
SECTION 22 05 48
PLUMBING SUPPORTS FOR PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Equipment support bases.
- B. Pipe and equipment Hangers
- C. Vibration isolators.

1.2 RELATED REQUIREMENTS

- A. Section 22 00 00 - Plumbing Common Work Results; for administrative requirements
- B. Section 22 00 00 - Plumbing Common Work Results; for product requirements
- C. Section 22 00 00 - Plumbing Common Work Results; for closeout requirements.
- D. Section 22 00 00 - Plumbing Common Work Results
- E. Section 03 3000 - Cast-in-Place Concrete.
- F. Section 09 90 00 - Painting and Coating.
- G. Section 20 00 00 - Common Work Results.
- H. Section 26 05 83 - Wiring Connections.

1.3 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2011.
- B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2011.
- C. ASTM B31.9 - Code for pressure piping, ASTM International.
- D. ASTM F708- Standard Practice for Design and Installation of Rigid Pipe Hangers, ASTM International.
- E. MSS SP-89 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation, Manufacturers Standardization Society, 2009.
- F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.
- G. SMACNA (SRM) - Seismic Duct Restraint Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

1.4 SUBMITTALS

- A. See Section 22 00 00 - Plumbing Common Work Results, for submittal procedures.
- B. Listed manufacturers and series are for reference only and do not promote any single product. Series are provided for reference, and should not be used as an ordering model number. Accessories and options may be custom components purchased separately.
- C. Product Data:
 - 1. Product Data: Provide manufacturer's most current catalog data sheet for equipment indicating rough-in size, finish, and accessories. Manufacturer's data sheets on each item of equipment and device, shall be clearly marked up to identify the items, accessories and options to be used on the project.
 - a. Equipment Support Bases (22 05 48 - 001 - A)
 - b. Vibration Isolators (22 05 48 - 001 - A)

PART 2 PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

A. General:

1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
2. Steel springs to function without undue stress or overloading.
3. Comply with:
 - a. ASHRAE Handbook - HVAC Applications.

2.2 EQUIPMENT SUPPORT BASES

A. Concrete Inertia Bases:

1. Construction: Engineered, steel forms, with integrated isolator brackets and anchor bolts, welded or tied reinforcing bars running both ways in a single layer.
2. Size: 6 inches minimum depth and sized to accommodate elbow supports.
3. Mass: Minimum of 1.5 times weight of isolated equipment.
4. Connecting Point: Reinforced to connect isolators and snubbers to base including template and fastening devices for equipment.
5. Concrete: Filled on site with minimum 3000 psi concrete.

2.3 VIBRATION ISOLATORS

A. Non-Seismic Type:

1. Elastomeric Mounts:
 - a. Material: Oil, ozone, and oxidant resistant compounds.
 - b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
2. Restrained Steel Springs:
 - a. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction.
 - b. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.
3. Elastomeric Hangers:
 - a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
 - b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
4. Spring Hanger:
 - a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
 - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
5. Combination Elastomeric-Spring Hanger:
 - a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
 - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

B. Seismic Type:

1. Coil Springs Consisting of Single Elements:
 - a. Housing: Manufactured from cast iron material.
 - b. Ductile Material: Designed and rated for seismic applications.
 - c. Spring: Restrained by housing without significant degradation of vibration isolation capabilities during normal equipment operating conditions.
 - d. Resilient Snubbing Grommet System: Incorporated and designed with clearances of no more than 0.25 inch in any direction preventing direct metal-to-metal contact between supported member and fixed restraint housing.
 - e. Resilient Pad: Located in series with spring.
 - f. Coil Springs: Color coded elements to have a lateral stiffness greater than 0.8 times the rated vertical stiffness with 50 percent overload capacity.
 - g. Finish: Suitable for the application.

2.4 PIPE HANGERS & ROOF SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 1. Carbon-Steel Pipe Hangers and Supports:
 - a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - b. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
 - c. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - d. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - e. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 2. Copper Pipe Hangers:
 - a. Manufacturers' catalogs indicate that copper pipe hangers are small, typically NPS 4 (DN 100) or smaller, and types available are limited.
 - b. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - c. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
 3. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 4. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 5. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
 6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
 8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
 - B. Trapeze Hangers:
 1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.
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- C. Thermal-Hanger Shield Inserts:
 - 1. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
 - 2. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
 - 3. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
 - 4. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
 - 5. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
 - D. Fastener Systems:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 3. Adhesive Anchoring Systems: Threaded-zinc-coated or Type 316 stainless steel anchor rod, nut, washer, and adhesive capsule, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

PART 3 EXECUTION

3.1 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Confirm framing and support members.
- B. Confirm rough-in and framing of walls and partitions with supports for equipment and accessories.
- C. Confirm rough-in locations and power requirements before rough-in installation. Refer to Section 26 05 83 - Wiring Connections.

3.2 INSTALLATION

- A. Install in accordance with the following:
 - 1. Federal State and Local Codes.
 - 2. Manufacturer's recommendations.
 - 3. ASHRAE recommendations.
 - B. Bases:
 - 1. Set steel bases for one inch clearance between housekeeping pad and base.
 - 2. Set concrete inertia bases for 2 inches clearance between housekeeping pad and base.
 - 3. Adjust equipment level.
 - C. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
 - 1. Up to 4 Inches Pipe Size: First three points of support.
 - 2. 5 to 8 Inches Pipe Size: First four points of support.
 - 3. 10 inches Pipe Size and Over: First six points of support.
 - D. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-89.
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2. Support horizontal piping as scheduled.
 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 4. Place hangers within 12 inches of each horizontal elbow.
 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 7. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - b. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
 8. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 9. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - b. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
 10. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
 11. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
 12. Provide copper plated hangers and supports for copper piping.
 13. Prime coat exposed steel hangers and supports. 09 90 00 - Painting and Coating Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 14. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories. Use lock nuts or vibration resistant nuts where potential vibration may cause failure. Install hangers plumb.
 15. Equipment support in first paragraph below requires calculating and detailing at each use.
 16. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
 17. Install hangers and supports to allow controlled thermal 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.
 18. Install lateral bracing with pipe hangers and supports to prevent swaying.
 19. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories. Use lock nuts or vibration resistant nuts where potential vibration may cause failure. Install hangers plumb.
 20. Equipment support in first paragraph below requires calculating and detailing at each use.
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21. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
 22. Install hangers and supports to allow controlled thermal 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.
 23. Install lateral bracing with pipe hangers and supports to prevent swaying.
- E. Painting:
1. Touchup: 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.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
 2. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.
 3. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.3 HANGER AND SUPPORT SCHEDULE

- A. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- B. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- E. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of uninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of uninsulated pipes NPS 3/4 to NPS 36, requiring clamp flexibility.
 4. 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.
 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of uninsulated, stationary pipes NPS 3/4 to NPS 8.
 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of uninsulated, stationary pipes NPS 1/2 to NPS 8.

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7. Adjustable Band Hangers (MSS Type 9): For suspension of uninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of uninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of uninsulated, stationary pipes NPS 3/8 to NPS 8.
 10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of uninsulated, stationary pipes NPS 3/8 to NPS 3.
 11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30. Use only on trapeze hanger systems or on fabricated frames.
 12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 13. 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 or carbon-steel plate.
 14. 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 or carbon-steel plate, and with U-bolt to retain pipe.
 15. 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.
 16. 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.
 17. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 18. 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.
 19. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 20. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system 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. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
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5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
 - L. Building Attachments: Unless otherwise indicated and except as specified in piping system 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. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape. Both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles. Provide with an added malleable-iron heel plate or adapter.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes. Both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. 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.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
 - M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): For insulated pipes NPS 4 to NPS 42 (DN 100 to DN 1050) when the temperature of the medium is 60 deg F (15 deg C) or higher. To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
 - N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
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2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or adhesive anchoring systems or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe stands for piping supports on roof.
- S. Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- T. Install roof accessories to fit substrates and to result in watertight performance.
- U. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Vertical Piping: MSS Type 8 or 42, clamps.
 - B. Individual, Straight, Horizontal Piping Runs:
 1. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 2. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
 3. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - C. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - D. Base of Vertical Piping: MSS Type 52, spring hangers.
 - E. Support vertical piping and tubing at base and at each floor.
 - F. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
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- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 6. NPS 6: 10 feet with 5/8-inch rod.
 7. NPS 8: 10 feet with 3/4-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 3. NPS 2: 10 feet with 3/8-inch rod.
 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 7. NPS 6: 12 feet with 3/4-inch rod.
 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- J. Install supports for vertical steel piping every 15 feet.
- K. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.
- L. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

END OF SECTION 22 05 48