SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Metal pipe hangers and supports.

Trapeze pipe hangers.

Fiberglass pipe hangers.

Metal framing systems.

Fiberglass strut systems.

Thermal-hanger shield inserts.

Fastener systems.

Pipe stands.

Equipment stands.

Equipment supports.

* + - * 1. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.

[**Section 230548 "Vibration and Seismic Controls for HVAC"**] [**Section 230548.13 "Vibration Controls for HVAC"**] for vibration isolation devices.

[**Section 233113 "Metal Ducts"**] [**and**] [**Section 233116 "Nonmetal Ducts"**] for duct hangers and supports.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.
				5. Shop Drawings: Show fabrication and installation details and for the following; include Product Data for components:

Trapeze pipe hangers.

Metal framing systems.

Fiberglass strut systems.

Pipe stands.

Equipment supports.

Retain "Delegated-Design Submittal" paragraph below if design services have been delegated to Contractor.

Retain "Welding certificates" paragraph below if retaining both "Structural-Steel Welding Qualifications" and "Pipe Welding Qualifications" paragraphs in "Quality Assurance" Article.

* + - * 1. Welding certificates.
			1. QUALITY ASSURANCE

Retain both "Structural-Steel Welding Qualifications" and "Pipe Welding Qualifications" paragraphs below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraphparagraph in "Informational Submittals" Article.

* + - * 1. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
				2. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.
				3. Regulatory Requirements:

Comply with the applicable requirements of the ASME B31 Piping Codes.

Unless otherwise shown or specified, comply with the requirements of the Manufacturer’s Standardization Society of the Valve and Fittings Industry (MSS) Standards SP-58, and SP-69.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

* + - 1. PERFORMANCE REQUIREMENTS

Retain "Delegated Design" Paragraphparagraph below if Contractor is required to assume responsibility for design.

* + - 1. METAL PIPE HANGERS AND SUPPORTS
				1. Carbon-Steel Pipe Hangers and Supports:

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

Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.

Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.

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**] [**stainless steel**] <**Insert material**>.

* + - * 1. Stainless Steel Pipe Hangers and Supports:

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

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 [**stainless steel**] <**Insert material**>.

* + - * 1. Copper Pipe and Tube Hangers:

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

Hanger Rods: Continuous-thread rod, nuts, and washer made of [**copper-plated steel**] [**stainless steel**] <**Insert material**>.

* + - 1. TRAPEZE PIPE HANGERS

Trapeze pipe hanger in "Description" Paragraphparagraph below requires calculating and detailing at each use.

* + - * 1. Description: MSS SP-58, 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.
			1. FIBERGLASS PIPE HANGERS
				1. Clevis-Type, Fiberglass Pipe Hangers:

Description: Similar to MSS SP-58, Type 1, factory-fabricated steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.

Hanger rods for fiberglass pipe hangers in first subparagraph below are typically stainless steel.

Hanger Rods: Continuous-thread rod, washer, and nuts made of [**fiberglass**] [**polyurethane**] [**or**] [**stainless steel**] <**Insert material**>.

Flammability: ASTM D635, ASTM E84, and UL 94.

* + - * 1. Strap-Type, Fiberglass Pipe Hangers:

Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.

Flammability: ASTM D635, ASTM E84, and UL 94.

Hanger rods and attachments in subparagraph below are typically stainless steel.

Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of [**stainless steel**] <**Insert material**>.

* + - 1. PLASTIC PIPE HANGERS
				1. Description: Similar to MSS SP-58, Types 1 through 58, factory-fabricated steel pipe hanger except hanger is made of plastic.
				2. Hanger Rods: Continuous-thread rod, nuts, and washer made of [**galvanized steel**] [**stainless steel**] <**Insert material**>.
				3. Flammability: ASTM D635, ASTM E84, and UL 94.
			2. METAL FRAMING SYSTEMS

Metal framing systems in this article require calculating and detailing at each use.

Framing systems in first paragraph below are made by MFMA members.

* + - * 1. MFMA Manufacturer Metal Framing Systems:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=6193) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[ABB (Electrification Products Division)](http://www.specagent.com/Lookup?uid=123457165959).

[Flex-Strut Inc](http://www.specagent.com/Lookup?uid=123457165958).

[MIRO Industries](http://www.specagent.com/Lookup?uid=123457165962).

Approved equivalent.

Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

Channels: Continuous slotted [**carbon-steel**] [**stainless steel, Type 304**] [**stainless steel, Type 316**] [**extruded-aluminum**] <**Insert material**> channel with inturned lips.

Channel Width: Selected for applicable load criteria.

Channel Nuts: Formed or stamped 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 [**galvanized steel**] [**stainless steel**] <**Insert material**>.

Retain one of four subparagraphs below for coating. Coordinate coating with material retained in "Channels" Subparagraphsubparagraph.

Metallic Coating: [**No coating**] [**Plain**] [**Pregalvanized G90 (Z275)**] [**Electroplated zinc**] [**Hot-dip galvanized**] [**Gold (yellow zinc dichromate) galvanized**].

Paint Coating: [**Green epoxy, acrylic, or urethane**] <**Insert paint type**>.

Plastic Coating: [**PVC**] <**Insert plastic type**>.

Combination Coating: <**Insert coating materials in order of application**>.

Framing systems in paragraph below should be equal to or able to exceed MFMA-4 requirements.

* + - * 1. Non-MFMA Manufacturer Metal Framing Systems:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=6194) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Carpenter & Paterson, Inc](http://www.specagent.com/Lookup?uid=123457165971).

[MIRO Industries](http://www.specagent.com/Lookup?uid=123457165973).

[Rooftop Support Systems, a division of Eberl Iron Works, Inc](http://www.specagent.com/Lookup?uid=123457165974).

Approved equivalent.

Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

Channels: Continuous slotted [**carbon-steel**] [**stainless steel**] <**Insert material**> channel with inturned lips.

Channel Width: Select for applicable load criteria.

Channel Nuts: Formed or stamped 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 [**galvanized steel**] [**stainless steel**] <**Insert material**>.

Retain one of three subparagraphs below for coating. Coordinate coating with material retained in "Channels" Subparagraphsubparagraph.

Metallic Coating: [**No coating**] [**Plain**] [**Pregalvanized G90 (Z275)**] [**Hot-dip galvanized**].

Paint Coating: [**Green epoxy, acrylic, or urethane**] <**Insert paint coating**>.

Plastic Coating: [**PVC**] <**Insert plastic type**>.

* + - 1. FIBERGLASS STRUT SYSTEMS

Fiberglass strut systems in this article require calculating and detailing at each use.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=6195) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Atkore International (Unistrut)](http://www.specagent.com/Lookup?uid=123457166018).

[Champion Fiberglass, Inc](http://www.specagent.com/Lookup?uid=123457166015).

[Fabco Plastics Wholesale Limited](http://www.specagent.com/Lookup?uid=123457166020).

Approved equivalent.

* + - * 1. Description: Structural-grade, factory-formed, glass-fiber-resin channels and angles for supporting multiple parallel pipes.

Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

Channels: Continuous slotted fiberglass-reinforced plastic channel with inturned lips.

Channel Width: Selected for applicable load criteria.

Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.

Fitting and Accessory Materials: Same as those for channels and angles[**, except metal items may be stainless steel**].

Rated Strength: Selected to suit applicable load criteria.

Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

* + - 1. THERMAL-HANGER SHIELD INSERTS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=6196) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Carpenter & Paterson, Inc](http://www.specagent.com/Lookup?uid=123457165993).

[National Pipe Hanger Corporation](http://www.specagent.com/Lookup?uid=123457165994).

[Piping Technology & Products, Inc](http://www.specagent.com/Lookup?uid=123457165991).

Approved equivalent.

* + - * 1. Insulation-Insert Material for Cold Piping: [**ASTM C552, Type II cellular glass with 100-psi (688-kPa)**] [**or**] [**ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi (862-kPa)**] minimum compressive strength and vapor barrier.
				2. Insulation-Insert Material for Hot Piping: [**Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi (688-kPa)**] [**ASTM C552, Type II cellular glass with 100-psi (688-kPa)**] [**or**] [**ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi (862-kPa)**] 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 (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.
			1. FASTENER SYSTEMS

Verify suitability of fasteners in this article for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick. Powder-actuated fasteners may be banned for use in certain occupancies (DOCCS Facilities as an example). Consult authorities having jurisdiction (DOCCS) and Owner's project requirements.

* + - * 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.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1742) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457165978).

[ITW Ramset/Red Head; Illinois Tool Works, Inc](http://www.specagent.com/Lookup?uid=123457165979).

[MKT Fastening, LLC](http://www.specagent.com/Lookup?uid=123457165980).

Approved equivalent.

* + - * 1. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1746) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457165985).

[ITW Ramset/Red Head; Illinois Tool Works, Inc](http://www.specagent.com/Lookup?uid=123457165986).

[MKT Fastening, LLC](http://www.specagent.com/Lookup?uid=123457165987).

Approved equivalent.

Indoor Applications: [**Zinc-coated**] [**or**] [**stainless**] steel.

Outdoor Applications: Stainless steel.

* + - 1. PIPE STANDS

Pipe stands in this article require calculating and detailing at each use.

* + - * 1. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
				2. Compact Pipe Stand:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13705) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[MIRO Industries](http://www.specagent.com/Lookup?uid=123457166001).

[PHP Systems/Design](http://www.specagent.com/Lookup?uid=123457166002).

[Rooftop Support Systems, a division of Eberl Iron Works, Inc](http://www.specagent.com/Lookup?uid=123457166000).

Approved equivalent.

Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.

Hardware: Galvanized steel or polycarbonate.

Accessories: Protection pads.

* + - * 1. Low-Profile, Single Base, Single-Pipe Stand:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13706) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[MIRO Industries](http://www.specagent.com/Lookup?uid=123457166005).

[PHP Systems/Design](http://www.specagent.com/Lookup?uid=123457166006).

[Rooftop Support Systems, a division of Eberl Iron Works, Inc](http://www.specagent.com/Lookup?uid=123457166004).

Approved equivalent.

Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.

Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.

Vertical Members: Two, [**galvanized**] [**stainless**]-steel, continuous-thread 1/2-inch (12-mm) rods.

Horizontal Member: Adjustable horizontal, [**galvanized**] [**stainless**]-steel pipe support channels.

Pipe Supports: [**Roller**] [**Strut clamps**] [**Clevis hanger**] [**Swivel hanger**].

Hardware: [**Galvanized**] [**Stainless**] steel.

Accessories: Protection pads.

Height: [**12 inches (300 mm) above roof**] <**Insert lesser dimension above roof**>.

* + - * 1. High-Profile, Single Base, Single-Pipe Stand:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13708) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[MIRO Industries](http://www.specagent.com/Lookup?uid=123457166009).

[PHP Systems/Design](http://www.specagent.com/Lookup?uid=123457166008).

[Rooftop Support Systems, a division of Eberl Iron Works, Inc](http://www.specagent.com/Lookup?uid=123457166007).

Approved equivalent.

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

Base: Single vulcanized rubber or molded polypropylene.

Vertical Members: Two, [**galvanized**] [**stainless**]-steel, continuous-thread 1/2-inch (12-mm) rods.

Horizontal Member: One, adjustable height, [**galvanized-**] [**or**] [**stainless**]-steel pipe support slotted channel or plate.

Pipe Supports: [**Roller**] [**Clevis hanger**] [**Swivel hanger**].

Hardware: [**Galvanized**] [**Stainless**] steel.

Retain first or second option in "Accessories" Subparagraphsubparagraph below if retaining "Clevis hanger" or "Swivel hanger" option in "Pipe Supports" Subparagraphsubparagraph.

Accessories: Protection pads[**, 1/2-inch (12-mm) continuous-thread galvanized-steel rod**] [**, 1/2-inch (12-mm) continuous-thread stainless steel rod**].

Height: [**36 inches (900 mm) above roof**] <**Insert lesser dimension above roof**>.

* + - * 1. High-Profile, Multiple-Pipe Stand:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13709) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[MIRO Industries](http://www.specagent.com/Lookup?uid=123457166012).

[PHP Systems/Design](http://www.specagent.com/Lookup?uid=123457166013).

[Rooftop Support Systems, a division of Eberl Iron Works, Inc](http://www.specagent.com/Lookup?uid=123457166010).

Approved equivalent.

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

Bases: Two or more; [**vulcanized rubber**] [**molded polypropylene**] <**Insert material**>.

Vertical Members: Two or more, [**galvanized**] [**stainless**]-steel channels.

Horizontal Members: One or more, adjustable height, [**galvanized**] [**stainless**]-steel pipe support.

Pipe Supports: [**Roller**] [**Strut clamps**] [**Clevis hanger**] [**Swivel hanger**].

Hardware: [**Galvanized**] [**Stainless**] steel.

Retain option in "Accessories" Subparagraphsubparagraph below if retaining "Clevis hanger" or "Swivel hanger" option in "Pipe Supports" Subparagraphsubparagraph.

Accessories: Protection pads[**, 1/2-inch (12-mm) continuous-thread rod**].

Height: [**36 inches (900 mm) above roof**] <**Insert lesser dimension above roof**>.

* + - * 1. 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.
			1. EQUIPMENT SUPPORTS

Equipment support in "Description" Paragraphparagraph below requires calculating and detailing at each use.

* + - * 1. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.
			1. OUTDOOR EQUIPMENT STANDS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13840) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[MIRO Industries](http://www.specagent.com/Lookup?uid=123457166021).

[RectorSeal HVAC; a CSW Industrials Company](http://www.specagent.com/Lookup?uid=123457166022).

[Rooftop Support Systems, a division of Eberl Iron Works, Inc](http://www.specagent.com/Lookup?uid=123457166023).

Approved equivalent.

* + - 1. MATERIALS
				1. Aluminum: ASTM B221 (ASTM B221M).
				2. Carbon Steel: ASTM A1011/A1011M.
				3. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
				4. Stainless Steel: ASTM A240/A240M.
				5. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
				6. Grout: ASTM C1107/C1107M, 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 (34.5-MPa), 28-day compressive strength.

1. EXECUTION
	* + 1. APPLICATION
				1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
				2. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus [**200 lb (90 kg)**] <**Insert value**>.
			2. HANGER AND SUPPORT INSTALLATION
				1. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

Trapeze pipe hanger in first paragraph below requires calculating and detailing at each use.

* + - * 1. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. 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 A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

* + - * 1. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

Framing system in first paragraph below requires calculating and detailing at each use.

* + - * 1. [**Metal**] [**Fiberglass**] Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
				2. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
				3. Space hangers or supports for horizontal piping on maximum center distances as listed below, except as otherwise specified, or noted on the Drawings.

| **PIPE MATERIAL** | **MAXIMUM SPACING (Feet)** |
| --- | --- |
| Steel | 12 |
| Steel Tubing | 8 |
| Copper or Copper Alloy | 12 |
| Copper Tubing | 8 |

For Directional Changes: Install a hanger or support close to the point of change of direction of all pipe runs in either a horizontal or vertical plane.

For Concentrated Loads: Install additional hangers or supports, spaced as required and directed, at locations where concentrated loads such as in-line pumps, valves, fittings or accessories occur, to support the concentrated loads.

For Branch Piping Runs and Runouts Over 5 feet In Length: Install a minimum of one hanger, and additional hangers if required by the hanger spacing schedules.

Parallel Piping Runs: Where several pipe lines run parallel in the same plane and in close proximity to each other, trapeze hangers may be submitted for approval. Base hanger spacing for trapeze type hangers on the smallest size of pipe being supported. Design the entire hanger assembly based on a safety factor of five, for the ultimate strength of the material being used.

* + - * 1. Fastener System Installation:

Verify suitability of fasteners in two subparagraphs below for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick. Powder-actuated fasteners may be banned for use in certain occupancies (DOCCS Facilities as an example). Consult authorities having jurisdiction (DOCCS) and project requirements.

Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) 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 in first paragraph below requires calculating and detailing at each use.

* + - * 1. 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. See Section 077200 "Roof Accessories" for curbs.

* + - * 1. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

Equipment support in first paragraph below requires calculating and detailing at each use.

* + - * 1. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
				2. 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.
				3. Install lateral bracing with pipe hangers and supports to prevent swaying.
				4. 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 (DN 65)**] <**Insert pipe size**> 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.
				5. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
				6. 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.
				7. Insulated Piping:

Specify parts in first three subparagraphs below as galvanized or painted, as required. Other materials are available in place of wooden blocks.

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.

Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

High-compressive-strength inserts may permit use of shorter shields or shields with less arc span. Revise first subparagraph below to suit Project.

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

Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

Shield Dimensions for Pipe: Not less than the following:

NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.

NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.

NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

Pipes NPS 8 (DN 200) 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.

* + - 1. UPPER HANGER ATTACHMENTS
				1. General:

Secure upper hanger attachments to overhead structural steel, steel bar joists, or other suitable structural members.

Do not attach hangers to steel decks that are not to receive concrete fill.

Do not attach hangers to precast concrete plank decks less than 2-3/4 inches thick.

Do not use flat bars or bent rods as upper hanger attachments.

* + - * 1. Attachment to Steel Frame Construction: Provide intermediate structural steel members where required by pipe support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of five.

Do not use drive-on beam clamps.

Do not support piping over 4 inches in size from steel bar joists. Secure upper hanger attachments to steel bar joists at panel points of joists.

Do not drill holes in main structural steel members.

Beam clamps, with tie rods as specified, may be used as upper hanger attachments for the support of piping, subject to clamp manufacturer’s recommended limits.

* + - * 1. Attachment to Concrete Filled Steel Decks;

New Construction: Install metal deck ceiling bolts.

Existing Construction: Install welding studs (except at roof decks). Do not support a load in excess of 250 lbs from any single welded stud.

Do not attach hangers to decks less than 2-1/2 inches thick.

* + - * 1. Attachment to Cast-In-Place Concrete: Secure to overhead construction by means of cast-in-place concrete inserts.
				2. Attachment to Existing Cast-In-Place Concrete:

For piping up to a maximum of 4 inches in size, secure hangers to overhead construction with self-drilling type expansion shields and machine bolts.

Secure hangers to wall or floor construction with single unit expansion shields or self-drilling type expansion shields and machine bolts.

* + - * 1. Attachment to Cored Precast Concrete Decks (Flexicore, Dox Plank, Spancrete, etc.): Toggle bolts may be installed in cells for the support of piping up to a maximum of 2-1/2 inches in size.
				2. Attachment to Hollow Block or Hollow Tile Filled Concrete Decks:

New Construction: Omit block or tile and pour solid concrete with cast-in-place inserts.

Existing Construction: Break out block or tile to access, and install machine bolt anchors at highest practical point on side of web.

* + - * 1. Attachment to Waffle Type Concrete Decks:

New Construction: Install cast-in-place inserts.

Existing Construction: Install machine bolt expansion anchors at highest practical point on side of web.

* + - * 1. Attachment to Precast Concrete Tee Construction:

New Construction: Tee hanger inserts between adjacent flanges, except at roof deck without concrete fill.

Existing Construction: Dual unit expansion shields in webs of tees. Install shields as high as possible in the webs.

Exercise extreme care in the field drilling of holes to avoid damage to reinforcing.

Do not use powder driven fasteners.

* + - * 1. Attachment to Wood Construction: Secure hangers to the sides (only) of wood members, by means of malleable iron side beam connectors, or malleable iron or steel side beam brackets. Do not secure hanger attachments to nailing strips resting on top of steel beams.

Secure side beam connectors to wood members with two No. 18 x 1-1/2 inch long wood screws, or two No. 16 x 1-1/2 inch long drive screws. Do not support piping over 1-1/2 inches in size from side beam connectors. Do not hammer in wood screws.

Secure side beam brackets to wood members with steel bolts or lag screws. Do not use lag screws in wooden members having a nominal thickness (beam face) under 2 inches in size. Install bolts or lag screws, in the sides of a timber or a joist, at the mid-point or above, not less than 2-1/2 inches from the lower edge when supporting branch lines and not less than 3 inches from the lower edge when supporting mains. Install heavy gage steel washers under all nuts.

Secure side beam brackets to wooden beams or joists, with lag screws or bolts of size as follows:

| **PIPE SIZE (Inches)** | **LAG SCREW SIZE (Inches)** | **BOLT DIAMETER (Inches)** |
| --- | --- | --- |
| 2 and under | 3/8 diameter x 1-3/4 | 3/8 |
| 2-1/2 and 3 | 1/2 diameter x 2 | 1/2 |
| 4 and 5 | Use Bolt | 5/8 |
|  |  |  |

Do not support piping larger than 3 inches with lag screws. Pre-drill holes for lag screws 1/8 inch in diameter less than the root diameter of the lag screw thread.

The minimum width of the lower face of wood beams or joints in which lag screws of size as specified may be used is as follows:

| **LAG SCREW DIAMETER (Inches)** | **NOMINAL WIDTH OF BEAM FACE (Inches)** |
| --- | --- |
| 3/8 | 2 |
| 1/2 | 3 |
|  |  |

Do not secure hanger attachment to the diagonals or vertical members of the trusses.

* + - 1. EQUIPMENT SUPPORTS
				1. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
				2. Grouting: Place grout under supports for equipment and make bearing surface smooth.
				3. Provide lateral bracing, to prevent swaying, for equipment supports.
			2. METAL FABRICATIONS
				1. Cut, drill, and fit miscellaneous metal fabrications for [**trapeze pipe hangers**] [**and**] [**equipment supports**].
				2. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
				3. 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.

* + - 1. ADJUSTING
				1. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
				2. Trim excess length of continuous-thread hanger and support rods to [**1-1/2 inches (40 mm)**] <**Insert dimension**>.
			2. PAINTING

Retain first "Touchup" Paragraphparagraph below if Section 0991143 "Exterior Painting" or Section 099123 "Interior Painting" is not in Project Manual.

* + - * 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.

Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

Retain "Touchup" Paragraphparagraph below if Section 0991143 "Exterior Painting" or Section 099123 "Interior Painting" is in Project Manual. Revise reference if Section 099600 "High-Performance Coatings" applies instead.

* + - * 1. Touchup: Comply with requirements in [**Section 0991143 "Exterior Painting"**] [**Section 099123 "Interior Painting"**] [**and**] [**Section 099600 "High-Performance Coatings"**] <**Insert painting Sections**> for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
				2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.
			1. HANGER AND SUPPORT SCHEDULE
				1. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
				2. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
				3. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
				4. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
				5. Use carbon-steel [**pipe hangers and supports**] [**metal trapeze pipe hangers**] [**and**] [**metal framing systems**] and attachments for general service applications.
				6. Use [**stainless steel pipe hangers**] [**and**] [**fiberglass pipe hangers**] [**and**] [**fiberglass strut systems**] and [**stainless steel**] [**or**] [**corrosion-resistant**] attachments for hostile environment applications.
				7. Use copper-plated pipe hangers and [**copper**] [**or**] [**stainless steel**] attachments for copper piping and tubing.
				8. Use padded hangers for piping that is subject to scratching.
				9. Use thermal-hanger shield inserts for insulated piping and tubing.
				10. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.

Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.

Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.

Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), 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 (DN 20 to DN 200).

Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).

Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).

U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), 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 (DN 100 to DN 900), 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 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), 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 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.

Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.

Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.

Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

* + - * 1. 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 (DN 24 to DN 600).

Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

* + - * 1. 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 (150 mm) for heavy loads.

Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) 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 (49 to 232 deg C) piping installations.

* + - * 1. 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.

Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

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.

Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

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 (340 kg).

Medium (MSS Type 32): 1500 lb (680 kg).

Heavy (MSS Type 33): 3000 lb (1360 kg).

Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

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

Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

* + - * 1. 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): To 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.

* + - * 1. 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 (32 mm).

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.

* + - * 1. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
				2. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Powder-actuated fasteners may be banned for use in certain occupancies (DOCCS FACILITIES as an example). Consult authorities having jurisdiction (DOCCS) and project requirements.

* + - * 1. Use [**powder-actuated fasteners**] [**or**] [**mechanical-expansion anchors**] instead of building attachments where required in concrete construction.

END OF SECTION 230529