

SECTION 15100 - GENERAL REQUIREMENTS FOR MECHANICAL WORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Scope of Section: Include all materials, equipment and labor necessary for a complete and properly functioning mechanical installation in accordance with local and state codes, contract drawings and as specified in all 15000 series of these specifications.

1.2 DRAWINGS

- A. Architectural and structural drawings are more descriptive than mechanical drawings with reference to the building construction. Mechanical drawings are diagrammatic and indicate the general arrangement and extent of work. Architectural drawings indicate more exactly the desired relationship between diffusers, registers, lighting fixtures, equipment, electric panels and devices, plumbing fixtures and other items which remain exposed in the complete building. Exact locations and arrangements of materials and equipment shall be determined, with the approval of the Architect, as work progresses to conform in the best possible manner with the surroundings and with the adjoining work of other trades. Where locations of equipment, devices or fixtures are controlled by architectural features, establish such locations by referring to dimensions on architectural drawings and not by scaling drawings.

1.3 COORDINATION OF WORK

- A. Prior to installation, coordinate all work with work of other trades and with architectural and structural drawings in detail to preclude interferences between the work of different trades and to insure necessary clearances at crossovers and equipment. Work requiring necessarily fixed locations such as graded piping shall take precedence over work not requiring such fixed locations and shall establish permissible routing of services associated with the latter. Should work be performed without adequate coordination so that interferences occur between work of different trades, Contractor shall eliminate such interferences by requiring necessary rework by the trades involved. Such rework shall meet approval of Architect and shall incur no additional cost to Owner.

1.4 CODES, PERMITS, TAXES

- A. Governing Law: Refer to architectural "General Conditions." Work shall meet requirements of applicable codes, ordinances, rules and regulations, in effect at time of signing contract of any body of bodies having jurisdiction, including utilities.
- B. Correction of Work: Work done contrary to above requirements shall be corrected at no additional cost to Owner.
- C. Permits and Fees: Refer to architectural "General Conditions." Secure and pay all necessary permits, inspections, licenses, meters, connections, etc., that may be

required.

1.5 DISCREPANCIES

- A. In case of differences between drawings and specifications or where drawings and/or specifications are not clear or definite, the subject shall be referred to Architect for clarification and instructions. Such items should be directed to Architect prior to taking bids.

1.6 SUBMITTALS

- A. Refer to Section: "General Requirements."
 - 1. **Material List:** Within thirty (30) days of award of contract submit a complete list of materials to be provided for the mechanical work. List shall include manufacturer's name and catalog number or series for each item on list.
 - 2. **Shop Drawings:** Before commencing work, submit drawings of all mechanical materials and equipment to be furnished under this contract. In addition, submit other drawings or diagrams dimensioned and in correct scale, requested by Architect to clarify the work intended to show its relationship to adjacent work or work of other trades. Drawings shall clearly indicate all characteristics, special modifications or features, and exceptions to or deviations from contract requirements.
 - 3. **Samples:** Submit samples of materials as listed elsewhere herein. Samples shall duplicate materials, workmanship, and finish of products intended for installation.

1.7 RECORDED DRAWINGS

- A. Provide in accordance with architectural "General Requirements" section.

1.8 INSTRUCTIONS

- A. **Personnel:** After completion of installation, competent personnel shall be furnished to instruct Owner's personnel in operation and maintenance of systems.
- B. **Written:** Furnish three (3) copies of instructions for operating various systems, including complete description of functions and operations of each piece of equipment, automatic control system, and diagrams indicating automatic control hook-up. Control devices shall be identified and their actual location in building noted on diagrams. Include cleaning, oiling and greasing instructions of each item of equipment. spare parts list and source of supply shall be identified for each item of equipment. Furnish in loose leaf hardboard 3-ring binders to Architect (for delivery to Owner).

1.9 FINAL CHECK

- A. Before submitting proposals, each bidder shall examine all drawings and specifications issued by the Architect and shall examine the site of work. He shall

be fully informed as to character of his work and coordination of his work with that of other trades. No consideration will be given at a later date for alleged misunderstandings as to requirements of work, materials to be furnished or conditions required by nature of site.

1.10 FOUNDATIONS

- A. The Contractor shall furnish all special foundations and supports for equipment which he installs and which are separate and distinct from building construction as shown by architectural drawings. Support equipment from building structures in a manner acceptable to the Architect.

1.11 SAFETY PROVISIONS

- A. Belt, pulleys, chains, gears, couplings, projecting set screws, keys and other rotating parts located so that any person may come in close proximity thereto, shall be fully enclosed or properly guarded.

1.12 RELATED WORK

- A. The following items of material and labor incidental to or related to the work will be provided as follows:
 1. Cutting and patching of existing building structure for location of pipes, air ducts, etc., shall be provided by this Contractor. Patching and finishes shall be performed by affected trades.
 2. Furring around pipes, ducts, etc., shall be by General Contractor.
 3. Masonry openings for outside air intakes and for exhaust outlets, louvers, etc., including curbs and flashing of roof structure shall be provided by this Contractor.
 4. All electrical power wiring, conduit, etc. for motors and motor starters shall be furnished and installed by the electrical contractor. Electrical automatic control devices, relays, etc., required for electrical interlock for operation of system shall be furnished complete by this Contractor in strict accordance with all requirements of wiring specifications as a part of the control system. Motor starters shall be provided under this section of this specification.

PART 2 PRODUCTS

2.1 QUALITY

- A. Conform to the quality and features specified and indicated by drawings. Where material or equipment is indicated or necessary, but not specifically described in the specifications or drawings, such shall conform to the quality and features of similar items so described or otherwise indicated.

2.2 SLEEVES

A. Pipe Sleeves:

1. Walls and Partitions: Sleeves 8-inch Diameter and Smaller (Above Grade): Mild steel or plastic built into wall, partition or beam sized to pass pipe and covering, leaving a clear space of $\frac{1}{4}$ -inch minimum between covering and sleeves. Steel sleeves must be used in all fire rated partitions.
2. Floors (Above Grade): 14 gauge galvanized steel or plastic, set before floor is poured, size to pass pipe and covering, leaving a clear space of $\frac{1}{4}$ inch between covering and sleeve, and shall extend $\frac{1}{2}$ inch above finished floor.
3. Exterior (Below Grade): PVC pipe, size and weight indicated for passage of piping and conduit under paving and walks. Set at a depth to prevent damage by traffic, and mark location (so that they may be recovered when necessary).

B. Duct Sleeves: Sleeves or openings sized to pass mechanical ducts and coverings of framed construction in roof, walls and partitions.

C. Sealing of Sleeves:

1. Below Grade: Caulk annular space between pipe and sleeve using oakum and poured lead both sides minimum one inch deep to make floor penetration watertight.
2. Above Grade: Make openings around pipes, etc., passing through sleeves draft-free and vermin-proof by packing solidly using mineral wool, glass fiber or an expandable foam.

2.3 SUPPORTING DEVICES

A. Inserts:

1. Preset Type: Malleable iron with removable interchangeable nuts having lateral adjustment of not less than one and five-eighths inch. Continuous inserts shall have a capacity of 2000 lbs. per foot and shall be hooked over reinforcing. Acceptable: C-B Universal Fig. 282; Unistrut Products Co., P-300; Binkley B-32-1.
2. Afterset Types: Self-drilling style expansion shields shall be used in concrete and brick. Toggle bolts shall be used on block walls and partitions.

B. Steel Framing:

1. Support hangers from bar joists with clamps or other means acceptable to Architects.

2. Hangers shall be plumb within one-half (½) inch in four feet and spaced as required for the service intended.
 3. Where unforeseen conditions necessitate additional hangers, install same in locations subject to Architect's approval.
 4. Hangers shall not be supported from bottom of light gauge metal trusses. Provide additional supports to hang from if necessary.
- C. Stud Partitions:
1. All anchorage shall be to studs or solid blocking built into the wall.
- D. Equipment, Piping and Duct Hangers:
1. Provide angles, brackets, clamps, anchors, braces, frames, rods and other miscellaneous steel items as necessary for support of equipment and piping specified herein. All bare metal shall be cleaned and finish painted per architectural specifications.
 2. All piping, ducts, etc. shall be run parallel with the lines of the building, unless otherwise shown or noted on the drawings. The different service pipes, valves, fittings, etc. shall be so installed that after the covering is applied there will be not less than ½ inch clear space between the finished covering and other work, and between the finished covering of parallel adjacent pipes. Hangers shall be so spaced to prevent sag and to permit proper drainage. Exact location of piping, ducts, etc., shall be coordinated between subcontractors so that there will be no interference.

2.4 FLOOR, WALL AND CEILING PLATES OR ESCUTCHEONS

- A. Furnish escutcheons or fabricated plates or collars and install at each location where pipe or duct passes through a finished surface. Escutcheons for flush sleeves shall be equal to Benton & Caldwell No. 3A chromium plated brass; for sleeves extending above floor shall be equal to Benton & Caldwell No. 36 chrome plated brass. Collars or plates for ducts and large diameter insulated pipe shall be fabricated of 18 gauge galvanized copper bearing steel, secured to structure and neatly fitted around duct or pipe.

2.5 ACCESS DOORS

- A. Each door shall be equipped with two flush, screwdriver operated cam latches and other than Style "M", shall be finished to match adjacent surface. Door sizes shall be applicable to the access required for normal service. Doors shall be manufactured by the Inryco/Milcor or an acceptable equal as follows:

<u>Location</u>	<u>Milcor Style</u>
Drywall	"DW"
Masonry or Tile	"M-Stainless"
Acoustical Tile	"AT"

Plaster	"K"
Fire-rated Wall	"Fire Rated"

Furnish as necessary for access to concealed valves, cleanouts, unions, expansion joints, dampers, coils, junction boxes, etc., where no other means of access is shown or specified.

2.6 BELT DRIVES

- A. Each motor driven machine not direct connected shall be equipped with V-belt drive. Belts shall be of correct cross section to fit properly in sheave grooves. Belts for each drive shall be carefully matched. sheaves shall be of cast iron or steel, bored to fit properly on shafts and secured with keys of proper size. Variable and adjustable pitch sheaves shall be furnished for fans and shall be selected so that required rpm will be obtained with sheave set approximately in mid-position. Rating of each drive shall be at least 1.5 times nameplate rating of motor.

2.7 BELT AND COUPLING GUARDS

- A. Equip each belt drive with a guard constructed of #12 U.S. standard gauge $\frac{3}{4}$ -inch diamond mesh steel wire screen or equivalent, welded to $\frac{1}{2}$ -inch steel angle frames which shall enclose all belts and sheaves. Tops and bottoms of guards shall be of #18 U.S. standard gauge steel. Braces or supports must not "bridge" sound and vibration isolators. Guards shall be designed with adequate provision for movement of motor required to adjust belt tension. Provide means to permit oiling, use of speed counters, and other maintenance and testing operations with guard in place. All direct drive equipment shall have coupling guards in accordance with all applicable safety regulations.

2.8 PAINTING AND MARKING

- A. **Painting:** Painting of equipment, pipe, and ducts (insulated or un-insulated) shall be as specified in Section "Painting". Touch-up of shop coats shall be performed under section furnishing equipment and shall match equipment factory finishes.
- B. **Marking:**
 1. **Pipes:** Exposed piping shall be stenciled with name of service to indicate the use of pipe and with arrows to indicate direction of flow. Stencils shall be applied after final painting is completed. In lieu of stencils, pipe identification labels may be used. Bands shall be color coded. Labels should be no farther than 10' o.c.
 2. **Equipment:** Fans, ducts, etc., shall be stenciled as specified above. Small equipment such as starters, control devices, etc., shall be neatly labeled with small engraved laminated plastic labels.

2.9 ELECTRICAL

- A. **General:** Unless specified otherwise, motors, starters, and control devices shall be

furnished under the division of the specifications that covers the driven equipment. Motor starters shall be installed by the electrical contractor except where as an integral part of the equipment. All electrical power wiring, conduits, and connections shall be provided under the Electrical Section. Contractor furnishing driven equipment shall coordinate wiring diagrams with contract requirements and shall furnish coordinated wiring diagrams for installation.

- B. Motors: Unless otherwise specified, each motor shall have sufficient capacity to start and operate the machine it drives without exceeding the motor nameplate ratings at the speed required. (except that the NEMA standard service factor may be applied to motors that are water or refrigerant cooled.) The horsepowers specified are those estimated to be required by the equipment when operating at specified duties and efficiencies. If the actual horsepower for the equipment to be furnished differs from that specified or indicated on drawings, it shall be the responsibility of the Section furnishing equipment to insure that proper size feeders, breakers, etc., are provided at no change in contract cost. Motors shall be rated for continuous duty, at 100% of nameplate rating with a service factor of 1.15. Squirrel cage induction motors shall have normal starting torque, full voltage low starting current, constant speed continuous duty type. Motors shall be wound for specified voltage.
- C. Starters shall be furnished under this section of the specification.
1. General: As specified with modifications and accessories as indicated in other Sections of his specification or by control diagrams on drawings. Starters shall have proper rating for motors controlled.
 2. Overcurrent Protection: Contacts shall break each ungrounded line to the motor. A thermal overcurrent device shall be provided in each ungrounded line. All contacts shall open simultaneously upon tripping of any overcurrent device.
 3. Magnetic Starters: For motors of $\frac{1}{2}$ HP or larger, combination type with unfused disconnect switch, unless specified otherwise in other sections. Each starter shall have a control transformer with fused 120 volt maximum control circuit. Control transformer shall be of adequate capacity for all controls on the circuit. Starters shall have on-off-automatic switches in cover.
 4. Manual Starters: Provide for motors through \square HP unless specified otherwise under equipment specifications.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

- A. Execute as necessary to accomplish work specified.
- B. Sleeves: Lay out work and set sleeves in new construction so there shall be minimum of cutting, drilling and patching. Sleeves not used during construction period shall be sealed using grout.

- C. Rejected Work: Any work rejected by Architect because it does not conform to specification requirements shall be removed immediately and replaced properly.

3.2 TESTS

- A. General: All systems shall be inspected, tested, given a trial run, and demonstrated to Architect's satisfaction that they are complete and ready for operation.
- B. Plumbing Waste and Soil Lines: Inspect and test in accordance with local codes.
- C. Piping: Unless required otherwise by code or other sections of specifications, test at a pressure of 150 percent of normal working pressure.
- D. Air conditioning systems: Operate equipment and log readings of energy consumed, air flow and temperatures to permit evaluation of equipment capacities. Refer to Section "Test and Balance."

3.3 ACCEPTANCE

- A. Prior to requesting final inspection:
 - 1. Complete work required by drawings and specifications.
 - 2. Balance air conditioning systems in accordance with Section "Test and Balance."
- B. Acceptance will be by Architect on basis of tests and inspection of project. Contractor shall furnish necessary mechanics to operate system, furnish test instruments and equipment as required, make necessary adjustments and assist with final inspection.

END OF SECTION

SECTION 15200 - TESTING AND BALANCING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Test and balance agency shall be hired directly by the Contractor. The Contractor shall make allowances to coordinate with the test and balance firm and assist as necessary.

1.2 QUALITY ASSURANCE

- A. Testing Agency:

1. Submit name, address and qualifications of testing agency to Architect for approval prior to start of testing.
2. All systems adjustments, test and balances are to be performed by a company regularly and exclusively engaged in this work. Agency shall be a member in good standing of the Associates Air Balance Council (AABC).
3. Procedures shall be as outlined in the AABC Publication 716-79 for total system balance.

1.3 SUBMITTALS

- A. Test Reports: After completion, submit three certified copies of test and balance report to the Architect for review and as a project record document.

1.4 JOB CONDITIONS

- A. Commencement of Test: Do not begin balancing until the systems have been completed and are in full working order, or at the direction of the Architect, place any part thereof in operation for the purpose of balancing.
- B. Plans and Date: Furnish the balance agency one complete set of all approved, up-to-date mechanical plans and shop drawings of all cooling, heating, and air distribution equipment.

1.5 FIELD QUALITY CONTROL

- A. Performance Data: Record the following data and submit to the Architect.

1. Leak test all duct systems and submit results to Architect. Testing procedures shall conform AABC and leakage rate shall not exceed their recommendations.
2. Air Volumes and Velocities: Determine and tabulate at each grille, diffuser, louver, outside air intake, etc., and adjust dampers, control devices and fan drives to obtain the indicated air quantities. Adjust or

modify each supply grille and diffuser distribution pattern as required to maintain air motion, noise level and temperature variations within acceptable limits throughout each space. Clearly and permanently mark all dampers at final setting for reported air balance.

3. System Component Capacity: Record and calculate all data necessary to demonstrate capacity under actual operating conditions, and adjust dampers, valves, control valves and machine drives to obtain a suitable operating balance for each system. Record data for each item of equipment simultaneously with data from all associated equipment together with coincident outside air dry bulb temperatures to permit evaluation of total system performance. Data to include the following:
 - a. Supply, return and outside air quantities for each air conditioning and ventilation system.
 - b. Air volumes and velocities for each fan, cooling coil and air cleaning assembly.
 - c. Entering and leaving air dry bulb and wet bulb temperature for each cooling and heating coil.
 - d. Static pressures for all air handling units and major fans.
 - e. Actual voltage and current input for each motor.
 - f. Test and adjust each diffuser, grille and register within 10 percent of design requirements. Test and record temperature rise, voltage and current across duct heaters.
4. In readings and test diffusers, grilles and registers include required fpm velocity and test fpm velocity, and required cfm and test cfm adjustments.

1.6 TEMPERATURE CONTROLS

- A. Set adjustments of all controllers to operate as indicated. Make four hour temperature traverse of each area or zone. Provide testing agency personnel with instruments to verify reports to Architect.

1.7 FINAL TEST

- A. At conclusion of testing agency's work, demonstrate to the Architect that the equipment is mechanically sound, that the systems deliver the rated output without objectionable noise, distress or vibration, and that the temperature controls are functioning properly.

END OF SECTION

SECTION 15400 - PLUMBING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provision of the Contract, including General and supplementary Conditions and division 1 specification sections apply to work specified in this section.

1.2 SCOPE OF WORK

- A. These specifications and the accompanying drawings are intended to provide for all labor and materials necessary for the installation of complete workable systems as specified herein or indicated on the drawings to 5 feet outside of building. The work required under this section of the specification shall include specifically, but is not limited to the following:
 - 1. A system of cold water piping including connections to fixtures and equipment as shown or indicated on the drawings.
 - 2. Hot water piping systems including connections to fixtures and equipment as shown or indicated on the drawings including all appliances.
 - 3. A system of sanitary soil, waste, and vent piping including connections to fixtures and equipment as shown or indicated on the drawings.
 - 4. All plumbing fixtures and equipment as hereinafter specified, completely installed and operational. This includes fixtures provided by others.
 - 5. A system of thermal insulation for piping and equipment.
 - 6. All necessary trenching and backfilling to install plumbing systems in this section.
 - 7. All natural gas piping as shown or indicated.

1.3 CODES AND REGULATIONS

- A. All work performed under this section shall conform with all local governing regulations and in case of conflicting requirements, the most stringent shall apply. Minimum requirements shall be the International Plumbing Code as published by the International Building Code Congress International, Inc..
- B. Handicap accessible fixtures shall be installed in accordance with the Americans with Disabilities Act (ADA) and the U.S. Architectural and Transportational Barriers Compliance Board (ATBCB) "Recommendations for Accessibility Standards for Children's Environments," Chapter 5. If a conflict exists, notify the architect prior to roughing in. A copy of this publication may be obtained from USATBCB, 1331 F. Street NW, Suite 1000, Washington, DC 20004-1111.

- C. Should it be found that any part of the work shown or specified is not in accordance with local regulations, the Architect shall be so advised at the time of bidding and all work shall be installed as required to meet the local codes.

1.4 FEES AND PERMITS

- A. The Contractor shall obtain and pay for all permits, fees for inspection and charges of every kind that may be necessary for fully completing the work. He shall make all necessary tests required by the City, County or State authorities, legal regulations and/or the Architect, and return to the Architect any certificates of approval issued in this district for plumbing work, etc., signed by the inspector in charge of each particular part of the work.

1.5 RECORD DRAWINGS

- A. Contractor shall keep a set of reproducible sepias on site at all times and log all changes made during construction period. No deviations from the drawings and specifications shall be made without full knowledge and consent of the Architect. Record drawings shall show dimensions, locations, and depth of all buried and concealed piping, plugged outlets, and equipment, and shall be kept up-to-date. No backfilling of trenches will be permitted until as-built drawings are approved as up-to-date by the Architect. No plumbing progress payments will be approved unless as-built drawings are up-to-date. Depth of sewers shall be from a permanent bench mark as shown on contract drawings. Upon completion of work, sepias shall be turned over to the Architect.

1.6 COOPERATION

- A. The Contractor shall lay out and proceed with his work so that this work will be executed in harmony with all other contractors and trades on the job.

1.7 VISITING THE PREMISES

- A. The Contractor, before submitting his bid on the work, must visit the site and familiarize himself with all existing conditions. As a result of having visited the premises, the Contractor shall be responsible for the installation of the work as it relates to such existing conditions. The submission of a bid will be considered an acknowledgment on the part of the bidder of his visitation to the site.

1.8 VERIFICATION OF CONTRACT DRAWINGS

- A. The drawings and specifications are intended to cooperate. Any materials, equipment, or systems related to this section and exhibited on the architectural and plumbing drawings, but not mentioned in the specifications are to be executed to the intent and meaning thereof, as if it were both mentioned in the specification and set forth on the drawings. Where the Contractor finds the specification and/or drawings to be in conflict or where they are not clear, same shall be brought to the attention of the Architect prior to submitting a bid.

The drawings are diagrammatic and do not necessarily show or indicate all fittings, offsets, and accessories which may be required. The Contractor shall carefully investigate the structural and finish conditions affecting all his work as well as the operational requirements of each system and shall arrange such work accordingly, furnishing such fittings, etc., as may be required for the proper and efficient functioning of each system. No unnecessary or unauthorized offsets will be permitted.

1.9 WORKMANSHIP

- A. All workmanship performed under this section shall be executed in a first class manner in accordance with the best practices of the trade. The Architect reserves the right to accept or reject workmanship and determine when the contractor has complied with the requirements herein specified. Only competent mechanics skilled in their respective trades shall be employed by the Contractor.

1.10 RESPONSIBILITY OF BIDDER

- A. The failure or omission of any bidder to receive or examine any form, instrument, addendum or other document shall in no way relieve any bidder from any obligation with respect to his bid or the contract. The submission of a bid shall be taken as prima facia evidence of compliance with this paragraph and that he has included in his proposal every item of cost necessary for a complete installation of the plumbing systems as drawn and/or specified.

1.11 NOISE AND VIBRATION

- A. This Contractor shall be held responsible for elimination of all noises or vibrations transmitted to occupied areas from equipment which he may install. This applies particularly to vibration and noises in piping, water hammer, and vibration from mechanical equipment transmitted through bases to building structure. He shall furnish and install anti-vibration bases, flexible connectors for piping, etc., as may be necessary.

1.12 SUBMITTAL DATA

- A. Materials and equipment schedules shall be submitted as soon as practicable, but not later than 30 days after the date of award of contact, and before commencement of installation of any material or equipment. A complete schedule of the material and equipment proposed for installation shall be submitted for approval by the Architect. The schedule shall include catalogs, cuts, diagrams, drawings, specifications and such other descriptive data as may be required by the Architect. The schedule and supplementary data shall be submitted in six (6) copies, and approval obtained. All materials required to be submitted for approval under this section shall be submitted at one time. Partial submittals will not be considered. Each item submitted shall be identified by its applicable drawing number.
- B. Where equipment named as equivalent or approved equal are proposed for use by the Contractor, he shall be responsible to coordinate any changes with all trades