# SECTION 22 0000
# GENERAL PLUMBING REQUIREMENTS

## PART 1 - GENERAL

### 1.01 REFERENCE

A. Work under this Section is subject to requirements of Contract Documents, including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

### 1.02 DESCRIPTION

A. Intent of drawings and Specifications is to obtain complete systems, tested, adjusted, and ready for operation.

B. The terms "provide", "furnish" and "install" as used in Contract Documents shall have the following meanings:
   1. "Provide" or "provided" shall mean "furnish and install".
   2. "Furnish" or "furnished" does not include installation.
   3. "Install" or "installed" does not include furnishing.

C. Include incidental details not usually shown or specified, but necessary for proper installation and operation.

D. Check, verify and coordinate work with drawings and specifications prepared for other trades. Include modifications, relocations or adjustments necessary to complete work or to avoid interference with other trades.

E. Information given herein and on drawings is as exact as could be secured but is not guaranteed. Do not scale drawings for exact dimensions.

F. Where Architectural features govern location of work, refer to architectural drawings.

G. Contractor may install additional piping, fittings and valves, not shown on drawings, for testing purposes or for convenience of installation. Where such materials are installed, they shall comply with specifications and shall be sized to be compatible with system design. Remove such installed materials when they interfere with design conditions or as directed by Architect.

### 1.03 RELATED WORK

A. Utility Services:
   1. Determine utility connection requirements and include in Base Bid all costs to Owner for utility service.
   2. Include costs for temporary service, temporary routing of piping or any other requirements of a temporary nature associated with utility service.

B. Temporary Services:
   1. Division 01 - Temporary Facilities and Controls.

C. Continuity of Service:
   1. No service shall be interrupted or changed without permission from Architect and Owner. Obtain written permission before any work is started.

D. When interruption of services is required, Architect, Owner, and other concerned parties shall be notified and shall determine a time.

E. Demolition:
   1. Division 02 - Selective Demolition.
   2. Perform demolition as required to accomplish new work.
   3. Accomplish work in neat workmanlike manner to minimize interference, annoyance or inconvenience such work might impose on Owner or other Contractors.
   4. Unless otherwise noted, remove from premises materials and equipment removed in demolition work.
   5. Equipment noted to be removed and turned over to Owner, shall be delivered to Owner at place and time Owner designates.

6. Where materials are to be turned over to Owner or reused and installed by Contractor, it shall be Contractor's responsibility to maintain condition of materials and equipment equal to that existing before work began. Repair or replace damaged materials or equipment at no additional cost to Owner.
7. Where demolition work interferes with Owner's use of premises, schedule work through Architect, Owner and with other Contractor to minimize inconvenience to Owner. Architect must approve schedule before Contractor begins such Work.

**1.04 REQUIREMENTS OF REGULATORY AGENCIES**

A. Rules and regulations of Federal, State and Local Authorities and utility companies, in force at time of execution of Contract shall become part of this specification.

**1.05 REFERENCE STANDARDS**

A. Agencies or publications referenced herein refer to the following:
1. AGA - American Gas Association
2. AMCA - Air Movement and Control Association
3. ANSI - American National Standards Institute
4. AHRI - Air-Conditioning, Heating and Refrigeration Institute
5. ASHRAE - American Society of Heating Refrigerating and Air Conditioning Engineers
6. ASPE - American Society of Plumbing Engineers
7. ASSE - American Society of Sanitary Engineering
8. AWS - American Welding Society
9. AWWA - American Water Works Association
10. ASME - American Society of Mechanical Engineers
11. ASTM - American Society for Testing and Materials
12. CDA - Copper Development Association
13. CISPI - Cast Iron Soil Pipe Institute
14. FMG - FM Global
15. FS - Federal Specifications
16. IEEE - Institute of Electrical and Electronics Engineers
17. MCA - Mechanical Contractors Association
18. MSS - Manufacturers Standardization Society
19. NEC - National Electrical Code
20. NEMA - National Electrical Manufacturers Association
21. NFPA - National Fire Protection Association
22. NIST - National Institute of Standards & Technology
23. NSF - National Sanitation Foundation
24. NSPI - National Spa and Pool Institute
25. OSHA - Occupational Safety and Health Administration
26. PDI - Plumbing and Drainage Institute
27. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
28. UL - Underwriters Laboratories, Inc.
29. WQA - Water Quality Association

B. Work shall be in accordance with latest edition of codes, standards or specifications unless noted otherwise.

**1.06 SUBMITTALS**

A. Product Data:
1. Refer to Division 01 - Submittal Procedures.
2. Submit for equipment and systems as requested in the respective specification sections.
3. Unless otherwise indicated submittals shall be in electronic Portable Document Format (pdf) and bookmarks shall be included to facilitate navigation through submittal documentation.
4. Specifically mark general catalog sheets and drawings to indicate specific items submitted and its correlation to specific designation for product in drawings.

5. Specifically indicate proper identification of equipment by name and/or number, as indicated in specification and shown on drawings.
6. When manufacturer's reference numbers are different from those specified, provide correct cross-reference numbers for each item. Clearly mark and note submittals accordingly.
7. Submit complete record of required components when fixtures, equipment and items specified include accessories, parts and additional items under one designation.
8. Include composite wiring diagrams for electrically powered equipment and devices.
9. Where submittals cover products containing non-metallic materials, include "Material Safety Data Sheet" (MSDS) from manufacturer stating physical and chemical properties of components and precautionary considerations required.
10. Submit shop drawings or product data as soon as practicable after signing contracts. Submittals must be approved before installation of materials and equipment.
11. Submittals that are not complete, not permanent or not properly checked by Contractor will be returned without review.

B. Certificates and Inspections:
1. Obtain and pay for inspections required by authorities having jurisdiction and deliver certificates approving installations to Owner unless otherwise directed.

C. Operation and Maintenance Manuals:
1. Refer to Division 01 - Operation and Maintenance Data.
2. Upon completion of Work but before final acceptance of system, submit to Architect for approval, electronic version of operation and maintenance manuals in pdf format. 2" Electronic file shall contain bookmarks for each submittal contained in manual.
3. Organize manuals by specification section number and furnish table of contents and tabs for each piece of equipment or system.
4. Fire protection system shall be separately bound.
5. Manuals shall include the following:
    a. Copies of Shop Drawings and Product Data
    b. Manufacturer's operating and maintenance instructions. Include parts lists of items or equipment, with component exploded views and part numbers. Where manufacturer's data includes several types or models, designate applicable type or model.
    c. Electronic versions of O&M data with exploded parts lists where available
    d. Phone numbers and addresses of local parts suppliers and service companies
    e. Internet/WEB page addresses where applicable
    f. Wiring diagrams
    g. Startup and shutdown procedures
    h. Composite electrical diagrams
    i. Flow diagrams
    j. Lubrication instructions
    k. Factory and field test records (Refer to Test and Balancing in Part 3 of this section.)
    l. Air and water balance reports
    m. Valve identification charts as specified in Section 22 0553 - Plumbing Systems Identification
    n. Access panel identification charts as specified in Section 22 0553 - Plumbing Systems Identification
    o. Additional information, diagrams or explanations as designated under respective equipment or systems specification sections.
6. Instruct Owner's Representative in operation and maintenance of equipment. Instruction shall include complete operating cycle on all apparatus.
7. Furnish O&M Manuals and instructions to Owner prior to request for final payment.

D. Record Documents:
1. Refer to General Conditions of Contract, and Division 01 - Project Record Documents. Prepare complete set of record drawings in accordance with Division 01.
2. Use designated set of prints of Contract Documents as prepared by Architect to mark-up for record drawing purposes.

**1.07 JOB CONDITIONS**

A. Building Access:
   1. Arrange for necessary openings in building to allow for admittance of all apparatus.

B. Electrical Coordination:
   1. Contractor shall provide the following items as specified under their respective Division(s):
      a. Motors
      b. Electrically powered equipment
      c. Electrically controlled equipment
      d. Starters, where specified
      e. Variable frequency drives, where specified
      f. Control devices, where specified
      g. Temperature Control wiring
      h. Wiring diagrams to Electrical Contractor for apparatus indicating external connection and internal controls.
      i. Disconnect devices furnished with units (VFDs, chillers, prepackaged control devices, etc.)
         1) Devices shall have an interrupting rating not less than that of the upstream overcurrent device as shown on electrical drawings.
         2) Equipment electrical connection points shall be labeled with listed electrical short circuit current rating (SCCR). SCCR shall not be less than interrupting rating of upstream overcurrent device as shown on electrical drawings. SCCR shall be marked on equipment control enclosure in accordance with UL 508, or other acceptable, accredited third-party testing agency standards.
   2. Electrical Contractor will provide the following devices required for control of motors or electrical equipment, unless noted otherwise.
      a. Starters
      b. Disconnect devices
      c. Control devices:
         1) Pushbuttons
         2) Pilot lights
         3) Contacts
      d. Conduit, boxes and wiring for power wiring.
      e. Conduit, boxes and wiring for control wiring, except temperature control wiring.
   3. Electrical Contractor will make connections, from power source to starter or variable frequency drive and from starter or variable frequency drive, where specified, to motor.
   4. Where starters or other similar control devices are furnished by this Contractor, they shall be installed by this Contractor and wired by Electrical Contractor.
   5. Should any change in size, hp rating, voltage, or means of control be made to any motor or other electrical equipment after Contracts are awarded, this Contractor shall immediately notify Electrical Contractor of change. Additional costs due to these changes shall be responsibility of this Contractor.

C. Cutting and Patching:
   1. Refer to General Conditions of the Contract, and Division 01 - Cutting and Patching.
   2. Perform cutting and patching required for complete installation of systems, unless otherwise noted. Patch and restore work cut or damaged to original condition. This includes openings remaining from removal or relocation of existing system components.
   3. Provide materials required for patching unless otherwise noted.
   4. Do not pierce beams or columns without permission of Architect and then only as directed. If openings are required through walls or floors where no sleeve has been provided, hole shall be core drilled to avoid unnecessary damage and structural weakening.
   5. Where alterations disturb lawns, paving, walks, etc., replace, repair or refinish surfaces to condition existing prior to commencement of work. This may include areas beyond construction limits.

D. Housekeeping and Cleanup:
   1. Refer to Division 01 - Closeout Procedures.
   2. As work progresses and/or as directed by Architect, periodically remove waste materials from building and leave area of work broom clean. Upon completion of Work, remove tools, scaffolding, broken and waste materials, etc., from site.

**1.08 WARRANTY**

A. Refer to Division 01 for general warranty requirements.

B. Refer to technical sections for warranty requirement for each system.
   1. Where no warranty requirements are called out, warrant equipment, materials, and workmanship to be free from defect for 1 year after acceptance by Owner.

C. Warrant that systems will operate without objectionable noise, vibration and uncontrolled expansion.

D. Repair, replace or alter systems or parts of systems found defective at no extra cost to Owner.

E. In any case, wherein fulfilling requirements of any warranty, if this Contractor disturbs any work warranted under another contract, this Contractor shall restore such disturbed work to condition satisfactory to Architect and warranty such restored work to same extent as it was warranted under such other contract.

F. Warranty shall include labor, materials, and travel time.

**PART 2 - PRODUCTS**

**2.01 PRODUCT SUBSTITUTIONS**

A. Refer to Division 01 - Product Requirements.

**PART 3 - EXECUTION**

**3.01 GENERAL**

A. Verify elevations and dimensions prior to installation of materials.

B. Size of pipe segments shall be equal to largest pipe segment to which it is connected where size for pipes are not indicated. Transition to smaller size shall occur on side of fitting where smaller size is indicated.

**3.02 DELIVERY, STORAGE, HANDLING, AND PROTECTION**

A. Deliver products to the site under provisions of Division 01.

B. Store and protect products under provisions of Division 01.

C. Store in clean, dry space.

D. Maintain factory wrapping or provide cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with manufacturer’s written instructions.

F. Handle carefully to avoid damage to components, enclosure, and finish. Lift only with lugs provided for the purpose.

G. Provide supplemental heat if required to prevent equipment from moisture contamination.

H. Protect openings in equipment until connected to system to prevent entry of foreign materials.

**3.03 EXCAVATION AND BACKFILL**

A. Provide excavation and backfill for underground work unless otherwise indicated. Blasting is not allowed on this project without written permission of Architect and Owner.

B. Backfill trenches beneath concrete floor and stair slabs within building and beneath concrete slabs, walks, stairs and drives at exterior of building with gravel fill and compact to same density as surrounding area.

**3.04 FLOOR, WALL, ROOF AND CEILING OPENINGS**

A. Coordinate location of openings, chases, furred spaces, etc., with appropriate Contractors. Provide sleeves and inserts that are to be built into structure during progress of construction.

B. Remove temporary sleeves, if used to form openings, prior to installation of permanent materials. Utilize minimum 24 ga galvanized sheet metal for permanent sleeves unless otherwise noted.

C. Provide Schedule 40 carbon steel pipe with integral water stop and 2" extension above floor slab for steel sleeves required in interior floor slabs.

D. Submit to Structural Engineer for review and approval size and location of core-drilled holes prior to execution.

E. Submit product data and installation details for penetrations of building structure. Include schedule indicating penetrating materials (metal pipe, plastic pipe, conduit, etc.), sizes of each, opening sizes and sealant products intended for use.

F. Where penetrations of fire-rated assemblies are involved, seal penetrations with appropriate firestopping systems as specified in Division 07 Thermal and Moisture Protection.

G. Submit complete penetration layout drawings showing openings in building structural members including floor slabs, bearing walls, shear walls, etc. Indicate and locate, by dimension, all required openings, including those sleeved, formed or core drilled. Drawings shall be approved prior to preparing openings in structural member.

H. Provide minimum 1" clearance around penetration openings intended for pipe. Where fire resistant penetrations are required, size openings in accordance with written recommendations of firestopping systems manufacturer.

I. Openings for underground pipes passing through foundations or under footings shall have minimum clearance of 1-1/2" to concrete. Do not disturb footing bearing soil.

J. Openings for underground pipe passing through on grade concrete slabs shall have minimum 1/4” clearance to concrete. Seal openings with urethane caulk.

K. Openings for insulated piping shall be sized based on outside diameter of insulation when it is specified or detailed to be continuous through opening.

L. Seal non fire-rated floor penetrations with non-shrink grout equal to Embeco by Master Builders, or urethane caulk, as appropriate.

M. Seal non fire-rated wall openings with urethane caulk.

N. Where penetrations occur through exterior walls into building spaces, use sleeves with integral water stop. For piping having outer surface temperature less than 150°F, use plastic (HDPE) sleeves, similar to PSI Link-Seal Model CS, rated to 150°F. For piping having outer surface temperature 150°F or higher, or where steel sleeves are shown or walls are fire rated, use steel sleeves with hot dip galvanizing, similar to PSI Link-Seal Model WS. Seal annular space between sleeves and pipe with Thunderline "Link-Seal" modular wall and casing seals, or sealing system by another manufacturer approved as equal by Architect. Where "Link-Seals" are used with insulated pipe, insulation shall be butted against seals on both sides. Sealing system shall utilize Type 316 stainless steel bolts, washers and nuts.

O. In lieu of openings as specified herein penetration systems as manufactured by Pro Set may be used, including sleeve couplings and plug.

P. If total ProSet system with Water Guard “CR” is used, opening shall not need additional water proofing or riser clamps.

Q. Finish and trim penetrations as shown on details and as specified.

R. Provide chrome or nickel plated escutcheons where piping passes through walls, floors or ceilings and is exposed in finished areas. Size escutcheons to fit pipe and pipe covering for finished appearance. Finished areas shall not include mechanical/electrical rooms, janitors' closets, storage rooms, etc., unless suspended ceilings are specified.

**3.05 EQUIPMENT SHUTOFF VALVES**

A. Provide shutoff valves at equipment connected to piping system. Refer to valve section or system section for requirements of valve type.

### 3.06 EQUIPMENT ACCESS

A. Install piping, conduit and accessories to permit access to equipment for maintenance. Relocate piping, equipment or accessories to provide access at no additional cost to Owner.

B. Install equipment with sufficient maintenance space for removal, repair or changes to equipment. Provide ready accessibility to equipment without moving other future or installed equipment (including light fixtures) or system components.

C. Access doors in walls, chases, or inaccessible ceilings will be provided under Division 08 - Access Doors and Frames, unless otherwise indicated. Access doors for valves, shock stops or other equipment shall provide access for servicing, repairs, and/or maintenance.

D. Provide necessary coordination and information to the Trade Contractor under Division 08 - Access Doors and Frames. This information shall include required locations, sizes, and rough-in dimensions.

E. Provide access doors in walls, chases or above inaccessible ceilings for valves, shock stops, unions or equipment/devices requiring access for servicing, repairs or maintenance, unless otherwise noted. Access frames and doors shall be as manufactured by Milcor, Incorporated, or similar, of style applicable to surface. Provide access doors used in fire rated construction with UL (FRD) Label. Provide steel, prime coated access doors unless otherwise specified. Provide stainless steel doors in ceramic tile walls, toilet rooms, locker rooms and in areas subject to excessive moisture. Provide access doors of sufficient size to allow complete maintenance. Coordinate location of access doors with General Contractor and rough-in equipment accordingly.

### 3.07 EQUIPMENT SUPPORTS

A. Provide supporting steel not indicated on drawings as required for installation of equipment and materials including angles, channels, beams, hangers, etc.

### 3.08 SUPPORT PROTECTION

A. In occupied areas, mechanical rooms and areas requiring normal maintenance access, guard certain equipment to protect personnel from injury.

B. Provide minimum 1/2" thick Armstrong Armaflex insulation or similar product applied with Armstrong 520 adhesive on lower edges of equipment and mechanical supporting devices suspended less than 7 ft above floors, platforms or catwalks in these areas.

C. Protect threaded rod or bolts at supporting elements as described above. Trim threaded rod or bolts such that they do not extend beyond supporting element and devices.

### 3.09 MECHANICAL SYSTEMS IDENTIFICATION

A. Refer to Section 22 0553 - Plumbing Systems Identification

### 3.10 TEST AND BALANCING

A. Tests for equipment, ductwork and piping systems shall be performed as specified in their respective specification sections in accordance with technical requirements noted.

B. Provide equipment required for testing, including fittings for additional openings required for test apparatus.

C. All ductwork and piping inspections and testing shall be successfully completed and approved before application of covering materials.

D. When equipment or systems fail to meet minimum test requirements, replace or repair defective work or material as necessary and repeat inspection and test until equipment or systems meet test requirements. Make repairs with new materials. Caulking of holes or threaded joints is not allowed.

E. Contractor is responsible for certifying in writing equipment and system test results. Certification shall include identification of portion of system tested, date, time, test criteria, test medium and pressure used, duration of test and name and title of person signing test certification document.

F. Maintain copies of certified test results, including those for any failed tests, at project site. At completion of project, include copies of test records and certifications in O&M Manuals.

G. Balancing of various systems shall be in accordance with associated specification sections in addition to requirements noted herein.

H. If exterior domestic water supply also serves as source for fire protection systems, either exterior or interior or both, it shall be tested according to fire protection system requirements as specified in applicable Specification Section.

**3.11 START-UP**

A. Systems and equipment shall be started, tested, adjusted and turned over to Owner ready for operation. This includes "Owner-Furnished, Contractor-Installed" (OFCI) and "Contractor-Furnished, Contractor-Installed" (CFCI) systems and equipment.

B. Follow manufacturer's pre-start-up check-out, start-up, trouble shooting and adjustment procedures.

C. Contractor shall provide services of technician/mechanic knowledgeable in start-up and check-out of types of systems and equipment on project.

D. Provide start-up services by manufacturer's representative where specified or where Contractor does not have qualified personnel.

E. Coordinate start-up with all trades.

**3.12 LUBRICATION**

A. Upon completion of work and before turning over to Owner, clean and lubricate bearings except sealed and permanently lubricated bearings. Use only lubricant recommended by manufacturer.

B. Contractor is responsible for maintaining lubrication of mechanical equipment under this Contract until Work is accepted by Owner.

**3.13 CLEANING**

A. Clean systems after installation is complete.

B. Clean piping and ductwork both internally and externally to remove dirt, plaster dust or other foreign materials. When external surfaces of piping are rusted, clean and restore surface to original condition.

C. Clean pipeline strainers to restore them to original condition or replace with new strainer elements.

D. Clean equipment and plumbing fixtures as recommended by manufacturers.

E. Replace throwaway or replaceable media air filters used during construction period with new filters or new filter media after construction has been completed and before building is turned over to Owner. Filter replacement shall be as hereinafter specified.

F. Blow and clean dirt, plaster dust and other foreign matter from coils, terminal devices, diffusers, registers and grilles.

G. Thoroughly clean equipment of stains, paint spots, dirt and dust. Remove temporary labels not used for instruction or operation.

H. Provide additional cleaning of individual piping systems and apparatus as hereinafter specified.

**END OF SECTION**

# SECTION 22 0529
# PLUMBING PIPING AND EQUIPMENT SUPPORTING DEVICES

## PART 1 - GENERAL

### 1.01 RELATED WORK

A. Section 22 0700 - Plumbing Insulation

### 1.02 REFERENCE

A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

### 1.03 DESCRIPTION

A. Provide all supporting devices not provided as part of building structure or indicated on structural drawings or structural details, as specified and as required for proper supporting, anchoring, and guiding of piping, equipment, materials and systems.

B. Support for all conditions of operation, including variations in installed and operating weight of equipment, piping and ductwork, to prevent excess stress and allow for proper expansion and contraction.

C. Support of fire protection pipe shall comply with NFPA 13 Standard for the Installation of Sprinkler Systems, 2019 Edition.

### 1.04 SUBMITTALS

A. Product Data for each piping system for all pipe sizes and all applicable equipment including the following:
   1. Manufacturer's name
   2. Model numbers
   3. Materials of construction and load ratings lbs.
   4. Schedule of hangers and support devices with pipe support spacing
   5. Insulated pipe supports along with application chart or table including pipe support spacing.
   6. Insulation protection saddles and weight bearing insulation table
   7. Details and calculations for sizing supplementary steel utilized for trapeze or specially designed supports
   8. Structural attachments, inserts, and concrete anchors. Submit ICC-ES Evaluation Report for each type of anchor.
   9. Calculations and drawings for concrete inserts and anchors for each application
   10. Drawings showing specific locations of any weld attachments to structure, including weight supported by such attachments
   11. Drawings showing specific locations of any suspended loads which exceed 100 lbs within joist chord panel to be attached to open web steel joist structural members. Include weight supported by such attachments. (Panel is length of chord between two adjacent diagonal web members at point of connection to chord.)
   12. Equipment mounting devices
   13. Pipe guides and anchors
   14. All other appropriate data

B. Submittals in PDF format shall be organized using PDF bookmarks per detailed instructions on assembling submittal packages identified under Submittal Requirements section of 22 0000 - General Plumbing Requirements.

### 1.05 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall conform to the latest requirements of ANSI B31/ASME B31.1 Code for Pressure Piping and MSS Standard Practice SP-58-2018 (Pipe Hangers and Supports Materials, Design, Manufacture, Selection, Application, and Installation), except as supplemented or modified herein.

B. Support materials shall be steel or stainless steel unless specifically indicated.

C. Support devices shall be factory fabricated and have published load ratings.

D. Unless otherwise indicated, design supports, anchors, and related components with safety factor in accordance with AISC Manual of Steel Construction, but not less than 2.0.

E. Determine maximum deflection using the following equation.

F. Maximum deflection of support members, including trapeze supports, shall be in accordance with the following equation, but shall not exceed 0.3":

D = L/240

Where D = Max deflection in "

L = Support member length in "

G. Unless otherwise indicated, hangers, support devices and hardware shall be steel and shall have factory standard black, primed, galvanized or electroplated finish for indoor application, and hot-dipped galvanized finish for outdoor application and corrosive atmospheres. Coat cut edges, welds or any damaged finish with galvanized paint.

1. Corrosive atmospheres include the following locations:
   a. Exterior locations
   b. Chemical storage and hazardous waste storage rooms
   c. Food service/kitchen areas
   d. Locker/shower rooms
   e. Meter pits
   f. Utility tunnels
   g. Cage wash room (dirty and clean)
   h. Sterilizer/autoclave room

H. Materials in contact with pipe shall be galvanically compatible with piping material to eliminate conductive path for galvanic corrosion. Provide galvanic separation, such as nonmetallic coating or inserts between piping and metallic supports where piping and support materials have galvanic potential. Pipe insulation is acceptable galvanic separation. Galvanic potential shall be determined by table below:

| | **Galvanized Steel** | **Carbon Steel** | **Stainless Steel (Type 304 or 316)** | **Copper Brass Bronze** |
|---|---|---|---|---|
| Copper, Brass, Bronze | Yes | Yes | No | NA |
| Stainless Steel (Type 304 or 316) | Yes<br>Note (1) | Yes<br>Note (1) | NA | |
| Carbon Steel | No | NA | | |
| Galvanized Steel | NA | | | |

(1) Required where stainless steel surface area near interface is equal or greater than steel surface area

I. Unless otherwise indicated, steel support devices exposed to ventilation air stream shall be stainless steel or steel with either galvanized finish or paint finish. Paint type shall be approved by Architect/Engineer.

J. This Contractor is responsible for proper placement and sizing of supporting devices to accommodate insulation thickness and pitching of pipe. Coordinate with Contractor performing work specified in Section 22 0700 - Plumbing Insulation.

K. In addition to hangers specified in this Section, piping connected to pumps, compressors, and similar rotating or reciprocating equipment shall have vibration isolation hangers or supports for specified distance from such equipment. Refer to Section 23 0550 - Vibration Isolation for required distance.

L. Where piping can be conveniently grouped to allow trapeze type supports, supporting steel shall be by means of standard structural shapes.

M. Hangers and rods shall be plumb when pipelines are at their normal operating temperatures.

N. Unless otherwise indicated, continuous insert channels are not allowed.

O. Punching, drilling, or welding of building structural steel is not allowed unless approved by Structural Engineer.

P. Refer to Structural Documents and ICC-ES Evaluation Report for application of concrete inserts and concrete anchors.

Q. Lateral braces shall be designed and detailed to apply loads as directly as possible to structural floor slabs, roof decks, or other building lateral elements. Braces shall not be applied to bottom flanges of steel beams or bottom chords of open web steel joists.

R. Coordinate with Contractor for any proposed weld attachments to building structure. This may result in use of welding codes or standards, which may apply to "structural work". and may necessitate repair of fireproofing and/or extension of fireproofing to support members. Execution of this work may be assigned to General Trades responsible for building structural steel. Cost for this work, however, will remain the responsibility of this Contractor.

S. Top or bottom chords of open web steel joists may be used to support loads, provided total load within panel does not exceed 100 lbs and load is placed concentric to joist. (Panel is length of chord between two adjacent diagonal web members at point of connection to chord).

T. Where fire rated fiberglass products are used for channel and support devices, the following properties shall apply:
   1. Flame Spread Properties
      a. Polyester Fiberglass (PF) Class 1 ASTM E84
      b. Vinylester Fiberglass (VF) Class 1 ASTM E84

## PART 2 - PRODUCTS

### 2.01 STRUCTURAL SUPPORTS

A. Unless specifically indicated on structural drawings, design and provide all supporting devices including miscellaneous steel (angles, channels, beams, etc.), required for proper support of piping, equipment and materials.

### 2.02 PIPE HANGERS AND SUPPORTS (METALLIC)

A. Manufacturers: Anvil, Erico, Tolco, PHD, National Pipe Hanger Corporation, or B-Line, equal to Anvil figures listed. Corresponding MSS Type is indicated where applicable.

B. Clevis and Roller Type Hangers:

| System | Pipe Size | Clevis | Roller |
|---|---|---|---|
| Hot Pipes with Insulation (105°F and above) | and 2" and smaller | 65 (MSS Type-1), 260 (MSS Type-1) | --- |
| | | | |
| | 2-1/2" to 6" | --- | 171 (MSS Type-41), 181 (MSS Type-43) |
| | | | |
| | | | |
| | 8" and larger | --- | 171 (MSS Type-41) |

| | | | |
|---|---|---|---|
| Ambient Bare Pipes (61°F to 104°F) | 2" and smaller | 65 (MSS Type-1), 260 (MSS Type-1) | --- |
| | 2-1/2" and larger | 260 (MSS Type-1), 216 (MSS Type-4) | --- |
| Cold Pipes with Insulation (33°F to 60°F) | 2" and smaller | 65 (MSS Type-1), 260 (MSS Type-1) | --- |
| | 2-1/2" and larger | 260 (MSS Type-1), 295 (MSS Type-1) | --- |
| Cold Pipes with Insulation 32°F and below) | 2" and smaller | 65 (MSS Type-1), 260 (MSS Type-1) | --- |
| | 2-1/2" to 6" | 260 (MSS Type-1) | 171 (MSS Type-41), 181 (MSS Type-43) |
| | 8" and larger | --- | 171 (MSS Type-41) |

1. For pipe size 2-1/2" and larger, where there is transverse movement at support points due to thermal expansion/contraction, clevis type hangers similar to Anvil Figure 260 (MSS Type-1) may be used if vertical angle of hanger rod is less than 4°.

C. Flat Surfaces (Trapeze, Rack Type):
1. Use structural steel members such as struts, angles, channels and beams to support pipes as required. Select members properly for pipe support types and loading conditions. Refer to Part 1 for design criteria. Submit support details with type of members selected and load calculations. Provide straps, clamps, rollers or slides indicated below at each support point.

| System | Pipe Size | Straps or Clamps | Rollers | Slides |
|---|---|---|---|---|
| Hot Pipes with Insulation (105°F and above) | 2" and smaller | Anvil Klo-Shure | --- | |
| | 2-1/2" and larger | --- | 171 or 177(MSS Type-41), 271 (MSS Type-45), 274 (MSS Type-46) | 257 or 436 with 212 or 432 clamps, Type 1, 2 or 3 for longitudinal movement only. Type 4, 5 or 6 for both longitudinal and transverse movement |
| Ambient Bare Steel Pipes (61°F to 104°F) | 6" and smaller<br>8" and larger | B-Line BVT<br>Unistrut<br>Cush-a-Clamp | --- | --- |
| Ambient Bare (Copper) pipes (61°F to104°F) | all sizes | B-Line BVT<br>Unistrut<br>Cush-a – Clump | | |
| Cold Pipes with Insulation (33°F | 10" and smaller | 137 (MSS Type-24) | --- | --- |

| | | | | |
|---|---|---|---|---|
| to 60°F) | 12" and larger | 432 | 171 or 177 (MSS Type-41), 271 (MSS Type-45), 274 (MSS Type-46) | 257 or 436 with 212 or 432 clamps, Type 1, 2 or 3 for longitudinal movement only and Type 4, 5 or 6 for both longitudinal and transverse movement. |
| Cold Pipes with Insulation (32°F to 59°F) and below) | 2" and smaller | 243, 244 | --- | --- |
| | 2-1/2" and larger | --- | 171 or 177 (MSS Type-41), 271 (MSS Type-45), 274 (MSS Type-46) | 257 or 436 with 212 or 432 clamps, Type 1, 2 or 3 for longitudinal movement only and Type 4, 5 or 6 for both longitudinal and transverse movement. |

D. Vertical Pipe within Wall Cavities
   1. Use clamps, straps, inserts or channels to support pipes concealed in wall cavity. Select members for pipe support types and loading conditions. Refer to Part 1 for design criteria.
   2. Provide clamps, strut channels, insulated supports, or brackets and inserts equal to manufacturer indicated below:

| System | Pipe Size | Supports | Clamps, Brackets/Inserts | Pre-insulated Inserts |
|---|---|---|---|---|
| Hot and Cold Pipes with Insulation | All sizes | Anvil 137 | HoldRite 260 series with SBIS bracket, Anvil 262 | Anvil Klo-Sure, Pipe Shields A2000 |
| Ambient Bare Pipes (61°F to 104 °F | All sizes | Anvil 137, 138-R | Anvil 262 | --- |
| Ambient Bare Copper Pipes (61°F to 104°F) | All sizes | Anvil CT-138R | HoldRite 260 series with SBIS bracket | --- |

## 2.03 INSULATION PROTECTION SHIELDS

A. Anvil Fig. 167 (MSS Type-40) constructed of galvanized carbon steel. Per the latest edition of Standard MSS SP-58, select shield to accommodate outer diameter of insulation. Shield length and gauge for insulation compression strength not less than 15 psi, shall be as follows:

| Pipe Size | Length | Gauge |
|---|---|---|
| 1/4" thru 3" | 12" | 18 |
| 4" | 12" | 16 |
| 5" and 6" | 18" | 16 |
| 8" thru 14" | 24" | 14 |
| 16" thru 24" | 24" | 12 |

## 2.04 INSULATED PIPE SUPPORTS

A. Description:
   1. Products designed specifically for weight-bearing support of insulated pipes. Apply products in accordance with manufacturer's recommendations and requirements indicated below:
   2. Refer to PART 3 – EXECUTION for application of Type A, Type B, and Type C Insulated Pipe Supports specified below.

B. General:
   1. Supports shall be designed and rated for applied load, including weight of pipe, fluid, insulation, and any other imposed loads, with minimum 1.5 safety factor. Ratings shall be published by manufacturer and included in submittals.
   2. High compressive strength inserts utilized to support loads shall encircle circumference of pipe. Block-style inserts are not allowed.
   3. Supports shall be suitable for hot or cold pipe service as applicable.
   4. Submit chart or table indicating selected model along with pipe sizes, rated loads, support device types and support spacing for each piping system.
   5. Pipe support spacing shall be in accordance with manufacturer's recommendations but shall not exceed maximum spacing indicated under Hanger and Support Spacing in Part 3 of this Section.
   6. Testing of insulation for compressive strength properties shall comply with ASTM D1621.
   7. Insulation thickness shall match adjacent pipe insulation thickness.
   8. Integrity of vapor barrier jacket shall be maintained continuously through support assembly.
   9. Insulated pipe support style shall be specifically selected for the application and shall consider the following criteria at minimum:
      a. Vertical, lateral and axial support design load limits.
      b. Vertical, lateral, and axial support design travel limits
      c. Test or pre-operational loads that may exceed normal operating conditions
      d. Material for any items that will be welded directly to the pipe
      e. Temperature at support steel
   10. All steel components shall have corrosion protection coating consisting of hot-dip galvanizing or zinc-rich primer coating.

C. Type A Insulated Pipe Supports (Light Duty)
   1. Description:
      a. Pipe insulation specified in Section 22 0700 - Plumbing Insulation with insulation protection shields specified in this Section. Weight-bearing inserts are not required.
      b. Type B or Type C supports may be utilized in lieu of Type A supports.

D. Type B Insulated Pipe Supports (Standard Duty):
   1. Manufacturers:
      a. SNAPP ITZ insulation inserts by KB Enterprise, Tru-Balance Insulated Saddles by Buckaroos, Inc., Value Engineered Products, or approved equal.
      b. Klo-Shure insulation couplings may be used for cold pipes insulated with elastomeric insulation. Mount shall be 7 Series Strup Mount with metal clamps or Clevis System for clevis hangers.
      c. Type C supports may be utilized in lieu of Type B supports"
      d. Contractor may propose to utilize contractor-fabricated insulated pipe supports in lieu of manufactured Type B Supports. Use of contractor-fabricated assemblies is subject to approval of appropriate submittal data. Submit detail drawings of assemblies and product data showing equivalency to specified manufactured products for approval.
   2. Description:
      a. Load-rated assembly consisting of high compressive strength insulation material completely encompassing circumference of pipe, vapor barrier jacket, and insulation protection shield.
      b. Insulation protection shield shall conform to ANSI/MSS SP-58. Shield shall be G90 galvanized steel and shall span full circumference of pipe insulation. Half-shields spanning lower 180° degrees arc of insulation outer circumference will be acceptable when used with clevis hangers.

c. Axial length of insulation material shall be not less than 9" or 2" longer than insulation protection shields (1" minimum on each end), whichever is longer.

3. Insulation Materials:
   a. Hot Pipes 105°F to 250°F:
      1) Rigid closed cell, polyisocyanurate or phenolic insulation by ITW, Resolco, or Kingspan. Minimum compressive strength shall be 100 psi.
   b. Hot Pipes 251°F to 1200°F:
      1) High-density calcium silicate insulation similar to Johns Manville Thermo-12 Gold. Minimum compressive strength shall be 100 psi.
   c. Cold Pipes 60°F and below:
      1) Rigid closed cell, polyisocyanurate, phenolic insulation similar to ITW, Resolco, Kingspan, or cellular glass insulation similar to Pittsburgh Corning Foamglas.

E. Type C Insulated Pipe Supports (Heavy Duty):
1. Manufacturers:
   a. Pipe Shields, Inc., Bergen Pipe Supports, or Rilco equal to Pipe Shields models listed.
   b. Unless otherwise indicated, pre-insulated pipe supports shall be as indicated in the following schedule. Model numbers are based on Pipe Shields, Inc.
      1) Pipe supported on hangers: Model “A” Series and Model “D” Series
      2) Pipe supported on flat surfaces and pipe rollers: Models “A” Series
      3) Pipe supported on slides: Model "B" Series with lateral guide or restraint
      4) Pipe anchors: Model “C” Series
   c. Contractor may propose to utilize contractor-fabricated insulated pipe supports in lieu of manufactured Type C Supports. Use of contractor-fabricated assemblies is subject to approval of appropriate submittal data. Submit detail drawings of assemblies and product data showing equivalency to specified manufactured products for approval.
2. Description:
   a. Load-rated assembly consisting of high compressive strength insulation material completely encircling circumference of pipe, vapor barrier jacket system incorporating structural inserts and insulation protection shield/casing where applicable.
3. Insulation Material:
   a. Structural Inserts:
   b. Jacket:
      1) Jacket shall consist of G90 galvanized steel conforming to ASTM A653/A653M and shall provide complete vapor barrier around insulation and bearing surface for protection of insulation.
      2) When recommended by manufacturer, use reinforced insulation protection shield at support bearing surface. Insulation shall extend 1" beyond insulation protection shield to maintain vapor barrier integrity.

**2.05 HANGER RODS (METALLIC)**

A. Rods shall conform to the latest MSS Standards except as modified herein. Furnish rods complete with adjusting and lock nuts.

B. Rods shall have electroplated zinc or hot dip galvanized finish.

C. Unless otherwise indicated, size rods for individual hangers and trapeze support as indicated in the following schedule. Rod size may be reduced one size for double rod hangers. Total weight of equipment, including valves, fittings, pipe, pipe content and insulation, shall not exceed limits indicated.

| Max. Pipe Size With Single Rigid Rod | Rod Diameter inches | Max Load lbs of Hanger Rod (Not exceeding 650 °F Service Temp.) |
|---|---|---|
| 2" | 3/8 | 730 |
| 3" | 1/2 | 1350 |
| 5" | 5/8 | 2160 |
| 8" | 3/4 | 3230 |

| Max. Pipe Size With Single Rigid Rod | Rod Diameter inches | Max Load lbs of Hanger Rod (Not exceeding 650 °F Service Temp.) |
|---|---|---|
| 12" | 7/8 | 4480 |
| 18" | 1 | 5900 |
| 30" | 1-1/4 | 9500 |

D. Threaded rods are not allowed in clean rooms.

**2.06 BOLTS, NUTS, STUDS AND WASHERS**

A. ASTM A307, electroplated zinc finish

**2.07 ROD ATTACHMENTS**

A. Anvil Fig. 290 (MSS Type-17), galvanized finish

**2.08 U-BOLTS**

A. Anvil Fig. 137 (MSS Type-24), galvanized finish

**2.09 BEAM CLAMPS**

A. Beam Clamps: Anvil Fig. 133/134 (MSS Type-21), 218 (MSS Type-30), 228 (MSS Type-28 or 29) and 292 (MSS Type-28 or 29)

B. Top Beam Clamps: Anvil Fig. 227 (MSS Type-25)

C. C-Clamps: Anvil Fig. 86, 92 or 93 (MSS Type-19 or 23) with set screw and lock nut

**2.10 ADJUSTABLE PIPE SADDLE SUPPORTS**

A. Anvil Fig. 264 (MSS Type-38), galvanized finish. Provide Anvil Fig. 63 Type T stanchion with base, galvanized finish, where applicable.

**2.11 CONCRETE INSERTS (WOODEN FORMED CONCRETE)**

A. Anvil Fig. 281 or 282, or Hilti HCI-WF (MSS Type-18), suitable for rod diameter and weight supported.

**2.12 CONCRETE INSERTS (METAL DECK FORMED CONCRETE)**

A. Anvil Fig. 284, Tolco No. 109DD, B-Line Fig. B3019, DeWalt/Powers "Bang-It+", Hilti HCI-MD, or MSCO No. MX34.

**2.13 CONCRETE ANCHORS**

A. Manufacturers: Hilti, DeWalt/Powers or Red Head

B. Anchors shall be selected, sized, and detailed by Contractor’s structural engineer registered in project’s jurisdiction, based on project conditions and in accordance with project building code. Calculations and drawings shall be submitted.

C. Anchors shall meet ICC Acceptance Criteria, and ICC-ES Evaluation Reports (ESRs) shall specifically list the current applicable codes.

D. Anchors installed in hardened concrete for purpose of transmitting structural loads from one connected element to another, or for safety related elements such as sprinkler pipes, heavy suspended pipes, and barrier rails shall have ICC-ES report demonstrating anchors have met requirements of AC 193 for mechanical anchors in concrete elements.

E. Post-installed expansion anchors and undercut anchors installed in hardened concrete shall be qualified for strength design and tested according to ACI 355.2. Designs shall be per the requirements of ACI 318, Appendix D.

F. Anchors shall be zinc plated in accordance with ASTM B633.

G. Select anchors with load ratings based on cracked concrete conditions.

**2.14 CONTINUOUS INSERT CHANNELS**

A. Manufacturers: Unistrut, Anvil, B-Line, Michigan, Halfen, Hilti or Kindorf. Brackets inserts and accessories shall be suitable for channel insert selected.

B. Length and support capabilities to be suitable for supporting plumbing piping in vicinity.

**2.15 METAL FRAMING SUPPORT SYSTEM (STRUT SYSTEM)**

A. Manufacturers: Unistrut, B-Line Strut Systems, Anvil-Strut, Power-Strut, Erico, Superstrut, Kindorf, Hilti, and Hydra-Zorb

B. Channels shall have epoxy paint or electroplated zinc finish.

C. Channels shall not be lighter than 12 ga.

**2.16 PIPE ROOF PENETRATION PROTECTIONS**

A. Manufacturers: Roof Products & Systems, ThyCurb or Vent Products equal to Roof Products & Systems "RPS-Pipe Portals" consisting of 12" OD prefabricated roof curb, laminated acrylic coated ABS plastic curb cover with EPDM protective rubber cap and stainless steel clamp.

**2.17 PIPE GUIDES**

A. Unless otherwise indicated, guides shall be equal to Pipe Shields "B" Series, selected by load and movement. Refer to Insulated Pipe Supports in Part 2.

**2.18 PIPE ANCHORS**

A. Unless otherwise indicated, anchors shall be Type C Insulated Pipe Supports. Refer to Insulated Pipe Supports in Part 2.

B. Contractor may propose to utilize contractor-fabricated anchors. Use of contractor-fabricated anchors is subject to approval of appropriate submittal data. Submit anchor system detail drawings, bearing stamp of Structural Engineer registered in project jurisdiction, for approval. Anchors shall be engineered to withstand static and dynamic forces with minimum safety factor of 3.0. Submit insulation details addressing thermal break from building structure and vapor barriers.

**2.19 CASEWORK PIPE SUPPORTS**

A. Hinged pipe clamp and Strutcatcher, nylon 12 Grilamid, Clic by Litchfield International.

B. Vibration isolation pipe clamp, yellow zinc chromate finish, B-Line BVT Series Vibraclamp or Kwik-Clip by B-Line.

**2.20 FIXTURE SUPPLY SUPPORT**

A. Acceptable manufacturers: Erico, Holdrite, Siou

B. Vertical Pipe Support:
   1. Galvanized steel stud support bracket, pre-drilled tube support mounting holes, adjustable stud width, Erico TSGB or equal.
   2. UV resistant nylon tube support, rated for (0-130°F through 0-130°F, resealable locking mechanism, Erico TPC or equal.
   3. Support bracket and tube support to be from same manufacturer.

C. Through Stud Support:
   1. Polypropylene stud insert for isolation of water tubing through metal wall studs, rated for maximum water temperature of 130°F, Erico ESGP or equal.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

A. Install supports to allow for free expansion of piping. Support piping from building structural members using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. At no time shall hangers and supports overload building structural members. Fasten ceiling plates and wall brackets securely to structure and test to demonstrate adequacy of fastening.

B. Select and size building attachments properly in accordance with MSS Standards and manufacturer's published load rating information.

C. Coordinate hanger and support installation to properly group piping of all trades.

D. Suspend piping hangers by means of hanger rods. Perforated band iron and flat wire (strap iron) are not allowed.

E. Piping and ductwork shall be supported independently from other piping or ductwork.

F. Pipe hangers and supports shall not penetrate vapor barrier of pipe insulation.

G. Do not support equipment, or piping from metal roof decking or ceiling grid.

H. Install adequate supports so as not to over stress either piping or equipment to which piping is connected.

I. Refer to Section 22 0000 - General Plumbing Requirements for requirements of personnel injury protection guards for supporting devices.

**3.02 HANGER AND SUPPORT SPACING**

A. Space pipe hangers and supports for horizontal pipe accordance with the following schedule, with exceptions as indicated herein:

B. Steel Pipe (Standard Weight and Extra Strong):

| Pipe Size | Max Spacing |
|---|---|
| 1-1/4" and smaller | 7 ft-0" |
| 1-1/2" | 9 ft-0" |
| 2" | 10 ft-0" |
| 2-1/2" | 11 ft-0" |
| 3" and larger | 12 ft-0" |

C. Copper Tube (Unless Otherwise Noted):

| Pipe Size | Max Spacing |
|---|---|
| 3/4" and smaller | 5 ft-0" |
| 1" to 1-1/4" | 6 ft-0" |
| 1-1/2" to 2-1/2" | 8 ft-0" |
| 3" and larger | 10 ft-0" |

D. Plastic Pipe

1. PVC Pipe:

| Pipe Size | Max Spacing |
|---|---|
| All sizes | 4 ft-0" |

2. Support plastic pipe at all changes of direction. Adequate consideration shall be given to piping expansion.

E. Cast Iron Pipe:

1. Maximum hanger and support spacing shall be 10 ft for all pipe sizes. Provide minimum of one hanger per pipe section close to joint on barrel, at each pipe fitting, at change of direction and branch connections.
2. Support Cast Iron No-Hub pipe as recommended in CISPI Publication "Cast Iron Soil Pipe and Fittings Handbook, Chapter IV - Installation of Cast Iron Soil Pipe and Fittings."

F. Maximum spacing shown above may be restricted by strength of attachment to building structure. Submit data with calculations with published load ratings showing attachment to be utilized and maximum spacing allowable for that type of attachment and pipe size.

G. Spacing less than indicated above may be required to conform to building structure design or loading limitations.

H. Spacing less than indicated may be required depending on compressive strength of pipe insulation and insulated pipe supports.

I. If pipe size changes between support points, maximum spacing shall be based on the smaller pipe size.

J. If trapeze hangers are used to support multiple services, spacing shall be based on the most restrictive pipe size and material on trapeze hanger.

K. For non-metallic pipe, follow manufacturer's installation recommendations in addition to requirements noted herein.

L. Install supports for vertical piping and anchors as recommended by pipe manufacturer.

M. Place hangers and supports to meet requirements of Section 232116 - Pipe and Pipe Fittings or specific pipe system sections, with regard to pitch for drainage and venting and clearance between services.

N. Hangers and supports shall bear on outside of insulation when pipes are to be insulated.

O. Place hangers and supports within 1 ft of each fitting, such as elbows and tees, and at each valve, strainer, and other piping specialty for piping 4" and larger.

P. Place hanger or support at first elbow upstream of pump inlet and first elbow downstream of pump outlet.

**3.03 INSULATED PIPE SUPPORTS APPLICATION**

A. Install insulated pipe support at each support point of insulated pipe.

B. Pipe Size 1-1/2" and Smaller:
   1. Use Type A insulated pipe support. Pipe insulation specified in Section 22 0700 - Plumbing Insulation shall be continuous through support points.
   2. Use one shield (bottom) for clevis hanger.
   3. Use 2 shields (top and bottom) for roller hanger/support or strap/clamp support. Apply 2 metal straps to hold top and bottom shields onto insulation jacket.
   4. Type B or Type C insulated pipe supports may be used in lieu of Type A support.

C. Pipe Size 2" through 5":
   1. Use Type B insulated pipe supports. Refer to Part 2 for acceptable products.
   2. Type C insulated pipe supports may be used in lieu of Type B supports.

D. Pipe Size 6" and Larger:
   1. Use Type C insulated pipe supports. Refer to Part 2 for applicable products.

**3.04 PIPE FLOOR SUPPORTS**

A. Unless specifically shown otherwise, use adjustable pipe saddle supports with associated stanchion similar to Anvil Fig. 264/63. Select supports properly for weight and height of pipe stand.

**3.05 CONCRETE INSERTS**

A. Concrete insert application, size, loading, and placement shall be this Contractor’s responsibility.

B. Coordinate with General Contractor for placement of inserts before concrete pour. Minimize use of inserts and anchors after concrete pour.

**3.06 CONTINUOUS INSERT CHANNELS**

A. Mount continuous insert channels when used for pipe support on 8 ft-0" maximum centers and 8 ft-0" from corners.

**3.07 BEAM CLAMPS**

A. Provide locknut for hanging rod at clamp.

B. C-clamps are allowed for rod size 3/8" or smaller and only for static loading such as air piping, cold water piping, fire protection piping and, other similar piping. C-clamps are not allowed for hot water piping and steam and steam condensate piping, except hot water runouts to terminal heating devices.

C. C-clamps are not allowed for open web steel joist application.

**3.08 TRAPEZE SUPPORTS**

A. Construct trapeze supports with struts, angles, or channels and hang them by inserts or welded beam attachments and rods.

B. Determine trapeze supports spacing by the smallest pipe on trapeze.

C. If trapeze supports are used to support multiple services, support spacing shall be based on the most restrictive pipe size and material on trapeze supports.

D. Refer to Part 1, Design Criteria for maximum deflection allowed for trapeze supports.

**3.09 CONCRETE ANCHORS**

A. Anchor application, size, and placement shall be this Contractor's responsibility.

**3.10 PIPE GUIDES**

A. Install where shown on drawings.

B. For manufactured expansion devices, install minimum of 2 pipe guides at each side of manufactured pipe expansion device. Locate first guide no more than 4 pipe diameters from expansion device and second guide at 14 pipe diameters from first guide. Install intermediate guides in accordance with guide spacing data recommended by manufacturer or the following table, whichever is more stringent.

| MAXIMUM DISTANCE BETWEEN INTERMEDIATE GUIDES (ft) | | | | |
|---|---|---|---|---|
| | Pipe Operating Pressure | | | |
| Pipe Size (inches) | 0-50 psig | 51-100 psig | 101-150 psig | 151-200 psig |
| 3 | 21 | 19 | 17 | 16 |
| 4 | 35 | 29 | 25 | 22 |
| 6 | 57 | 44 | 37 | 32 |
| 8 | 66 | 52 | 45 | 40 |
| 10 | 91 | 69 | 58 | 51 |
| 12 | 107 | 79 | 66 | 58 |
| 14 | 115 | 85 | 71 | 62 |
| 16 | 127 | 94 | 78 | 68 |

C. If anchor is located within 4 pipe diameters from expansion joints, guides need not be installed on anchor side.

**3.11 PIPE ANCHORS**

A. Install anchors where shown on drawings or in conjunction with expansion joints, loops and swing joints as required to allow proper expansion and contraction of piping without damage to structure, equipment or piping.

B. Do not anchor piping to concrete block walls, wood, or partition walls.

**END OF SECTION**

# SECTION 22 0553
# PLUMBING SYSTEMS IDENTIFICATION

## PART 1 - GENERAL

### 1.01 REFERENCE

A. Work under this Section is subject to requirements of Contract Documents, including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

### 1.02 SUBMITTALS

A. Product Data: For identification materials and devices

B. Valve Schedules: For each piping system

C. Samples: Of color, lettering style, and graphic representation required for each identification material and device.

## PART 2 - PRODUCTS

### 2.01 IDENTIFYING DEVICES

A. Stencil Paint:
   1. Oil-based, alkyd enamel, black color

B. Marker System:
   1. Manufacturers: Brady USA, Marking Services Inc. (MSI), Kolbi, or Seton
   2. Manufacturer's standard, preprinted with color coding, lettering size, and length of color field according to ASME A13.1.
   3. Use pressure-sensitive type or “snap-on” type.
   4. “Strap-on” type may be used for piping over 6” size, including insulation.

C. Valve Tags:
   1. Minimum 1-1/2” diameter, 0.032" thick, polished brass or 316 stainless steel.

D. Laminated Plastic Nameplates:
   1. Nameplates shall be approximately 1-1/2” x 4“, 1/16” thick, and have 1/2" high lettering. Face of plastic nameplates shall be black with white letters.
   2. Fasteners shall be self-tapping, stainless steel screws or contact type with permanent adhesive.

## PART 3 - EXECUTION

### 3.01 GENERAL

A. After painting and/or covering is completed, identify equipment and piping as indicated. Locate identification as conspicuously as possible except where such would distract from finished area.

B. Where markers are used in high heat applications or exposed to harsh chemical or acid environments, specifically select marker materials for those applications.

C. Coordinate, obtain and confirm mechanical systems identification criteria and requirements from Owner.

### 3.02 PIPING SYSTEM IDENTIFICATION

A. Install pipe identification on each system.

B. Place flow directional arrows at each pipe identification location.

C. Identify all piping not less than once every 25 ft, not less than once in each room, at each branch, adjacent to each access door or panel, at each valve and where exposed piping passes through walls and floors.

D. Identify piping by stenciling. Height of lettering shall be same as pipe diameter up to maximum of 1” in height. When finished color of piping is dark, stenciling shall be on white background.

E. Identify piping with marker system.
   1. For “strap-on” type, ensure marker is fitted snugly to pipe or pipe insulation surface with sufficient straps.

### 3.03 VALVE IDENTIFICATION

A. Identify valves with brass tags bearing system identification and valve sequence number in 1/2” black characters. Attach tag to valve body with brass jack chain and “S“ hook for brass tag and SS jack chain or SS braided wires with swag sleeves and “S“ hook for stainless steel tag. Non-metallic fasteners are not allowed.

B. Valve numbers shall be prefixed with corresponding piping system identification in 1/4” black letters.

C. Furnish typewritten valve schedule indicating valve number, fixtures, equipment or areas served by each numbered valve and incorporate in O&M Manuals.

### 3.04 EQUIPMENT IDENTIFICATION

A. Identify major equipment, including heat exchangers, pumps, water heaters, tanks, compressors, etc.

B. Identify equipment by stenciling equipment number and service in 2” high letters.

C. Identify equipment with marker system.

D. Identify equipment with laminated plastic nameplates.

E. Identify control equipment and panels with laminated plastic nameplates.

F. Nameplate Markings:
   1. Identify model number, size, capacity, electrical characteristics, serial number, along with other items scheduled for equipment on drawings.
   2. Indicate motor horsepower, voltage, phase, cycles, RPM, full load amps, locked motor amps, frame size, manufacturer’s name and model number, Service Factor, Power Factor, efficiency, minimum circuit amps, minimum feeder conductor size, disconnect or fuse size, refrigerant, and other pertinent information.

G. Locate motor nameplates for easy reading. Relocate or provide new nameplates on motors if original nameplates are not located for easy reading.

### 3.05 ACCESS PANEL IDENTIFICATION

A. Identify each service opening or access opening with minimum 1/2” high letters indicating type of damper.

B. Furnish typewritten charts with identification and location of all access panels serving equipment and valves and incorporate in O&M Manuals.

### 3.06 SPRINKLER ZONE CONTROL VALVE IDENTIFICATION

A. Identify sprinkler zone control valves with laminated plastic nameplates. Nameplate shall include name of sprinkler zone served and description of area served.

B. Identify inspector’s test valve with laminated plastic nameplate if valve is located remote from sprinkler control valve. Nameplate shall include name of sprinkler zone served.

**END OF SECTION**