



SECTION 22 05 29 - HANGERS & SUPPORTS FOR PLUMBING PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Hanger rods.
 - 3. Inserts.
 - 4. Flashing.
 - 5. Sleeves.
 - 6. Mechanical sleeve seals.
 - 7. Formed steel channel.
 - 8. Firestopping relating to plumbing work.
 - 9. Firestopping accessories.
 - 10. Equipment bases and supports.
 - 11. Metal framing system.
 - 12. Fastener systems.
 - 13. Pipe stand fabrication.
 - 14. Pipe positioning systems.

1.2 REFERENCES

- A. General: Comply with Appropriate Standards.
 - 1. American Welding Society: AWS
 - 2. Underwriters Laboratories Inc.: UL

1.3 SUBMITTALS

- A. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and details of trapeze hangers.
- B. Product Data:
 - 1. Submit manufacturers catalog data including load capacities.
 - 2. Submit Manufacturers preparation and installation instructions.
- C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply fire-stopping materials when temperature of substrate material and ambient air is below 60 degrees F.



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- B. Mold/mildew resistant Firestop materials per ASTM G21 Standard. Provide product data as evaluation for Resistance of Synthetic Polymeric Materials to Fungi.

1.5 WARRANTY

- A. Provide one-year minimum.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
1. **B-Line / Cooper Industries / Eaton**
 2. **Tolco / B-Line / Cooper Industries / Eaton.**
 3. **PHD Manufacturing, Inc.**
- B. Plumbing Piping – Drainage, Waste, Vent and Storm:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
 2. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 4. Wall Support: Welded steel bracket and wrought steel clamp.
 5. Vertical Support: Steel riser clamp.
 6. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 7. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
- C. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
 2. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 3. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
 5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
 7. Wall Support for Pipe Sizes 4 inches and Smaller: Welded steel bracket and wrought steel clamp.
 8. Wall Support for Pipe Sizes 5 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.



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9. Vertical Support: Steel riser clamp.
10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Floor Support for Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
12. Floor Support for Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
13. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

- A. Manufacturers:
 1. **B-Line / Cooper Industries / Eaton.**
 2. **Tolco / B-Line / Cooper Industries / Eaton.**
 3. **Hilti Corporation.**
- B. 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.

2.4 FLASHING

- A. Metal Flashing: 26 gauge thick galvanized steel.
- B. Metal Counterflashing: 22 gauge thick galvanized steel.
- C. Lead Flashing:
 1. Waterproofing: 5 lb./sq. ft sheet lead.
 2. Soundproofing: 1 lb./sq. ft sheet lead.
- D. Flexible Flashing: 47 mil thick sheet; compatible with roofing.
- E. Caps: Steel, 22 gauge minimum; 16 gauge at fire resistant elements.

2.5 SLEEVES

- A. Sleeves for pipe through all concrete floors and walls, all masonry walls: steel pipe or 18 gauge galvanized steel.
- B. Sleeves through rated gypsum assemblies: 18 gauge galvanized steel



- C. Sealant: Listed and approved type.

2.6 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 - 1. **Thunderline / Link-Seal / GPT / EnPro Industries, Inc.**
 - 2. **Or approved equal.**
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. **Tolco / B-Line / Cooper Industries / Eaton.**
 - 2. **Hilti Corporation.**
 - 3. **Unistrut Corp / Atkore International Inc.**

2.8 FIRESTOPPING

- A. Manufacturers:
 - 1. **Dow Corning Corporation.**
 - 2. **Hilti Corporation.**
 - 3. **3M Company.**
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

2.9 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- C. General:
 - 1. Furnish UL listed products or products tested by independent testing laboratory.
 - 2. Select products with rating not less than rating of wall or floor being penetrated.



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3. Floor Penetrations subject to wet areas: prevent water from flowing floor to floor by providing W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

D. Non-Rated Surfaces:

1. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

2.10 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, MFMA-4, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 1. **Tolco / B-Line / Cooper Industries / Eaton.**
 2. **Hilti Corporation.**
 3. **Unistrut Corp / Atkore International Inc.**
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.11 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 1. Manufacturers:
 - a. **B-Line / Cooper Industries / Eaton.**
 - b. **Hilti Corporation.**
 - c. **Powers Fasteners.**
 2. Expansion Anchors:
 - a. Smooth wall, non-self-drilling internal plug expansion type.
 - (1) Zinc plated steel anchors – Carbon steel anchor body, nut, and washer shall have an electroplated zinc coating conforming to ASTM B633.
 - (2) Galvanized steel anchors – Carbon steel anchor body, nut, and washer shall be hot dipped galvanized, conforming to ASTM A153.
 - (3) Stainless steel anchors - Anchor body, nut, and washer shall be stainless steel conforming to F593.
 - b. Locate spacing and install anchors in accordance with the manufacturer's recommendations.
 - c. Installer to provide ICC Evaluation Service – Evaluation Reports and/or LADBS Research Reports for anchorages where applicable.



2.12 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support piping.
- B. 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.
 - 1. Manufacturers:
 - a. **ERICO International Corporation.**
 - b. **MIRO Industries, Inc.**
 - c. **Or Approved Equal.**
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
 - 1. Manufacturers:
 - a. **MIRO Industries, Inc.**
 - b. **Or Approved Equal.**
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 1. Manufacturers:
 - a. **ERICO International Corporation.**
 - b. **MIRO Industries, Inc.**
 - c. **Portable Pipe Hangers, Inc. / also known as PHP Systems/Design.**
 - 2. Base: Stainless steel.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.13 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
 - 1. **C & S Manufacturing Corporation.**
 - 2. **Holdrite, Inc. / also known as Hubbard Enterprises.**
 - 3. **Or approved equal.**



2.14 EQUIPMENT SUPPORTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.
- B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Obtain permission from LAWA before drilling or cutting structural members.

3.3 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated 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.



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4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. 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.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. 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.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. 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.
17. 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.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. 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.
20. 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.
21. 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.



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- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 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.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - a. Inserts shall be steel, slotted type and factory-painted.
 - 1) Single rod shall be equal to Anvil International Fig. 281.
 - 2) Multi-rod shall be with end caps and closure strips.
 - 3) Clip form nails flush with inserts.
 - 4) Maximum loading including pipe, contents and covering shall not exceed 75% of rated insert capability.
 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. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.



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10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
 16. Supports from Steel Decks:
 - a. Support piping from steel deck with metal deck ceiling bolt.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.



7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Steel 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 building structure.
- B. 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.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A36 / A36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Pipe Stand Installation:
 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.



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2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
- F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. 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.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. 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.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.



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- c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood inserts.
 - 6. Insert Material: Length at least as long as protective shield.
 - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- N. Suspended Horizontal Piping:
- 1. Support piping independently from structure using heavy iron-hinged type hangers.
 - 2. Provide electroplated solid-band hangers for 2-inch and smaller pipe.
 - 3. Provide trapeze hangers of angles, angles bolted back-to-back, or channels to parallel lines of piping.
 - 4. Provide wall brackets for wall-supported piping, and furnish pipe saddles for floor-mounted piping.
 - 5. Provide supports with recommended lining for glass piping.
 - 6. Provide supports with copper lining for uninsulated copper piping.
 - 7. Suspend piping from inserts, using beam clamps with retaining clamp or locknut, steel fish plates, cantilever brackets or other accepted means.
 - 8. Suspend piping by rods with double nuts.
 - 9. Provide additional steel framing as required and accepted where overhead construction does not permit fastening hanger rods in required locations.
 - 10. Support branch fixture water piping in chases with copper-plated metal brackets, secured to studs.

3.5 EQUIPMENT SUPPORTS

- A. Mount on or support from accepted foundations and supports, all noted equipment and related piping.
- B. Size, locate, and install noise and vibration isolation equipment in accordance with manufacturer's recommendations and after review.
- C. Select noise and vibration isolation equipment for lowest operating speed of equipment to be isolated.
- D. Ensure that lateral motion under equipment at start-up, shut-down or when unbalanced is no more than a maximum of 1/4 inch.
- E. Provide corrosion resistant mounting systems when exposed to the elements and other corrosive environments. Provide hot dip galvanized metal parts of mountings (except springs and hardware). Provide cadmium-plated and neoprene-coated springs and cadmium-plated nuts and bolts.



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- F. Correct noise and vibration problems due to faulty equipment or poor workmanship, as directed, without additional charge to LAWA.
- G. Steel Spring Type:
 - 1. Utilize bare stable springs without restraints.
 - 2. Provide spring with diameter not less than 80% of loaded operating height of spring.
 - 3. Design ends of spring so that they remain parallel during and after springs are loaded to their minimum specified deflections.
 - 4. Provide springs with 50% travel from operating deflection before reaching solid height.
 - 5. Provide spring mounts with 1/4 inch thick waffled neoprene acoustical pad bonded to underside of base plate.
- H. Provide resiliently mounted equipment bases raised to operating height with a minimum of 2 inch of clearance at bottom of base prior to installing equipment.
- I. Concrete inertia blocks with adequate reinforcing steel will be provided under General Construction Work.
- J. Spring-Supported, Factory-Fabricated Inertia Bases: Provide for horizontal pumps (except fire pumps), bottom-supported vertical booster pumps, jockey pumps, rotary air compressors and vacuum pumps with five horsepower and larger motors.
 - 1. Provide concrete inertia block with factory-fabricated steel structural perimeter frame, set on roofing paper, with equipment anchor bolt templates and mounting brackets supplied by vibration control manufacturer.
 - 2. Provide and locate under brackets, spring supports with a minimum static deflection of 1 inch and with leveling device to raise entire isolation base 2 inch above foundation.
 - 3. Provide minimum thickness required for concrete inertia bases as follows:
 - a. Motor Size 5 hp to 15 hp: 6 inch.
 - b. Motor Size 20 hp to 50 hp: 8 inch.
 - c. Motor Size 60 hp to 100 hp: 10 inch.
 - d. Motor Size Over 100 hp: 12 inch.
- K. Spring supported factory fabricated structural steel bases: Provide for vertical booster pumps suspended from floor slab above and through penetration.
 - 1. Provide equipment rigidly bolted to spring supported reinforced structural base and isolated from suitable framed structural supports erected from floor slab.
 - 2. Provide reinforced structural steel base constructed with structural members having depth of section not less than 1/12 span between spring mountings and supplied by vibration control manufacturer.
 - 3. Provide a framed base to permit removal of any pump mounted on structural base.
 - 4. Provide structural supports erected from floor slab, sized and framed to accept spring mountings and supported loads.



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5. Piping in projected area of isolated structural pump base may be rigidly supported from isolated pump base.
 6. Provide spring mountings designed so that they are capable of supporting equipment at fixed elevation during installation, and adjusted to provide operating clearance in mountings of 1/4 inch.
- L. Center of gravity (C.G.) mounted spring inertia blocks:
1. Equipment and its driving motor shall be integrally mounted on spring-supported concrete inertia blocks.
 2. Provide inertia blocks sized to provide sufficient mass so that dynamic movement of equipment block assembly will be less than 1/16 inch peak-to-peak at any connection flange. Form shall be as noted for foundations.
 3. Provide blocks and spring mountings arranged to accomplish dynamically symmetrical system with respect to total C.G. of spring assembly in all three major axes.
 4. Provide steel spring mountings consisting of bare stable springs arranged in pendulum configuration with built-in adjustable side snubbers, leveling device and 1/4 inch thick neoprene acoustical base pad.
 5. Provide mountings with a minimum static deflection corresponding to isolation efficiency of 90% at lowest equipment operating speed.

3.6 METAL FABRICATIONS

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

3.7 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.



3.8 FIELD QUALITY CONTROL

- A. All tests shall be in accordance with the City of Los Angeles and Inspector of Record.

END OF SECTION 22 05 29