

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Divisions 00 and 01, apply to this Section.
- B. Related Sections:
 - 1. Division 23.

1.2 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 CODES AND STANDARDS

- A. Codes and Standards shall be the current version adopted by the Authority Having Jurisdiction.

1.5 PERFORMANCE REQUIREMENTS

- A. Design channel support systems, and/or heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.6 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, thermal-hanger shield insert, and roof equipment support indicated. Refer to Part 3 Hanger and Support Applications for specific hanger requirements.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports, trapeze hangers, and equipment supports. Include design calculations and indicate size and characteristics of components and fabrication details.

1.7 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and calculations for each multiple pipe support, trapeze, equipment supports, and seismic restraint by a qualified professional engineer.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing

engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

2. Comply with MSS SP-69.
- C. Equipment supports shall comply with "Guidelines For Roof Mounted Outdoor Air-Conditioner Installations," AHRI/SMACNA Guideline B.

PART 2 – PRODUCTS

2.1 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pipe Hangers:
 - 1) B-Line Systems, Inc.
 - 2) Tolco.
 - 3) Anvil Corp.
 - 4) Erico International Corp.
 - 5) National Pipe Hanger Corp.
 - 6) Or Approved Equal
 2. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Channel Support Systems:
 - 1) B-Line Systems, Inc.
 - 2) Anvil Corp.
 - 3) Tolco.
 - 4) Unistrut Corp.
 - 5) Erico International Corp.
 - 6) Or Approved Equal
 2. Material: Steel, structural quality, ASTM A1011.
 3. Coatings: G90 galvanized coating. Threaded hardware, zinc plated.
 4. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

- C. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thermal-Hanger Shield Inserts:
 - 1) Carpenter & Patterson, Inc.
 - 2) PHS Industries, Inc.
 - 3) PT&P, Pipe Shields, Inc.
 - 4) Rilco Manufacturing Co., Inc.
 - 5) Value Engineered Products, Inc.
 - 6) Erico International Corp.
 - 7) Or Approved Equal
 2. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 3. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
 4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 5. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
 6. All insulated pipe supports shall be load rated. Load ratings shall be established by pipe support manufacturer based upon testing and analysis in conformance with the latest edition of the following codes: ASME B31.1, MSS SP-58, MSS SP-69, and MSS SP-89.
 7. Load tests shall be made on both supporting materials and configurations. All tests shall be performed by an independent testing laboratory. Results of pertinent tests shall be available, on request, to the purchaser.

2.2 MANUFACTURED ROOF CURBS

- A. Roof curbs shall be manufactured to support rooftop equipment, where indicated.
- B. Construction:
1. Roof curbs shall be continuous-perimeter construction of galvanized steel, minimum 18-gauge thickness, or as required to support equipment weight. Corners shall be mitered and fully welded.
 2. Coordinate curb dimensions with equipment manufacturer.
 3. Provide curb with integral 3-inch cant, raised as required by roof type.
 4. Curbs shall be rated to withstand applicable seismic loads.
 5. Finished top of curb shall be level when installed, coordinate curb dimensions with roof pitch as indicated on Architectural drawings.
 6. Unless indicated otherwise, minimum curb height shall be 18-inches, or top of curb shall be 8-inches above adjacent finished floor elevation, whichever is higher. Coordinate with roof construction detail on Architectural drawings.
 7. Curbs shall be provided with minimum R-7 insulation.
- C. Accessories:

1. Provide curb with adhesive gasket, to be field installed by contractor prior to equipment installation.

2.3 FABRICATED SUPPORTS

- A. Indoor Equipment Supports: Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor where indicated.
- B. Roof Equipment Support Frame: Fabricate structural-steel support frame for mounting mechanical equipment, and elevating above finished roof.
 1. Frame may be constructed of I-beam, channel, or angle steel members. Provide engineering calculations or manufacturers' data to show that roof equipment support frame gauge and dimensions are adequate for equipment and seismic loads.
 2. Frame shall have hot-dipped, galvanized finish.

2.4 MISCELLANEOUS MATERIALS

- A. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Powder-Actuated Fastener Systems:
 - 1) Gunnebo Fastening Corp.
 - 2) Hilti, Inc.
 - 3) ITW Ramset/Red Head.
 - 4) Masterset Fastening Systems, Inc.
 - 5) Or Approved Equal
- B. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- C. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink, and nonmetallic, dry, hydraulic-cement grout.
 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 – EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:
 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.

2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 4. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 8. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 9. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 10. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 11. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- C. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
- D. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg f piping installations.
 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg f piping installations.
- E. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 3. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 4. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 5. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

- a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
- F. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
 - 2. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.
 - 3. Thermal-Hanger Shield Inserts shall be supplied and installed by the mechanical contractor on all insulated pipe and tubing.
- G. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 - 2. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 - 3. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 - 1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- E. If concrete inserts cannot be used, install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- J. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9.
 - 2. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 4. Pipes NPS 8 and Larger: Include wood inserts.
 - 5. Insert Material: Length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 ROOF CURB INSTALLATION

- A. Coordinate exact location of curb with Architectural drawings.
- B. Install roof curbs so that top is level.
- C. Fasten curb to roof by welding or with anchor bolts as appropriate for roof type, in accordance with manufacturer's guidelines, AHRI Guideline B, and seismic requirements.

- D. Prior to equipment placement, install continuous adhesive gasket material on top of curb.

3.4 EQUIPMENT SUPPORTS

- A. Indoor equipment supports:
 - 1. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- B. Roof equipment support frame:
 - 1. Cut equipment pipe supports (provided by Architect) at desired elevation, weld roof equipment support frame to equipment pipe supports so that top of frame is level at desired equipment mounting elevation.
 - 2. Apply cold galvanizing compound during construction to repair finish where damaged by welding or installation.

3.5 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.6 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.7 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION