

SECTION 15140 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. Regulatory Requirements: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
 - 2. NFPA Compliance: Hangers and supports shall comply with NFPA standard No. 13 when used as a component of a fire protection system and NFPA Standard No. 14 when used as a component of a standpipe system. NFPA 99 shall be used for medical gas systems.
 - 3. UL and FM Compliance: Hangers, supports, and components shall be listed and labeled by UL and FM where used for fire protection piping systems.

OR

Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Hangers, supports, and components shall be listed and labeled by a NRTL where used for fire protection piping systems. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

- 4. Duct Hangers: SMACNA Duct Manuals
 - 5. MSS Standard Compliance:
 - a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-69.
- 1.2 SUBMITTALS:
- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing Manufacturer's figure number, size, location, and features for each required pipe hanger and support.
 - B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.
 - C. Product certificates signed by the manufacturer of hangers and supports certifying that their products meet the specified requirements.
 - D. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 15.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers and Supports:

- a. B-Line Systems Inc.
- b. ANVIL International
- c. PHD Manufacturing, Inc.
- d. Unistrut Metal Framing Systems
- e. Hubbard Enterprises (Supports for domestic water piping)
- f. Specialty Products Co. (Supports for domestic water piping).

2. Saddles, Shield and Thermal Shield Inserts:

- a. ANVIL International
- b. Pipe Shields, Inc.
- c. B-Line
- d. Insulated Saddle Shield Insert Product Inc.

3. Roof Equipment Supports:

- a. Custom Curb, Inc.
- b. Pate Co.
- c. Thycurb Div.; Thybar Corp.
- d. Vent Products, Inc.

4. Concrete Inserts and Anchors:

- a. Unistrut Metal Framing Systems
- b. Power-Strut
- c. ITW Ramset/Red Head
- d. Hilti
- e. B-Line

2.2 PIPE HANGERS & SUPPORTS:

A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-69.

1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

- B. Adjustable Clevis Hanger: MSS Type.
 - 1. Steel Pipe, size 3/8" thru 30", Type 1.
 - 2. Non-insulated Copper Pipe, size 1/2" thru 4", Type 1. (PVC Coated)
 - 3. Cast Iron Pipe, size 4" thru 24", Type 1.

- C. Adjustable Swivel Ring for Non-insulated Pipe: MSS Type .
 - 1. Steel Pipe, size 1/2" thru 8", Type 7.
 - 2. Copper Pipe, size 1/2" thru 4", Type 7 (PVC Coated)

- D. Pipe Clamps: MSS Type .
 - 1. Steel Pipe, size 3/4" thru 24", Type 8.
 - 2. Copper Pipe, size 1/2" thru 4", Type 8 (PVC Coated).

- E. U Bolts: MSS Type .
 - 1. Steel Pipe, size 1/2" thru 30" Type 24
 - 2. Copper Pipe, size 1/2" thru 8", Type 24 (PVC Coated).

- F. Straps: MSS Type 26.

- G. Pipe Stanchion Saddle: MSS Type 37.

- H. Yoke & Roller Hanger: MSS Type 43

- I. Hanger Rods: Continuous threaded steel, sizes as specified.

- J. Hangers:
 - 1. Hot Pipes:
 - a. 1/2" through 1-1/2": Adjustable wrought steel ring.
 - b. 2" through 5": Adjustable wrought steel clevis.
 - c. 6" and Over: Adjustable steel yoke and cast iron roll.

 - 2. Cold Pipes:
 - a. 1/2" through 1-1/2": Adjustable wrought steel ring.
 - b. 2" and Over: Adjustable wrought steel clevis.

 - 3. Multiple or Trapeze: Structural steel channel (with web vertical and engineered for the specific applications), with welded spacers and hanger rods. Provide cast iron roll and base plate for hot pipe sizes six inches and over. Provide hanger rods one size larger than for largest pipe in trapeze. If the deflection at center of trapeze exceeds 1/360 of the distance between the end hangers, install an additional hanger at mid-span or use a larger channel.

- K. Wall Supports for Horizontal Steel Pipe:
 - 1. 1/2 inch through 4inches: Offset or straight j-hook.

2. 4 inches and Over: Welded steel bracket Type 31, 32 or 33 and wrought steel clamp. Provide adjustable steel yoke and cast iron roll Type 44 for hot pipe 200° F and over and for sizes six inches and over.
- L. Supports for Vertical Pipe: Steel riser clamp. Type 8.
- M. Upper Attachments:
1. For attaching hanger rods to structural steel I-beams:
 - a. Provide adjustable beam clamp, MSS-Type 21. Attach to bottom flange of beam.
 2. For attaching hanger rods to bar joists:
 - a. When bottom chord is constructed of structural steel angles, provide square washer. Place hanger rod between backs of the two angles and support with the washer and dual locking nuts on top of the angles. Spot weld washer to angles.
 - b. When bottom chord is constructed of round bars, provide Elcen No. 137 bar joint washer or equal.

2.3 CONCRETE INSERTS AND ANCHORS:

- A. Inserts: Case shall be of galvanized carbon steel with square threaded concrete insert nut for hanger rod connection; top lugs for reinforcing rods, nail holes for attaching to forms. This type of upper attachment is to be used for all areas having poured in place concrete construction.
1. Size inserts to suit threaded hanger rods.
- B. Provide fasteners attached to concrete ceilings that are vibration and shock resistant. Provide hangers for piping attached to concrete construction with one of the following types.
1. Concrete insert per MSS SP 69, Type 18.
 2. Powder driven fasteners subject to approval of Architect and Structural Engineer. Each fastener shall be capable of holding a test load of 1000 pounds whereas the actual load shall not exceed 50 pounds.
 3. Self-drilling expansion shields. The load applied shall not exceed one-fourth the proof test load required.
 4. Machine bolt expansion anchor. The load applied shall not exceed one-fourth the proof test load required.
- C. Anchors: Carbon steel, zinc plated and coated with a clear chromate finish. Installation shall be in holes drilled with carbide-tipped drill bits or by use of self-drilling anchors.
1. Provide anchors suitable for the location of installation and designed to withstand all forces and movements acting in the anchor. Manufacture pipe anchors in accordance with MSS SP 69. Provide a safety factor of four for the anchor installation.

2.4 SADDLES AND THERMAL SHIELD INSERTS:

- A. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
- B. Protection Shields: MSS Type 40; 180 degrees arc, galvanized steel, minimum 12 inches long, to prevent crushing of insulation.
- C. Thermal Shield Inserts: Provide 100-psi minimum compressive strength, waterproof, asbestos free calcium silicate, encased with a sheet metal enclosure. Insert and shield shall cover the entire circumference or the bottom half circumference of the pipe as required by Part 3 of this Specification, and shall be of length recommended by the manufacturer for pipe size and thickness of insulation. For cold piping, calcium silicate shall extend beyond the sheet metal shield to allow overlap of the vapor barrier. Where piping 4 inches and larger is supported on trapeze or pipe rollers, provide double thickness shields. For piping 12 inches and over, provide 600 psi calcium silicate structural insert.

2.5 MISCELLANEOUS MATERIALS:

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix ratio shall be 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
- C. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.
- D. Pipe Alignment Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

Provide Details

2.6 ROOF EQUIPMENT SUPPORTS:

- A. [See details on drawings](#)

PART 3 1 EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION:

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments. Review Structural Drawings to obtain structural support limitations.

- B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site / Engineer's office with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified. Provide Shop Drawing showing method and support locations from structure.

3.3 INSTALLATION OF BUILDING ATTACHMENTS:

- A. Install building attachments within concrete or on 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, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.
- B. New Construction:
1. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
 2. Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 4 inches or ducts over 60 inches wide.
 3. Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
 4. Where inserts are omitted drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab if construction above permits.
- C. Existing Construction:
1. In existing concrete construction, drill into concrete slab and insert and tighten expansion anchor bolt. Connect anchor bolt to hanger rod. Care must be taken in existing concrete construction not to sever reinforcement rods or tension wires.

3.4 INSTALLATION OF HANGERS AND SUPPORTS:

- A. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on field fabricated, heavy-duty trapeze hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
- C. Support fire-water piping independently from other piping systems.
- D. Prevent electrolysis and abrasion in support of copper tubing by use of hangers and supports which are plastic coated, or with EPDM isolation strips. Duct tape or copper coated hangers are not acceptable.

- E. Install hangers and supports to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, to facilitate action of expansion joints, expansion loops, expansion bends and similar units and within 1'-0" of each horizontal elbow.
- F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31.9 Building Services Piping Code is not exceeded.
- H. Insulated Piping: Comply with the following installation requirements.

NOTE: Industry standard for commercial work is sheet metal shields for piping 2 inches and less and thermal inserts on piping over 2 inches. For budget jobs, consider allowing insulation to be notched on heating and domestic hot water piping. Large (>12 inches) pipe may require special consideration.

- 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
- 2. Saddles: Install Protection saddles where supported by pipe rollers. Fill interior voids with segments of insulation that match adjoining pipe insulation.
- 3. Shields: Install galvanized steel protection shields, on all insulated piping 2 inches and less, except where required to be clamped. Where necessary to prevent dislocation, strap shield to pipe with wire ties or "Zip Strips".
- 4. Thermal Inserts: Provide thermal shield inserts at all supports for all insulated piping over 2 inches and for all piping required to be clamped. Provide 180 percent inserts at clevis and roller hangers. Provide 360 percent inserts for all trapeze and clamped supports.
- I. Install horizontal hydronic and steam piping with the following minimum rod sizes and maximum spacing:

SIZE (NPS)	MAX. SPAN IN FEET		MIN. ROD SIZE-INCHES
	Steel	Copper	
1	7	6	3/8
1-1/2	9	8	3/8
2	10	8	3/8
3	12	10	1/2
4	14	12	5/8
5	16	13	5/8
SIZE (NPS)	MAX. SPAN IN FEET		MIN. ROD SIZE-INCHES
	Steel	Copper	

6	17	14	3/4
8	19	16	7/8
10	22	18	7/8
12	23	19	7/8
14	25	-	1"
16	27	-	1"
18	20	-	1"
20	30	-	1-1/4"
24	32	-	1-1/4"
30	33	-	1-1/4"

J. Install steel natural gas piping with the following minimum rod size and maximum spacing:

SIZE (NPS)	MAX. SPAN IN FEET	MIN. ROD SIZE - INCHES
1/2	8	3/8
3/4 TO 1	9	3/8
1-1/2	12	3/8
2	13	3/8
3	15	1/2
4	17	5/8
5	19	5/8
6	21	3/4
8	24	7/8
10	26	7/8
12	30	7/8

Vertical, all sizes every floor level

K. Install medical gas piping hangers with the following maximum spacing.

1. 1/2" Pipe Size: 6' O.C.
2. 3/4" Pipe Size: 7' O.C., 1" pipe size: 8'
3. 1-1/4" or Larger Pipe Size: 9' O.C.
4. 1-1/2" and larger: 10'
5. Vertical Piping: Every floor level.

L. Support horizontal cast iron pipe as follows:

1. Hub & Spigot: All sizes.
 - a. 10 ft. max spacing: min of one (1) hanger per pipe section close to joint on the barrel. Also at change of direction and branch connections.
 - b. Support vertical cast iron pipe at each story height and at its base. Secure vertical hub and spigot pipe immediately below the hub.
 - c. Use hanger rods same size as for steel pipe.
2. .No-Hub: All sizes
 - a. With Clamp-All and Anaheim Series 4000 stainless steel couplings and MG cast iron couplings: one hanger to each joint.
 - b. With all other stainless steel band type couplings: one hanger to each side of joint.
 - c. Support all horizontal cast iron pipe within 18 inches of each joint and with 5 feet maximum spacing between hangers, except that pipe exceeding 5 feet in length shall be supported at intervals no greater than 10 feet.
 - d. Use hanger rods same size as for steel pipe.
 - e. Support vertical cast iron pipe at each story height and at its base. Support vertical no-hub pipe so that the weight is carried from the pipe to the support and not from the joint to the support.
- M. Place a hanger within one foot of each horizontal elbow.
- N. Use hangers which are vertically adjustable 1-1/2 inch minimum after piping is erected.
- O. Support vertical steel and copper piping at every story height but at not more than 15 foot intervals for steel and 10 feet for copper.
- P. Where several pipes can be installed in parallel and at same elevation, provide trapeze hangers.
- Q. Where practical, support riser piping independently of connected horizontal piping.
- R. Support steam supply and condensate return pipe runs on adjustable roller hangers.
- S. Each pipe drop to equipment shall be adequately supported. All supporting lugs or guides shall be securely anchored to the building structure.
- T. Securely anchor and support plumbing domestic water piping in chases or walls. Use factory manufactured clamps and brackets connected to fixture s, waste/vent piping or brackets connected to studs. Wires or straps will not be permitted.
 1. When copper supplies are connected to flush valves, support the tubing by the studs or by a fixture, not by clamping to waste/vent piping.
 2. Prevent copper tubes from making contact with steel brackets using fire retardant polyethylene inserts or other dielectric insulating material. Duct tape shall not be used.

- U. Install anchors and fasteners in accordance with manufacturer's recommendations and the following:
1. In the event a self-drilling expansion shield or machine bolt expansion shield is considered to have been installed improperly, the Contractor shall make an acceptable replacement or demonstrate the stability of the anchor by performing an on-site test under which the anchor will be subjected to a load equal to twice the actual load.
 2. Powder-driven fasteners may be used only where they will be concealed after the construction is complete. Where an occasional fastener appears to be improperly installed, additional fastener(s) shall be driven nearby (not closer than 6 inches) in undisturbed concrete. Where it is considered that many fasteners are improperly installed, the Contractor shall test load any 50 successively driven fasteners. If 10 percent or more of these fasteners fail, the Contractor shall utilize other fastening means as approved and at no additional cost to the Owner.
 3. Hangers for piping and ducts shall be attached to cellular steel floor decks with steel plates and bolted rod conforming to the steel deck manufacturer's requirements. Where the individual hanger load exceeds the capacity of a single floor deck attachment, steel angles, beams or channels shall be provided to span the number of floor deck attachments required.
 4. Welding may be used for securing hangers to steel structural members. Welded attachments shall be designed so that the fiber stress at any point of the weld or attachment will not exceed the fiber stress in the hanger rod.

3.5 INSTALLATION OF ANCHORS:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31.9, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31.9 and with AWS Standards D1.1.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to control movement to compensators.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping. Provide shop drawing for review by Engineer.

3.6 SHEET METAL DUCT HANGERS AND SUPPORTS:

- A. Provide in accordance with SMACNA HVAC duct construction standards.
- B. Additional Hanger Requirements:
 1. 2" to 24" from flexible connections of fans.
 2. 2" to 24" from the outlets or flexible connections of VAV control units or mixing boxes.
 3. 12" to 36" from the main duct to the first hanger of long branch ducts.
 4. 2" to 12" from the ends of all branch ducts and linear diffuser plenums.
 5. 2" to 24" from fire damper break-away joints.
 6. Hangers at throat and heel of round or square elbows 48" or greater in width.

3.7 EQUIPMENT SUPPORTS:

- A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.
- B. Grouting: Place grout under supports for piping and equipment.
- C. Concrete bases for the mechanical equipment indoors or outdoors will be provided by the General Contractor only if shown on the architectural or structural drawings. Otherwise, all bases shall be provided by this Contractor.
- D. For inertia bases, see Section 15241.
- E. Housekeeping bases shall be 4 inches thick minimum, extended 4 inches beyond machinery bedplates.
- F. This Contractor shall be responsible for the proper size and location of all bases and shall furnish all required anchor bolts and sleeves. If bases are provided by the General Contractor, furnish him with templates showing the bolt locations.
- G. Equipment shall be secured to the bases with anchor bolts of ample size. Bolts shall have bottom plates and pipe sleeves and shall be securely imbedded in the concrete. All machinery shall be grouted under the entire bearing surface. After grout has set, all wedges, shims and jack bolts shall be removed and the space filled with non-shrinking grout. This Contractor shall provide lead washers at all equipment anchor bolts.
- H. Construct equipment supports above floor of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- I. Provide rigid anchors for ducts and pipes immediately after vibration connections to equipment. See also Section 15241.

3.8 PREFABRICATED ROOFTOP EQUIPMENT SUPPORTS:

A. Equipment Bases:

1. Equipment base shall be solid top combination equipment base with integral duct curb and stepped cant to match roof insulation. Base shall pitch to match roof pitch and provide level unit installation.
2. Base shall be constructed of reinforced 18 gauge galvanized steel with all welded components, full mitered corners, factory installed 1-1/2 inches thick rigid fiberglass insulation, wood nailer, and galvanized steel counter- flashing. Base shall be shipped as one piece.

B. Equipment Rails:

1. Equipment rail shall be constructed of 18 gauge galvanized steel shell, base plate, and counterflashing with factory installed wood nailer, fully mitered end sections, stepped cant to match roof insulation. Rails shall pitch to match roof pitch and provide level installation.

C. All supports shall be installed in accordance with manufacturer's recommendations.

3.9 METAL FABRICATION:

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.
- 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 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and 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 at welded surfaces match adjacent contours.

3.10 ADJUSTING:

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

OR

Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 section "Painting" of these specifications.

- C. For galvanized surfaces clean welds bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 15140