

## SECTION 22 0010 - BASIC PLUMBING REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 GENERAL PROVISIONS AND SUPPLEMENTAL GENERAL PROVISIONS

- A. The "General Conditions" and "Supplementary Conditions" are by reference made a part of this section and shall apply to each and every heading as though included herein.
- B. In the event of conflict, the requirements of the "General Conditions" and "Supplementary Conditions" will take precedence over these "General Requirements".

#### 1.2 GENERAL

- A. The Contractor shall provide all plans, labor, equipment, appliances and materials, and shall perform all operations in connection with the installation of the plumbing work in accordance with the Specifications, applicable drawings, and the conditions specified above.
- B. Contractor shall provide all equipment required and usually furnished in connection with such work and systems whether or not specifically mentioned or specifically indicated on the drawings.

#### 1.3 COMMISSIONING

- A. The Contractor shall provide all system commissioning services as required by section C408 of the 2018 International Energy Conservation Code (IECC). Plumbing systems shall comply with IECC section C403.
- B. Commissioning, as outlined in IECC section C408 shall include the following:
  - 1. A commissioning plan.
  - 2. Water heater(s).
  - 3. Hot water systems balancing.
  - 4. Functional performance testing for all plumbing equipment and controls.
  - 5. A preliminary commissioning report.
  - 6. Final documentation including drawings, O&M manual(s), T&B report, and final commissioning report.

#### 1.4 INSPECTION OF THE SITE

- A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, and local requirements. The submission of bids shall be deemed evidence of such visits.
- B. All proposals shall take these existing conditions into consideration, and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility.

- C. The trade furnishing the equipment shall be responsible for notifying the Contractor prior to ordering it, in the event that equipment specified and/or reviewed is incompatible with this requirement.

#### 1.5 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

- A. Refer to other sections of the specifications for construction phasing and time increments.
- B. The Contractor shall obtain and pay for all required utility connections, impact fees, utility extensions and/or relocations and shall pay all costs and inspection fees for all work included herein.

#### 1.6 APPLICABLE CODES AND STANDARDS

- A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of the Specifications, except as may be hereinafter modified in these Specifications and associated drawings.
- B. Latest edition of the National Fire Protection Association Standards (NFPA):
  - 1. NFPA No. 70 National Electrical Code
  - 2. NFPA No. 101 Safety to Life from Fire in Buildings and Structures
  - 3. NFPA No. 255 Test of Surface Burning Characteristics of Building Materials
- C. United States of America Standards Institute (ASA) Standards:
  - 1. A40.8 National Plumbing Code
  - 2. B31.1 & B31.1a Code for Pressure Piping
- D. American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Codes.
- E. American Society of Testing and Material (ASTM): All applicable manuals and standards.
- F. American Water Works Association (AWWA): All applicable manuals and standards.
- G. National Electrical Manufacturer's Association (NEMA): All applicable manuals and standards.
- H. City and State Building Codes.
- I. State of Texas Occupational Safety Act: Applicable safety standards.
- J. Occupational Safety and Health Act (OSHA).
- K. State of Texas Energy Conservation Construction Code.
- L. All work shall be in accordance with all regulations and requirements of the State of Texas Architectural Barriers Act (TAS).
- M. Refer to Specifications sections hereinafter bound for additional codes and standards.

- N. All materials and workmanship shall comply with all applicable state and national codes, specifications, and industry standards. All material shall be listed by the Underwriter's Laboratories, Inc., as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.
- O. All equipment provided and all installation methods shall meet all applicable requirements of the International Energy Conservation Code.
- P. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by other specifications of the Contract Documents, providing no work or fabrication of materials has been accomplished in a manner of non-compliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

#### 1.7 CONTRACT DOCUMENTS

- A. These specifications are accompanied by drawings of the building and details of the installations indicating the locations of equipment, piping, ductwork, outlets, switch controls, circuits, lines, etc. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
- B. If the Contractor deems any departures from the drawings necessary, details of such departures and the reasons therefore shall be submitted to the Architect for review. No departures shall be made without prior written acceptance.
- C. There are intricacies of construction that are impractical to specify or indicate in detail; however, in such cases the current rules of good practice and applicable specifications shall govern.
- D. It is the Contractor's responsibility to properly use all information found on the Civil, Architectural, Structural, Fire Protection, Plumbing, Mechanical and Electrical drawings where such information affects his work.
- E. All dimensional information related to new structures should be taken from the appropriate drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.
- F. The interrelation of the specifications, the drawings, and the schedules is as follows: The specifications determine the nature and setting of the several materials, the drawings establish the quantities, dimensions and details, and the schedules give the performance characteristics.
- G. Should the drawings or specifications disagree within themselves, or with each other, the better quality of greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Architect in writing, shall be performed or furnished. Figures indicated on drawings govern scale measurements and large-scale details govern small-scale drawings.

1.8 SPACE AND EQUIPMENT ARRANGEMENT

- A. The size of fire protection, plumbing, mechanical, and electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared to indicate a suitable arrangement.
- B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.
- C. Maintain all Code required clearances for equipment access.

1.9 FABRICATION DRAWINGS

- A. Contractor shall submit shop drawings whenever (1) equipment proposed varies in physical size and arrangement from that indicated on the drawings, thus causing rearrangement of equipment space, (2) where tight spaces require extreme coordination between ductwork, piping, conduit and other equipment, and (3) where called for elsewhere in these specifications.
- B. Contractor shall submit piping shop drawings for review by the Architect. Fabrication drawings shall be fully coordinated with ALL other trades and with existing conditions.
- C. All required shop drawings, except as hereinafter specified, shall be prepared at a scale of not less than 1/8 in. equal to 1 ft. for floor plans and 1/4 in. equal to 1 ft. for mechanical rooms.

1.10 SUPERVISION

- A. Each contractor shall keep a competent superintendent or foreman on the job at all times necessary for the timely and proper completion of the work.
- B. It shall be the responsibility of each superintendent to study all drawings and familiarize himself with the work to be done by other trades. He shall coordinate this work with other trades, and before material is fabricated or installed, make sure that his work will not cause an interference that cannot be resolved without major changes to the drawings. If a conflict between trades arises that cannot be resolved at the jobsite, the matter shall be referred to the Architect for his ruling.

1.11 EXISTING FACILITIES

- A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all plumbing, heating, air conditioning, and ventilating services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, and remove all such temporary protection upon completion of the work. All barricades and safety devices shall be in compliance with OSHA.
- B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

- C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.
- D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall, in locations approved by the Architect, all devices required for the operation of the various systems installed in the existing construction. This is to include, but is not limited to, temperature control system devices, electrical switches, relays, fixtures, piping, conduit, etc.
- E. Outages of services, as required by the new installation, will be permitted only at a time approved by the Architect.

#### 1.12 DEMOLITION AND RELOCATION

- A. The Contractor shall modify, remove and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition.
- B. All items that are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed and sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Architect. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas of facilities, which must remain in operation during the construction period, shall not be interrupted without prior specific approval of the Architect as hereinbefore specified.
- D. All equipment and materials indicated to be removed and not be re-used shall remain the property of the Owner. Coordinate with Owner where materials are to be stored.

#### 1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. The Contractor shall prepare, in triplicate for the Owner's Manual, complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc., for each item of equipment. Include copies of all equipment warranties.
- B. In addition, the Contractor shall provide the services of a competent engineer or a technician acceptable to the Architect to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of not less than 4 hours to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, stating the dates of instruction and the personnel to whom instructions were given. The Contractor shall be responsible for proper maintenance until the instructions have been given to the Owner's maintenance personnel.

1.14 GUARANTEE

- A. All work and equipment shall be guaranteed for a period of one year from the date of substantial completion.
- B. Guarantee shall be for all labor and materials.
- C. Certain items for equipment shall have additional or extended warranties when so specified.

1.15 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be of current U.S. manufacture, new, free from all defects, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall present a neat, workmanlike appearance. Materials, and/or equipment damaged in shipment, or otherwise damaged prior to installation, shall not be repaired at the job site, but shall be replaced with new materials and/or equipment.
- B. The responsibility for furnishing the proper equipment and/or material, and to see that it is installed as intended by the manufacturer rests entirely upon the Contractor, who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

1.16 FLAME SPREAD PROPERTIES OF MATERIALS

- A. Materials and adhesives incorporated in this project shall conform to NFPA 255, latest edition. The classification shall not exceed No. 2, with the range of indices between 0 to 25 for these Classifications as listed in the Federal Specifications. Modifications shall be made to insulating materials, etc., as required to comply with the Federal Specification.

1.17 LARGE APPARATUS

- A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

1.18 FLOOR AND CEILING PLATES

- A. Except as otherwise noted, provide chrome plated brass floor and ceiling plates around all pipes, conduits, ducts, etc., passing exposed through walls, floors, or ceilings, in any spaces, except under floor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the insulation on lines that are insulated and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend 3/4 in. above finished floor. All equipment rooms are classified as finished areas. Round and rectangular ducts shall have plates made to fit accurately at all floor, wall and ceiling penetrations.

1.19 SLEEVES, INSERTS AND FASTENINGS

- A. Proper openings through floors, walls, roofs, etc., for the passage of piping, ductwork, etc., shall be provided. All penetrations must pass through sleeves except soil pipe installed under concrete slabs on fill. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Architect.
- B. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.
- C. The minimum clearance between horizontal penetrations including insulation where applicable, and sleeves shall be 1/4 in., except that the minimum clearance shall be 2 in. where piping contacts the ground. Sleeves through walls and partitions shall be installed flush with exposed surfaces. Sleeves through floors shall be extended 2 in. above finished floor.
- D. Above grade and dry location sleeves shall be constructed from 20 to 22 gauge galvanized steel. Sleeves passing through walls or floors on or below grade and/or moist areas such as mechanical rooms shall be constructed of galvanized steel Schedule 40 pipe and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the pipes have been installed in the sleeves, void space around the pipe shall be sealed with "Link-Seal" modular wall and casing seals as manufactured by Thunderline Corporation.
- E. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction.
- F. Fastening of pipes, conduits, etc., in the building shall be as follows: To wood members - by wood screws; to masonry - by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry; to steel - machine screws or welding (when specifically permitted or directed), or bolts, and to concrete by suitable inserts anchored to reinforcing steel, and poured in place unless other means are acceptable for general use, and will only be permitted where specifically acceptable to the Architect.
- G. Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.
- H. Vermin Proofing: The open space around all ductwork, piping, etc., passing through the ground floor and/or exterior walls shall be sealed with a continuous bead of sealant.
- I. The space around piping, ductwork, etc., penetrating walls, ceilings and floors that define air plenums shall be sealed airtight in an acceptable manner. Ceiling plenums used for return air are considered air plenums.

1.20 ACCESS DOORS

- A. This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed shutoff or service valves, strainers, unions, flow switches, pressure reducing valves, control valves, air terminal units, fire and/or smoke dampers, and other items of concealed mechanical equipment. All access door locations are not shown on the drawings. It is the Contractor's responsibility to provide access doors at all locations required.

- B. Access doors mounted in painted surfaces shall be equal to Milcor (Inland-Ryerson Construction Products Company) manufacture, Style K for plastered surfaces and Style M or DW for non-plastered surfaces. The Style K doors shall be set so that the finished surface of the door is even with the finished surfaces of the adjacent finishes. Access doors mounted on tile surfaces shall be stainless steel materials. Access doors shall be minimum of 18 in. x 18 in. in size.

#### 1.21 CONSTRUCTION REQUIREMENTS

- A. The Civil, Architectural, Structural, Fire Protection, Mechanical, Plumbing, and Electrical plans and specifications including the General Provisions, Supplemental General Provisions, and other pertinent documents issued by the Architect, are a part of these specifications and the accompanying fire protection drawings, and shall be complied with in every respect. All the above is included in the Contract Documents, and shall be examined by all bidders. Failure to comply shall not relieve the Contractor of responsibility or be used as a basis for additional compensation due to omission of architectural, structural and electrical details from the plumbing drawings.
- B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation, whether mentioned or not.
- C. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed and thereby to provide an integrated satisfactory operating installation.
- D. The plumbing and associated drawings are necessarily diagrammatic in character and cannot show every connection in detail or every pipe or equipment in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate pipe hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc., shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.
- E. When the plumbing drawings do not give exact details as to the elevation of pipe, ducts, etc., physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Piping and duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner, and the plans do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas. Piping specified to be insulated shall be supported in a manner that will allow the insulation to be installed without gaps. Insulated piping in concealed areas shall be offset with fittings as necessary to permit installation of insulation. Bending of pipes or installing pipes in a strain in order to insulate will not be permitted.



- F. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. Piping, ductwork, valve stems, etc., shall not block service space.

#### 1.22 PLUMBING SUBMITTALS

- A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 Section: "SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES" for submittal definitions, requirements, and procedures.
- B. Submittal of Shop Drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from Subcontractors and material suppliers directly to the Architect will not be processed.
- C. Submit Shop Drawings, product data, and samples on items indicated in the individual sections.
- D. Shop Drawings and submittal data shall not be used as requests or proposals for alternate equipment or materials. Refer to Item "Product Options and Substitutions" elsewhere in this section.
- E. THIRD PARTY CERTIFICATION: All Packaged equipment shall be independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399, as well as NFPA Pamphlet #70, National Electric Code (NEC), Article 90-7.

#### 1.23 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Refer to the Instructions to Bidders and the Division 01 Section "SUBSTITUTION PROCEDURES" for requirements in selecting products and requesting substitutions.
- B. Standards for Materials:
  - 1. These specifications indicate a standard for all materials incorporated into the work, with manufacturer's names and catalog numbers used to establish a grade and quality of materials and equipment. The manufacturer listed on the equipment schedules, or named first in the specifications, is the one on whose equipment the layout is based. Other named manufacturers must meet the indicated performance and space requirements.
  - 2. The "approved equal" clause used in these specifications is to permit the proposal of unnamed manufacturer's products for the work, and the Architect/Engineer's decision concerning equal products is final.
  - 3. Considerations as to determination of equal products include, but are not limited to, the following:

|                                   |                               |
|-----------------------------------|-------------------------------|
| Materials                         | Physical size                 |
| Workmanship                       | Weight                        |
| Gauges of Materials               | Appearance                    |
| Available Local Service Personnel | Performance                   |
| Previous successful installations | Capacity                      |
| Delivery Schedules                | Required Equipment Clearances |

- C. Requests for substitutions for equipment, materials and apparatus listed in Division 22 Sections must be submitted in writing a **MINIMUM OF 10 DAYS** prior to the scheduled bid date. Such requests must be accompanied by complete data to permit proper evaluation.
- D. BIDS SHALL NOT BE BASED ON UN-APPROVED MATERIALS, EQUIPMENT, OR APPARATUS. UNAPPROVED MATERIAL, EQUIPMENT OR APPARATUS WILL NOT BE ACCEPTED.
- E. Should electrical, water, drain, natural gas, structural support, or other similar requirements for alternate equipment, whether named in the specifications or approved as a substitution, be different from requirements for the products used in laying out the project, such changes shall be the responsibility of the Contractor, and shall not result in extra charges to the Owner or Architect/Engineer.

#### 1.24 RECORD DOCUMENTS

- A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for requirements. The following paragraphs supplement the requirements of Division 01.
- B. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned for column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- C. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

#### 1.25 PAINTING

- A. Field painting of plumbing equipment, piping systems, etc., shall be accomplished under Division 09 of these specifications.
- B. Protection of Factory-applied Finishes:
  - 1. Factory-applied finishes on equipment and apparatus installed on the project shall be carefully protected.
  - 2. At the conclusion of the work, and prior to final acceptance of the project, equipment and apparatus shall be thoroughly cleaned of all construction dirt, oil and grease smears, temporary labels, debris, paint droppings, etc.
  - 3. Damaged factory finishes shall be restored to their original condition using procedures, materials and application techniques as set forth in Division 09 found elsewhere in these specifications.

#### 1.26 CLEANING

- A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for general requirements for final cleaning.

- B. Refer to Division 23 Section: "TESTING, ADJUSTING, AND BALANCING" for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.
- C. Name Plates:
  - 1. All nameplates shall be protected from damage during the construction process.
  - 2. At the conclusion of the work, the nameplates shall be carefully cleaned and left in a fully legible condition.
- D. Removal of Rubbish: Each Contractor is responsible for the timely removal of rubbish and trash generated by his work, such as empty cartons, containers, materials crates, etc. Particular attention is called to residue that may present a potential tripping or injury hazard.

## PART 2 - PRODUCTS

### 2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer's materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.
- B. The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.
- C. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of start-up or other overload conditions.
- D. Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriter's Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers, the Contractor shall submit proof that the items furnished under these sections of the specifications conform to such requirements. The ASME stamp will be acceptable as sufficient evidence that the items conform to the respective requirements.
- E. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Observation.
- F. Standard factory finish will be acceptable on equipment specified by model number; otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking, and no signs of rust creepage beyond 1/8 in. on either side of the scratch mark. Where rust-inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable, unless a specific coating is specified, except that coal tar or asphalt type coatings will not be acceptable, unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-6215.

- G. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.
- H. The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect of any discrepancy before performing any work. Adjustments to the work required, in order to facilitate a coordinated installation, shall be made at no additional cost to the Owner.

## 2.2 PROTECTION

- A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.
- B. Take particular care not to damage the building structure in performing work. All finished floors, steel treads, and workmen or their tools and equipment shall cover finished surfaces to prevent any damage during the construction of the building.
- C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final observation must be cleaned of rust and repainted as specified elsewhere in these specifications.

## 2.3 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

- A. Each trade, subcontractor and/or contractor must work in harmony with the various other trades, subcontractors, and/or contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or contractor must pursue his work promptly and carefully as not to delay the general progress of the job. This Contractor shall work in harmony with contractors working under other contracts on the premises.

## 2.4 PRECEDENCE OF MATERIALS

- A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the available space, and which will insure complete and satisfactory systems. Each Contractor shall be responsible for the proper fitting of his material and apparatus into the building.
- B. Each Contractor shall so harmonize his work with that of the other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines that require a stated grade for proper operation. Where space requirements conflict, the following order of precedence shall, in general, be observed:

1. Building lines

2. Structural members
3. Drain piping
4. Vent piping
5. Steam piping
6. Condensate piping
7. Refrigerant piping
8. Electrical bus duct
9. Supply ductwork
10. Return ductwork
11. Exhaust ductwork
12. Chilled water and heating water piping
13. Automatic Fire Protection Sprinkler Piping
14. Natural gas piping
15. Domestic hot and cold water piping
16. Electrical conduit

## 2.5 LOCATION OF OUTLETS IN ROOMS

- A. All fire protection, plumbing, acoustical tile, diffusers, grilles, registers, and other devices shall be referenced to coordinated, established data points and shall be located to present symmetrical arrangements with these points and to facilitate the proper arrangements of acoustical tile panels and other similar panels with respect to the mechanical and electrical outlets and devices. Those mechanical and electrical outlets shall be referenced to such features as wall and ceiling furrings, balanced border widths, masonry joints, etc. Outlets in acoustical tile shall occur symmetrically in tile joints or in the center of whole tiles. When locations of mechanical and electrical devices shown on the Architect's reflected ceiling plans need to be modified, the final determination of the exact location of each outlet and the arrangement to be followed shall be acceptable to the Architect.
- B. The drawings show diagrammatically the location of the various outlets and apparatus. Exact locations of these outlets and apparatus shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with the other trades. The Architect reserves the right to make any reasonable change in location of any outlet or apparatus before installation, without additional cost to the Owner.

- C. The Contractor, by submitting a bid on this work, sets forth that he has the necessary technical training and ability, and that he will install his work in a satisfactory and workmanlike manner which is up to the best standards of the trade, complete, and in good working order. If any of the requirements of the drawings and specifications are impossible of performance, or if the installation, when made in accordance with such requirements, will not perform satisfactorily, he shall report it to the Architect for correction promptly after discovery of the discrepancy.

## 2.6 CONNECTIONS FOR OTHERS

- A. This Contractor shall rough-in for and make all gas, water, steam, sewer, etc., connections to all fixtures, equipment, machinery, etc., provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, along with actual measurements of the equipment connections, or as detailed.
- B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, etc.
- C. Provide all air gap fittings where required. In each water line serving an item of equipment or piece of machinery, provide a shut-off valve. On each drain not provided with a trap, provide a suitable trap.
- D. All pipe fittings, valves, traps, etc., exposed in finished areas and connected to chrome-plated lines provided by others shall be chrome plated to match.

## PART 3 - INSTALLATION

### 3.1 INSTALLATION METHODS

- A. All pipes shall be concealed in pipe chases, walls, furred spaces, or above the ceiling, unless otherwise indicated.
- B. Piping may be run exposed in mechanical rooms, janitors' closets, or storage spaces, but only where necessary. All exposed piping shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.
- C. All piping shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.
- D. Where limited space is available above the ceilings and below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, in a manner to provide maximum above-floor clearance. Sleeves shall be as specified or as required.
- E. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run, exposed in machinery and equipment rooms, shall be installed parallel to the building plans, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.
- F. There shall be no pipe joints nearer than 12 in. to a wall, ceiling, or floor penetration, unless pipe joint is the welded type joint.

- G. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur, the Contractor shall meet with all involved trades and the Architect and resolve the conflict, prior to erection of any work, in the area involved.

### 3.2 CUTTING AND PATCHING

- A. Cut and patch openings through walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.
- B. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills at locations acceptable to the Architect. Impact-type equipment will not be used, except where specifically acceptable to the Architect. Openings in Precast concrete slabs for pipes, conduits, outlet boxes, etc., shall be core drilled or cast to exact size.
- C. All openings shall be restored to "as-new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.
- D. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect.
- E. All plumbing work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.
- F. No cutting, boring, or excavating, which will weaken the structure, shall be undertaken. NO STRUCTURAL MEMBER MAY BE CUT WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT.

### 3.3 FABRICATION OF PIPE

- A. All the various piping systems shall be made up straight and true and run at proper grades to permit proper flow of the contained material. Lines shall also be graded for proper drainage.
- B. Piping shall follow as closely as possible the routes shown on plans, but shall take into consideration conditions to be met at the site.
- C. Should any unforeseen conditions arise, lines shall be changed or rerouted as required after approval has been obtained.
- D. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping, in connections, and in equipment to which lines are connected.
- E. All piping shall be clean when it is installed. Before installation it shall be checked, upended, swabbed, if necessary, and all rust or dirt from storage shall be removed. Pipe shall not be permitted to lie on the ground during storage. Pipe ends shall be sealed during storage.

### 3.4 IDENTIFICATION AND LABELING

- A. The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them.
- B. The Contractor shall install identification tags to be affixed to those valves that have functions that are not obvious. For example, it would not be expected that valves at a pressure reducing station in a machine room would be tagged. The valve identification tags shall be brass discs, 2 in. in diameter. Each tag shall be attached to its valve with copper clad annealed iron wire or other approved material.

### 3.5 TESTS AND INSPECTIONS

- A. The Contractor shall, during the progress of the work and upon its completion, test his work and make all tests as required by the specifications, state, municipal and other authorities having jurisdiction of the work. Piping pressure tests shall be made before pipe is concealed or covered. Tests shall be made in the presence of authorities requiring tests. The Contractor shall pay all costs, inspection charges and fees required for the tests of his work.
- B. The Contractor shall provide all apparatus, temporary piping connection, etc., required for tests. The Contractor shall take all due precautions to prevent damage to the building or its contents incurred by such tests. The Contractor shall repair and make good at his own expense any damage caused by failures or leaks during the tests.
- C. Leaks, defects or deficiencies shall be repaired and/or replaced, and tests shall be repeated until the test requirements are complied with fully.
- D. All equipment shall be placed in operation and tested for proper automatic control before the final balancing of the system is started.
- E. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description, and extent of system tested, test condition, test results, specified results, and any other pertinent data. Data shall be delivered to the Architect.

### 3.6 COOPERATION AND CLEANUP

- A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of his tools, equipment and materials and shall clean his debris from the job. Upon the completion of the job, each trade shall immediately remove all of his tools, equipment, any surplus materials and all debris caused by his portion of the work.

### 3.7 CLEANING AND PAINTING

- A. All equipment, piping, ductwork, grills, insulation, etc., in finished areas furnished and installed by the Contractor shall be painted. Finished areas include mechanical rooms, boiler rooms, and outside the building as well as occupied areas inside the building. Final painting is to be done by the General Contractor. This Contractor shall thoroughly clean all part of materials and equipment of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.



- B. This Contractor shall thoroughly clean the finish on all parts of the materials and equipment with factory applied finishes. Exposed parts in equipment rooms, above crawl space slabs, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. If the finish has been damaged, the Contractor shall re-paint to the satisfaction of the Architect.
- C. All canvas finishes shall be painted with one sizing coat if not already sized, containing a mildew resistant additive and Arabol adhesive prior to any other specified finish paint.
- D. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during painting operation.

### 3.8 ELECTRICAL PROVISIONS OF PLUMBING WORK

- A. The extent of electrical provisions to be provided as plumbing work is indicated in other sections of the specifications, on the drawings and as further specified in this section.
- B. Starters, Controllers: In general, plumbing includes furnishing combination starters. Controllers are specifically included as electrical work when mounted in motor control centers. Electrical work includes installation, mounting and wiring of starters and controllers that are furnished as mechanical work. Free standing, large motor controllers shall be set in place, on pads, as plumbing work.
- C. Electrical heating equipment shall be furnished complete with internal or integral fusing and subdivision of loads to comply with the NEC.
- D. Wherever possible, match the elements of the electrical provisions of plumbing work with similar elements of the electrical work specified in electrical sections of the specifications.
- E. Standards:
  - 1. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards to definitions of terminology herein.
  - 2. Comply with National Electrical Code (NFPA No. 70) for installation requirements.
  - 3. Comply with National Electrical Contractors Association (NECA) "Standard of Installation".

### 3.9 TEMPORARY FACILITIES

- A. Unless noted otherwise in the Supplementary General Conditions; provide temporary facilities.

### 3.10 EQUIPMENT INSTALLATION REQUIREMENTS

- A. All plumbing equipment shall be furnished and installed complete and ready for use.

### 3.11 OWNER FURNISHED EQUIPMENT

- A. The Contractor's responsibility shall include receiving and installing all Owner-furnished equipment.

END OF SECTION 22 0010

## SECTION 22 0506 - PLUMBING DEMOLITION

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Demolition of:

1. Plumbing fixtures and trim, specialties, equipment and associated piping.
2. Fire protection equipment and associated piping.
3. Hanger and support devices.
4. All other appliances or devices associated with equipment or devices to be removed.

##### B. Demolition of all power wiring and conduit from each plumbing item to be removed back to the point of supply.

#### 1.2 QUALITY ASSURANCE

##### A. Perform all demolition and removal work necessary to arrive at the arrangement shown on the Contract Drawings.

##### B. Perform all operations in such a method to cause minimum damage to items to be relocated, salvaged, or to remain intact and in use.

#### 1.3 JOB CONDITIONS

##### A. Perform site repair and removal of salvaged items at times approved by the Owner. Accomplish repair and removal of items in a continuous and diligent manner in order to limit interference with Owner's on-going operations.

##### B. Drawings may not indicate and specifications may not identify every item required to be moved or removed.

##### C. Before submitting bids, visit and examine the site of the work and become familiar with the scope of the work and the details of the demolition work to be accomplished.

##### D. Submittal of a bid will be evidence that such an examination has been made and the various details noted.

##### E. Claims for extra compensation because of additional labor, materials, or equipment required because of difficulties encountered, will not be recognized unless items were concealed at time of inspection of the Contract Documents. Bring all such items to the attention of the Owner's Representative and the Architect for their disposition before continuing with the work.

##### F. Execute demolition work in a manner to protect adjacent equipment and other existing items against damage.

##### G. Provide and erect lights, barricades, warning signs, and other items as required for protection of the Owner's employees, building occupants, and the public.

##### H. Maintain barricades in good condition throughout the project to substantial completion.

- I. Control the dust resulting from demolition to prevent it from spreading the occupied areas of the building and to avoid creating a nuisance in the immediate surrounding area.

## PART 2 - PRODUCTS - NOT USED

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Provide protection for all building elements, all items which are to remain, all occupants and all workers at all times, and in accordance with all requirements of the Owner.

### 3.2 PROTECTION OF BUILDING FROM THE WEATHER

- A. Maintain weather protection for the space(s) being worked in at all times, and in accordance with all requirements of the Owner.

### 3.3 DEMOLITION

- A. Perform demolition in accordance with all requirements of the Owner.

### 3.4 DISPOSITION OF MATERIALS

- A. Dispose of all demolition items and materials in a legal off-site location.

### 3.5 RELOCATION AND REUSE OF PLUMBING ITEMS

- A. Relocate items indicated on the Contract Drawings as required to accommodate the new construction. Remove, relocate and reconnect equipment and accessories that are to be reused.
- B. Coordinate the work with the Electrical Contractor. Determine which items and equipment are to remain, to be relocated or to be removed. Perform the work consistent with the scope of the project.
- C. Transport and store materials removed and designated for relocation as directed by the Owner's Representative.
- D. Remove all salvage items not be reused or delivered to the Owner, from the property at the end of each workday.
- E. Maintain full water, drain, electrical service, etc., to all equipment and apparatus that remains in service in the building.

### 3.6 CLEANING

- A. Section 22 0010 "BASIC PLUMBING REQUIREMENTS".

### 3.7 REMOVAL OF WATER

- A. Be responsible for the removal of water in areas in which scheduled work is to be performed.

1. Remove water by pumping, siphoning, absorbent mopping, or compressed air brooming.
2. Do not use any method of removal that will cause damage to new or reused adjacent equipment or materials.

3.8 SCHEDULING

- A. Schedule demolition in strict compliance with the Owner's instructions.

3.9 DISCONNECTION AND RECONNECTION OF UTILITIES

- A. Do not disconnect or reconnect any utilities until notifying the Owner's Representative.
  - B. Notify the Electrical Contractor when requiring Electrical Disconnect or Reconnect.
- END OF SECTION 22 0506

SECTION 22 0512 - PLUMBING AND ELECTRICAL COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Refer to Section 26 0510 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK .
- B. Refer to Section 21 0010 - BASIC FIRE PROTECTION REQUIREMENTS.
- C. Refer to Section 22 0010 - BASIC PLUMBING REQUIREMENTS.
- D. Refer to Section 23 0010 - BASIC MECHANICAL REQUIREMENTS.

1.2 SUMMARY

- A. This Section describes the coordination between the Fire Protection, Plumbing, Mechanical and Electrical portions of the work.
- B. This Section is included under the Division 21 portion of the Specifications as Section 21 0512, under the Division 22 portion of the Specifications as Section 21 0512, under the Division 23 portion of the Specifications as Section 23 0512, and under the Division 26 portion of the Specifications as Section 26 0512.

1.3 WORK INCLUDED

- A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. **This schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:**

| ITEM   | FURNISHED UNDER DIVISION | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|--|--------------------------|--------------------------|------------------------------------|
| 1. Equipment Motors  | 21/22/23                 | 21/22/23                 | 26                                 |
| 2. Magnetic Motor Starters   |                          |                          |                                    |
| a. Automatically controlled, with or without HOA switches  | 21/22/23                 | 26                       | Notes 1,3,5                        |
| b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment | 21/22/23                 | 22/23                    | Notes 1,3,5                        |
| c. Manually controlled   | 21/22/23                 | 26                       | Notes 1,3,5                        |
| d. Manually controlled and furnished as part of factory wired equipment                                    | 21/22/23                 | 26                       | Notes 1,3,5                        |
| e. Furnished in Motor Control Centers  | 26                       | 26                       | Notes 1,3,5                        |
| 3. Variable Speed (Frequency) AC Drives  | 22/23                    | 26                       | Notes 1,4,5                        |
| 4. Line voltage thermostats, time clocks, etc., not connected to control                                   | 23                       | 26                       | 23                                 |

| ITEM  | FURNISHED UNDER DIVISION | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|---|--------------------------|--------------------------|------------------------------------|
| panel systems   |                          |                          |                                    |
| 5. Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached to ducts, pipes, etc.         | 22/23                    | 22/23                    | 22/23                              |
| 6. Temperature control panels and time switches mounted on temperature control panels   | 23                       | 23                       | 23                                 |
| 7. Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc.   | 23                       | 23                       | Note 1                             |
| 8. Alarm bells furnished with equipment installed by Division 22 or 23  | 22/23                    | 22/23                    | 22/23                              |
| 9. Wiring to obtain power for control circuits, including circuit breaker   | 21/22/23                 | 21/22/23                 | 21/22/23                           |
| 10. Low voltage controls  | 21/22/23                 | 21/22/23                 | 21/22/23                           |
| 11. Fire protection system (sprinkler) controls   | 21                       | 21                       | Note 8                             |
| 12. Fire and smoke detectors installed on mechanical units and in ductwork  | 28                       | 23                       | Note 8                             |
| 13. All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment | 23                       | 23                       | Note 1                             |
| 14. Smoke dampers, and combination fire/smoke dampers   | 23                       | 23                       | Note 7                             |
| 15. Boiler and water heater controls, boiler burner controls panels   | 22/23                    | 22/23                    | 22/23                              |
| 16. Pushbutton stations, pilot lights   | 22/23                    | 22/23                    | 22/23                              |
| 17. Heat Tape   | 21/22/23                 | 21/22/23                 | 26                                 |
| 18. Disconnect switches, manual operating switches furnished as a part of the equipment   | 21/22/23                 | 21/22/23                 | Notes 1,5                          |
| 19. Disconnect switches, manual operating switches furnished separate from equipment  | 26                       | 26                       | 26                                 |
| 20. Multispeed switches   | 23                       | 23                       | 26                                 |
| 21. Thermal overloads   | 21/22/23                 | 21/22/23                 | 21/22/23                           |
| 22. Control relays, transformers  | 21/22/23                 | 21/22/23                 | 21/22/23                           |

| ITEM   | FURNISHED UNDER DIVISION  | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|--|---|--------------------------|------------------------------------|
| 23. Refrigeration cycle, cooling tower and controls                      | 23  | 23                       | 23                                 |
| 24. Tamper switches for fire protection (sprinkler) system               | 21  | 21                       | 28                                 |
| 25. Flow and/or pressure switches for fire protection (sprinkler) system | 21  | 21                       | 28                                 |
| 26. Fire and jockey pump controllers and automatic transfer switch       | 21  | 21                       | Note 6                             |
| 27. Alarm bells or horns for fire protection (sprinkler) system          | 21  | 21                       | 28                                 |
| 28. Generator (underground) fuel tank                                    | 22  | 22                       | --                                 |
| 29. Generator fuel level indicator                                       | 22  | 22                       | 26                                 |
| 30. Generator fuel piping from tank to generator                         | 22  | 22                       | --                                 |
| 31. Underground fuel tank leak detection and monitoring system           | 22  | 22                       | 22                                 |
| NOTES:   | <p>(1) Power wiring as defined in Section 26 2913 of the specifications shall be provided under Division 26; control wiring as defined in Section 26 2913 of the specifications shall be provided under Division 21/22/23.</p> <p>(2) Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 specifications, Division 26 and Drawings for more specific requirements.</p> <p>(3) For requirements for Magnetic Motor Starters, refer to Section 23 8965 - MOTOR CONTROLLERS.</p> <p>(4) For requirements for Variable Speed (Frequency) AC drives, refer to Section 23 8965 - MOTOR CONTROLLERS.</p> <p>(5) Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.</p> <p>(6) Power wiring from energy source to controllers and automatic transfer switch provide shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 21, 22 or 23 and conforming to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.</p> <p>(7) Division 26 will provide power to all smoke and combination fire/smoke dampers, and Division 28 will provide control for all such dampers using area smoke detectors.</p> <p>(8) Wiring for sprinkler system controls to be provided by Division 21. Wiring</p> |                          |                                    |

from devices to Fire Alarm System to be provided by Division 28.

- B. CONNECTIONS: Make all connections to controls that are directly attached to ducts, piping and mechanical equipment with flexible connections.
- C. PRECEDENCE
1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.
  2. Precedence for pipe, conduit and duct systems shall be as follows.
    - a. Building lines
    - b. Structural members
    - c. Soil and drain piping
    - d. Vent piping
    - e. Steam piping
    - f. Condensate piping
    - g. Refrigerant piping
    - h. Electrical bus duct
    - i. Supply ductwork
    - j. Return ductwork
    - k. Exhaust ductwork
    - l. Chilled water and heating water piping
    - m. Automatic Fire Protection Sprinkler Piping
    - n. Natural gas piping
    - o. Domestic hot and cold water piping
    - p. Electrical conduit
  3. Lighting Fixtures shall have precedence over air grilles and diffusers.
- D. FINAL INSPECTION AND REPORT



1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical Fire Alarm and Temperature Control Contractors, representatives of mechanical and electrical equipment manufactures whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies that they represent, shall be filed with the Owner and Architect or Engineer.

END OF SECTION 22 0512

SECTION 22 0529 - PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Extent of supports and anchors required by this section is indicated on Drawings and/or specified in other Division 22 sections.
- B. Types of supports and anchors specified in this section include the following:
  - 1. Pipe and equipment hangers, supports, and anchors.
  - 2. Equipment bases.
- C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
  - 1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
  - 2. MSS Standard Compliance:
    - a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
    - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
    - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
    - d. Terminology used in this section is defined in MSS SP-90.
- C. All hangers, supports and attachments shall be manufactured with materials compatible with the environment in which they will be installed. Unless directed otherwise, all hangers, supports, and attachments installed exterior to the building or within high humidity environments shall be galvanized steel or stainless steel.
- D. Manufacturers of Hangers and Supports:
  - 1. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
    - a. B-Line Systems Inc. (Cooper)
    - b. ANVIL International

### 1.3 SUBMITTALS

- A. Submit product data and maintenance data as required under provisions of Division 01 and Section 22 0010.
- B. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.
- C. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.
- D. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 01.

## PART 2 - PRODUCTS

### 2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS

- A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
- B. Adjustable Steel Clevis Hangers: MSS Type 1.
- C. Yoke Type Pipe Clamps: MSS Type 2.
- D. Steel Double Bolt Pipe Clamps: MSS Type 3.
- E. Steel Pipe Clamps: MSS Type 4.
- F. Pipe Hangers: MSS Type 5.
- G. Adjustable Swivel Pipe Rings: MSS Type 6.
- H. Adjustable Steel Band Hangers: MSS Type 7.
- I. Adjustable Band Hangers: MSS Type 9.
- J. Adjustable Swivel Rings, Band Type: MSS Type 10.
- K. Split Pipe Rings: MSS Type 11.
- L. Extension Split Pipe Clamps: MSS Type 12.
- M. U-Bolts: MSS Type 24.

- N. Clips: MSS Type 26.
- O. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
  - 1. Plate: Unguided type.
  - 2. Plate: Guided type.
  - 3. Plate: Hold-down clamp type.
- P. Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast-iron floor flange.
- Q. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.
- R. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast-iron floor flange.
- S. Single Pipe Rolls: MSS Type 41.
- T. Adjustable Roller Hangers: MSS Type 43.
- U. Pipe Roll Stands: MSS Type 44.
- V. Pipe Rolls and Plates: MSS Type 45.
- W. Adjustable Pipe Roll Stands: MSS Type 46.

## 2.2 VERTICAL-PIPING CLAMPS

- A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- B. Two-Bolt Riser Clamps: MSS Type 8.
- C. Four-Bolt Riser Clamps: MSS Type 42.

## 2.3 HANGER-ROD ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. Steel Turnbuckles: MSS Type 13.

- C. Steel Clevises: MSS Type 14.
- D. Swivel Turnbuckles: MSS Type 15.
- E. Malleable Iron Sockets: MSS Type 16.
- F. Steel Weldless Eye Nuts: MSS Type 17.

#### 2.4 BUILDING ATTACHMENTS

- A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
- B. Top Beam C-Clamps: MSS Type 19.
- C. Side Beam or Channel Clamps: MSS Type 20.
- D. Center Beam Clamps: MSS Type 21.
- E. Welded Beam Attachments: MSS Type 22.
- F. C-Clamps: MSS Type 23.
- G. Top Beam Clamps: MSS Type 25.
- H. Side Beam Clamps: MSS Type 27.
- I. Steel Beam Clamps W/Eye Nut: MSS Type 28.
- J. Linked Steel Clamps W/Eye Nut: MSS Type 29.
- K. Malleable Beam Clamps: MSS Type 30.
- L. Steel Brackets: One of the following for indicated loading:
  - 1. Light Duty: MSS Type 31, suspending 750 lbs. max.
  - 2. Medium Duty: MSS Type 32, suspending 1500 lbs. max.
  - 3. Heavy Duty: MSS Type 33, suspending 3000 lbs. max.
- M. Side Beam Brackets: MSS Type 34.
- N. Plate Lugs: MSS Type 57.
- O. Horizontal Travelers: MSS Type 58.

## 2.5 CONCRETE INSERTS

- A. Cast-In-Place Spot Type: Malleable iron, or steel with recommended insert nut. Size inserts nut to suit threaded hanger rod. MSS SP-69, Type 18.
- B. Drill-In Spot Type: Steel, attached wedge, lock washer and nut. Size inserts to suit threaded hanger rod.
  - 1. Acceptable Manufacturers and Models:
    - a. Hilti "Kwik Bolt"
    - b. Ramset "Wedge Anchor"
    - c. Rawl "Stud"
- C. Continuous Channel Type: Steel, anchoring lugs, with channel nuts, rated for 2000 lbs. per foot minimum load. Size channel nut to suit threaded hanger rod.
  - 1. Acceptable Manufacturers and Models:
    - a. B-Line B22
    - b. Elcen 1150
    - c. Unistrut P3200

## 2.6 SADDLES AND SHIELDS

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
- C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
- D. Thermal Hanger Shields: Constructed of 360° insert of high density, 125-psi compressive strength, and water-proofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.
  - 1. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
    - a. Elcen Metal Products Co.
    - b. Pipe Shields, Inc.

## 2.7 SPRING HANGERS AND SUPPORTS

- A. General: Except as otherwise indicated, provide factory-fabricated spring hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.
- B. Restraint Control Devices: MSS Type 47.
- C. Spring Cushion Hangers: MSS Type 48.
- D. Spring Cushion Roll Hangers: MSS Type 49.
- E. Spring Sway Braces: MSS Type 50.
- F. Variable Spring Hangers: MSS Type 51; preset to indicated load and limit variability factor to 25%.
- G. Variable Spring Base Supports: MSS Type 52; preset to indicated load and limit variability factor to 25%; include load flange.
- H. Variable Spring Trapeze Hangers: MSS Type 53; preset to indicated load and limit variability factor to 25%.
- I. Constant Supports: Provide one of the following types, selected to suit piping system. Include auxiliary stops for erection and hydrostatic test, and field load-adjustment capability.
  - 1. Horizontal Type: MSS Type 54.
  - 2. Vertical Type: MSS Type 55.
  - 3. Trapeze Type: MSS Type 56.

## 2.8 MANUFACTURERS OF HANGERS AND SUPPORTS

- A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
  - 1. B-Line Systems Inc.
  - 2. ITT Grinnell Corp.

## 2.9 MISCELLANEOUS MATERIALS

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

- D. Auxiliary Steel: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.
- E. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

#### 2.10 SLEEVES, INSETS AND FASTENINGS

- A. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### 3.2 PREPARATION

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.
- B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

#### 3.3 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at all changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.



### 3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Install additional at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at all changes in direction of piping. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- C. Support fire-water piping independently of other piping.
- D. Prevent electrolysis in support of copper tubing by use of hangers and supports that are copper plated, or by other recognized industry methods.
- E. Support and laterally brace vertical pipe runs at every floor level and at intervals not to exceed 20 ft. 0 in. Support vertical pipe with riser clamps installed below hubs, couplings or lugs welded to the pipe.
- F. Provisions for Movement:
  - 1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
  - 2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
  - 3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- G. Insulated Piping: Comply with the following installation requirements.
  - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
  - 2. Piping hangers shall be sized large enough to allow insulation to pass through. Hangers for piping 2-1/2 in. and greater shall be provided with pipe covering protection saddle, or high compressive strength insulation saddle. Hangers for piping 2 in. and less shall be provided with pipe covering shields. On cold or chilled water piping provide vapor barrier through hanger.
  - 3. Do NOT utilize "pipe size" hangers with insulation placed over the pipe and hanger.
- H. Unless directed otherwise, all hangers, supports, and attachments installed exterior to the building or within high humidity environments shall be galvanized steel or stainless steel.

3.5 INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
- D. Anchor spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.6 ADJUSTING AND CLEANING

- A. Hanger Adjustments: Adjust hangers so as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 22 0529

## SECTION 22 0553 - PLUMBING IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Extent of mechanical identification work required by this section is indicated on Drawings and/or specified in other Division 22 sections.
- B. Types of identification devices specified in this section include the following:
  - 1. Plastic Pipe Markers.
  - 2. Valve Tags.
  - 3. Valve Schedule Frames.
- C. Plumbing identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division 22 sections.
- D. Refer to other Division 22 sections for identification requirements at central-station mechanical control center; not work of this section.
- E. Refer to Division 21, 23 and 26 sections for identification requirements of fire protection, mechanical and electrical work; not work of this section.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
  - 1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2 in. x 11 in. bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 01.
- C. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:
1. Allen Systems, Inc.
  2. Brady (WHO) Co.; Signmark Div.
  3. Industrial Safety Supply Co., Inc.
  4. Seton Name Plate Corp.

### 2.2 IDENTIFICATION MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

### 2.3 PLASTIC PIPE MARKERS

- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
- B. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, and pressure-sensitive vinyl pipe markers, complying with ANSI A13.1.
- C. Insulation: Furnish 1 in. thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on un-insulated pipes subjected to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2 in. beyond each end of plastic pipe marker.
- D. Small Pipes: For external diameters less than 6 in. (including insulation if any), provide full-band pipe markers, extending 360° around pipe at each location, fastened by one of the following methods:
1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
  2. Adhesive lap joint in pipe marker overlap.
  3. Laminated or bonded application of pipe marker to pipe (or insulation).
  4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4 in. wide; full circle at both ends of pipe marker, tape lapped 1-1/2 in.
- E. Large Pipes: For external diameters of 6 in. and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
1. Laminated or bonded application of pipe marker to pipe (or insulation).

2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2 in. wide; full circle at both ends of pipe marker, tape lapped 3 in.
  3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
- F. Lettering: Manufacturer's standard pre-printed nomenclature that best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with name as shown or specified.
- G. Lettering: Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length.
1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

#### 2.4 VALVE TAGS

- A. Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4 in. high letters and sequenced valve numbers 1/2 in. high, and with 5/32 in. hole for fastener.
1. Provide 1+ in. diameter tags, except as otherwise indicated.
  2. Fill tag engraving with black enamel.
- B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
- C. Access Panel Markers: Provide manufacturer's standard 1/16 in. thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8 in. center hole to allow attachment.

#### 2.5 VALVE SCHEDULE FRAMES

- A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

#### 2.6 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification that indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

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PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination: Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPING SYSTEM IDENTIFICATION

- A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.

- B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
4. At access doors, manholes and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50 ft. along each piping run, except reduce spacing to 25 ft. in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

- C. Piping Identification:

| System                            | Background Color | Text Color |
|-----------------------------------|------------------|------------|
| Domestic Cold Water               | Green            | White      |
| Domestic Hot Water                | Yellow           | Black      |
| Domestic Hot Water - Recirculated | Yellow           | Black      |

### 3.3 VALVE IDENTIFICATION

- A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
  - 1. Tagging Schedule: Comply with requirements of "Valve Tagging Schedule" at end of this section.
- B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect.
  - 1. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.

### 3.4 ADJUSTING AND CLEANING

- A. Adjusting: Relocate any mechanical identification device, which has become visually blocked by work of this division or other divisions.
  - B. Cleaning: Clean face of identification devices, and glass frames of valve charts.
- END OF SECTION 22 0553

SECTION 22 0593 - PLUMBING TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Adjust and balance plumbing hot water recirculation systems
- B. Check each piece of operating equipment provided under Division 22.
- C. Provide Balancing Report

1.2 QUALITY ASSURANCE

- A. Independent Subcontractor: All testing, adjusting and balancing shall be performed by a Testing, Adjusting and Balancing firm that is independent from the plumbing systems installer.
- B. Balancing Work: Under direct supervision of AABC accredited testing organization certified supervisor.

1.3 REFERENCES

- A. Reference Standards: Comply with AABC National Standards for Total System Balance, latest edition.

1.4 SUBMITTALS

- A. Certificate: Before beginning work, submit certification of AABC certified supervisor and AABC firm certification in accordance with Section 22 0010.
- B. Balancing Report: At completion of work, submit balancing report in accordance with Section 22 0010. After adjustments have been made submit three (3) copies of a complete detailed report on mechanical systems and their operation to include:
  - 1. Blackline prints with balance valves marked to correspond with data sheets and with thermometer locations clearly marked.
  - 2. Data sheets showing amount of water at balance valves, instrument used.
  - 3. Operating data including pump RPM, measured motor current and voltage BHP and flow (GPM).
  - 4. Equipment and operating data including water temperatures entering and leaving the thermostatic mixing valve(s).
  - 5. A statement outlining any abnormal or notable conditions not covered in above data. Make special note of any discrepancies between tabulated data and specified conditions.

1.5 PROJECT CONDITIONS

- A. Existing Conditions: Verify following conditions before proceeding with work:



1. Installation of the designated system is complete and in full operation.

## PART 2 - PRODUCTS

### 2.1 INSTRUMENTS

- A. Calibration and maintenance of instruments shall be in accordance with manufacturer's standards and recommendations and requirements of AABC.
- B. Calibration histories for each instrument shall be available for examination.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect preceding work in accordance with Section 22 0010 - BASIC PLUMBING REQUIREMENTS.

### 3.2 PREPARATION

- A. Water Systems: Check:
  1. Strainers are clean.
  2. Automatic control valves operation.
  3. Pump rotation.
  4. Other conditions as required.

### 3.3 ADJUSTING AND BALANCING

- A. General: Check, adjust and balance hot water recirculation system to meet the design performance and tabulate results on acceptable forms. Minimum data to include amperage, voltage input, and thermal heater capacity of each pump, equipment nameplate data and operating speed, pressure rise across each pump, GPM capacity of each balance valve.
- B. Test Run: In order to determine that the system installation is complete and will operate satisfactorily, make a test run with equipment operating per normal temperature control schedule and sequence. Run test and operate and adjust equipment as may be required during test run.

### 3.4 COMPLETION SERVICES

- A. Final Check: Make final checks and do any rebalancing as directed.
- B. Report: Submit Balancing Report as specified above.
- C. Acceptance: Final acceptance of the project will not be made until a satisfactory report is received. Owner reserves the right to spot check the report by field verification prior to final acceptance.

END OF SECTION 22 0593

## SECTION 22 0716 - PLUMBING PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Extent of plumbing insulation required by this section is indicated on Drawings and schedules, and by requirements of this section.
- B. Types of mechanical insulation specified in this section include the following:
  - 1. Piping System Insulation:
    - a. Fiberglass.
    - b. Flexible Unicellular.
- C. Refer to Section 22 0529 - PLUMBING SUPPORTS AND ANCHORS for protection saddles, protection shields, and thermal hanger shields; not work of this section.
- D. Refer to Section 22 0553 - PLUMBING IDENTIFICATION for installation of identification devices for piping, ductwork, and equipment; not work of this section.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- C. Flame/Smoke Ratings: Provide composite mechanical (insulating material, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
  - 1. Exception: Outdoor mechanical insulation may have flame-spread index of 75 and smoke developed index of 150.
  - 2. Exception: Industrial mechanical insulation that will not affect life safety egress of building may have flame-spread index of 75 and smoke developed index of 150.

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
  - 1. Armacell.
  - 2. Manson.
  - 3. Knauf Fiber Glass.
  - 4. Johns Manville Products Corp.
  - 5. Owens-Corning Fiberglass Corp.
  - 6. Rubatex Corp.
  - 7. Thermacor Process, Inc. (CT1 9501)
  - 8. IMCOA
  - 9. Kingspan Corporation Inc.
  - 10. Unifrax Corporation

2.2 PIPING INSULATION MATERIALS

- A. Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated.
- B. Flexible Unicellular Piping Insulation: ASTM C 534, Type I.
- C. Jackets for Piping Insulation: ASTM C 921 and ASTM C 1136, Type I (Vapor Barrier) for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installer's option.
  - 1. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations, ASTM D 1784.
  - 2. Encase exterior piping insulation with aluminum jacket with weather-proof construction, ASTM C 1729.

- D. Staples, Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.
- E. Adhesives, Sealers and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

### 2.3 METAL PROTECTIVE JACKET

- A. Sheet aluminum: ASTM B209, 3003 alloy, H-14 temper, and 0.016 in. thick. Provide moisture barrier lining for service temperatures 60°F or less except where applied over a Type I or II jacket. Longitudinal lap shall be at least two in. wide.
- B. Stainless Steel: ASTM A-240, manufactured from T-304 prime grade Stainless Steels, supplied with a regular dull finish for reduced glare and 0.016 in. thick. These alloys shall be of a soft-annealed temper, for ease in fabrication. Jacketing shall be used for insulated piping, tanks, and vessels less than 8 ft. in diameter. Deep corrugated sheets shall be used for diameters greater than 8 ft. Roll jacketing shall be 3/16 in. corrugated.
- C. Fitting covers: Factory fabricated from not lighter than 0.020 in. thick type 3003 sheet aluminum.
- D. Bands: 3/4 in wide aluminum on maximum 18 in. centers.
- E. Provide metal jackets over insulation as follows:
  - 1. All piping exposed to outdoor weather.
  - 2. Piping exposed in building within five (5) ft. of the floor that connect to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling and floor penetrations.
  - 3. A two in. overlap is required at longitudinal and circumferential joints.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- B. Thickness of insulation shall be as recommended by the manufacturer for the temperatures and pipe sizes involved, and in accordance with standards of T.I.M.A.

### 3.2 PLUMBING PIPING SYSTEM INSULATION

- A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre-insulated equipment.
- B. Cold Piping:

1. Application Requirements: Insulate the following cold plumbing piping systems:
  - a. Potable cold water piping.
  - b. Waste and vent piping above grade and located outside the building insulation envelope.
2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
  - a. Fiberglass: 1 in. thickness; ½ in. thick for condensate drain piping.
  - b. Flexible Unicellular: 1 in. thickness; ½ in. thick for condensate drain piping.

C. Hot Piping:

1. Application Requirements: Insulate the following hot plumbing piping systems:
  - a. Potable hot water piping.
  - b. Potable hot water recirculating piping.
2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
  - a. Fiberglass (Above Ground Only): 1 in. thick for pipe sizes up to and including 1-1/4 in., 1-1/2 in. thick for pipe sizes 1-1/2 in. and larger.
  - b. Flexible Unicellular: 1 in. thick for pipe up to and including 1-1/4 in.; 1-1/2 in. thick for pipe sizes over 1-1/4 in.
  - c. All insulation requirements shall comply with applicable edition of IECC.

3.3 INSTALLATION OF PIPING INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3 in. wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 in. wide vapor barrier tape or band.
- I. Do NOT insulate over pipe hangers. If pipe hangers for piping to be insulated are not adequately sized for insulation to pass through the hanger, notify the General Contractor and Architect.

#### 3.4 EXISTING INSULATION REPAIR

- A. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

#### 3.5 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture-saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 22 0716

## SECTION 22 1000 - PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Extent of Plumbing Piping Work required by this section is indicated on Drawings and by requirements of this section.
- B. Types of Plumbing Piping systems specified in this section include the following:
  - 1. Sanitary waste and vent system.
  - 2. Domestic water system.
  - 3. Trap primer-piping system.

#### 1.2 REFERENCES

- A. ANSI/ASME B16.18 - Cast Copper Alloy Solder - Joint Pressure Fittings.
- B. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- C. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- D. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- E. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- F. ANSI/ASME Sec. 9 - Welding and Brazing Qualifications.
- G. ANSI/ASTM B32 - Solder Metal.
- H. ANSI/AWS D1.1 - Structural Welding Code.
- I. AWS D10.12 - Recommended Practices and Procedures for Welding Plain Carbon Steel Pipe.
- J. AWS D10.9 - Qualifications and Procedures for Piping and Tubing Welding.
- K. AWS B3.0 - Welding Procedure and Performance Qualification.
- L. ASME - Boiler and Pressure Vessel Code.
- M. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- N. ASTM B88 - Seamless Copper Water Tube.
- O. ASTM B306 - Copper Drainage Tube (DWV).
- P. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- Q. ASTM C 1540 - Heavy Duty Shielded Hubless Couplings

- R. ASTM E84 - Standard test method for surface burning characteristics of building materials.
- S. AWS A5.8 - Brazing Filler Metal.
- T. AWWA C651 - Standard for Disinfecting Water Mains.
- U. AWWA C601 - Standard Methods for the Examination of Water and Waste Water.
- V. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- W. CISPI 310 - Couplings for Use with Hubless Cast Iron Soil Pipe and Fittings.
- X. NFPA 24 - Installation of private fire service mains and their Appurtenances, latest edition.
- Y. NFPA 54 - National Fuel Gas Code, latest edition.
- Z. ANSI LC-1 / CSA 6.26 - Use and Installation of Corrugated Stainless Steel Tubing (CSST).

### 1.3 QUALITY ASSURANCE

- A. Plumbing Certification: Persons performing plumbing work shall have a current Texas State Plumbing License.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Conform to ASME Code and AWS 10.12.
- D. Welders Certification: In accordance with ANSI/ASME Sec. 9 or AWS D1.1, AWS D10.9, and AWS B3.0, as applicable.
- E. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the engineer.
- F. All adhesives, sealants and sealant primers shall contain low VOC (Volatile Organic Compounds), as outlined in the South Coast Air Quality Management District (SCAQMD) Rule #1168.

### 1.4 REGULATORY REQUIREMENTS

- A. Conform to the most recent editions of the applicable City codes and ordinances and NFPA 54.
- B. Piping materials specified herein are acceptable products to the Architect, but all are not necessarily acceptable to applicable local codes and ordinances. It is the responsibility of the Contractor to provide materials, from the options listed herein, that are acceptable to both the Architect and applicable local codes and ordinances.

### 1.5 SUBMITTALS

- A. Submit product data on pipe materials, fittings, valves and accessories in accordance with Division 01 and Section 22 0010.
- B. Submit shop drawings and piping layout in accordance with Division 01 and Section 22 0010.



- C. Submit certificates as listed below to Architect in accordance with Division 01 and Section 22 0010.
  - 1. Test Certificates of Approval for Piping Systems.
  - 2. Flushing Certificates of Approval for Piping Systems.
  - 3. Disinfection Certificates of Approval for Domestic Water Piping Systems.

## 1.6 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

## PART 2 - PRODUCTS

### 2.1 SANITARY WASTE AND VENT PIPING

- A. Sanitary waste and vent piping, above grade.
  - 1. Cast Iron Pipe & Fittings: CISPI 301, hubless. Joints: ASTM C 564, neoprene gaskets and stainless steel clamp-and-shield assemblies. Joints shall be Heavy Duty couplings conforming to ASTM C 1540 as manufactured by Husky SD 4000.
  - 2. Copper Pipe: ASTM B306, DWV. Fittings; ANSI/ASME B16.3, cast bronze, or ANSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B23, solder, Grade 50B.

### 2.2 WATER PIPING

- A. Water piping, above grade.
  - 1. Copper Tubing: For 4 in. diameter and less, ASTM B88, Type "L", hard drawn. Fittings: ANSI/ASME B16.18, cast brass, or ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA. Press fittings are not allowed.

### 2.3 TRAP PRIMER PIPING

- A. Trap primer piping, above grade.
  - 1. Copper Tubing: ASTM B88, Type L, annealed. Fittings: ANSI/ASME B16.18, cast copper or ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA. Exposed piping in finished areas shall be chrome plated.

### 2.4 FLANGES, UNIONS AND COUPLINGS

- A. Pipe Size 2 in. and under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
- B. Pipe Size Over 2 in.: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; gaskets suitable for intended service – NO ASBESTOS GASKET MATERIAL ALLOWED.

- C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction and expansion; "C" shape composition sealing gasket; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.

1. Acceptable Manufacturers:

- a. Victaulic
- b. Apollo Shurjoint

- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, and water impervious isolation barrier.

## 2.5 BALL VALVES

- A. Ball valves: For water shut-off and throttling.

1. Ball valves 2 in. and less: Rated 175 lb. minimum water, oil, air and gas pressure, bronze construction, seat material as recommended by manufacturer for material conveying, lever handle, threaded or soldered connections. Throttling valves shall be provided with memory stops (for establishing any setpoint from 0-100% flow).

a. Acceptable Manufacturers and Models:

- 1) Crane
- 2) Apollo
- 3) Jomar
- 4) ITT Grinnell
- 5) Milwaukee
- 6) Watts
- 7) Nibco
- 8) KITZ

2. Ball valves 2-1/2 in. and greater, 150 lb. minimum water, oil, air and gas pressure, bronze or carbon steel construction, seat material as recommended by manufacturer for material conveying, lever handle, flanged connections. Throttling valves shall be provided with memory stops (for establishing any setpoint from 0-100% flow).

a. Acceptable Manufacturers and Models:

- 1) Crane
- 2) Jomar

- 3) Apollo
- 4) Jamesbury
- 5) KITZ

## 2.6 PIPING SPECIALTIES

- A. Provide piping specialties in accordance with Section 22 1119.

## 2.7 PLUMBING SUPPORTS AND ANCHORS

- A. Provide supports and anchors in accordance with Section 22 0529.

## 2.8 PLUMBING METERS AND GAUGES

- A. Provide meters and gauges in accordance with Section 22 0519.

## 2.9 PLUMBING INSULATION

- A. Provide mechanical insulation in accordance with Section 22 0716.

## 2.10 PLUMBING IDENTIFICATION

- A. Provide mechanical identification of all piping systems and valves in accordance with Section 22 0553.

## PART 3 - EXECUTION

### 3.1 PIPING

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- E. Route piping in orderly manner and maintain gradient.
- F. Install piping to conserve building space and not interfere with use of space.
- G. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.
- H. Group piping whenever practical at common elevations.

- I. Exposed piping, valves, fittings, escutcheons, trim, etc., serving plumbing fixtures in finished areas, shall be polished chromium plated. Exposed piping, valves, fittings, escutcheons, trim, etc., serving plumbing equipment, kitchen equipment, or other equipment located in finished areas, shall be chrome plated, or when not available with chrome plating, they shall be painted with chromium paint.
- J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- K. Provide clearance for installation of insulation and access to valves and fittings.
- L. Provide access where valves and equipment are not accessible. Coordinate size and location of access doors with applicable Section.
- M. Slope water piping and arrange to drain at low points.
- N. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Division 09, PAINTING.
- O. Install piping parallel with or at right angles to walls unless otherwise shown on Drawings.
- P. Conceal piping above ceilings, in walls or chases etc., unless otherwise shown or noted on Drawings.
- Q. Soft copper shall not be routed through areas with exposed ceilings except in mechanical rooms.
- R. Bending of rigid piping is not permitted; only ells shall be utilized for a change in direction.
- S. Temporarily plug or cap open ends of pipe at the end of each workday.
- T. Establish invert elevations for drainage piping. Minimum slopes for drainage are 1/4 in. per foot for 3 in. diameter and less and 1/8 in. per ft. for 4 in. diameter pipe and greater.
- U. Trap primer piping shall slope to floor drain at no less than 1/16 in. per ft. Horizontal trap primer piping shall run as shown in the Drawings. Piping in slab is not permitted.
- V. All sanitary waste stacks and storm drain down spouts 4 in. diameter and larger with vertical drops over 30 ft. 0 in. shall be provided with joint restraint on the horizontal branch or offset below the vertical drop. Threaded joints, grooved joints or a combination of pipe clamps and tie-rods as required in NFPA 24 shall accomplish joint restraint. Thrust blocks shall accomplish joint restraint below ground as required in NFPA 24. Vertical joint restraint shall be provided from the 90° ell at the bottom of the vertical drop through every joint up to the riser clamp at the floor penetration of the floor above. Horizontal joint restraint shall be provided from that same 90° ell through every joint on the horizontal branch.
- W. Materials exposed within ducts or plenums (ceiling spaces used as supply or return air plenums) shall have a flame-spread index of not more than 25 and a smoke-developed rating of not more than 50 when tested in accordance with the test for Surface Burning Characteristics of Materials, U.B.C. Standard No. 42-1. Do not install any PVC piping in any Return Air Plenums.
- X. Fuel-gas lines and waste cleanouts shall not be located within an air supply plenum.

- Y. Piping hangers shall be sized large enough to allow insulation to pass through. Hangers for piping 2-1/2 in. and greater shall be provided with pipe covering protection saddle, or high compressive strength insulation saddle. Hangers for piping 2 in. and less shall be provided with pipe covering shields. On cold or chilled water piping provide vapor barrier through hanger.

### 3.2 PIPING CONNECTIONS

#### A. Threaded Connections

1. Threaded joints shall be in accordance with ANSI B1.20.1. Threaded joints shall be made up Teflon tape or lead free pipe joint compound applied to the male thread only. Should a joint be loosened after being made up, it shall not be made up a second time unless the threads are cleaned and new compound applied.
2. All steel piping which is assembled with screwed joints shall have exposed threads thoroughly primed with a coat of lead free rust resistant paint. Paint immediately after installation. This shall apply to both piping that is to be covered as well as uncovered.

#### B. Soldered Connections

1. Soldered joints shall be in accordance with ASTM B32. Flux shall be nonacid type. Remove composition discs from solder end valves during soldering. Pipe ends, fittings and valves shall be properly cleaned before soldering and wiped clean to remove flux and excess solder after soldering.

#### C. Welded Connections

1. Welded joints shall be in accordance with AWS D10.12-79. The oxyacetylene or electric process shall make all joints.
2. Nipples or half couplings welded into the mains will not be accepted. Welded branch connections shall be used to tap mains only where the mains are at least two pipe sizes larger than the branch.
3. All openings cut into pipe for welded outlets shall be accurately made, to give matched intersections. For welded branch outlet fittings, the opening shall be cut before the fittings welded.
4. Long radius type ells shall be on all bends in welded pipelines. No field fabricated or factory segmentally fabricated fittings shall be allowed.
5. Welds on piping shall be cleaned and primed with corrosion resistant paint before insulation is applied or installation is complete.

#### D. Solvent Cement Connections:

1. Solvent cement connections shall be joined with primer and PVC solvent cement complying with ASTM D2564. Solvent cement connections shall be in compliance with GSR Bulletin SCJ-1 Solvent Cementing Procedure.

#### E. Mechanical Grooved Connections:

1. Pipe shall be prepared and mechanical grooved connections shall be assembled in accordance with ANSI/AWWA C606 and the latest published instructions from the manufacturer.

### 3.3 FLANGES AND UNIONS

- A. Provide flanges and unions at all final connections to equipment, and traps. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shut-off valves.
- B. All flanged connections shall be in accordance with ANSI B16.5 for steel flanges and ANSI B16.1 for cast iron flanges.
- C. Bolting shall be in accordance with ASTM A307 Grade B with bolts and nuts in accordance with ANSI B18.2.1 and ANSI B18.2.2.
- D. Tighten flange bolts in sequence 180° directly opposite each to equal tension.
- E. Flanges and unions shall be made of same material or compatible material as piping systems in which they are installed.

### 3.4 VALVES

- A. Install valves with stems upright or horizontal, not below horizontal.
- B. Horizontal swing check valves shall be installed in a true horizontal position. Vertical lift check valves shall be installed in a true vertical position.
- C. Install ball valves for shut-off and to isolate fixtures, parts of systems, or vertical risers.
- D. Throttling or balancing valves shall be provided with memory stops.

### 3.5 TESTING

- A. General: Furnish pumps, gauges, equipment and personnel required, and test as necessary to demonstrate the integrity of the finished installation.
- B. Soil, Waste and Vent, and Storm Drainage: Unless otherwise directed, plug all openings and fill with water to a height equal to the lowest vent or roof drain. Allow to stand one hour or longer as required. Remake leaking joints and retest.
- C. Water Lines: Hydrostatically test and make tight at 150 psi. Retain for four hours. Repair all leaking joints and retest.
- D. Tests and test procedures shall be witnessed and approved by the Architect.
- E. After completion and approval of testing, submit "Test Certificates of Approval" for Sanitary Waste and Vent and Water piping systems stating that all test results are satisfactory. Certificates of approval must be signed by Contractor.

### 3.6 FLUSHING

- A. General: After piping systems have been tested and approved, systems shall be flushed. Furnish compressors, pumps, equipment, personnel, etc. required to flush piping systems.
- B. Water Lines: Flush piping with water until water flows clear for a minimum of 60 seconds per 100 linear ft. of piping being flushed at a velocity of 9 ft. per second.
- C. All strainers and filters shall be cleaned and replaced prior to start-up.
- D. Flushing and flushing procedures shall be witnessed and approved by the Architect.
- E. After completion and approval of flushing, submit "Flushing Certificates of Approval" for water piping systems stating that all flushing results are satisfactory. Certificates of approval must be signed by Contractor.

### 3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50-to 80 mg/L residual.
- C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 5 remote outlets.
- D. Maintain disinfectant in system for 24 hours.
- E. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- F. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- G. Take samples no sooner than 24 hours after flushing, from 5 remote outlets and from water entry, and analyze in accordance with AWWA C651.
- H. Disinfection and disinfection procedures shall be witnessed and approved by the Architect.
- I. After disinfection is completed, submit "Disinfection Certificate of Approval" for domestic water piping systems to the Architect stating that all test results are satisfactory. Certificate of Approval must be signed by Contractor. Certificate shall show the date, time and residual of each of the following tests:
  - 1. Initial disinfection residual (50 PPM minimum) - 5 samples.
  - 2. Final disinfection residual (25 PPM minimum) - 5 samples.
  - 3. After flushing residual (5 PPM maximum) - 5 samples.
  - 4. Analyze in accordance AWWA C651 - 5 samples.

3.8 CLOSING IN UNINSPECTED WORK

- A. Do not cover up or enclose work until it has been properly and completely inspected and approved. Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required. After it has been completely inspected and approved, make all repairs and replacements as necessary to the satisfaction of the Architect, Engineer, and Owner's Representative. Repairs and replacements shall be at no additional cost to the Owner.

END OF SECTION 22 1000



## SECTION 22 1001 - PLUMBING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of Plumbing Specialties Work required by this section is indicated on Drawings and by requirements of this section.
- B. Types of Plumbing Specialties specified in this section include the following:
  - 1. Hub drains.
  - 2. Cleanouts.
  - 3. Backflow preventers.
  - 4. Water hammer arrestors.
  - 5. Trap primers.

#### 1.2 REFERENCES

- A. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
- B. ANSI A112.26.1 - Water Hammer Arresters.
- C. PDI WH-201 Water Hammer Arresters.
- D. NFPA 54 - National Fuel Gas Code, latest edition.

#### 1.3 QUALITY ASSURANCE

- A. Conformance with applicable state and local codes and ordinances.
- B. Manufacturer: For each product specified, provide components by same manufacturer throughout.
- C. Plumbing Certification: Persons performing plumbing work shall have a current Texas State Plumbing License.

#### 1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable City codes and ordinances and NFPA 54.

#### 1.5 SUBMITTALS

- A. Submit product data in accordance with Division 01 and Section 23 0010.
- B. Include component sizes, rough-in requirements, service sizes, and finishes.
- C. Submit Certificates as listed below to Architect in accordance with Division 01 and Section 23 0010.

1. Certificates of Approval - Backflow Preventers.

## PART 2 - PRODUCTS

### 2.1 HUB DRAIN

- A. Hub drain: Cast bronze body and supplementary dome strainer, 5 in. diameter top, P-trap, and 1/2" primer tap.

1. Acceptable Manufacturers and Models:
  - a. Josam Series 88210-8-51-72-T
  - b. Smith Series 3823T
  - c. Zurn Series ZAB-1019-DS

### 2.2 CLEANOUTS

- A. Wall Clean out: Recessed wall type, cast iron body with threaded bronze plug, flush mounted stainless steel access cover with countersunk center screw and vandal proof secured.

1. Acceptable Manufacturer and Models:
  - a. Josam Series 58710-15
  - b. Smith Series 4422C-U
  - c. Zurn Series Z-1441-BP-VP
  - d. Mifab Series C1450
  - e. Watts Series CO-450

- B. Wall Clean out: Cast iron clean out tee type with countersunk tapered threaded bronze plug. Provide "T" handle wrench.

1. Acceptable Manufacturers and Models:
  - a. Josam Series 58910
  - b. Smith Series 4512S
  - c. Zurn Series Z-1445-BP
  - d. Mifab Series C1460
  - e. Watts Series CO-460

- C. Wall Clean out: Cast iron clean out tee type with countersunk tapered threaded bronze plug, and stainless steel round access cover with countersunk center screw and vandal proof secured. Provide "T" handle wrench.

1. Acceptable Manufacturers and Models:

- a. Josam Series 58790-15
- b. Smith Series 4532S-U
- c. Zurn Series Z-1446-BP-VP
- d. Mifab Series C1460-RD
- e. Watts Series CO-460-RD

2.3 BACKFLOW PREVENTERS

A. Reduced Pressure

1. Reduced pressure backflow preventer 2 in. and smaller: ANSI/ASSE 1013; complete unit of two independently acting check valves together with an automatically operating pressure relief valve, two ball valves, strainer, and four test cocks, bronze or iron body with bronze internal parts, lead free, 150 psi working pressure, and shall comply with AWWA Standard C506. Devices used in domestic water systems shall be certified "lead free".

a. Acceptable Manufacturers and Models:

- 1) Apollo
- 2) Watts
- 3) Zurn
- 4) Febco

B. Backflow Preventer Test Kits

1. Reduced Pressure Principle Test Kit: Gauge test valves, hoses, adaptors, securing strap, instruction guide and lightweight case.

a. Acceptable Manufacturer and Model:

- 1) Apollo
- 2) Watts

2.4 WATER HAMMER ARRESTORS

- A. Water Hammer Arrestors (WHA): ANSI A112.26.1, ASSE 1010, and PDI WH-201; permanently sealed expanding chamber type . Sizing symbols indicated on Drawings refer to Plumbing and Drainage Institute "Standard PDI-WH201" established standard classifications. Air chambers are not allowed.

1. Acceptable Manufacturers and Models:

- a. Expanding Chamber Type
  - 1) PPP "SC" Series
  - 2) Sioux Chief "Hydra-Rester" Series
  - 3) Watts Series 15
  - 4) Mifab CL/MWH

## 2.5 TRAP PRIMERS

- A. Trap Primer: Brass, O-ring seals, with the minimum quantity of distribution units as recommended by manufacturer. Trap primer shall automatically activate and supply a minimum of 2 oz/ of potable water at 20 PSIG at preset factory setting of 6 seconds every 24 hours. The entire unit is pre-assembled in a steel cabinet ready to be flush wall mounted.
  - 1. Acceptable Manufacturer and Model:
    - a. Precision Plumbing Products (PPP) PT-4
- B. Trap Primer: Complete electronic type system for service to multiple floor drains. System shall consist of controller time clock with solenoid valves that will open at a programmed time.
  - 1. Controller: Programmable, solid state, 6 zone, minimum adjustable run time of 1 minute for each zone, 12 hour program battery backup, 120 VAC to 24 VAC internal transformer, fuse protected circuitry, UL listed, 120 VAC input - 24 VAC output, constructed of enameled steel or plastic.
    - a. Acceptable Manufacturers and Models:
      - 1) Toro Vision 1
      - 2) Weathermatic LM
      - 3) Irri-Trol 600
  - 2. Solenoid Valve: Brass body, buna "N" seats, normally closed, 125 psi rated, 24 VAC.
    - a. Acceptable Manufacturers and Models:
      - 1) Asco 8210
  - 3. Provide all interconnecting electrical wiring from controller to solenoid valves and accessories required for a complete operable system. All wiring shall be in conduit.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Coordinate cutting or forming of floor construction to receive drains to required invert elevations.

### 3.2 INSTALLATION AND APPLICATION

- A. Install specialties in accordance with manufacturer's instructions to permit intended performance.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded clean out plugs with mixture of graphite and linseed oil. Ensure clearance at clean out for rodding of drainage system.
- C. Trap all drains connected to the sanitary sewer.
- D. In addition to cleanouts, as shown on the Drawings, Contractor shall provide any additional cleanouts required by local codes and ordinances at no additional cost to the Owner.
- E. Relief valve discharge drain from reduced pressure backflow preventers shall be piped full outlet size down to nearest hub drain. Drain line shall terminate above hub drain with air gap.
- F. One backflow preventer test kit shall be provided for each type of backflow preventer (Reduced Pressure Principle) provided by the Contract Documents.
- G. Install trap primers on all hub drains unless specifically not required by local codes.
- H. All trap primers shall be concealed, within cabinets, walls and/or chases as approved by the Architect. Install access doors at each valve location.
- I. Install line size wye-pattern strainer upstream of backflow preventer. Strainer shall be lead free for all potable water systems.

### 3.3 TESTING

- A. Backflow preventers shall be tested for proper operation by the backflow preventer Manufacturer's Representative. The test shall be performed prior to initial start-up. Manufacturer's Representative shall submit certificates of approval to the Architect.

END OF SECTION 22 1001

## SECTION 22 1119 - PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Extent of piping specialties work required by this section is indicated on Drawings and schedules and by requirements of this section.
- B. Types of piping specialties specified in this section include the following:
  - 1. Pipe Escutcheons.
  - 2. Dielectric Unions.
  - 3. Mechanical Penetration Seals.
  - 4. Fire Barrier Penetration Seals.
  - 5. Pipe Sleeves.
  - 6. Penetration Seals.
- C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 22 sections.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
  - 1. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type".

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned Drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.
- B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.

## PART 2 - PRODUCTS

### 2.1 PIPING SPECIALTIES

- A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

### 2.2 PIPE ESCUTCHEONS

- A. General: Provide pipe escutcheons as specified herein with inside diameter tightly fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
- B. Pipe Escutcheons for Moist Areas: Exterior use and interior use including mechanical rooms and any room with water or floor type drains. For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
- C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.
- D. Manufacturer: Subject to compliance with requirements, provide pipe escutcheons of one of the following or approved equal:
1. Chicago Specialty Mfg. Co.
  2. Producers Specialty & Mfg. Corp.
  3. Sanitary-Dash Mfg. Co.

### 2.3 DIELECTRIC UNIONS

- A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.
- B. Manufacturer: Subject to compliance with requirements, provide dielectric unions of one of the following or approved equal:
1. B & K Industries, Inc.
  2. Capital Mfg. Co.; Div. of Harsco Corp.
  3. Eclipse, Inc.
  4. Epco Sales, Inc.
  5. Perfection Corp.

6. Rockford-Eclipse Div.

## 2.4 PENETRATION SEALS

- A. Caulked Seals: Provide seals for penetrations through interior walls of one of the following:

1. Mineral Wool or Oakum: Caulked watertight between sleeve and pipe.

- B. Mechanical Seals:

1. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2. Manufacturer: Subject to compliance with requirements, provide mechanical sleeve seals of one of the following or approved equal.

- a. Thunderline Corp.

- C. Fire Barrier Seals:

1. Provide seals for any opening through smoke or fire-rated walls, and all above grade floors, used as passage for mechanical components such as piping or ductwork.

2. Cracks, Voids, or Holes Up to 4 in. Diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.

3. Openings 4 in. or Greater: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350°F UL-listed.

4. Manufacturer: Subject to compliance with requirements, provide fire barrier penetration seals of one of the following or approved equal.

- a. Electro Products Div./3M.

- b. Nelson; Unit of General Signal.

## 2.5 PIPE SLEEVES

- A. Provide pipe sleeves of one of the following:

1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snap lock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3 in. and smaller, 20 gauge; 4 in. to 6 in. 16 gauge; over 6 in., 14 gauge.

2. Steel-Pipe: Fabricate from Schedule 10 (minimum) steel pipe; remove burrs.

3. Floor sleeves shall be provided with water stop or link seal around perimeter of sleeve.



### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF PIPING SPECIALTIES

- A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.
- B. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.
- C. Mechanical Penetration Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.
- D. Fire Barrier Penetration Seals: Fill opening with sealing compound. Adhere to manufacturer's installation instructions.
- E. Pipe Penetrations: Sleeve new construction or core drill existing construction pipe penetrations as specified below where piping passes through walls, floors, and roofs. Do not penetrate structural members, except as detailed on Drawings, or as reviewed by Architect. Install penetrations accurately centered on pipe runs. Size penetrations so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than two pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide penetration with sufficient clearance for installation. When sleeves are required, install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves two inches above finished floor. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeve. Pipe penetrations shall be as follows:
  - 1. Existing Floors Above Grade: Provide core-drilled penetrations for all piping.
  - 2. New and Existing Walls: Provide sleeved or core drilled penetrations for all piping.
  - 3. Floor type drains, cleanouts, and water closet waste connections do not require sleeved or core drilled penetrations. Concrete shall be placed tight to connection.
- F. Pipe Sleeves: Install in accordance with the following:
  - 1. Install sheet metal on steel pipe sleeves in interior walls.
  - 2. Install steel pipe sleeves in interior floors above grade.
- G. Penetration Seals:
  - 1. Install mineral wool/oakum seals as follows:
    - a. In interior walls where piping passes from one space to another, where any one of the spaces the piping penetration is not concealed by a ceiling. Caulk penetration watertight.

2. Install mechanical seals in accordance with manufacturer's recommendations as follows:
  - a. In interior floors above grade, use three-hour fire rated type only.
3. Install fire barrier seals in accordance with manufacturer's recommendations as follows:
  - a. In all floors above grade and fire rated walls.

END OF SECTION 22 1119

## SECTION 22 4001 - PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Extent of Plumbing Fixture Work required by this section is indicated on Drawings and Schedules, and by requirements of this section.
- B. Types of plumbing fixtures specified in this section include the following:
  - 1. Sinks.
  - 2. Plumbing Brass.

#### 1.2 REFERENCES

- A. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
- B. All fixtures shall comply with ANSI/NSF STD 61.

#### 1.3 QUALITY ASSURANCE

- A. Conformance with applicable state and local codes and ordinances.
- B. Fixtures: By same manufacturer throughout.
- C. Trim: By same manufacturer throughout.

#### 1.4 REGULATORY REQUIREMENTS

- A. Conform to the most recent editions of the City codes and ordinances.
- B. Conform to Article 7/601b. - Vernon's Texas Civil Statutes (Handicapped Accessibility Act) (Texas Accessibility Standards (TAS)).

#### 1.5 SUBMITTALS

- A. Submit product data in accordance with Division 01 and Section 22 0010.
- B. Include fixtures, sizes, utility sizes, trim, and finishes.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data in accordance with Division 01 and Section 22 0010.
- B. Include fixture trim exploded view and replacement parts lists.

#### 1.7 WARRANTY

- A. Provide one-year manufacturer's warranty for electric water cooler compressor in accordance with Division 01 and Section 22 0010.

## PART 2 - PRODUCTS

### 2.1 PLUMBING FIXTURES

- A. Provide plumbing fixtures as scheduled or approved equal.
- B. Approved equals will be limited to the following manufacturers:
  - 1. Stainless Steel Sinks:
    - a. Elkay.
    - b. Just.
    - c. Dayton
  - 2. Plumbing Brass:
    - a. Kohler.
    - b. T & S Brass.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
- B. Verify adjacent construction is ready to receive rough-in work of this Section.

### 3.2 INSTALLATION

- A. Install each fixture in accordance with the manufacturer's recommendations.
- B. Piping, valves, fittings, trim, etc. shall be polished chromium plated when exposed in finished areas.
- C. Piping penetrating floors, walls or ceilings shall be provided with solid polished chromium plated escutcheons.
- D. Install components level, plumb, and at right angles to walls.
- E. Install and secure fixtures in place with wall supports carriers and bolts. Exposed bolts, nuts, etc. shall be stainless steel or chrome-plated brass.
- F. Seal fixtures to wall and floor surfaces with white sealant.
- G. Mount fixtures to Architectural drawings interior wall elevations and to requirements of ADA and TAS.

- H. Provide removable insulation covering on stops and supplies and drains and P-traps on all handicapped lavatories with hot water supply. All lavatories in rooms with handicapped water closets are considered handicapped lavatories.
- I. Provide keyed stops on all water supplies to fixtures and equipment.
- J. Provide water hammer arrestors on hot and cold water supplies to all plumbing fixtures. Water hammer arrestors shall be as shown on diagrams and if not shown, provide for each fixtures in accordance with Standard PDI-WH-201.
- K. Provide drainage and vent piping run outs to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the Plumbing Code.

### 3.3 ADJUSTING AND CLEANING

- A. Adjust and balance stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. At completion clean plumbing fixtures and equipment.

END OF SECTION 22 4001

SECTION 23 0010 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS AND SUPPLEMENTAL GENERAL PROVISIONS

- A. The "General Conditions" and "Supplementary Conditions" are by reference made a part of this section and shall apply to each and every heading as though included herein.
- B. In the event of conflict, the requirements of the "General Conditions" and "Supplementary Conditions" will take precedence over these "General Requirements".

1.2 GENERAL

- A. The Contractor shall provide all plans, labor, equipment, appliances and materials, and shall perform all operations in connection with the installation of the mechanical work in accordance with the Specifications, applicable drawings, and the conditions specified above.
- B. Contractor shall provide all equipment required and usually furnished in connection with such work and systems whether or not specifically mentioned or specifically indicated on the drawings.

1.3 COMMISSIONING

- A. The Contractor shall provide all system commissioning services as required by section C408 of the 2018 International Energy Conservation Code (IECC). Mechanical systems shall comply with IECC section C403.
- B. Commissioning, as outlined in IECC section C408 shall include the following:
  - 1. A commissioning plan.
  - 2. Air systems balancing.
  - 3. Hydronic systems balancing.
  - 4. Functional performance testing for all mechanical equipment, controls and economizers.
  - 5. A preliminary commissioning report.
  - 6. Final documentation including drawings, O&M manual(s), T&B report, and final commissioning report.

1.4 INSPECTION OF THE SITE

- A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, and local requirements. The submission of bids shall be deemed evidence of such visits.
- B. All proposals shall take these existing conditions into consideration, and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility.

- C. In the event that equipment specified and/or reviewed is not compatible with the existing conditions, the trade furnishing the equipment shall be responsible for notifying the Contractor prior to ordering it.

#### 1.5 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

- A. Refer to other sections of the specifications for construction phasing and time increments.
- B. The Contractor shall obtain and pay for all required utility connections, utility extensions and/or relocations and shall pay all costs and inspection fees for all work included herein.

#### 1.6 APPLICABLE CODES AND STANDARDS

- A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of the Specifications, except as may be hereinafter modified in these Specifications and associated drawings.
- B. Latest edition of the National Fire Protection Association Standards (NFPA):
  - 1. NFPA No. 70 National Electrical Code
  - 2. NFPA No. 90A Installation of Air Conditioning and Ventilating systems
  - 3. NFPA No. 91 Exhaust systems of Air Conveying of Gases, etc.
  - 4. NFPA No. 101 Safety to Life from Fire in Buildings and Structures
  - 5. NFPA No. 255 Test of Surface Burning Characteristics of Building Materials
- C. United States of America Standards Institute (ASA) Standards:
  - 1. A40.8 National Plumbing Code
  - 2. B31.1 & B31.1a Code for Pressure Piping
- D. American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Codes.
- E. Air Conditioning and Refrigeration Institute Standards (ARI): All standards related to refrigeration and air conditioning equipment and piping furnished under these Specifications.
- F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) 1985: All applicable manuals and standards.
- G. Air Moving and Conditioning Association (AMCA): All applicable manuals and standards.
- H. American Society of Testing and Material (ASTM): All applicable manuals and standards.
- I. American Water Works Association (AWWA): All applicable manuals and standards.
- J. National Electrical Manufacturer's Association (NEMA): All applicable manuals and standards.
- K. City Fire Department as applicable to construction of this site.

- L. City and State Building Codes.
- M. State of (Texas) Occupational Safety Act: Applicable safety standards.
- N. Occupational Safety and Health Act (OSHA).
- O. State of (Texas) Energy Conservation Construction Code.
- P. All work shall be in accordance with all regulations and requirements of the State of Texas Architectural Barriers Act (TAS).
- Q. Refer to Specifications sections hereinafter bound for additional codes and standards.
- R. All materials and workmanship shall comply with all applicable state and national codes, specifications, and industry standards. All material shall be listed by the Underwriter's Laboratories, Inc., as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.
- S. All equipment provided and all installation methods shall meet all applicable requirements of the International Energy Conservation Code.
- T. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by other specifications of the Contract Documents, providing no work or fabrication of materials has been accomplished in a manner of non-compliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

#### 1.7 CONTRACT DOCUMENTS

- A. These specifications are accompanied by drawings of the building and details of the installations indicating the locations of equipment, piping, ductwork, outlets, switch controls, circuits, lines, etc. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
- B. If the Contractor deems any departures from the drawings necessary, details of such departures and the reasons therefore shall be submitted to the Architect for review. No departures shall be made without prior written acceptance.
- C. There are intricacies of construction that are impractical to specify or indicate in detail; however, in such cases the current rules of good practice and applicable specifications shall govern.
- D. It is the Contractor's responsibility to properly use all information found on the Civil, Architectural, Structural, Mechanical, Plumbing, Fire Protection, and Electrical drawings where such information affects his work.
- E. All dimensional information related to new structures should be taken from the appropriate drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.



- F. The interrelation of the specifications, the drawings, and the schedules is as follows: The specifications determine the nature and setting of the several materials, the drawings establish the quantities, dimensions and details, and the schedules give the performance characteristics.
- G. Should the drawings or specifications disagree within themselves, or with each other, the better quality of greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Architect in writing, shall be performed or furnished. Figures indicated on drawings govern scale measurements and large-scale details govern small-scale drawings.

#### 1.8 SPACE AND EQUIPMENT ARRANGEMENT

- A. The size of fire protection, plumbing, mechanical, and electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared to indicate a suitable arrangement.
- B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.
- C. Maintain all code required clearances for equipment access.

#### 1.9 FABRICATION DRAWINGS

- A. Contractor shall submit ductwork fabrication and hydronic piping shop drawings for review by the Architect. Fabrication drawings shall be fully coordinated with ALL other trades and with existing conditions.
- B. All required shop drawings, except as hereinafter specified, shall be prepared at a scale of not less than 1/8 in. equal to 1 ft. for floor plans and 1/4 in. equal to 1 ft. for mechanical rooms.

#### 1.10 SUPERVISION

- A. Each contractor shall keep a competent superintendent or foreman on the job at all times necessary for the timely and proper completion of the work.
- B. It shall be the responsibility of each superintendent to study all drawings and familiarize himself with the work to be done by other trades. He shall coordinate this work with other trades, and before material is fabricated or installed, make sure that his work will not cause an interference that cannot be resolved without major changes to the drawings. If a conflict between trades arises that cannot be resolved at the jobsite, the matter shall be referred to the Architect for his ruling.

1.11 EXISTING FACILITIES

- A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all plumbing, heating, air conditioning, and ventilating services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, and remove all such temporary protection upon completion of the work. All barricades and safety devices shall be in compliance with OSHA.
- B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.
- C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.
- D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall, in locations approved by the Architect, all devices required for the operation of the various systems installed in the existing construction. This is to include, but is not limited to, temperature control system devices, electrical switches, relays, fixtures, piping, conduit, etc.
- E. Outages of services, as required by the new installation, will be permitted only at a time approved by the Architect.

1.12 DEMOLITION AND RELOCATION

- A. The Contractor shall modify, remove and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition.
- B. All items that are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed and sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Architect. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas of facilities, which must remain in operation during the construction period, shall not be interrupted without prior specific approval of the Architect as hereinbefore specified.
- D. All equipment and materials indicated to be removed and not be re-used shall remain the property of the Owner. Coordinate with Owner where materials are to be stored.

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. The Contractor shall prepare, in triplicate for the Owner's Manual, complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc., for each item of equipment. Include copies of all equipment warranties.
- B. In addition, the Contractor shall provide the services of a competent engineer or a technician acceptable to the Architect to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of not less than 4 hours to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, stating the dates of instruction and the personnel to whom instructions were given. The Contractor shall be responsible for proper maintenance until the instructions have been given to the Owner's maintenance personnel.

1.14 GUARANTEE

- A. All work and equipment shall be guaranteed for a period of one year from the date of substantial completion.
- B. Guarantee shall be for all labor and materials.
- C. Certain items for equipment shall have additional or extended warranties when so specified.

1.15 MATERIALS AND WORKMANSHIP

- A. All materials, unless otherwise specified, shall be of current U.S. manufacture, new, free from all defects, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall present a neat, workmanlike appearance. Materials, and/or equipment damaged in shipment, or otherwise damaged prior to installation, shall not be repaired at the job site, but shall be replaced with new materials and/or equipment.
- B. The responsibility for furnishing the proper equipment and/or material, and to see that it is installed as intended by the manufacturer rests entirely upon the Contractor, who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

1.16 FLAME SPREAD PROPERTIES OF MATERIALS

- A. Materials and adhesives incorporated in this project shall conform to NFPA 255, latest edition. The classification shall not exceed No. 2, with the range of indices between 0 to 25 for these Classifications as listed in the Federal Specifications. Modifications shall be made to insulating materials, etc., as required to comply with the Federal Specification.

1.17 LARGE APPARATUS

- A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

1.18 FLOOR AND CEILING PLATES

- A. Except as otherwise noted, provide chrome plated brass floor and ceiling plates around all pipes, conduits, ducts, etc., passing exposed through walls, floors, or ceilings, in any spaces, except under floor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the insulation on lines that are insulated and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend 3/4 in. above finished floor. All equipment rooms are classified as finished areas. Round and rectangular ducts shall have plates made to fit accurately at all floor, wall and ceiling penetrations.

1.19 SLEEVES, INSERTS AND FASTENINGS

- A. Proper openings through floors, walls, roofs, etc., for the passage of piping, ductwork, etc., shall be provided. All penetrations must pass through sleeves except soil pipe installed under concrete slabs on fill. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Architect.
- B. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.
- C. The minimum clearance between horizontal penetrations including insulation where applicable, and sleeves shall be 1/4 in., except that the minimum clearance shall be 2 in. where piping contacts the ground. Sleeves through walls and partitions shall be installed flush with exposed surfaces. Sleeves through floors shall be extended 2 in. above finished floor.
- D. Above grade and dry location sleeves shall be constructed from 20 to 22 gauge galvanized steel. Sleeves passing through walls or floors on or below grade and/or moist areas such as mechanical rooms shall be constructed of galvanized steel Schedule 40 pipe and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the pipes have been installed in the sleeves, void space around the pipe shall be sealed with "Link-Seal" modular wall and casing seals as manufactured by Thunderline Corporation.
- E. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction.
- F. Fastening of pipes, conduits, etc., in the building shall be as follows: To wood members - by wood screws; to masonry - by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry; to steel - machine screws or welding (when specifically permitted or directed), or bolts, and to concrete by suitable inserts anchored to reinforcing steel, and poured in place unless other means are acceptable for general use, and will only be permitted where specifically acceptable to the Architect.
- G. Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.
- H. Vermin Proofing: The open space around all ductwork, piping, etc., passing through the ground floor and/or exterior walls shall be sealed with a continuous bead of sealant.

- I. The space around piping, ductwork, etc., penetrating walls, ceilings and floors that define air plenums shall be sealed airtight in an acceptable manner. Ceiling plenums used for return air are considered air plenums.

#### 1.20 ACCESS DOORS

- A. This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed shutoff or service valves, strainer, unions, pressure reducing valves, trap primers, water hammer arrestors, heat trace cable junction boxes, and other items of concealed mechanical equipment. All access door locations are not shown on the drawings. It is the Contractor's responsibility to provide access doors at all locations required.
- B. Access doors mounted in painted surfaces shall be equal to Milcor (Inland-Ryerson Construction Products Company) manufacture, Style K for plastered surfaces and Style M or DW for non-plastered surfaces. The Style K doors shall be set so that the finished surface of the door is even with the finished surfaces of the adjacent finishes. Access doors mounted on tile surfaces shall be stainless steel materials. Access doors shall be minimum of 18 in. x 18 in. in size.

#### 1.21 CONSTRUCTION REQUIREMENTS

- A. The Civil, Architectural, Structural, Fire Protection, Mechanical, Plumbing, and Electrical plans and specifications including the General Provisions, Supplemental General Provisions, and other pertinent documents issued by the Architect, are a part of these specifications and the accompanying mechanical drawings, and shall be complied with in every respect. All the above is included in the Contract Documents, and shall be examined by all bidders. Failure to comply shall not relieve the Contractor of responsibility or be used as a basis for additional compensation due to omission of architectural, structural and electrical details from the mechanical drawings.
- B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation, whether mentioned or not.
- C. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed and thereby to provide an integrated satisfactory operating installation.

- D. The mechanical and associated drawings are necessarily diagrammatic in character and cannot show every connection in detail or every pipe or equipment in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate pipe hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc., shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.
- E. When the mechanical drawings do not give exact details as to the elevation of pipe, ducts, etc., physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Piping and duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner, and the plans do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas. Piping specified to be insulated shall be supported in a manner that will allow the insulation to be installed without gaps. Insulated piping in concealed areas shall be offset with fittings as necessary to permit installation of insulation. Bending of pipes or installing pipes in a strain in order to insulate will not be permitted.
- F. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. Piping, ductwork, valve stems, etc., shall not block service space.

#### 1.22 MECHANICAL SUBMITTALS

- A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 Section: "SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES" for submittal definitions, requirements, and procedures.
- B. Submittal of Shop Drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from Subcontractors and material suppliers directly to the Architect will not be processed.
- C. Submit Shop Drawings, product data, and samples on items indicated in the individual sections.
- D. Shop Drawings and submittal data shall not be used as requests or proposals for alternate equipment or materials. Refer to Item "Product Options and Substitutions" elsewhere in this section.
- E. THIRD PARTY CERTIFICATION: All Packaged equipment shall be independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399, as well as NFPA Pamphlet #70, National Electric Code (NEC), Article 90-7.

#### 1.23 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Refer to the Instructions to Bidders and the Division 01 Section "PRODUCTS AND SUBSTITUTION" for requirements in selecting products and requesting substitutions.

B. Standards for Materials:

1. These specifications indicate a standard for all materials incorporated into the work, with manufacturer's names and catalog numbers used to establish a grade and quality of materials and equipment. The manufacturer listed on the equipment schedules, or named first in the specifications, is the one on whose equipment the layout is based. Other named manufacturers must meet the indicated performance and space requirements.
2. The "approved equal" clause used in these specifications is to permit the proposal of unnamed manufacturer's products for the work, and the Architect decision concerning equal products is final.
3. Considerations as to determination of equal products include, but are not limited to, the following:

|                                   |                               |
|-----------------------------------|-------------------------------|
| Materials                         | Physical size                 |
| Workmanship                       | Weight                        |
| Gauges of Materials               | Appearance                    |
| Available Local Service Personnel | Performance                   |
| Previous successful installations | Capacity                      |
| Delivery Schedules                | Required Equipment Clearances |

- C. Requests for substitutions for equipment, materials and apparatus listed in Division 23 Sections must be submitted in writing a **MINIMUM OF 10 DAYS** prior to the scheduled bid date. Such requests must be accompanied by complete data to permit proper evaluation.
- D. BIDS SHALL NOT BE BASED ON UN-APPROVED MATERIALS, EQUIPMENT, OR APPARATUS. UNAPPROVED MATERIAL, EQUIPMENT OR APPARATUS WILL NOT BE ACCEPTED.
- E. Should electrical, water, drain, natural gas, structural support, or other similar requirements for alternate equipment, whether named in the specifications or approved as a substitution, be different from requirements for the products used in laying out the project, such changes shall be the responsibility of the Contractor, and shall not result in extra charges to the Owner or Architect/Engineer.

1.24 RECORD DOCUMENTS

- A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for requirements. The following paragraphs supplement the requirements of Division 01.
- B. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned for column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
- C. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.25 PAINTING

- A. Field painting of mechanical equipment, duct systems, piping systems, etc., shall be accomplished under Division 09 of these specifications.
- B. Protection of Factory-applied Finishes:
  - 1. Factory-applied finishes on equipment and apparatus installed on the project shall be carefully protected.
  - 2. At the conclusion of the work, and prior to final acceptance of the project, equipment and apparatus shall be thoroughly cleaned of all construction dirt, oil and grease smears, temporary labels, debris, paint droppings, etc.
  - 3. Damaged factory finishes shall be restored to their original condition using procedures, materials and application techniques as set forth in Division 09 found elsewhere in these specifications.

1.26 CLEANING

- A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for general requirements for final cleaning.
- B. Refer to Division 23 Section: "TESTING, ADJUSTING, AND BALANCING" for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.
- C. Name Plates:
  - 1. All nameplates shall be protected from damage during the construction process.
  - 2. At the conclusion of the work, the nameplates shall be carefully cleaned and left in a fully legible condition.
- D. Removal of Rubbish: Each Contractor is responsible for the timely removal of rubbish and trash generated by his work, such as empty cartons, containers, materials crates, etc. Particular attention is called to residue that may present a potential tripping or injury hazard.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer's materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.
- B. The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.



- C. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of start-up or other overload conditions.
- D. Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriter's Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers or the Air Moving and Conditioning Association, the Contractor shall submit proof that the items furnished under these sections of the specifications conform to such requirements. The ASME stamp or the AMCA label will be acceptable as sufficient evidence that the items conform to the respective requirements.
- E. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Observation.
- F. Standard factory finish will be acceptable on equipment specified by model number; otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking, and no signs of rust creepage beyond 1/8 in. on either side of the scratch mark. Where rust-inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable, unless a specific coating is specified, except that coal tar or asphalt type coatings will not be acceptable, unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-6215.
- G. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.
- H. The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect of any discrepancy before performing any work. Adjustments to the work required, in order to facilitate a coordinated installation, shall be made at no additional cost to the Owner.

## 2.2 PROTECTION

- A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.
- B. Take particular care not to damage the building structure in performing work. All finished floors, steel treads, and workmen or their tools and equipment shall cover finished surfaces to prevent any damage during the construction of the building.

- C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final observation must be cleaned of rust and repainted as specified elsewhere in these specifications.

## 2.3 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

- A. Each trade, subcontractor and/or contractor must work in harmony with the various other trades, subcontractors, and/or contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or contractor must pursue his work promptly and carefully as not to delay the general progress of the job. This Contractor shall work in harmony with contractors working under other contracts on the premises.

## 2.4 PRECEDENCE OF MATERIALS

- A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the available space, and which will insure complete and satisfactory systems. Each Contractor shall be responsible for the proper fitting of his material and apparatus into the building.
- B. Each Contractor shall so harmonize his work with that of the other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines that require a stated grade for proper operation. Where space requirements conflict, the following order of precedence shall, in general, be observed:
  - 1. Building lines
  - 2. Structural members
  - 3. Soil and drain piping
  - 4. Vent piping
  - 5. Steam piping
  - 6. Condensate piping
  - 7. Refrigerant piping
  - 8. Electrical bus duct
  - 9. Supply ductwork
  - 10. Return ductwork
  - 11. Exhaust ductwork
  - 12. Chilled water and heating water piping
  - 13. Automatic Fire Protection Sprinkler Piping
  - 14. Natural gas piping

15. Domestic hot and cold water piping

16. Electrical conduit

## 2.5 LOCATION OF OUTLETS IN ROOMS

- A. All fire protection, plumbing, acoustical tile, diffusers, grilles, registers, and other devices shall be referenced to coordinated, established data points and shall be located to present symmetrical arrangements with these points and to facilitate the proper arrangements of acoustical tile panels and other similar panels with respect to the mechanical and electrical outlets and devices. Those mechanical and electrical outlets shall be referenced to such features as wall and ceiling furrings, balanced border widths, masonry joints, etc. Outlets in acoustical tile shall occur symmetrically in tile joints or in the center of whole tiles. When locations of mechanical and electrical devices shown on the Architect reflected ceiling plans need to be modified, the final determination of the exact location of each outlet and the arrangement to be followed shall be acceptable to the Architect.
- B. The drawings show diagrammatically the location of the various outlets and apparatus. Exact locations of these outlets and apparatus shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with the other trades. The Architect reserves the right to make any reasonable change in location of any outlet or apparatus before installation, without additional cost to the Owner.
- C. The Contractor, by submitting a bid on this work, sets forth that he has the necessary technical training and ability, and that he will install his work in a satisfactory and workmanlike manner which is up to the best standards of the trade, complete, and in good working order. If any of the requirements of the drawings and specifications are impossible of performance, or if the installation, when made in accordance with such requirements, will not perform satisfactorily, he shall report it to the Architect for correction promptly after discovery of the discrepancy.

## 2.6 CONNECTIONS FOR OTHERS

- A. This Contractor shall rough-in for and make all gas, water, steam, sewer, etc., connections to all fixtures, equipment, machinery, etc., provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, along with actual measurements of the equipment connections, or as detailed.
- B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, etc.
- C. Provide all air gap fittings where required. In each water line serving an item of equipment or piece of machinery, provide a shut-off valve. On each drain not provided with a trap, provide a suitable trap.
- D. All pipefittings, valves, traps, etc., exposed in finished areas and connected to chrome-plated lines provided by others shall be chrome plated to match.
- E. Provide all sheet metal ductwork, transition pieces, etc., required for a complete installation of vent hoods, exhaust hoods, etc., provided by others.

## 2.7 SMOKE DETECTORS

- A. The contractor shall for each air handling system with 2000 CFM (nominal 5 Tons) or greater airflow, install UL-listed ionized smoke detectors in the main supply air duct and main return air duct and/or where shown on the drawing. Smoke detectors furnished by Division 26. Refer to Section 23 0512. Connect the detectors into the control circuit to stop the fan in the event of the presence of smoke.
  - 1. System airflow included the total airflow of all units serving any single space and all units connected to the same return air plenum.

## PART 3 - INSTALLATION

### 3.1 INSTALLATION METHODS

- A. All pipes shall be concealed in pipe chases, walls, furred spaces, or above the ceiling, unless otherwise indicated.
- B. Piping may be run exposed in mechanical rooms, janitors' closets, or storage spaces, but only where necessary. All exposed piping shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.
- C. All piping shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.
- D. Where limited space is available above the ceilings and below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, in a manner to provide maximum above-floor clearance. Sleeves shall be as specified or as required.
- E. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run, exposed in machinery and equipment rooms, shall be installed parallel to the building plans, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.
- F. There shall be no pipe joints nearer than 12 in. to a wall, ceiling, or floor penetration, unless pipe joint is the welded type joint.
- G. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur, the Contractor shall meet with all involved trades and the Architect and resolve the conflict, prior to erection of any work, in the area involved.

### 3.2 CUTTING AND PATCHING

- A. Cut and patch openings through walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.

- B. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills at locations acceptable to the Architect. Impact-type equipment will not be used, except where specifically acceptable to the Architect. Openings in Precast concrete slabs for pipes, conduits, outlet boxes, etc., shall be core drilled or cast to exact size.
- C. All openings shall be restored to "as-new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.
- D. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect.
- E. All mechanical work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.
- F. No cutting, boring, or excavating, which will weaken the structure, shall be undertaken. NO STRUCTURAL MEMBER MAY BE CUT WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT.

### 3.3 FABRICATION OF PIPE

- A. All the various piping systems shall be made up straight and true and run at proper grades to permit proper flow of the contained material. Lines shall also be graded for proper drainage.
- B. Piping shall follow as closely as possible the routes shown on plans, but shall take into consideration conditions to be met at the site.
- C. Should any unforeseen conditions arise, lines shall be changed or rerouted as required after approval has been obtained.
- D. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping, in connections, and in equipment to which lines are connected.
- E. All piping shall be clean when it is installed. Before installation it shall be checked, upended, swabbed, if necessary, and all rust or dirt from storage shall be removed. Pipe shall not be permitted to lie on the ground during storage. Pipe ends shall be sealed during storage.

### 3.4 IDENTIFICATION AND LABELING

- A. The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them.
- B. All items of mechanical and electrical equipment shall be identified by the attachment of engraved nameplates constructed from laminated phenolic plastic, at least 1/16 in. thick, 3-ply, with black surfaces and white core. Engraving shall be condensed gothic, at least 1/2 in. high, appropriately spaced. Nomenclature on the label shall include the name of the item, its mark number, area, space, or equipment served, and other pertinent information. Equipment to be labeled shall include, but not be limited to, the following:

1. Terminal units
  2. Air conditioning control panels and switches
  3. Miscellaneous similar and/or related items.
- C. The Contractor shall install identification tags to be affixed to those valves that have functions that are not obvious. For example, it would not be expected that valves at a pressure reducing station in a machine room would be tagged. The valve identification tags shall be brass discs, 2 in. in diameter. Each tag shall be attached to its valve with copper clad annealed iron wire or other approved material.

### 3.5 TESTS AND INSPECTIONS

- A. The Contractor shall, during the progress of the work and upon its completion, test his work and make all tests as required by the specifications, state, municipal and other authorities having jurisdiction of the work. Piping pressure tests shall be made before pipe is concealed or covered. Tests shall be made in the presence of authorities requiring tests. The Contractor shall pay all costs, inspection charges and fees required for the tests of his work.
- B. The Contractor shall provide all apparatus, temporary piping connection, etc., required for tests. The Contractor shall take all due precautions to prevent damage to the building or its contents incurred by such tests. The Contractor shall repair and make good at his own expense any damage caused by failures or leaks during the tests.
- C. Leaks, defects or deficiencies shall be repaired and/or replaced, and tests shall be repeated until the test requirements are complied with fully.
- D. All equipment shall be placed in operation and tested for proper automatic control before the final balancing of the system is started.
- E. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description, and extent of system tested, test condition, test results, specified results, and any other pertinent data. Data shall be delivered to the Architect.

### 3.6 COOPERATION AND CLEANUP

- A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of his tools, equipment and materials and shall clean his debris from the job. Upon the completion of the job, each trade shall immediately remove all of his tools, equipment, any surplus materials and all debris caused by his portion of the work.

### 3.7 CLEANING AND PAINTING

- A. All equipment, piping, ductwork, grills, insulation, etc., in finished areas furnished and installed by the Contractor shall be painted. Finished areas include mechanical rooms, boiler rooms, and outside the building as well as occupied areas inside the building. Final painting is to be done by the General Contractor. This Contractor shall thoroughly clean all part of materials and equipment of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.

- B. This Contractor shall thoroughly clean the finish on all parts of the materials and equipment with factory applied finishes. Exposed parts in equipment rooms, above crawl space slabs, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. If the finish has been damaged, the Contractor shall re-paint to the satisfaction of the Architect.
- C. All canvas finishes shall be painted with one sizing coat if not already sized, containing a mildew resistant additive and Arabol adhesive prior to any other specified finish paint.
- D. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during painting operation.

### 3.8 ELECTRICAL PROVISIONS OF MECHANICAL WORK

- A. The extent of electrical provisions to be provided as mechanical work is indicated in other mechanical sections of the specifications, on the drawings and as further specified in this section.
- B. Starters, Controllers: In general, mechanical work includes furnishing combination starters. Controllers are specifically included as electrical work when mounted in motor control centers. Electrical work includes installation, mounting and wiring of starters and controllers that are furnished as mechanical work. Free standing, large motor controllers shall be set in place, on pads, as mechanical work.
- C. Electrical heating equipment shall be furnished complete with internal or integral fusing and subdivision of loads to comply with the NEC.
- D. Wherever possible, match the elements of the electrical provisions of mechanical work with similar elements of the electrical work specified in electrical sections of the specifications.
- E. Standards:
  - 1. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards to definitions of terminology herein.
  - 2. Comply with National Electrical Code (NFPA No. 70) for installation requirements.
  - 3. Comply with National Electrical Contractors Association (NECA) "Standard of Installation".

### 3.9 TEMPORARY FACILITIES

- A. Unless noted otherwise in the Supplementary General Conditions; provide temporary facilities.

### 3.10 EQUIPMENT INSTALLATION REQUIREMENTS

- A. All mechanical equipment shall be furnished and installed complete and ready for use.
- B. All mechanical equipment and appliances shall be installed in a manner that all Code required access and services space is provided. Coordinate exact position of equipment and appliances with routing of new ductwork and piping, and with all existing conditions to provide required clearances.

1. Ensure that a minimum of 30" deep and 30" wide working space is provided in front of the control side of each appliance and piece of air moving equipment.
  2. Ensure that air moving equipment and appliance in attics are installed so that they also have Code required clear passageway.
- C. Others shall furnish certain lab or Owner process equipment. Contractor shall be responsible for furnishing and installing all items as required to make kitchen equipment complete operating systems. The Contractor shall furnish and install all auxiliary piping, valves, controls, control wiring, conduit, alarms, etc., required. All necessary devices, control wiring, conduit, etc., will not necessarily be shown on the drawings.
- 3.11 OWNER FURNISHED EQUIPMENT
- A. The Contractor's responsibility shall include receiving and installing all Owner-furnished equipment.

END OF SECTION 23 0010



SECTION 23 0506 - MECHANICAL DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Demolition of:

1. HVAC ductwork.
2. Grilles, registers, diffusers, variable air volume boxes.
3. Hydronic piping.
4. Plumbing fixtures and trim, specialties, equipment and associated piping.
5. Fire protection equipment and associated piping.
6. Hanger and support devices.
7. All other appliances or devices associated with equipment or devices to be removed.

B. Demolition of all power wiring and conduit from each mechanical item to be removed back to the point of supply.

1.2 QUALITY ASSURANCE

A. Perform all demolition and removal work necessary to arrive at the arrangement shown on the Contract Drawings.

B. Perform all operations in such a method to cause minimum damage to items to be relocated, salvaged, or to remain intact and in use.

1.3 JOB CONDITIONS

A. Perform site repair and removal of salvaged items at times approved by the Owner. Accomplish repair and removal of items in a continuous and diligent manner in order to limit interference with Owner's on-going operations.

B. Drawings may not indicate and specifications may not identify every item required to be moved or removed.

C. Before submitting bids, visit and examine the site of the work and become familiar with the scope of the work and the details of the demolition work to be accomplished.

D. Submittal of a bid will be evidence that such an examination has been made and the various details noted.

E. Claims for extra compensation because of additional labor, materials, or equipment required because of difficulties encountered, will not be recognized unless items were concealed at time of inspection of the Contract Documents. Bring all such items to the attention of the Owner's Representative and the Architect for their disposition before continuing with the work.

- F. Execute demolition work in a manner to protect adjacent equipment and other existing items against damage.
- G. Provide and erect lights, barricades, warning signs, and other items as required for protection of the Owner's employees, building occupants, and the public.
- H. Maintain barricades in good condition throughout the project to substantial completion.
- I. Control the dust resulting from demolition to prevent it from spreading the occupied areas of the building and to avoid creating a nuisance in the immediate surrounding area.

## PART 2 - PRODUCTS - NOT USED

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Provide protection for all building elements, all items which are to remain, all occupants and all workers at all times, and in accordance with all requirements of the Owner.

### 3.2 PROTECTION OF BUILDING FROM THE WEATHER

- A. Maintain weather protection for the space(s) being worked in at all times, and in accordance with all requirements of the Owner.

### 3.3 DEMOLITION

- A. Perform demolition in accordance with all requirements of the Owner.

### 3.4 DISPOSITION OF MATERIALS

- A. Dispose of all demolition items and materials in a legal off-site location.
- B. Any VAV boxes that are to be demolished shall be salvaged and returned to the Owner. Contractor shall coordinate item type, quantity, and storage location with the Owner.

### 3.5 RELOCATION AND REUSE OF MECHANICAL ITEMS

- A. Relocate items indicated on the Contract Drawings as required to accommodate the new construction. Remove, relocate and reconnect equipment and accessories that are to be reused.
- B. Coordinate the work with the Electrical Contractor. Determine which items and equipment are to remain, to be relocated or to be removed. Perform the work consistent with the scope of the project.
- C. Transport and store materials removed and designated for relocation as directed by the Owner's Representative.
- D. Remove all salvage items not to be reused or delivered to the Owner, from the property at the end of each workday.

- E. Maintain full water, drain, electrical service, etc., to all equipment and apparatus that remains in service in the building.

3.6 CLEANING

- A. Section 23 0010 - Basic Mechanical Requirements.

3.7 REMOVAL OF WATER

- A. Be responsible for the removal of water in areas in which scheduled work is to be performed.
  - 1. Remove water by pumping, siphoning, absorbent mopping, or compressed air brooming.
  - 2. Do not use any method of removal that will cause damage to new or reused adjacent equipment or materials.

3.8 SCHEDULING

- A. Schedule demolition in strict compliance with the Owner's instructions.

3.9 DISCONNECTION AND RECONNECTION OF UTILITIES

- A. Do not disconnect or reconnect any utilities until notifying the Owner's Representative.
- B. Notify the Electrical Contractor when requiring Electrical Disconnect or Reconnect.

END OF SECTION 23 0506

SECTION 23 0512 - MECHANICAL AND ELECTRICAL COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Refer to Section 26 0510 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
- B. Refer to Section 21 0010 - BASIC FIRE PROTECTION REQUIREMENTS.
- C. Refer to Section 22 0010 - BASIC PLUMBING REQUIREMENTS.
- D. Refer to Section 23 0010 - BASIC MECHANICAL REQUIREMENTS.

1.2 SUMMARY

- A. This Section describes the coordination between the Fire Protection, Plumbing, Mechanical and Electrical portions of the work.
- B. This Section is included under the Division 21 portion of the Specifications as Section 21 0512, under the Division 22 portion of the Specifications as Section 22 0512, under the Division 23 portion of the Specifications as Section 23 0512, and under the Division 26 portion of the Specifications as Section 26 0512.

1.3 WORK INCLUDED

- A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. **This schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:**

| ITEM   | FURNISHED UNDER DIVISION | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|--|--------------------------|--------------------------|------------------------------------|
| 1. Equipment Motors  | 21/22/23                 | 21/22/23                 | 26                                 |
| 2. Magnetic Motor Starters   |                          |                          |                                    |
| a. Automatically controlled, with or without HOA switches  | 21/22/23                 | 26                       | Notes 1,3,5                        |
| b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment | 21/22/23                 | 22/23                    | Notes 1,3,5                        |
| c. Manually controlled   | 21/22/23                 | 26                       | Notes 1,3,5                        |
| d. Manually controlled and furnished as part of factory wired equipment                                    | 21/22/23                 | 26                       | Notes 1,3,5                        |
| e. Furnished in Motor Control Centers  | 26                       | 26                       | Notes 1,3,5                        |
| 3. Variable Speed (Frequency) AC Drives  | 22/23                    | 26                       | Notes 1,4,5                        |
| 4. Line voltage thermostats, time clocks, etc., not connected to control                                   | 23                       | 26                       | 23                                 |

| ITEM  | FURNISHED UNDER DIVISION | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|---|--------------------------|--------------------------|------------------------------------|
| panel systems   |                          |                          |                                    |
| 5. Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached to ducts, pipes, etc.         | 22/23                    | 22/23                    | 22/23                              |
| 6. Temperature control panels and time switches mounted on temperature control panels   | 23                       | 23                       | 23                                 |
| 7. Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc.   | 23                       | 23                       | Note 1                             |
| 8. Alarm bells furnished with equipment installed by Division 22 or 23  | 22/23                    | 22/23                    | 22/23                              |
| 9. Wiring to obtain power for control circuits, including circuit breaker   | 21/22/23                 | 21/22/23                 | 21/22/23                           |
| 10. Low voltage controls  | 21/22/23                 | 21/22/23                 | 21/22/23                           |
| 11. Fire protection system (sprinkler) controls   | 21                       | 21                       | Note 8                             |
| 12. Fire and smoke detectors installed on mechanical units and in ductwork  | 28                       | 23                       | Note 8                             |
| 13. All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment | 23                       | 23                       | Note 1                             |
| 14. Smoke dampers, and combination fire/smoke dampers   | 23                       | 23                       | Note 7                             |
| 15. Boiler and water heater controls, boiler burner controls panels   | 22/23                    | 22/23                    | 22/23                              |
| 16. Pushbutton stations, pilot lights   | 22/23                    | 22/23                    | 22/23                              |
| 17. Heat Tape   | 21/22/23                 | 21/22/23                 | 26                                 |
| 18. Disconnect switches, manual operating switches furnished as a part of the equipment   | 21/22/23                 | 21/22/23                 | Notes 1,5                          |
| 19. Disconnect switches, manual operating switches furnished separate from equipment  | 26                       | 26                       | 26                                 |
| 20. Multispeed switches   | 23                       | 23                       | 26                                 |
| 21. Thermal overloads   | 21/22/23                 | 21/22/23                 | 21/22/23                           |
| 22. Control relays, transformers  | 21/22/23                 | 21/22/23                 | 21/22/23                           |

| ITEM   | FURNISHED UNDER DIVISION  | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|--|---|--------------------------|------------------------------------|
| 23. Refrigeration cycle, cooling tower and controls                      | 23  | 23                       | 23                                 |
| 24. Tamper switches for fire protection (sprinkler) system               | 21  | 21                       | 28                                 |
| 25. Flow and/or pressure switches for fire protection (sprinkler) system | 21  | 21                       | 28                                 |
| 26. Fire and jockey pump controllers and automatic transfer switch       | 21  | 21                       | Note 6                             |
| 27. Alarm bells or horns for fire protection (sprinkler) system          | 21  | 21                       | 28                                 |
| 28. Generator (underground) fuel tank                                    | 22  | 22                       | --                                 |
| 29. Generator fuel level indicator                                       | 22  | 22                       | 26                                 |
| 30. Generator fuel piping from tank to generator                         | 22  | 22                       | --                                 |
| 31. Underground fuel tank leak detection and monitoring system           | 22  | 22                       | 22                                 |
| NOTES:   | <p>(1) Power wiring as defined in Section 26 2913 of the specifications shall be provided under Division 26; control wiring as defined in Section 26 2913 of the specifications shall be provided under Division 21/22/23.</p> <p>(2) Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 specifications, Division 26 and Drawings for more specific requirements.</p> <p>(3) For requirements for Magnetic Motor Starters, refer to Section 23 8965 - MOTOR CONTROLLERS.</p> <p>(4) For requirements for Variable Speed (Frequency) AC drives, refer to Section 23 8965 - MOTOR CONTROLLERS.</p> <p>(5) Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.</p> <p>(6) Power wiring from energy source to controllers and automatic transfer switch shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 21, 22 or 23 and conforming to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.</p> <p>(7) Division 26 will provide power to all smoke and combination fire/smoke dampers, and Division 28 will provide control for all such dampers using area smoke detectors.</p> <p>(8) Wiring for sprinkler system controls to be provided by Division 21. Wiring</p> |                          |                                    |

from devices to Fire Alarm System to be provided by Division 28.

- B. CONNECTIONS: Make all connections to controls that are directly attached to ducts, piping and mechanical equipment with flexible connections.
- C. PRECEDENCE
1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.
  2. Precedence for pipe, conduit and duct systems shall be as follows.
    - a. Building lines
    - b. Structural members
    - c. Soil and drain piping
    - d. Vent piping
    - e. Steam piping
    - f. Condensate piping
    - g. Refrigerant piping
    - h. Electrical bus duct
    - i. Supply ductwork
    - j. Return ductwork
    - k. Exhaust ductwork
    - l. Chilled water and heating water piping
    - m. Automatic Fire Protection Sprinkler Piping
    - n. Natural gas piping
    - o. Domestic hot and cold water piping
    - p. Electrical conduit
  3. Lighting Fixtures shall have precedence over air grilles and diffusers.
- D. FINAL INSPECTION AND REPORT

1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical Fire Alarm and Temperature Control Contractors, representatives of mechanical and electrical equipment manufactures whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies that they represent, shall be filed with the Owner and Architect or Engineer.

END OF SECTION 23 0512



SECTION 23 0593 - MECHANICAL TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Adjust and balance Mechanical Water systems
- B. Adjust and balance Mechanical Air systems
- C. Check each piece of operating equipment provided under Division 23.
- D. Provide Balancing Report

1.2 QUALITY ASSURANCE

- A. Independent Subcontractor: All testing, adjusting and balancing shall be performed by Owner provided Testing, Adjusting and Balancing firm that is independent from the HVAC systems installer.
- B. Balancing Work: Under direct supervision of AABC accredited testing organization certified supervisor.

1.3 REFERENCES

- A. Reference Standards: Comply with AABC National Standards for Total System Balance, latest edition.

1.4 SUBMITTALS

- A. Certificate: Before beginning work, submit certification of AABC certified supervisor and AABC firm certification in accordance with Section 23 0010.
- B. Balancing Report: At completion of work, submit balancing report in accordance with Section 23 0010. After adjustments have been made submit three (3) copies of a complete detailed report on mechanical systems and their operation to include:
  - 1. Blackline prints with air openings marked to correspond with data sheets and with thermometer locations clearly marked.
  - 2. Data sheets showing amount of air handled at each opening, instrument used, velocity readings and manufacturer free area factors.
  - 3. Equipment data sheets giving make, size, etc., of fans, motors and drives. Include supply fans, exhaust and recirculating fans.
  - 4. Operating data including fan RPM, measured motor current and voltage BHP and CFM (total).
  - 5. Equipment and operating data at each section of the unit and at the unit connection points including air temperatures entering and leaving coils (maximum air temperature rise), together with corresponding air flow and air pressure drop, water temperatures entering and leaving coils and water pressure drop through coil.

6. Equipment and operating data as required to show performance of H&V units, fan coils, cabinet heaters, unit heaters, temperature control devices, pumps and domestic hot water circulating systems.
7. Static pressure loss across variable air volume boxes and associated reheat coils.
8. Prime source refrigeration equipment operating data at design conditions including temperature measurements, flow conditions and corresponding power consumption.
9. A statement outlining any abnormal or notable conditions not covered in above data. Make special note of any discrepancies between tabulated data and specified conditions.

#### 1.5 PROJECT CONDITIONS

A. Existing Conditions: Verify following conditions before proceeding with work:

1. Installation of the designated system is complete and in full operation.
2. Outside temperature conditions, occupant loads, lighting loads, special equipment requiring extra sensible or ventilation requirements, and solar conditions are within a reasonable range relative to design conditions.

#### PART 2 - PRODUCTS

##### 2.1 INSTRUMENTS

- A. Calibration and maintenance of instruments shall be in accordance with manufacturer's standards and recommendations and requirements of AABC.
- B. Calibration histories for each instrument shall be available for examination.

#### PART 3 - EXECUTION

##### 3.1 INSPECTION

- A. Inspect preceding work in accordance with Section 23 0010 BASIC MECHANICAL REQUIREMENTS.

##### 3.2 PREPARATION

A. Water Systems: Check:

1. Strainers are clean.
2. Automatic control valves operation.
3. Pump rotation.
4. Other conditions as required.

B. Air Systems: Check:

1. Filters are clean.
2. Filter leakage.
3. Damper operation and leakage.
4. Duct leakage.
5. Fan rotation.
6. Equipment vibration.

### 3.3 ADJUSTING AND BALANCING

- A. General: Check, adjust and balance air and water system to meet the design performance and tabulate results on acceptable forms. Minimum data to include amperage, voltage input, and thermal heater capacity of each motor, equipment nameplate data and operating speed, pressure drop across each filter bank, pressure rise across each fan and pump, CFM capacity each outlet, zone and fan, and heating or cooling capacity of each coil or element.
- B. Belt Drives: Adjust so that when the desired speed and belt tension had been established, the variable speed pulley and the belt tension adjustment shall be at approximately the midpoint of their range.
- C. Water Balance and Equipment Test: Include circulating pumps, converters, coils, coolers, chillers, boilers and condensers.
  1. Coordinate water chiller flow balancing with chiller equipment manufacturer and design requirements.
  2. Adjust flow rates for equipment, coils and evaporator for instance, to values on equipment submittals if different from values on Contract Drawings.
  3. Primary-secondary (variable volume systems: Coordinate TAB with Controls Sequence of Operation. Balance systems at design flow then verify that variable flow controls function properly.
  4. Record final measurements for hydronic equipment performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, chiller evaporators and condensers, boilers and for converters. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.
- D. Air Systems:
  1. Adjust dampers for the delivery and distribution of air quantities indicated on the drawings.
  2. Mark balancing device at final setting.
  3. Replacement of adjustable pulleys, installation of additional balancing dampers or pressure taps, required to effect proper air balance shall be furnished and installed by the HVAC Contractor at no additional cost to the Owner.

4. Adjust exhaust and recirculation air systems for air quantities indicated on drawings and to establish the proper relationship between supply and exhaust.
5. Adjust distribution system to obtain uniform space temperature free from objectionable drafts and noise within the capabilities of the system.
6. Acceptable Tolerances: Adjust fan systems, air devices, etc. as follows:
  - a. Supply air fan CFM: -5% to +5% of scheduled
  - b. Return air fan CFM: -5% to +5% of scheduled
  - c. Exhaust air fan CFM: -0% to +10% of scheduled
  - d. Supply air device CFM: -10% to +10% of scheduled
  - e. Return air device CFM: -10% to +10% of scheduled
  - f. Exhaust air device CFM: -0% to +10% of scheduled
  - g. Outside air CFM: -0% to +10% of scheduled
- E. Test Run: In order to determine that the system installation is complete and will operate satisfactorily, make a test run with equipment operating per normal temperature control schedule and sequence. Run test and operate and adjust equipment as may be required during test run.

#### 3.4 COMPLETION SERVICES

- A. Final Check: Make final checks and do any rebalancing as directed.
- B. Report: Submit Balancing Report as specified above.
- C. Acceptance: Final acceptance of the project will not be made until a satisfactory report is received. Owner reserves the right to spot check the report by field verification prior to final acceptance.

END OF SECTION 23 0593

## SECTION 23 0713 - HVAC DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Extent of mechanical insulation required by this section is indicated on Drawings and schedules, and by requirements of this section.
- B. Types of mechanical insulation specified in this section include the following:
  - 1. Ductwork System Insulation:
    - a. Fiberglass.
- C. Refer to Section 23 0529 - MECHANICAL SUPPORTS AND ANCHORS for protection saddles, protection shields, and thermal hanger shields; not work of this section.
- D. Refer to Section 23 3113 - METAL DUCTWORK for duct linings; not work of this section.
- E. Refer to Section 23 0553 - MECHANICAL IDENTIFICATION for installation of identification devices for piping, ductwork, and equipment; not work of this section.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- C. Flame/Smoke Ratings: Provide composite mechanical (insulating material, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
1. Manson.
  2. Knauf Fiber Glass.
  3. Johns Manville Products Corp.
  4. Owens-Corning Fiberglass Corp.
  5. Morgan Thermal Ceramics.
  6. UNIFRAX.
  7. Vesuvins USA
  8. 3M

### 2.2 DUCTWORK INSULATION MATERIALS

- A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Class 1.
- B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, Class B-4.
- C. Jackets for Ductwork Insulation: ASTM C 921, Type I (vapor barrier) for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient.
1. Encase exterior ductwork insulation with aluminum jacket with weatherproof construction, as specified.
- D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

### 2.3 METAL PROTECTIVE JACKET

- A. Sheet aluminum: ASTM B209, 3003 alloy, H-14 temper, and 0.016-in. thick. Provide moisture barrier lining for service temperatures 60°F or less except where applied over a Type I or II jacket. Longitudinal lap shall be at least two inches wide.

- B. Stainless Steel: ASTM A-240, manufactured from T-304 prime grade Stainless Steels, supplied with a regular dull finish for reduced glare and 0.016-in. thick. These alloys shall be of a soft-annealed temper, for ease in fabrication. Jacketing shall be used for insulated piping, tanks, and vessels less than 8 ft. in diameter. Deep corrugated sheets shall be used for diameters greater than 8 ft. Roll jacketing shall be 3/16 in. corrugated.
- C. Fitting covers: Factory fabricated from not lighter than 0.020 in. thick type 3003 sheet aluminum.
- D. Bands: 3/4-in. wide aluminum on maximum 18-in. centers.
- E. Provide metal jackets over insulation as follows:
  - 1. All insulation exposed to outdoor weather.
  - 2. Insulation exposed in building within five (5) ft. of the floor that connect to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling and floor penetrations.
  - 3. A two-inch overlap is required at longitudinal and circumferential joints.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- B. Thickness of insulation shall be as recommended by the manufacturer for the temperatures and pipe sizes involved, and in accordance with standards of T.I.M.A.

#### 3.2 DUCTWORK SYSTEM INSULATION

- A. Insulation Omitted: Do not insulate fibrous glass ductwork or lined ductwork.
- B. Dual Temperature Ductwork:
  - 1. Application Requirements: Insulate the following dual temperature ductwork:
    - a. Hot/cold supply and return ductwork between fan discharge or HVAC unit discharge and room terminal outlets; except omit insulation on return air ductwork located in return air ceiling plenums.
  - 2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
    - a. Rigid Fiberglass: 2 in. thick.
    - b. Flexible Fiberglass: 2 in. thick. Flexible insulation will not be used in machine, fan and equipment rooms.

### 3.3 INSTALLATION OF DUCTWORK INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
- F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.
- G. Corner Angles: Except for oven and hood exhaust duct insulation; install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

### 3.4 EXISTING INSULATION REPAIR

- A. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

### 3.5 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture-saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 23 0713



## SECTION 23 3113 - METAL DUCTWORK

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.
- B. All duct dimensions shown on drawings are net inside clear dimensions.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.
- C. Codes and Standards:
  - 1. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible", First Edition, 2005, for fabrication and installation of metal ductwork.
  - 2. ASHRAE Standards: Comply with ASHRAE Handbook latest edition, HVAC Systems and Equipment volume, Chapter 16 "Duct Construction", for fabrication and installation of metal ductwork.
  - 3. NFPA Compliance: Comply with latest editions of NFPA 90A "Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Installation of Warm Air Heating and Air Conditioning Systems".
- D. Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
- E. Flame/Smoke Ratings: Provide composite mechanical system (insulating material, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
- F. All adhesives, sealants and sealant primers shall contain low VOC (Volatile Organic Compounds), as outlined in the South Coast Air Quality Management District (SCAQMD) Rule #1168.

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.

- B. Shop Drawings: Submit scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials and rigidity are not reduced.
- C. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 01.
- D. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 01.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protection: Protect shop fabricated and factory fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

### PART 2 - PRODUCTS

#### 2.1 DUCTWORK MATERIALS

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials that are free from visual imperfections including pitting, seam marks, roller marks, and stains and discolorations, and other imperfections, including those that would impair painting.
- B. Sheet Metal: All interior ducts shall be constructed with G-60 or better galvanized steel (ASTM A 653/A 653M) LFQ, chem treat. Exterior ductwork or duct exposed to high humidity conditions (i.e. moisture laden exhausts not specified to be stainless steel) shall be G-90 or better galvanized steel LFQ, chem treat.
- C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A167; Type 302, 304, or 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.
- D. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B209, Alloy 3003, Temper H14.
- E. Copper Sheet: Where indicated, provide copper sheet complying with ASTM B370; H00 temper, except where 060 temper is required for unusual forming.

#### 2.2 MISCELLANEOUS DUCTWORK MATERIALS

- A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

- B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° laterals and 45° elbows for branch takeoff connections. Where 90° branches are indicated, provide conical type tees.
- C. Duct Liner:
1. Fibrous glass, complying with Thermal Insulation Manufacturer's Association (TIMA) AHC-101; of thickness indicated with a minimum installed R-Value equal to 6.0 (1-1/2 in. thick minimum), with black-coated, fire-resistant airstream face, with EPA-registered antimicrobial agent.
  2. Flexible Unicellular
    - a. Ductwork Liner: ASTM C534 Type 1, Thickness 1-1/2 : with a minimum R-value equal to R-6.0.
  3. Manufacturers:
    - a. Certainteed "Toughgard".
    - b. Knauf Type "EM".
    - c. Johns Mansville "Permacote Linacoustic".
    - d. Owens-Corning "Aeroflex Plus".
    - e. Manson.
- D. Duct Liner Adhesive:
1. Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation." Application shall conform to Manufacturer's written recommendations for the apparent application.
  2. Adhesives shall be non-inflammable after curing.
  3. Manufacturers:
    - a. Benjamin-Foster.
    - b. Duro Dyne "FPG".
    - c. Kinco 15-137.
    - d. Miracle PF-91.
    - e. Manufacturer of duct liner used for this project.
- E. Duct Liner Fasteners:
1. Comply with SMACNA "Installation Standards for Rectangular Ducts using Flexible Liner", Articles S2.0 through S2.11.

2. Comply with lining details as shown in the referenced SMACNA Section, Figures 2-22 and 2-23.
3. Clinched-pin type fasteners shall be "Grip-Nail", or approved equal.
4. Projecting pins in Type 3 or Type 4 applications shall be clipped off close enough to the retaining disc to provide proper anchoring and to prevent injury to personnel.

F. Duct Sealant:

1. Duct sealer shall be flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall seal out water, air, and moisture. Sealer shall be UL listed and conform to ASTM E 84.
2. Comply with requirements of SMACNA Table 1-2.
3. Manufacturers:
  - a. Benjamin-Foster
  - b. Ductmate - PROseal.
  - c. Duro Dyne S2.
  - d. Hardcast.
  - e. United Sheet Metal.

G. Duct Cement:

1. Non-hardening, non-migrating mastic or liquid elastic sealant of type applicable for fabrication/installation detail as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
2. Comply with requirements of SMACNA Table 1-2.
3. Manufacturers:
  - a. Benjamin-Foster.
  - b. Duro Dyne S2.
  - c. Hardcast.
  - d. United Sheet Metal.

H. Ductwork Support Materials:

1. General:
  - a. Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

- b. Comply with applicable provisions of SMACNA 2005 Standards, Figures 4-1 through 4-8, and Tables 4-1 through 4-3.
2. Except where space is indicated as "High Humidity" area, interior support materials of not less than 1/4 in. diameter or 3/16 in. thickness may be plain (not galvanized).
3. For exposed stainless steel ductwork, provide matching stainless steel support materials. For copper ductwork, provide copper, bronze or brass support materials.
4. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.

## 2.3 FLEXIBLE DUCTS

### A. General:

1. Spiral wound spring steel with flameproof metallized polyester sheathing, complying with UL181.
2. Comply with applicable provisions of SMACNA 2005 Standards, pages 3-13 through 3-20.
3. Installation shall conform to conditions under which UL listing was granted.
4. Flexible Ductwork runouts shall be limited to 6' - 0" extended length.

### B. Insulation:

1. Insulate all flexible ducts, both supply and return, with a minimum R-Value of 6.0, per International Energy Conservation Code – latest edition. Duct shall have a continuous flexible fiberglass sheath with UL approved metallized polyester barrier jacket.

### C. Flexible Ductwork shall be equal to ATCO #036

### D. Manufacturers: Subject to compliance with requirements, provide flexible ducts manufactured by one of the following:

1. ATCO.
2. Thermaflex.
3. Quietflex.

## 2.4 FABRICATION

- A. Shop-fabricate ductwork in 4,8,10, or 12 ft. lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match mark sections for reassembly and coordinated installation.
- B. All duct dimensions shown on drawings are net inside clear dimensions.

- C. Shop-fabricate ductwork of gauges and reinforcement complying with SMACNA 2005 Standards as follows:
  - 1. Rectangular, Steel:
    - a. Tables 1-1 through 1-13.
    - b. Figures 1-2 through 1-18.
    - c. Fittings and Construction, Section II.
  - 2. Rectangular, aluminum: Pages 1-31 through 1-33.
  - 3. Round, Oval and Flexible Duct: Section III.
- D. Shop fabricate ductwork of gauges and reinforcement complying with ASHRAE Handbook, HVAC Systems and Equipment Volume, Chapter 16 "Duct Construction".
- E. Longitudinal Seams: Pittsburgh lock shall be used on all longitudinal seams. All longitudinal seams will be sealed with mastic sealant. Snaplock is not acceptable.
- F. Ductmate or W.D.C.I. proprietary duct connection systems will be acceptable. Duct constructed using these systems will refer to the manufacturers guidelines for sheet gauge, intermediate reinforcement size and spacing, and joint reinforcements.
- G. Formed on flanges (T.D.C./T.D.F./T-25A/T-25B) will only be acceptable when submitted for approval prior to installation of any ductwork. Formed on flanges will be constructed as SMACNA T-25 flanges, whose limits are defined on Page 1.36 of the 2005 SMACNA Manual, First Edition. No other construction pertaining to form on flanges will be acceptable. Formed on flanges shall be acceptable for use on ductwork 42 in. wide or less, with 2 in. positive pressure static or less, and must include the use of corners, bolts and cleat.
- H. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.
- I. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 23 Section "Ductwork Accessories" for accessory requirements.
- J. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners. Comply with previous paragraph 2.2.
- K. Round Duct Joints:
  - 1. 0 in. - 20 in. diameter, interior slip coupling beaded at center, fastened to duct with sealing compound applied continuously around joint before assembling and after fastening. Wrap joints with 3 in. wide duct tape.

2. 21 in. - 72 in. diameter, use 3 piece, gasketed, flanged joints consisting of 2 internal flanges (with integral mastic sealant) split to accommodate minor differences in duct diameter, and one external closure band designed to compress gasketing between internal flanges. Example: Ductmate Spiralmate or equal.
3. 73 in. diameter and up, use companion angle flanged joints only as defined on page 3-6 of the SMACNA Manual. Refer to manual for proper sizing and construction details. Ductwall to be welded longitudinal seams.

L. Pressure Classifications:

1. Static pressure ratings for ductwork systems shall be as noted on the drawings, and/or shall conform to requirements of 2005 SMACNA Standards, Table 1-1.
2. In no case shall the pressure rating of the duct be less than that indicated in Table 1-1 for the apparent duct velocity.
3. Gauges of metal and reinforcing methods shall conform to SMACNA requirements as follows:
  - a. Rectangular Steel: Table 1-3 through 1-13.
  - b. Rectangular Aluminum: Tables 1-14 through 1-16.
  - c. Round, or Flat Oval, Steel: Table 3-2.
  - d. Round Aluminum: Table 3-3.

2.5 FACTORY-FABRICATED DUCTWORK

- A. At Contractor's option, factory-fabricated ductwork sections, fittings, etc., may be substituted for shop-made items.
- B. Factory-fabricated items shall comply in every respect with SMACNA requirements listed previously in this Section, or show proof from a recognized, approved independent laboratory, prior to bidding, that the proposed construction methods produce products that equal, or exceed, the SMACNA 2005 Standards.
- C. Comply with applicable provisions of International Mechanical Code and local amendments.
- D. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork and/or fittings of one of the following:
  1. Ductmate, Inc., Monongahela, PA.
  2. Semco Mfg., Inc.
  3. United Sheet Metal Div., United McGill, Inc.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### 3.2 INSTALLATION OF METAL DUCTWORK

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage for systems rated 3 in. and under; 1% for systems rated over 3 in.) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8 in. misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type that will hold ducts true to shape and to prevent buckling. Support vertical ducts at every floor. Seal all longitudinal and transverse duct joints and seams with non-hardening duct mastic.
- B. All round duct taps shall be conical type. All rectangular duct taps shall have 45° mitered entry per SMACNA.
- C. Inserts: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work.
- D. Field Fabrication: Complete fabrication of work at project as necessary to match shop fabricated work and accommodates installation requirements.
- E. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Where possible, locate insulated ductwork for 1 in. clearance outside of insulation. Limit clearance to 1/2 in. where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with structural members, suspended ceiling, lighting layouts, sprinkler piping, plumbing systems and similar finished work.
- F. Electrical Equipment Spaces: Do not route ductwork through Electric Rooms, transformer vaults, and other electrical equipment spaces and enclosures.
- G. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2 in. Fasten to duct and substrate.
  - 1. Where ducts pass through fire rated floors, walls, or partitions, provide fire stopping between duct and substrate, in accordance with requirements of Division 07 Section "FIRE STOPPING".



- H. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- I. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

### 3.3 INSTALLATION OF DUCT LINER

- A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards, pages 2-25 thru 2-29.
- B. All new transfer ducts shown in the drawings shall be provided with 1-1/2" thick acoustical lining.

### 3.4 INSTALLATION OF FLEXIBLE DUCTS

- A. Maximum Length: For any duct run using flexible ductwork, do not exceed 6 ft. 0 in. extended length.
- B. Installation: Install in accordance with Section III of SMACNA's, HVAC Duct Construction Standards, Metal and Flexible".

### 3.5 FIELD QUALITY CONTROL

- A. Leakage Tests: After installation of each duct system that is constructed for duct classes over 3 in. is completed, test for duct leakage. Repair leaks and repeat tests until total leakage is less than 1% of system design airflow.
- B. The testing shall be performed as follows:
  - 1. Perform testing in accordance with HVAC Air Duct Leakage Test Manual.
  - 2. Use a certified orifice tube for measuring the leakage.
  - 3. Define section of system to be tested and blank off.
  - 4. Determine the percentage of the system being tested.
  - 5. Using that percentage, determine the allowable leakage (CFM) for that section being tested.
  - 6. Pressurize to operating pressure and repair any significant or audible leaks.
  - 7. Re-pressurize and measure leakage.
  - 8. Repeat steps 6 and 7 until the leakage measured is less than the allowable defined in step 5.

3.6 EQUIPMENT CONNECTIONS

- A. General: Connect metal ductwork to equipment as indicated; provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.7 ADJUSTING AND CLEANING

- A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
- B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.
- C. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until time connections are to be completed.
- D. Balancing: Refer to Division 23 Section "TESTING, ADJUSTING AND BALANCING" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION 23 3113

## SECTION 23 3113.19 - DUCTWORK ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.
- B. Types of ductwork accessories required for project include the following:
  - 1. Dampers.
    - a. Low-pressure manual dampers.
  - 2. Turning vanes.
  - 3. Duct hardware.
  - 4. Duct access doors.
- C. Refer to other Division 23 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Codes and Standards:
  - 1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible," 2005 edition.
  - 2. Industry Standards: Comply with latest ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
  - 3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers."
  - 4. NFPA Compliance: Comply with applicable provisions of NFPA 90A latest edition "Installation of Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.
- B. Shop Drawings: Submit manufacturer's assembly type Shop Drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.

- C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and Shop Drawings in maintenance manual; in accordance with requirements of Division 01.

## PART 2 - PRODUCTS

### 2.1 DAMPERS

- A. Low Pressure Manual Dampers: Provide dampers of single blade type or multi blade type, constructed in accordance with SMACNA "HVAC Duct Construction Standards." Each damper shall have an orange ribbon on the handle for identification for balancing.
- B. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
  - 1. Air Balance, Inc.
  - 2. Nailor
  - 3. American Warming & Ventilating, Inc.
  - 4. Louvers & Dampers, Inc.
  - 5. Penn Ventilator Co.
  - 6. Ruskin Mfg. Co.
  - 7. Pottorff

### 2.2 TURNING VANES

- A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".
- B. Turning Vanes: Turning vanes shall be double wall turning vanes fabricated from the same material as the duct. Tab spacing shall be SMACNA standard. Rail systems with non-standard tab spacings shall not be accepted. All tabs shall be used, do not skip tabs. Mounting rails shall have friction insert tabs that align the vanes automatically. Vanes shall be subjected to tensile loading and be capable of supporting 250 lbs when fastened per the manufacturer's instructions.
- C. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of air-foil shaped aluminum extrusions with perforated faces and fiberglass fill.
- D. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:
  - 1. Aero Dyne Co.
  - 2. Anemostat Products Div.; Dynamics Corp. Of America
  - 3. Barber-Colman Co.

4. Ductmate Industries, Inc.
5. Duro Dyne Corp.
6. Hart & Cooley Mfg. Co.
7. Register & Grille Mfg. Co., Inc.

### 2.3 DUCT HARDWARE

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
  1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
  2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12 in. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
- B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
  1. Ventfabrics, Inc.
  2. Young Regulator Co.

### 2.4 DUCT ACCESS DOORS

- A. General: Provide where indicated, duct access doors of size indicated.
- B. Construction: Construct of same or greater gauge as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12 in. high and smaller, 2 handle-type latches for larger doors.
- C. As an option, clamping type access doors may be installed.
- D. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
  1. Air Balance Inc.
  2. Ductmate Industries, Inc.
  3. Duro Dyne Corp.
  4. Register & Grille Mfg. Co., Inc.
  5. Ruskin Mfg. Co.
  6. Ventfabrics, Inc.

7. Zurn Industries, Inc; Air Systems Div.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90° elbows in supply, return and exhaust air systems, and elsewhere as indicated.
- C. Install manual balancing dampers for branch ducts and individual runout ducts as close to the main duct as possible. Each branch duct/individual runout duct shall have a balancing damper. Refer to Mechanical Drawings.
- D. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- E. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 FIELD QUALITY CONTROL

- A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.

3.4 ADJUSTING AND CLEANING

- A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
  - 1. Label access doors in accordance with Division 23 Section "MECHANICAL IDENTIFICATION".
  - 2. Final positioning of manual dampers is specified in Division 23 Section "MECHANICAL TESTING, ADJUSTING AND BALANCING".
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 3113.19

## SECTION 23 3713 - AIR OUTLETS AND INLETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Extent of air outlets and inlets work is indicated by Drawings and schedules, and by requirements of this section.
- B. Types of air outlets and inlets required for project include the following:
  - 1. Ceiling return air grilles.
  - 2. Ceiling air diffusers.

#### 1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
  - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
  - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets", latest edition.
  - 3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
  - 4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
  - 5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
  - 6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
  - 7. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Installation of Air Conditioning and Ventilating Systems" latest edition.

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
  - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
  - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

- B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

#### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

### PART 2 - PRODUCTS

#### 2.1 CEILING AIR DIFFUSERS

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of aluminum or steel, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction Drawings and specifications for types of ceiling systems that will contain each type of ceiling air diffuser. All air devices installed in plaster, gyp board or other hard ceilings or walls shall be provided with a separate mounting frame.
- D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on the air device schedule.
- E. Diffuser Finishes:
  1. Finish shall be per air device schedule in mechanical drawings.
  2. Color selection shall be from manufacturer's standard color chips, unless otherwise noted.
- F. Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:
  1. Metalaire,
  2. Krueger,



3. Nailor,
4. Price,
5. Titus,
6. No Substitutions.

## 2.2 CEILING GRILLE

- A. General: Except as otherwise indicated, provide manufacturer's standard grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide grilles that have, as minimum, noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling construction with accurate fit and adequate support. Refer to general construction Drawings and specifications for types of ceiling construction that will contain each type of ceiling grille.
- D. Types: Provide ceiling grilles of type and with accessories as listed on the air device schedule.
- E. Grille Finishes:
  1. Finish shall be per air device schedule in mechanical drawings.
  2. Color selection shall be from manufacturer's standard color chips, unless otherwise noted.
- F. Manufacturer: Subject to compliance with requirements, provide grilles of one of the following:
  1. Metalaire,
  2. Krueger,
  3. Nailor,
  4. Price,
  5. Titus,
  6. No Substitutions.

## 2.3 OPPOSED BLADE DAMPER

- A. Provide opposed blade dampers for all air devices unless where otherwise indicated on the plans.

- B. Square damper frames shall be heavy duty extruded aluminum and interlocked to prevent corner separation. The blades shall be heavy gauge extruded aluminum, webbed to prevent bowing in large sizes and tapered to ensure tight closure. Blades shall be assembled on 1 in. centers and pivot on nylon bushings to ensure jam-free operation. Square neck opposed blade dampers shall be Metalaire Model D7 or approved equal.
- C. Radial opposed blade dampers shall provide full radial volume control and manufactured of corrosion resistant aluminum material. Radial dampers shall provide durable, jam-free operation for the life of the air handling system. Radial dampers shall have overlapping blade design that insures positive shut-off when required. Radial damper operator shall be accessible through an opening located in the diffuser center cone. Radial opposed blade damper shall be Metalaire Model D3 or approved equal.
- D. Radial slide dampers are not acceptable.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

#### 3.3 SPARE PARTS

- A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION 23 3713