# GENERAL

## SECTION INCLUDES

### Pipe and equipment hangers, supports, anchors, saddles and shields.

### Equipment supports.

### Equipment roof curbs.

### Equipment roof supports.

### Sleeves and seals.

### Mechanical sleeve seals.

### Flashing and sealing equipment and pipe stacks.

### Sealants, firestop insulation, putty and compounds.

### Mechanical seals.

## REFERENCE SECTION 23 05 00 FOR THE FOLLOWING:

### Quality assurance.

### References.

### Submittals.

### Operation and maintenance manuals.

### Project record documents.

### Delivery, storage, and handling.

## REFERENCES

### ANSI/ASME B31.1 – Power Piping.

### ANSI/AMSE B31.9 – Building Services Piping.

### MSS SP-58 – Pipe Hangers and Supports – Materials, Design, and Manufacture.

### MSS SP-69 – Pipe Hangers and Supports – Selection and Application.

### MSS SP-89 – Pipe Hangers and Supports – Fabrication and Installation Practices.

## REFERENCE SECTION 22 05 00 FOR THE FOLLOWING GUIDELINES

### References

### Submittals

### Delivery, storage and handling

### Quality Assurance

# PRODUCTS

## PIPE HANGERS AND SUPPORTS

### Plumbing Piping:

#### Conform to International Plumbing Code, International Fuel Gas Code, ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89 as applicable.

### Pure Water Piping and Laboratory Waste and Vent Piping:

#### Conform to manufacturer’s recommendations, MSS SP58, MSS SP69, MSS SP89, as applicable.

### Natural Gas Piping:

#### Conform to International Fuel Gas Code, MSS SP58, MSS SP69, MSS SP89, as applicable.

### Compressed Air, Vacuum, and Laboratory Gas (Nitrogen, Argon, Helium, etc.) Piping:

#### Conform to ASME B31.9, MSS SP58, MSS SP69, MSS SP89, as applicable.

### Carbon-Steel Pipe Hangers and Supports:

#### Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

#### Galvanized Metallic Coatings: Pregalvanized or hot dipped.

#### Nonmetallic Coatings: Plastic coating, jacket, or liner.

#### Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

#### Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

### Copper Pipe Hangers:

#### Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.

#### Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

### Hangers and Supports:

#### Hangers for Hot and Cold Pipe Sizes 1/2 to 1‑1/2 Inch, Carbon steel, adjustable swivel, band type.

#### Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

#### Hangers for Hot Pipe Sizes 2 to 4 Inches; Carbon steel, adjustable, clevis.

#### , cast iron roll, double hanger.

#### Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

#### Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.

#### Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

#### Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

#### Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

#### Vertical Support: Steel riser clamp.

#### Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

#### 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.

#### Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

#### Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

#### Hangers for insulated pipe shall be enlarged to compensate for insulation thickness so that hangers support insulation. See Section 22 07 19.

#### See Section 22 05 48 for vibration isolation hangers and supports.

## TRAPEZE PIPE HANGERS

### 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.

## METAL FRAMING SYSTEMS

### MFMA Manufacturer Metal Framing Systems:

#### Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

#### Standard: MFMA-4.

#### Channels: Continuous slotted steel channel with inturned lips.

#### Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

#### Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

## FASTENER SYSTEMS

### 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.

### 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.

## PIPE STANDS

### General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

### Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

### Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

### High-Type, Single-Pipe Stand:

#### Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

#### Base: Plastic.

#### Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

#### Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

### High-Type, Multiple-Pipe Stand:

#### Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

#### Bases: One or more; plastic.

#### Vertical Members: Two or more protective-coated-steel channels.

#### Horizontal Member: Protective-coated-steel channel.

#### Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

### Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## EQUIPMENT SUPPORTS

### Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## MISCELLANEOUS MATERIALS

### Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

### Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

#### Properties: Nonstaining, noncorrosive, and nongaseous.

#### Design Mix: 5000-psi, 28-day compressive strength

## ACCESSORIES

### Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

## INSERTS

### 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.

## THERMAL-HANGER SHIELD INSERTS

### Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

### Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

### For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

### For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

### Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## FLASHING

### Metal Flashing: 26 gage galvanized steel.

### Metal Counterflashing: 22 gage galvanized steel.

### Flexible Flashing: 47 mil thick sheet buty; compatible with roofing.

### Floor Drain and Floor Sink Flashing: 40 mil thick chlorinated polyethylene (CPE), equivalent to Chloraloy.

### Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

## EQUIPMENT CURBS

### Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, 1‑1/2 inch thick insulation, factory installed wood nailer. Minimum 18 inch height, unless specified otherwise.

## EQUIPMENT ROOF CURBS

### Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, 1‑1/2 inch thick insulation, factory installed wood nailer. Minimum 24 inch height above top of insulation (not the roof structure).

## EQUIPMENT ROOF SUPPORTS

### Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, 1‑1/2 inch thick insulation, factory installed wood nailer. Minimum 24 inch height above top of insulation (not the roof structure).

## SLEEVES

### Sleeves for Pipes Through Non‑fire Rated Floors: 18 gage galvanized steel.

### Sleeves for Pipes Through Non‑fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.

### Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

## SEALANTS, FIRESTOP INSULATION, PUTTY, AND COMPOUNDS

### Firestopping Insulation: Glass fiber type, non‑combustible, UL listed.

### Firestop Putty: Non-harding, non shrinking, UL listed.

### Firestop Compounds: Cementitous material, non-shrinking, UL listed.

### Sealants:

#### Non fire/smoke rated partitions: Acrylic or silicone based caulking.

#### Fire/smoke rated partitions: Silicone based caulking, UL listed.

## MECHANICAL SEALS

### Mechanical Seals: Modular mechanical type, consisting of interlocking EPDM synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with type 316 stainless steel bolts and reinforced plastic polymer pressure plates which cause rubber sealing elements to expand when tightened, providing a watertight and gas-tight seal and electrical insulation. Provide Advance Products & Systems Model Innerlynx or equivalent.+

#### A sleeve shall be provided for each mechanical seal.

##### Thermoplastic sleeves: Sleeve shall have smooth walls and shall be made of molded non-metallic high density polyethylene (HDPE) with an integral solid water stop, Advance Products & Systems Model PWS or equivalent.

##### Steel sleeves: Sleeve shall have smooth walls, shall be made of Schedule 40 steel with an integral welded solid water stop, and shall have corrosion-resistant coating, Advance Products & Systems Model GWS or equivalent.

#### Provide high-temperature silicone links rated for 400 Deg. F for steam and condensate applications.

# EXECUTION

## INSTALLATION

### Install in accordance with manufacturer's instructions.

## INSERTS

### Provide inserts for placement in concrete formwork.

### Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

### Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

### Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

### Where inserts are omitted, drill through concrete slab from below and provide through‑bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

## PIPE HANGERS AND SUPPORTS

### Reference applicable codes for maximum support spacing; see Section 22 0 500. Additional supports shall be provided at other locations as specified in this Section.

### Reference applicable codes for maximum support spacing; see Section 22 0 500. Additional supports shall be provided at other locations as specified in this Section.

### Support grooved pipe adjacent to each joint and at other locations per manufacturer recommendations.

### Support piping adjacent to large pipe accessories such as valves, air separators, traps, etc. Provide additional supports as recommended by accessory manufacturer.

### Independently support valves 16” and larger.

### Install all hangers, supports, and accessories that shall be attached to structural steel prior to the application of structural steel fireproofing. Repair fireproofing if damaged during remainder of project.

### Support horizontal piping as scheduled.

### Support fire protection systems piping independently from other piping systems. Fire main piping may be trapezed with other piping systems. Coordinate trapeze hangers with the Sprinkler Contractor.

### Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

### Place hangers within 12 inches of each horizontal elbow.

### Use hangers with 1‑1/2 inch minimum vertical adjustment.

### Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

### Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

### Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

### Support riser piping independently of connected horizontal piping.

### Provide copper plated hangers and supports for non-insulated copper pipe.

### Design hangers for pipe movement without disengagement of supported pipe.

### Prime coat steel hangers and supports in the mechanical room and other exposed areas. Refer to the Architectural reflected ceiling plans for location of exposed ceilings. Hangers and supports located in attic space, crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

### Adjust hangers to distribute loads equally on attachments and to achieve specified pipe slopes.

### Space hangers for pure water and laboratory waste and vent systems to avoid pipe sags. Use manufacturer-recommended V-groove channel if necessary to maintain sag-free installation.

### Saddles, Shields and Inserts

#### Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

#### Install protective shields MSS Type 40 on cold piping that has vapor barrier. Shields shall span an arc of 180 degrees (360 degrees on trapeze hangers with U-bolt clamps) and shall have dimensions in inches not less than the following:

NPS LENGTH THICKNESS

1 through 3-1/2 12 0.048

4 12 0.060

5 & 6 18 0.060

8 through 14 24 0.075

16 through 24 24 0.105

#### Pipes 8 inches and larger shall have wood inserts.

#### Insert materials shall be at least as long as the protective shield.

#### Provide manufacturer-recommended saddles, inserts, and/or shields where cellular foam insulation is used. The removal of sections of cellular foam insulation for the purpose of pipe support is not acceptable.

### Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

### 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.

#### 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.

#### Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

### Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

### Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

### Fastener System Installation:

#### Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

#### Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

### Pipe Stand Installation:

#### Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

#### Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

### Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

### Equipment Support Installation: Fabricate from welded-structural-steel shapes.

### 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.

### Install lateral bracing with pipe hangers and supports to prevent swaying.

### Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger 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.

### Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

### Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

### Insulated Piping:

#### Attach clamps and spacers to piping.

##### Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

##### Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

##### Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

#### Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

#### Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

#### Shield Dimensions for Pipe: Not less than the following:

##### NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

##### NPS 4: 12 inches long and 0.06 inch thick.

##### NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

##### NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

##### NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

##### Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

##### Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

## INSTALLATION OF ANCHORS

### Install anchors at proper locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

### Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and with AWS Standards D1.1.

### Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to control movement to compensators.

### Anchor Spacing’s: Where not otherwise indicated, install anchors at ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

## FLASHING

### Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls and floors.

### Flash floor drains in floors with topping over finished areas with CPE membrane, a minimum of 12 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

### Seal floor, shower, mop sink, etc. drains watertight to adjacent materials.

### Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

## SLEEVES

### Provide pipe and duct sleeves at all fire/smoke rated partitions, exterior wall penetrations and wall penetrations into exposed areas. Pipe and duct sleeves are not required for penetrations through non-rated concealed partitions.

### At the Contractor’s option, pipe sleeves may be omitted if the wall or floor is core drilled, except in areas potentially exposed to wet conditions (such as mechanical rooms, loading dock, generator room, penthouse, kitchen, etc.).

### Set sleeves in position in formwork. Provide reinforcing around sleeves.

### Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

### Sleeves through floors shall be grinded flush with finish floor level. In areas potentially exposed to wet conditions (such as mechanical rooms, loading dock, generator room, penthouse, kitchen, etc.), sleeve shall extend a minimum of 2” above finish floor.

### Where piping penetrates non-rated ceilings or walls, close off space between pipe or duct and adjacent work with urethane rod stock and caulk air tight.

### Seal pipe penetrations through non-rated floors.

#### Where piping is not located in a rated shaft and it penetrates a single non-rated floor, close off space between pipe and adjacent work with urethane rod stock and caulk air tight.

#### Where piping is not located in a rated shaft and it penetrates multiple non-rated floors, close off space between pipe and adjacent work with appropriate fire-rated sealant, insulation, putty, or compound.

### Where piping penetrates rated floor, ceiling, or wall, close off space between pipe or duct with appropriate fire rated sealant, insulation, putty or compound. Refer to the Drawings for fire/smoke rated wall locations and the appropriate ratings.

### Install chrome plated steel escutcheons on piping at finished surfaces.

### Waste, vent and storm pipe penetrations through the concrete floor slab shall be encased in the poured concrete slab.

### PVC pipe casing around the cold and hot water and gas piping shall be encased in poured concrete when penetrating the floor slab. Seal the opening between the piping and PVC casing with putty or rigid polyisocyanurate insulation plug and seal with caulking.

### Provide mechanical seals and sleeves through exterior wall and floor penetrations and 3 hour or higher fire rated partitions.

## HANGER SPACING AND SIZE

### Reference International Plumbing Code and International Fuel Gas Code where applicable.

### Reference manufacturer’s recommendations for pure water piping and laboratory waste and vent piping.

### Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

### Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

### Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

### Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

#### Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

### Use padded hangers for piping that is subject to scratching.

### Use thermal-hanger shield inserts for insulated piping and tubing.

### Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

#### Pipe Hangers

##### Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

##### 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.

##### Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.

##### Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

##### Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

##### Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.

##### U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

##### 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.

##### 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.

##### Vee Bottom Clevis Hanger: For suspension of flexible plastic piping, Cooper B-Line B3106 or equivalent. Include plastic pipe support channel, Cooper B-Line B3106V.

#### Pipe Clamps

##### Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

##### 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.

##### Wall or Ceiling Mounted Pipe Strap/Clamp (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

#### Pipe Supports

##### 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.

##### 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.

##### 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.

##### Pipe Rollers (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.

##### 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.

##### 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.

### Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

#### Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

#### 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.

### Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

#### Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

#### Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

#### Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

#### Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

#### Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

### Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

#### Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

#### Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

#### Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

#### Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

#### C-Clamps (MSS Type 23): For structural shapes. Shall only be connected to bottom joist chord if weight is 200 lbs. or less.

#### Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads. Shall only be connected to bottom joist chord if weight is 200 lbs. or less.

#### Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions. Shall only be connected to bottom joist chord if weight is 200 lbs. or less.

#### Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel. Shall only be connected to bottom joist chord if weight is 200 lbs. or less.

#### 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:

##### Light (MSS Type 31): 750 lb.

##### Medium (MSS Type 32): 1500 lb.

##### Heavy (MSS Type 33): 3000 lb.

#### Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

### Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

#### Steel-Pipe-Covering Protection Saddles (MSS Type 39): For protection of pipe insulation; depth of saddle to be larger than insulation thickness. Fill interior voids with insulation that matches adjoining insulation.

#### Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

#### Thermal-Hanger Shield Inserts: For supporting insulated pipe.

### Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

#### Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

#### Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

#### Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

#### Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

#### 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.

#### 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.

#### 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.

#### 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:

##### Horizontal (MSS Type 54): Mounted horizontally.

##### Vertical (MSS Type 55): Mounted vertically.

##### Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

### Comply with MSS SP-69 for trapeze pipe-hanger selections.

### Comply with MFMA-103 for metal framing system selections.

### Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

## MECHANICAL SEALS

### Provide mechanical seals and sleeves through exterior wall and floor penetrations, and in 3-hour or higher fire rated partitions.

## EQUIPMENT ROOF CURBS

### Provide an equipment roof curb for each roof-mounted equipment item that does not have integral equipment curb that would extend the bottom of the equipment a minimum of 24” above the roof insulation. Coordinate location of roof supports with equipment manufacturer.

### Provide all necessary sealants and flashing required for a waterproof installation. Coordinate with roof manufacturer and other trades.

## EQUIPMENT ROOF SUPPORTS

### Provide a minimum of two equipment roof supports for each roof-mounted equipment item that does not have integral equipment rails that would extend the bottom of the equipment a minimum of 24” above the roof insulation. Coordinate location of roof supports with equipment manufacturer.

### Provide all necessary sealants and flashing required for a waterproof installation. Coordinate with roof manufacturer and other trades.

## EQUIPMENT SUPPORTS

### Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

### Grouting: Place grout under supports for equipment and make bearing surface smooth.

### Provide lateral bracing, to prevent swaying, for equipment supports.

## METAL FABRICATIONS

### Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

### Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

### Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

#### Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

#### Obtain fusion without undercut or overlap.

#### Remove welding flux immediately.

#### Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

## ADJUSTING

### Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

END OF SECTION 22 05 29