

## SECTION 20 05 29 - HANGERS AND SUPPORTS FOR FACILITY SERVICES

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes

1. Hangers and supports for the following facility services piping and equipment:
  - a. Fire suppression
  - b. Plumbing
  - c. Heating, ventilating, and air conditioning
  - d. Electrical
  - e. Electronic safety and security

#### 1.2 DEFINITIONS

- ##### A. Terminology:
- As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.3 SUBMITTALS

##### A. Product Data:

1. Trapeze hangers.
2. Steel slotted channel systems.
3. Cable strut support systems.
4. Equipment supports.

- ##### B.
- Refer to Division 26 Section "Lighting" for lighting fixture hangers.

#### 1.4 QUALITY ASSURANCE

- ##### A. Welding:
- Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.
- ##### B.
- Comply with NFPA-70.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, raceways, lighting, and other equipment capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Manufacturers:
  - 1. AAA Technology & Specialties Co., Inc.
  - 2. Bergen-Power Pipe Supports.
  - 3. B-Line Systems, Inc.; a division of Cooper Industries.
  - 4. Carpenter & Paterson, Inc.
  - 5. Empire Industries, Inc.
  - 6. ERICO/Michigan Hanger Co.
  - 7. Globe Pipe Hanger Products, Inc.
  - 8. Grinnell Corp.
  - 9. GS Metals Corp.
  - 10. National Pipe Hanger Corporation.
  - 11. PHD Manufacturing, Inc.
  - 12. PHS Industries, Inc.
  - 13. Piping Technology & Products, Inc.
  - 14. Tolco Inc.

### 2.2 SUPPORTING DEVICES (ELECTRICAL SYSTEMS):

- A. Provide supporting devices which comply with manufacturer's standard materials, design and construction, in accordance with published product information and as required for complete installation; and as herein specified. Where more than one type of supporting device meets requirements, selection is Contractor's option.
- B. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:
- C. Clevis Hangers: For supporting rigid metal conduit; galvanized steel; with **1/2-inch (13-mm)** diameter hole for round steel rod; approximately **54-lbs. (25-kg)** per 100 units.
- D. Riser Clamps: For supporting rigid metal conduit; black steel; with two (2) bolts and nuts, and **4-inch (101.6-mm)** ears; approximately **510-lbs. (231-kg)** per 100 units.
- E. C-Clamps: Malleable iron; **1/2-inch (13-mm)** rod size; approximately **70-lbs. (32-kg)** per 100 units.
- F. Beam Clamps: Malleable iron, **1-1/4-inch by 3/16-inch (32-mm by 5-mm)** stock; **5/16-inch (8-mm)** cross bolt; approximately **22-lbs. (10-kg)** per 100 units for **1-inch (25.4-mm)** size.

- G. One-Hole Conduit Straps: For supporting 3/4-inch (19-mm) rigid metal conduit, galvanized steel; approximately 7-lbs. (3-kg) per 100 units.
- H. Two-Hole Conduit Straps: For supporting 3/4-inch (19-mm) rigid metal conduit, galvanized steel; 3/4-inch (19-mm) strap width; and 2-1/8-inch (54-mm) between center of screw holes.
- I. Conduit Clamps: For supporting electrical metal tubing or rigid steel conduit; galvanized stamp steel, with bolt, approximately 7-lbs. (3-kg) per 100 units. Heat-treated spring steel clamps not permitted.
- J. Hexagon Nuts: For 1/2-inch (13-mm) rod size; galvanized steel; approximately 4 lbs. (2-kg) per 100 units.
- K. Round Steel Rod: Black steel; 1/2-inch (13-mm) diameter; approximately 67 lbs. (30-kg) pounds per 100-ft. (30.5-m).
- L. Anchors: Provide anchors of types, sizes and materials indicated, with following construction features:
  - 1. Lead Expansion Anchors: 1/2-inch (13-mm); approximately 38 lbs. (17-kg) per 100 units.
  - 2. Toggle Bolts: Springhead; 3/16-inch by 4-inch (5-mm by 102-mm); approximately 5-lbs (2-kg) per 100 units.
  - 3. Wood Screws: Cadmium-plated, with machine or flat heads; size.
  - 4. Sheet Metal Screws: Cadmium-plated, with machine, pan heads or hex-drive heads; size.
  - 5. Threaded Studs: Cadmium-plated, set by a power charge, and provided with lock washers and nuts; size.
  - 6. Nylon Anchors: Nail-type.
- M. Building Support Systems: Provide one of the following or a combination of both:
  - 1. U-Channel Support Systems: 12 gage, 0.108-inch (2.743-mm), hot-dip galvanized steel, of types and sizes indicated; construct with 9/16-inch (14-mm) diameter holes, 8-inches (203-mm) o.c. on top surface, with standard plated finish and with the following fittings, which mate and match with U-channel:
    - a. Fixture Hangers
    - b. Channel Hangers
    - c. End Caps
    - d. Beam Clamps
    - e. Wiring Studs
    - f. Thinwall Conduit Clamps
    - g. Rigid Conduit Clamps
    - h. Conduit Hangers
    - i. U-Bolts
  - 2. Cable Strut Support Systems (Lighting Only): System consisting of wire rope spanning between structural members connected with proprietary fasteners.
    - a. Manufacturer: Gripple, Inc.

- b. Performance Requirements: Design, fabricate and construct wire rope hanger and support system to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- c. Wire Rope: 7-by-19, 1/8 inch or 1/4 inch diameter as required by lengths and loads, made from stainless steel wire complying with ASTM A 492, Type 304 or galvanized steel complying with ASTM A 603.
  - 1) Length: Per manufacturer or Engineer of Record's recommendation.
- d. Cable Strut Fastener: one-piece die cast Type ZA2 zinc two-channel housing, encasing a series of Type 302 stainless steel springs with serrated self-locking steel wedges, adjustable by means of a setting key; sizes as required to accommodate design loads.
  - 1) Product: Gripple, Inc.; D3 or D6 depending on wire diameter.
- e. C-Clip Hanger: ZA2 Zinc; Capable of accommodating design load.
  - 1) Product: Gripple, Inc.; C-Clip, 1/8 inch or 1/4 inch as required for cable strut.

## 2.3 SUPPORTING DEVICES (FIRE SUPPRESSION, PLUMBING, AND HVAC PIPING AND EQUIPMENT)

### A. Steel Pipe Hangers and Supports

- 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- 2. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### B. Trapeze Pipe Hangers: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### C. Metal Framing Systems:

- 1. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- 2. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

### D. Thermal-Hanger Shield Inserts

- 1. Description: ~~100-psig-~~ (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.
- 2. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.

3. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.
4. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
5. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
6. Insert Length: Extend **2 inches (50 mm)** beyond sheet metal shield for piping operating below ambient air temperature.

E. Fastener Systems

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

F. Equipment Supports: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

G. Copper Pipe Hangers

1. Description: MSS SP-58, Types 1 through 58 copper-coated-steel, factory fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

## 2.4 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: **5000-psi (34.5-MPa)**, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Refer to Division 26 Section "Lighting" for installation of building attachments for lighting fixtures.
  2. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

3. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
4. Side-Beam or Channel Clamps (MSS Type 20): For attaching to top flange of beams, channels, or angles.
5. Center-Beam Clamps (MSS Type 21): For attaching to center of top flange of beams.
6. Welded Beam Attachments (MSS Type 22): For attaching to top of beams if loads are considerable and rod sizes are large.
7. C-Clamps (MSS Type 23): For structural shapes.
8. 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 (340 kg).
  - b. Medium (MSS Type 32): 1500 lb (680 kg).
  - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
9. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
10. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

B. Electrical Systems

1. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
2. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
3. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - a. Secure raceways and cables to these supports with two-bolt conduit clamps.
4. Spring-steel clamps designed for supporting single conduits without bolts may be provided for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
5. Hang racks with two or more conduits by hangers suspended from roof trusses and joists/joist girders only at panel points, at top cord only, unless otherwise indicated.

C. Fire Suppression, Plumbing, and HVAC Piping and Equipment

1. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
2. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
3. Provide hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
4. Provide nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
5. Provide padded hangers for piping that is subject to scratching.
6. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

- a. 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)**.
  - b. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of **120 to 450 deg F (49 to 232 deg C)** pipes, **NPS 4 to NPS 16 (DN 100 to DN 400)**, requiring up to **4 inches (100 mm)** of insulation.
  - c. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, **NPS 3/4 to NPS 24 (DN 20 to DN 600)**, requiring clamp flexibility and up to **4 inches (100 mm)** of insulation.
  - d. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, **NPS 1/2 to NPS 8 (DN 15 to DN 200)**.
  - e. U-Bolts (MSS Type 24): For support of heavy pipes, **NPS 1/2 to NPS 30 (DN 15 to DN 750)**.
  - f. 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.
  - g. Single Pipe Rolls (MSS Type 41): For suspension of pipes, **NPS 1 to NPS 30 (DN 25 to DN 750)**, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  - h. 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 not necessary.
7. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, **NPS 3/4 to NPS 20 (DN 20 to DN 500)**.
  - b. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, **NPS 3/4 to NPS 20 (DN 20 to DN 500)**, if longer ends are required for riser clamps.
8. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel Turnbuckles (MSS Type 13): For adjustment up to **6 inches (150 mm)** for heavy loads.
  - b. Steel Clevises (MSS Type 14): For **120 to 450 deg F (49 to 232 deg C)** piping installations.
9. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  - b. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
  - c. Side-Beam or Channel Clamps (MSS Type 20): For attaching to top flange of beams, channels, or angles.
  - d. Center-Beam Clamps (MSS Type 21): For attaching to center of top flange of beams.



- e. Welded Beam Attachments (MSS Type 22): For attaching to top of beams if loads are considerable and rod sizes are large.
  - f. C-Clamps (MSS Type 23): For structural shapes.
  - g. 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 (340 kg).
    - 2) Medium (MSS Type 32): 1500 lb (680 kg).
    - 3) Heavy (MSS Type 33): 3000 lb (1360 kg).
  - h. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  - i. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
10. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  - b. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  - c. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
11. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
- a. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  - b. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  - c. 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.
12. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
13. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
14. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

### 3.2 HANGER AND SUPPORT INSTALLATION

#### A. Electrical Systems

- 1. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- 2. Install supporting devices and attachments, in accordance with manufacturer's written instructions and with recognized industry practices.



- a. Comply with requirements of NEC and NECA for installation of supporting devices.
    - b. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze-type hangers, where possible.
    - c. Install supports with spacings in compliance with NEC requirements.
    - d. Wire or perforated metal strap is not acceptable for hanger supports or securing raceways to supporting devices.
  3. Supports and Anchors: Securely and rigidly fasten equipment in place with pipe hangers, wall brackets, clamps, approved hangers, threaded C-clamps, with retainers or ceiling trapeze.
    - a. Hangers, clamps and support fittings to be malleable iron.
    - b. Fasten with wood screws or screw-type bolts on concrete or brick; by machine screws, welded threaded studs, steel or malleable iron clamps on steel work.
    - c. Nail-type nylon anchors and threaded studs, driven in by powder charge, and provided with lock washers and nuts, may be provided in lieu of expansion bolts or machine or wood screws.
    - d. Anchors shall not be welded to steel structures, or attached to roof or floor deck.
    - e. Cut holes in reinforced concrete beams or in concrete joists without cutting reinforcing bars. Holes not used, to be filled.
  4. Install supporting devices securely and rigidly in place.
  5. Conduits supported, using suspended ceiling system, will not be permitted.
- B. Fire Suppression, Plumbing, and HVAC Piping and Equipment
1. 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.
  2. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
    - a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
    - b. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
  3. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
  4. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
  5. Fastener System Installation:
    - a. Install powder-actuated fasteners in concrete after concrete is placed and cured for 28 days. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
    - b. Install mechanical-expansion anchors in concrete after concrete is placed and cured for 28 days. Install fasteners according to manufacturer's written instructions.

6. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
7. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
8. 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.
9. Install lateral bracing with pipe hangers and supports to prevent swaying.
10. 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)** 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.
11. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
12. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
13. Insulated Piping: Comply with the following:
  - a. 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 B31.1 for power piping and ASME B31.9 for building services piping.
  - b. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  - c. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  - d. Shield Dimensions for Pipe: Not less than the following:
    - 1) **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.
    - 2) **NPS 4 (DN 100): 12 inches (305 mm)** long and **0.06 inch (1.52 mm)** thick.
    - 3) **NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm)** long and **0.06 inch (1.52 mm)** thick.
    - 4) **NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm)** long and **0.075 inch (1.91 mm)** thick.
    - 5) **NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm)** long and **0.105 inch (2.67 mm)** thick.
  - e. Pipes **NPS 8 (DN 200)** and Larger: Include wood inserts.
  - f. Insert Material: Length at least as long as protective shield.
  - g. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 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.

### 3.5 ADJUSTING

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

### 3.6 PAINTING

- A. Touch 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.

END OF SECTION 20 05 29

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