ensure a watertight joint. Where applicable, when installing seals, take into account the pipe O.D. if non-standard due to coating or jacketing.

1.18 MISCELLANEOUS IRON AND STEEL

- A. Each trade shall provide all primary and secondary steel supports and hangers as shown on the drawings and/or as required to support equipment, ductwork, piping, exhaust fans, or any other materials provided under the work of this Section.
- B. The work of this Section of designing, furnishing and installing all miscellaneous metal work associated with the system, and related items as indicated on the drawings and/or as specified herein, and includes, but is not limited to the items listed herein below.
- C. The scope of work shall include:
1. Exhaust fan support platforms including ship ladders, steel grating for decking, cross-bracing and floor stands.
 2. Intermediate beams to hang ductwork and piping from the roof. All piping and ductwork must be hung from beam or supported from the floor. Provide supplemental steel for support of equipment.
 3. Support of ductwork and piping in shafts in addition to support provided by structure.
 4. Support of ductwork via floor stands as required.
 5. Heat exchanger support racks.
 6. Piping support in underground concrete trench and manholes.
 7. Pipe anchors in the building.
 8. Hangers, brackets, angel irons or rods required for the support and protection of HVAC, plumbing and fire protection equipment.

9. Field prime painting of galvanized steel and field finish painting.
 10. Provide neoprene gasket 1/8" beyond all baseplates.
- D. Shop Drawings for General Miscellaneous Items
1. Submit Shop Drawings of all miscellaneous metal items to Architect for approval, showing sizes and thickness of all members, types of materials, methods of connection and assembly, complete dimensions, clearances, anchorage, relationship to surrounding work by other Trades, shop paint, and other pertinent details of fabrication and installation.
- E. The Subcontractor shall engage the services of a Professional Engineer registered within the state of Maine to prepare complete Design Drawings and structural design computations based on, and closely following, the design and details on the Drawings. The Design Drawings and structural design computations, with the Engineer's seal affixed thereto, shall be submitted to the Architect for review. The structural design computations shall provide a complete structural analysis, including anchors and fastening devices, and shall certify as to conformation to governing laws and codes. These submittals, upon review, must be sufficient, when taken in conjunction with this Specification to provide the complete basis of the fabrication and erection.
- F. Samples
1. Submit duplicate samples of all materials to be furnished under this Section if, and in size and form, requested by Architect.
- G. Do not order materials or begin fabrication until Architect's approval of submittals has been obtained.
- H. In addition to the governing laws and codes, the following Specifications and Codes form a part of this Specification:
1. American Iron and Steel Institute applicable standards.
 2. American Institute of Steel Construction "Code of Standard Practice for Steel Buildings and Bridges" and "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".
 3. American Welding Society Code: Standard Code for Arc and Gas Welding in Building Construction.
- I. All materials shall be new stock, free from defects impairing strength, durability or appearance and of best commercial quality for each intended purpose.
1. Unless other wise specifically called for, work of this Section shall be fabricated of structural steel conforming to ASTM Specification A36.
 2. Steel pipe shall be seamless steel pipe conforming to ASTM Specification A53, Schedule 40.
 3. Steel tubing shall be seamless steel tubing conforming to ASTM Specifications A500 to A501.

4. Construction specialties such as slotted inserts, wedge inserts, etc., shall be as manufactured by Hohmann and Barnard, Gateway Erectors, Inc., Richmond Screw Anchor Co. or equal approved by Architect.
 5. Non-ferrous metals shall be as specified under descriptions of specific items, herein below.
- J. Provide all anchors, bolts, sockets, sleeves, and other parts required for securing each item of work of this Section to the construction, including furnishing to concrete workers all required insets and sleeves for use at concrete.
1. All exposed fastenings shall be of the same material and finish as the metal to which applied, unless otherwise noted.
 2. Welding rods shall conform to AWS Standards and the recommendation of the welding rod manufacturer.
 3. Shop primer for other ferrous surfaces shall be a high-quality, lead-free, rust-inhibitive primer, Tnemec No. 10-99 Metal Primer or equivalent by Devoe and Reynolds Co., Carboline or equal.
- K. Metal surfaces shall be clean and free from mill scale, flake, rust and rust pitting. metal work shall be well formed and finished to required shape and size, true to details, with straight, sharp lines and angles and smooth surfaces. Curved work shall be true radii. Exposed sheared edges shall be eased.
- L. Weld all permanent connections. Welds shall be continuous on all exposed surfaces and where required for strength on concealed surfaces. Exposed welds shall be ground flush and smooth, with voids filled with metallic filling compound (metallic filling compound not permitted on surfaces to receive hot-dip galvanizing). Tack-welding will not be permitted unless specifically called for. Do not use screws or bolts where they can be avoided. Where used, heads shall be countersunk, screwed up tight, and threads nicked to prevent loosening.
- M. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water.
- N. Do all cutting, punching, drilling and tapping required for attachment of anchor bolts and other hardware and for attachment of work by other Trades. All such cutting, punching, drilling, etc., shall be done prior to hot-dip galvanizing of the various components.
- O. Live loads shall be not less than the minimum required by law. Where specific live load are not set forth in the laws and codes applicable to this work, and are not given on the Drawings or in this Specification, designs shall be such as to support the live loads which may normally be imposed without failure, without deflection of more than 1/360 of length of any member, and without permanent deformation, all with a factor of safety of not less than 2 1/2 to 1.

P. Shop Painting

1. All ungalvanized ferrous metals under this Section shall be given a shop coat of rust inhibitive primer as specified under Section 05500 – Metal Fabrications.
 - a. Immediately before shop painting, remove all rust, loose mill scale, dirt, weld flux, weld spatter, and other foreign material with wire brushes and/or steel scrapers. Power tool clean in accordance with SSPC SP-3 (Power Tool Cleaning). Remove all grease with oil by use of solvent recommended by paint manufacturer. Sandpaper exposed surfaces as required to produce smooth, even finishes.
 - b. Apply paint by spray process in strict accordance with manufacturer's printed instructions to uniform thickness(es) recommended by manufacturer. Apply thoroughly and evenly and work well into corners and joints taking care to avoid sags and runs.
 - c. Do not paint surfaces to be embedded in concrete, or to be welded in the field. After field welds are complete, grind smooth and flush, thoroughly clean and then apply specified primer over all unprimed in the field by brush roller.
 - d. After erection, sand smooth and retouch all portions of the shop coats chipped or damaged during erection, and coat all field welds and connections with primer equivalent to that used for the shop coat.

Q. Installation

1. All materials shall be carefully handled and stored under cover in manner to prevent deformation and damage to the materials and to shop finishes, and to prevent rusting and the accumulation of foreign matter on the metal work. All such work shall be repaired and cleaned prior to erection.
2. Work shall be erected square, plumb and true, accurately fitted, and with the tight joints and intersections. All anchors, inserts and other members to be set in concrete or masonry shall be furnished loose by this Trade to be built-into concrete and masonry and by those Trades as the work progresses. Later cutting or drilling shall be avoided wherever possible.
3. All metal work shall be rigidly braced and secured to surrounding construction, and shall be tight and free of rattle, vibration, or noticeable deflection after installed.
4. Where members, other than expansion bolts or inserts, are fastened into concrete, set such members in holes formed as specified below, and secure permanently in place by installation of proprietary-type expanding grout manufactured specifically for such purpose, used strictly in accordance with manufacturer's directions. Holes to receive members shall be formed with galvanized sheetmetal sleeves, expanded polystyrene foam, or other approved method to provide at least 1/2 inch clearance around entire perimeter. At exposed applications, hold expanding grout back 1/2 inch from finish surface and fill voids with Portland cement grout to match color and texture of surrounding concrete surface.

5. Electrolytic Isolation

- a. Where dissimilar metals are to come into contact with one another, isolate by application of a heavy coating of bituminous paint on contact surfaces in addition to shop coat specified above. Do not permit the bituminous paint in any way to remain on surfaces to be exposed or to receive sealant.

R. Description of Major Items

1. The items described below constitute the major part of the work of this Section, but are not intended or implied to cover each and every item that may be required to properly complete the work. Carefully review the Drawings to determine the full extent of the miscellaneous metal work required.

S. Steel Ladders/Platforms

1. Fabricate and install interior steel ladder at fans, air handling units, filter racks and all equipment requiring service. Ladders shall have a safety cage as required by OSHA regulations.
2. Except as may be otherwise indicated on the Drawings, ladder shall be minimum 16 inches wide, fabricated of minimum 3/8 inch by 2 1/2 inches hot rolled steel rails and minimum 3/4 inches outside diameter steel pipe rungs. Rungs shall be spaced 12 inches on center and shall be continuously welded to the rails. Provide a pair of steel clip angles or wall brackets at bottom and steel anchor plates or wall brackets at top, welded to the rails, as indicated.
3. Exterior steel ladders shall be hot dip galvanized after fabrication as specified hereinbefore. Rungs are to have non-slip surfaces.
4. All shall be OSHA and ANSI compliant.

T. Gratings and Frames

1. Fabricated and install steel gratings and frames at fan platforms.
2. Steel grating frames shall consist of a steel angle perimeter frame constructed of steel angles, at least 4 inches by 4 inches by 3/8 inches carried around perimeter with coped or mitered, full-welded corners. Perimeter frames shall be anchored with 7/16 inch minimum diameter expansion bolts or other suitable devices of adequate capacity, at corners, two (2) per beam end, and spaced not more than 2 feet on center around full perimeter.
3. Steel Gratings shall be pressure-locked type, with bearing bars spaced 1 3/16 inch on center and cross-bars spaced 4 inches on center. Sizes of bars shall be as required by manufacturer's loading tables to limit deflection of any member across any span to 1/240th of the span at live load of 100 pounds per square foot. Gratings shall be as manufactured by Borden Metal Products, Co., Irving Subway Grating Co., Reliance Steel Products Co., approved by Architect.
4. All (gratings and) frames shall be hot-dip galvanized after fabrication as specified hereinbefore.

U. Miscellaneous Items

1. Carefully review all Drawings for miscellaneous metal items required but not specifically listed above, such as miscellaneous steel clip angles, miscellaneous steel bracketing, and other miscellaneous metal items as indicated on the Drawings, reasonably implied therefrom, or reasonably necessary for the thorough completion of the work.
2. Provide rigid and secure anchorage of all components whether or not specifically described in complete detail on the Drawings.

V. Piping supports shall be coordinated with the building structure and shall span between roof beams as required.

1.19 WATERPROOFING, FLASHING AND COUNTERFLASHING

- A. Unless specifically indicated otherwise on the drawings, each Contractor shall provide all counterflashing and waterproofing of all piping, ductwork and equipment provided by him, which pierce roofs, walls and other weatherbarrier surfaces. All work under this paragraph shall be coordinated with the CM.
- B. All work shall be performed in a workmanlike manner to ensure weatherproof installation. Any leaks developed due to each Contractor's work shall be repaired at his expense, to the Architect's satisfaction.
- C. Pipes passing through slabs shall have the sleeve extended above floors as hereinbefore specified to retain any water and the space between the pipe and sleeve caulked waterproof fire stopping. The top and the bottom shall be sealed with monolastic caulking compound.
- D. All flashing required for ductwork and piping penetrations shall be provided by the CM.

1.20 ELECTRICAL WORK, MOTORS, MOTOR CONTROLLERS

- A. See Section 15170

1.21 IDENTIFICATION OF MATERIALS

- A. See Section 15075

1.22 VALVE TAGS, NAMEPLATES AND CHARTS

- A. See Section 15075.

1.23 PARTS LIST AND INSTRUCTIONS FOR OPERATION AND MAINTENANCE

- A. Each Contractor shall thoroughly instruct the representative(s) of the Owner, to the complete satisfaction of the Architect, in the proper operation of all systems and equipment provided by him. Each Contractor shall make arrangements, via the CM as to whom the instructions are to be given in the operation of the basic and auxiliary systems and the periods of time in which they are to be given. The Architect shall be completely satisfied that the representative of the Owner has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Architect determines that complete and thorough instructions have not been given by each Contractor to the Owner's representative, then each Contractor shall be directed by the Architect to provide whatever instructions are necessary until the intent of this paragraph of the specification has been complied with. All time required for Owner's instruction to satisfy the above requirements shall be included in this Contract. No extra compensation for such instructions will be allowed.
- B. Each contractor including but not limited to the HVAC, Plumbing and/or Fire Protection Contractor shall submit to the Architect for approval, a total of (6) typed sets, bound neatly in loose-leaf binders, of all maintenance and operating instructions for the installation, operation, care and maintenance of all equipment and systems. All data and literature furnished shall be specific for the make and model of the equipment furnished. General non-specific catalog data will not be acceptable. Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section such as fans, valves, plumbing fixtures, hot water heaters, boilers, air handling units, etc., shall be clearly divided from the other sections. A sub-index for each section shall also be provided. The methodology of setting-up the manuals shall be submitted to the Architect and Owner through the Construction Manager for approval prior to final submission of manuals.
- C. The instructions shall contain information deemed necessary by the Architect and shall include, but not be limited to, the following:
1. Instructional classes on equipment and systems operation for Owner's representative and maintenance personnel, by engineering staff of each Contractor. Minimum of 48 hours of instruction for minimum of (6) people. Instruction shall include:
 - a. Explanation of manual and its use.
 - b. Summary description of the HVAC, Plumbing and Fire Protection systems.
 - c. Purpose of systems.
 2. System
 - a. Detailed description of all systems.
 - b. Illustrations, schematics, block diagrams, catalog cuts and other exhibits.
 3. Operations
 - a. Complete detailed, step-by-step, sequential description of all phases of operation for all portions of the systems, including start-up, shutdown, adjusting and balancing. Include all posted instruction charts.

4. Maintenance
 - a. Parts list and part numbers.
 - b. Maintenance, lubrication and replacement charts and manufacturer's recommendations for preventive maintenance, as applicable to his work.
 - c. Troubleshooting charts for systems and components.
 - d. Instructions for testing each type of part.
 - e. Recommended list of on-hand spare parts.
 - f. Complete calibration instructions for all parts and entire systems.
 - g. Instruction for charging, filling, draining and purging, as applicable.
 - h. General or miscellaneous maintenance notes.

5. Manufacturer's Literature
 - a. Furnish complete listing for all parts required for models actually furnished.
 - b. Names, addresses and telephone numbers of manufacturers and suppliers.
 - c. Describe and operation of all models actually furnished.
 - d. Furnish all and only pertinent brochures, illustrations, drawings, cuts, bulletins, technical data, certified performance charts and other literature with the model actually furnished to be clearly and conspicuously identified.
 - e. Internal wiring diagrams and engineering data sheets for all items and/or equipment furnished under each Contract.
 - f. Guarantee and warranty data.

6. Each Contractor shall furnish instructions for lubricating each piece of equipment installed by him. Instructions shall state type of lubricant, where and how frequently lubrication is required. Frame instructions under glass and hang in a location as directed by Architect.

1.24 MANUFACTURER'S REPRESENTATIVE AND COMMISSIONING OF SYSTEMS

- A. Each Contractor shall provide, at appropriate time or as directed by the Architect, the on-site services of a competent factory trained Engineer or authorized representative of particular manufacturer of equipment provided under his Contract, such as for the air handling units, automatic temperature controls, building automation system (BAS), fire pump, domestic hot water heaters, boilers, etc., provided under this Contract, to instruct the Owner, inspect, adjust and place in proper operating condition any item provided by him, as applicable.

- B. Each Contractor, as applicable, shall commission and set in operating condition all major equipment and systems, such as the condenser water, hot water and all air handling systems, etc., in the presence of the applicable equipment manufacturer's representatives, and the Owner and Architect's representatives. In no case will major systems and equipment be commissioned by any of the Contractor's forces alone, without the assistance or presence of the equipment manufacturers.

- C. A written report shall be issued by the particular equipment manufacturer and the Mechanical Contractor summarizing the results of the commissioning and performance of each system for

the Architect's record. No additional compensation will be allowed for any Contractor for such services.

- D. The Contractor shall prepare and submit to the Architect for acceptance, a schedule of anticipated system start-up. No system shall be started without prior acceptance of the schedule by the Architect and Owner. No systems shall be started prior to submittal and acceptance of Operation and Maintenance Manuals.

1.25 CONNECTIONS TO EQUIPMENT

- A. Each Contractor shall provide all duct and/or pipe connections, condensate traps, drains, overflows, relief valves and vents, power connections, etc., to make equipment operable, as provided under other Sections of the specifications, as shown on the Architectural and/or each Trade's drawings and herein specified, including final connections to equipment to result in a complete system, fully operational. Coordinate location of all equipment with Architect. Obtain installation diagrams and methods of installation of all equipment from manufacturers. Follow instructions strictly. If additional information is required, obtain same from Architect. If equipment is indicated on the Architectural drawings, it shall also be construed and understood by the Mechanical Contractor to be constructed as shown on the HVAC, Plumbing and/or Fire Protection drawings and shall be fully serviced and connected at no extra cost to the Owner.

1.26 SMOKE DETECTION AND FIRE SAFETY SYSTEMS

- A. All duct or unit mounted smoke detectors shall be furnished and wired to the building fire alarm system by the Electrical Contractor. All smoke detectors required in units and ducts and for smoke barrier dampers shall be installed in the field by the HVAC Contractor. Refer to the Contractor Coordination Matrix contained under paragraph "Component Coordination" of this section.
- B. All smoke dampers and fire smoke dampers, except in built-up air handling units, shall be furnished and by the ATC Contractor with electric actuators field wired by the Mechanical Contractor. Dampers shall be field installed by the HVAC Contractor, except dampers inside the air handling units. Dampers inside of the AHUs shall be provided by the AHU manufacturer.
- C. The Electrical Contractor, when providing smoke detectors, shall include two (2) auxiliary contacts, coordinated with the ATC Contractor, to allow for other control functions, as specified hereinafter. Close coordination must be exercised to allow for the provision of contacts.
- D. All smoke detectors shall be installed as recommended by the smoke detection system manufacturer in sheet metal ducts or plenums to ensure that the sensing elements are effective and shall coordinate installation of smoke detectors with the Electrical Contractor and detector manufacturer.

- E. The HVAC Contractor shall provide access doors to make all such detection heads accessible, and shall provide bracing for smoke detection sampling tubes, as recommended by the detector manufacturer, to properly and securely support such tubes.
- F. If duct smoke detectors are required to be installed in ducts that are exposed to outside ambient conditions, they shall be installed in ventilated accessible weatherproof enclosures. See details on HVAC Drawings.

1.27 ELECTRICAL ROOM REQUIREMENTS

- A. The HVAC, Plumbing and Fire Protection Contractors [or Subcontractors] shall not install any piping, ductwork or equipment in or through electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms, unless piping, ductwork or equipment is intended to serve these rooms. If any Contractor violates this requirement, he shall remove and/or relocate all items as required at his expense and to the satisfaction of the Architect.

1.28 HOISTING EQUIPMENT AND MACHINERY

- A. All hoisting equipment and machinery required for the proper and expeditious prosecution and progress of the work under this Contract shall be furnished, installed, operated and maintained in safe condition by each Contractor for his material and/or equipment delivered to the designated hoisting area. All costs for hoisting operating services shall be borne by the Mechanical Contractor for all equipment and work under his charge.

1.29 STAGING

- A. All staging, exterior and interior, required to be over 7'-0" in height shall be furnished and erected by each Contractor for work under his charge and maintained in safe condition by him for proper execution of his work.

1.30 CONTROL WIRING

- A. The ATC Contractor shall provide all control and interlock wiring for all systems provided under the HVAC, plumbing and ATC Contracts.
- B. All control wiring in Mechanical Rooms; serving critical/life safety systems, smoke control or where wiring is exposed, shall be installed in conduit and in accordance with the respective equipment manufacturer's requirements, and all connections shall be provided by the Mechanical and/or the ATC Contractor. All conduit and wiring provided by these Contractors shall be installed in accordance with the requirements of Division 16 of the specifications.

1.31 COMPONENT COORDINATION

- A. The HVAC, ATC and Electrical Contractors Scope of Work shall be implements in accordance with the following matrix:

Device	Furnished By	Installed By	Power Wiring	Control Wiring	Fire Alarm Wiring
Duct Smoke Detectors	Electric	HVAC	Electric	ATC	Electric
Smoke Dampers at AHUs	HVAC	HVAC	N/A	N/A	N/A
Smoke Damper Actuators at AHUs	HVAC	HVAC	N/A	ATC	N/A
Smoke Control Dampers	HVAC	HVAC	N/A	N/A	N/A
Smoke Control Dampers (Floor) Actuators	HVAC	HVAC	Electric	ATC	N/A
Fire Dampers	HVAC	HVAC	N/A	N/A	N/A
Supply, Return and Exhaust Boxes	HVAC	HVAC	ATC	ATC	N/A
Box Flow Pick-Up	Box Mfr	Box Mfr	N/A	Box Mfr	N/A
Box Damper Actuator	ATC	Box Mfr	ATC	ATC	N/A
Box DDC Controller	ATC	Box Mfr	ATC	ATC	N/A
Supply Reheat Coil	HVAC	HVAC	N/A	N/A	N/A
Reheat Coil Valve	ATC	HVAC	N/A	ATC	N/A
Controls at Fume Hood	ATC	ATC	ATC	ATC	N/A
Sheet Metal Damper	HVAC	HVAC	N/A	N/A	N/A
Sheet Metal Damper Actuators	ATC	ATC	N/A	ATC	N/A
Flow Measuring Stations	ATC	HVAC	N/A	ATC	N/A
DDC Panels	ATC	ATC	Electric	ATC	N/A
Fuel Oil System	HVAC	HVAC	Electric	ATC	N/A
Control Valves	ATC	HVAC	ATC	ATC	N/A
Humidifiers	HVAC	HVAC	N/A	ATC	N/A
Humidifier Valve	HVAC	HVAC	N/A	ATC	N/A
Humidifier Airflow Switch	ATC	ATC	N/A	ATC	N/A
Variable Speed Drives	HVAC	HVAC	Electric	ATC	N/A

1.32 TELECOMMUNICATION ROOM REQUIREMENTS

- A. The HVAC Contractor shall not install any mechanical equipment or piping foreign to the telecommunication or data installation within any room in which telecommunications or data equipment or systems are located. These include the main Communications Equipment Room (CER), the Telephone PBX Main Distribution Frame (MDF) Room or any floor Telecommunications Room (TR) or Floor Data Distribution Center in accordance with NEC, TIA/EIA, and/or BICSI standards.
- B. Specifically, no panels, pipes, valves, ductwork or mechanical equipment shall be installed within the above-stated locations unless they are specifically for the use of these rooms or the telecommunications or data system.

- C. Any mechanical systems being provided for use in the room shall be fully coordinated with the Telecom Engineer, Owner and HVAC Contractor so as not to interfere with other hardware and equipment to be used for the telecommunications and/or data network. Specifically, pipes, condensers, or other hazards shall not be installed above electronic equipment or in a means that will impede the proper clearances thereof.

1.33 ALTERNATES

- A. Provide “Add” or “Deduct” pricing/costs for the Owner’s and Architect’s consideration. Prices shall be complete with all overhead, profit, equipment costs, labor, insurance, etc., so that if Owner exercises his option to delete or add scope of work, the resultant “Add” or “Deduct” price will be all-inclusive.
- B. Refer to Section 01230, “ALTERNATES” for description of Alternates related to Division 15.

PART 2 – PRODUCTS

2.1 NOT USED

PART 3 – EXECUTION

3.1 NOT USED

END OF SECTION