**PART 1 - GENERAL**

* 1. **SUMMARY**
		1. This Section includes hangers and supports for mechanical system piping and equipment.
		2. See section 23 05 48 “HVAC Sound Vibration Seismic Control” for vibration isolation supports and hangers and seismic restraints.
	2. **DEFINITIONS**
		1. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."
	3. **PERFORMANCE REQUIREMENTS**
		1. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
		2. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
		3. Design seismic-restraint hangers and supports for piping and equipment.
		4. Design and obtain approval from authorities having jurisdiction for seismic-restraint hangers and supports for piping and equipment.
	4. **SUBMITTALS**
		1. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
		2. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
		3. Welding certificates.
	5. **QUALITY ASSURANCE**
		1. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
		2. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and seismic restraint by a qualified professional engineer.

**PART 2 - PRODUCTS**

* 1. **MANUFACTURERS**
		1. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
			1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
			2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
	2. **MANUFACTURED UNITS**
		1. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components.
			1. Manufacturers:
				1. AAA Technology and Specialties Co., Inc.
				2. B-Line Systems, Inc.
				3. Carpenter & Patterson, Inc.
				4. Empire Tool & Manufacturing Co., Inc.
				5. Globe Pipe Hanger Products, Inc.
				6. Grinnell Corp.
				7. GS Metals Corp.
				8. Michigan Hanger Co., Inc.
				9. National Pipe Hanger Corp.
				10. PHD Manufacturing, Inc.
				11. PHS Industries, Inc.
				12. Piping Technology & Products, Inc.
			2. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
			3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
		2. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
			1. Manufacturers:
				1. B-Line Systems, Inc.
				2. Grinnell Corp.
				3. GS Metals Corp.
				4. Michigan Hanger Co., Inc.
				5. National Pipe Hanger Corp.
				6. Thomas & Betts Corp.
				7. Unistrut Corp.
				8. Wesanco, Inc.
			2. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
			3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
		3. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.
			1. Manufacturers:
				1. Carpenter & Patterson, Inc.
				2. Michigan Hanger Co., Inc.
				3. PHS Industries, Inc.
				4. Pipe Shields, Inc.
				5. Rilco Manufacturing Co., Inc.
				6. Value Engineered Products, Inc.
			2. Material for Cold Piping: ASTM C 552, Type I cellular glass or water- repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
			3. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent- treated, ASTM C 533, Type I calcium silicate.
			4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
			5. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
			6. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
	3. **MISCELLANEOUS MATERIALS**
		1. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
		2. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
		3. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
		4. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
			1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
			2. Properties: Non-staining, non-corrosive, and nongaseous.
			3. Design Mix: 5000-psi, 28-day compressive strength.

**PART 3 - EXECUTION**

* 1. **APPLICATIONS**
		1. Specific hanger requirements are specified in Sections specifying equipment and systems.
		2. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
		3. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
			1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
			2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
			3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
			4. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
			5. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
			6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
			7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
			8. 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.
		4. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
			1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
			2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
		5. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
			1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
			2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
		6. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
			1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
			2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
			3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
			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.
			7. 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:
				1. Light (MSS Type 31): 750 lb.
				2. Medium (MSS Type 32): 1500 lb.
				3. Heavy (MSS Type 33): 3000 lb.
			8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
			9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
		7. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
			1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
			2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
			3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water- repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360- degree sheet metal shield.
		8. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
			1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
			2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
			3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
	2. **INSTALLATION**
		1. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89.
		2. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
		3. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems. Field assemble and install according to manufacturer's written instructions.
		4. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes. Support pipes of various sizes together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
		5. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
		6. Install powder-actuated drive-pin fasteners 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.
		7. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
		8. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
		9. 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.
		10. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
		11. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
		12. Insulated Piping: Comply with the following:
			1. Attach clamps and spacers to piping.
1. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
2. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
3. Do not exceed pipe stress limits according to ASME B31.9.
	* + 1. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
			2. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
			3. Shield Dimensions for Pipe: Not less than the following:
4. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
5. NPS 4: 12 inches long and 0.06 inch thick.
6. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
7. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
8. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
	* + 1. Pipes NPS 8 and Larger: Include wood inserts.
			2. Insert Material: Length at least as long as protective shield.
			3. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
	1. **EQUIPMENT SUPPORTS**
		1. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor. Place grout under supports for equipment and make smooth bearing surface.
	2. **METAL FABRICATION**
		1. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports. Fit exposed connections together to form hairline joints. Field- weld connections that cannot be shop-welded because of shipping size limitations. Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
			1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
			2. Obtain fusion without undercut or overlap.
			3. Remove welding flux immediately.
			4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
	3. **ADJUSTING**
		1. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
	4. **PAINTING**
		1. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field- painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils. See Division 9 Section 09900 Painting for paint materials and application requirements.
		2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

# END OF SECTION