Anvil CSI 3 Part MasterFormat Specifications

HANGERS AND SUPPORTS SECTION 23 05 29

PART 4 GENERAL

4.1 SECTION INCLUDES

A. Hangers and supports for mechanical piping, ducting and equipment.

4.2 RELATED SECTIONS

A. Division 3 Section: Cast-in-Place Concrete.

B. Division 5 Section: Structural Steel.

C. Division 5 Section: Metal Fabrications.

4.3 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. B31.1 - Power Piping (SI Edition).
   2. B31.3 - Chemical Plant and Petroleum Refinery Piping.
   3. B31.9 - Building Services Piping.

B. ASTM International (ASTM):
   1. A36 - Standard Specification for Carbon Structural Steel.
   2. A47 - Standard Specification for Ferritic Malleable Iron Castings.
   3. A48 - Standard Specification for Gray Iron Castings.
   4. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   5. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   6. A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   7. A387 - Standard Specification for Pressure Vessel Plates, Alloy Steel, Chromium-Molybdenum.
   8. A515 - Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate-and Higher-Temperature Service.
   9. A536 - Standard Specification for Ductile Iron Castings.
   10. A575 - Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
   11. A668 - Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
   12. A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   13. B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

C. Manufacturers Standardization Society of The Valve and Fittings Industry (MSS) Standard Practices:
   1. SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.
   2. SP-69 Pipe Hangers and Supports - Selection and Application.
   3. SP-77 Guidelines for Pipe Support Contractual Relationships.
   4. SP-90 Guidelines on Terminology for Pipe Hangers and Supports.
   5. SP-127 Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application.

4.4 SYSTEM DESCRIPTION

A. Contractor General Requirements:
   1. Incorporate in construction pipe hangers and supports to manufacturer’s recommendations utilizing manufacturer’s regular production components, parts and assemblies.
   2. Comply with maximum load ratings with consideration for allowable stresses prescribed by ASME B31.1 or MSS SP-58.
   3. Provide supports, guides and anchors that do not transmit unacceptable heat and vibration to building structure.
   4. The selection of pipe hangers and supports shall be based upon the overall design concept of the piping systems and any special requirements, which may be called for in the specifications. The support systems shall provide for, and control, the free or intended movement of the piping including its movement in relation to that of connected equipment. (Extracted from ANSI/MSS-SP69, 2003, Page 1, Section 4.2, with permission of the publisher, the Manufacturers Standardization Society.)
   5. Provide for vertical adjustments after installation of supported material and during commissioning, where feasible, to ensure pipe is at design elevation and slope.

B. Selection of Hangers and Supports for Pipe Movement:
   1. Select hangers and supports to perform under all conditions of operation, allowing free expansion and contraction,

TABLE 3 – Maximum Horizontal Pipe Hanger and Support Spacing

Nominal Pipe or Tube Size		1		2		3		4		5	6	7	8	9	10
		Std Wt Steel Pipe				Copper Tube				Fire Protection	Ductile Iron Pipe	Cast Iron Soil	Glass	Plastic	Fiberglass Reinforced
		Water Service		Vapor Service		Water Service		Vapor Service							
in.	*mm*	*ft.*	*m*	*ft.*	*m*	*ft.*	*m*	*ft.*	*m*						
¼	(6)	–	–	–	–	5	1.5	5	1.5	Follow requirements of the National Fire Protection Association See Section 14.	20 ft. (6.1 m) max spacing; min of one (1) hanger per pipe section close to the joint behind the bell and at change of direction and branch connections. For pipe sizes six (6) inches (150 mm) and under, installed on ASME B31 projects, that are subjected to loadings other than weight of pipe and contents, the span should be limited to the maximum spacing for water service steel pipe.	10 ft. (3.0 m) max spacing; min of one (1) hanger per pipe section close to joint on the barrel also at change of direction and branch connections	8 ft. (2.4 m) max spacing, follow pipe manufacturer's recommendations See Section 17.	Follow pipe manufacturer's recommendations for material and service condition. See Section 18.	Follow pipe manufacturer's recommendations for material and service condition. See Section 19.
⅜	(10)	7	2.1	8	2.4	5	1.5	6	1.8						
½	(15)	7	2.1	8	2.4	5	1.5	6	1.8						
¾	(20)	7	2.1	9	2.7	5	1.5	7	2.1						
1	(25)	7	2.1	9	2.7	6	1.8	8	2.4						
1¼	(32)	7	2.1	9	2.7	7	2.1	9	2.7						
1½	(40)	9	2.7	12	3.7	8	2.4	10	3.0						
2	(50)	10	3.0	13	4.0	8	2.4	11	3.4						
2½	(65)	11	3.4	14	4.3	9	2.7	13	4.0						
3	(80)	12	3.7	15	4.6	10	3.0	14	4.3						
3½	(90)	13	4.0	16	4.9	11	3.4	15	4.6						
4	(100)	14	4.3	17	5.2	12	3.7	16	4.9						
5	(125)	16	4.9	19	5.8	13	4.0	18	5.5						
6	(150)	17	5.2	21	6.4	14	4.3	20	6.1						
8	(200)	19	5.8	24	7.3	16	4.9	23	7.0						
10	(250)	22	6.7	26	7.9	18	5.5	25	7.6						
12	(300)	23	7.0	30	9.1	19	5.8	28	8.5						
14	(350)	25	7.6	32	9.8	–	–	–	–						
16	(400)	27	8.2	35	10.7	–	–	–	–						
18	(450)	28	8.5	37	11.3	–	–	–	–						
20	(500)	30	9.1	39	11.9	–	–	–	–						
24	(600)	32	9.8	42	12.8	–	–	–	–						
30	(750)	33	10.1	44	13.4	–	–	–	–						

Notes: (1) For spacing supports incorporating type 40 shields, see table 5.
(2) Does not apply where span calculations are made or where there are concentrated loads between supports such as flanges, valves, specialties, etc. or changes in direction requiring additional supports.
(3) Unbalanced forces of hydrostatic or hydrodynamic origin (thrust forces) unless restrained externally can result in pipe movement and separation of joints if the joints of the system are not of a restrained joint design. See Section 13.3.

and to prevent excessive stresses being introduced into piping system and connected equipment.

2. Angularity of rod hanger resulting from horizontal movement of the piping system from cold to hot positions shall not to exceed 4 degrees from vertical.
3. Where horizontal pipe movement is greater than 1/2 inch offset pipe hanger and support so that rod hanger is vertical in hot position.
4. Where significant vertical movement of the pipe occurs at the hanger location, a resilient support must be used. Selection of resilient supports shall be based on permissible load variation and effects on adjacent equipment. Support selection for typical load variations are shown in Table 2 of MSS-SP-69. Load and movement calculations shall be made for the proper selection of spring hangers. Vertical movement and load transfer from riser expansion to horizontal runs shall be given consideration when applying spring hangers. Spring Cushion Hangers may be used where vertical movement does not exceed 1/4 inch, and where formal load and movement calculations are not required. Variable spring Hangers shall be used for all other resilient support requirements. Constant Support Hangers shall be used on piping systems where the deviation in supporting force must be limited to 6 percent and which cannot be accommodated by a Variable Spring Hanger. (Extracted from ANSI/MSS-SP69, 2003, Page 7, Section 7.4 and 7.4.1 to 7.4.3, inclusive, with permission of the publisher, the Manufacturers Standardization Society.)

C. Hanger Spacing: (Extracted from ANSI/MSS-SP69, 2003, Page 8, Table 3, with permission of the publisher, the Manufacturers Standardization Society.)

D. Pipe Attachments for Insulated Lines:
1. The connections to pipe attachments shall be outside the insulation so that movement of the line shall not cause damage

D. Pipe Attachments for Insulated Lines:
1. The connections to pipe attachments shall be outside the insulation so that movement of the line shall not cause damage to the insulation. Insulation protection shields shall be provided to protect the vapor barrier of the insulation on cold lines. Under no circumstances shall hangers, supports or guides be applied directly to horizontal pipe or tubing on vapor barrier lines. For cryogenic piping systems, shields incorporating rigid, high-density polyurethane foam inserts or other load bearing insulation should be used. The support should include means for maintaining vapor barrier integrity. Because of the temperature/compressive strength relationship of polyurethane foam, the recommended shield designs must be selected to accommodate loading conditions at both the installation and operating temperature. (Extracted

from ANSI/MSS-SP69, 2003, Page 10, Section 10 and 10.1 to 10.3, inclusive, with permission of the publisher, the Manufacturers Standardization Society.)

2. Deviation to the above is permissible when the Anvil Fig 260 ISS (Insulation Saddle System) is used when proper insulating techniques are employed including the use of mastic and caulk on all insulation edges, and final taping.

TABLE 4 – Recommended Min. Rod Diameter for Single Rigid Rod Hangers[1][2]

		Columns[3] 1, 2, 6, 7		Columns[3] 3, 4, 8, 9, 10	
Nominal Pipe or Tubing Size		Nominal Rod Diameter		Nominal Rod Diameter	
in.	*mm*	*ft.*	*m*	*ft.*	*m*
¼	(6)	–	–	⅜	M10
⅜	(10)	⅜	M10	⅜	M10
½	(15)	⅜	M10	⅜	M10
¾	(20)	⅜	M10	⅜	M10
1	(25)	⅜	M10	⅜	M10
1¼	(32)	⅜	M10	⅜	M10
1½	(40)	⅜	M10	⅜	M10
2	(50)	⅜	M10	⅜	M10
2½	(65)	½	M12	½	M12
3	(80)	½	M12	½	M12
3½	(90)	½	M12	½	M12
4	(100)	⅝	M16	½	M12
5	(125)	⅝	M16	½	M12
6	(150)	¾	M20	⅝	M16
8	(200)	¾	M20	¾	M20
10	(250)	⅞	M20	¾	M20
12	(300)	⅞	M20	¾	M20
14	(350)	1	M24	–	–
16	(400)	1	M24	–	–
18	(450)	1	M24	–	–
20	(500)	1¼	M30	–	–
24	(600)	1¼	M30	–	–
30	(750)	1¼	M30	–	–

E. Recommended Minimum Rod Diameters for Single Rigid Rod Hangers: (Extracted from ANSI/MSS-SP69, 2003, Page 9, Table 4, with permission of the publisher, the Manufacturers Standardization Society.)

1. (1) For calculated loads, rod diameters may be sized in accordance with MSS SP-58, Table 3 provided Table 1 and Section 73 of MSS SP-58 are satisfied.
2. (2) Rods may be reduced one size for double rod hangers. Minimum rod diameter shall be 3/8 inch (M10).
3. (3) Columns noted refer to Table 3.

F. Anchors Guides and Restraints:

1. Anchors, guides and restraints shall be located by the Engineer responsible for piping design. Should the need or the desirability of relocating, eliminating or adding anchors, guides or restraints arise; such changes shall be brought to the attention of the Engineer for consideration and approval.
2. Anchors, guides and restraints shall be designed for imposed loadings as determined by the Engineer. For guided systems, in the absence of specified lateral loads, the guide shall be designed for 20 percent of the dead weight load based on the spans listed in Table 3, with a design load of 50 lb (0.22 kN) as a minimum.
3. For pressure piping with joints not having a restraining design, other positive restraining means such as clamps, rods and/or thrust blocking shall be used to maintain the integrity of the joints.
4. The necessity for, and the location of, shock suppressors and seismic control devices shall be as determined by the Engineer responsible for piping design.
5. The location, type and number of corrective devices which may be necessary to control any unforeseen vibrations, as determined after the piping is in service, are not a part of this standard.
6. Refer to MSS SP-127 for the design, selection, and application of the bracing piping systems subject to seismic - wind - dynamic loading.
7. (Extracted from ANSI/MSS-SP69, 2003, Page 11, Section 13 and 13.1 to 10.6, inclusive, with permission of the publisher, the Manufacturers Standardization Society.)

4.5 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Load capacity and sizing schedules specific to Project.
3. Installation methods.

C. Certifications:
1. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements. Certificates shall be furnished only as required by specific codes, upon request.

D. Shop Drawings:
1. Bases, hangers and supports.
2. Connections to equipment and structure.
3. Structural assemblies.

E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

G. Closeout Submittals:
1. Warranty: Warranty documents.
2. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

4.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Manufacturing facilities shall be registered to ISO 9001.2000 and assessed to ISO 9000.2000 standard. A copy of the current certificate shall be available upon request.

B. Installer Qualifications:
1. Utilize an installer experienced in performing work of this section who is experienced in installation of work similar to that required for this project and per the minimum requirements of MSS SP-89.

C. Conduct pre-installation meeting to verify project requirements, coordinate with other trades, and establish condition and completeness of substrate. Review manufacturer's installation instructions and manufacturer's warranty requirements.

4.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

4.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

4.9 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights, Owner may have under Contract Documents.

PART 5 PRODUCTS

5.1 MANUFACTURERS

A. Acceptable Manufacturer: Anvil International, which is located at: 2 Holland Way; Exeter, NH 03833; Tel: 603-418-2800; Email: bgunnell@anvilintl.com; Web: www.anvilintl.com

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

5.2 MANUFACTURED UNITS - APPLICATION REQUIREMENTS

A. Fabricate hangers, supports and sway braces to comply with building codes.

B. Do not use installed hangers for rigging or erection purposes.

C. Materials available by product type. Provide materials to comply with location and application requirements unless noted otherwise on drawings and schedules.
1. Pipe rings - Malleable iron, carbon steel, stainless steel.
2. Clevis - Carbon steel, stainless steel.

3. Steel pipe clamps - Carbon steel, alloy, stainless steel.
4. Socket clamps - Carbon steel.
5. Beam clamps - Malleable/ductile iron, hardened steel, carbon steel, forged steel.
6. Structural attachments - Carbon steel, malleable iron.
7. Ceiling plates/ceiling flanges - Plastic, cast iron, malleable iron.
8. Concrete inserts and attachments – Malleable iron, carbon steel; stainless steel body, fiberglass bars, polypropylene disc (iron cross design).
9. Rod attachments - Carbon steel, malleable iron, forged steel.
10. Pipe supports - Carbon steel, cast iron.
11. Pipe shields and saddles - Carbon steel, alloy steel, stainless steel.
12. Pipe rolls - Cast iron, carbon steel.
13. Guides - Carbon steel; slides, carbon steel with PTFE slide plates.
14. Engineered hangers - Carbon steel, stainless steel, chrome molybdenum steel.

D. Finishes: Provide finishes to comply with location and application requirements unless noted otherwise on drawings and schedules.
1. Electro-plating galvanizing process per ASTM B633.
2. Hot Dipped galvanizing process per ASTM A153.
3. Epoxy paint.
4. Zinc-rich paint.
5. Standard primer shall meet Fed Spec TT-P-636.

E. Application Requirements: Use components for intended service conditions only. Comply with service requirements below unless noted otherwise on drawings and schedules.
1. Steel hangers in contact with copper piping shall be copper plated, copper painted or epoxy coated.
2. Exterior utility and mechanical yard areas shall use piping that is hot dip galvanized.
3. Interior piping to be black iron.
4. Hydronics and plumbing piping hangers shall be manufactured from carbon steel, cast malleable iron or cast iron.
5. Steam piping hangers shall be manufactured from Chrome Molybdenum steel.
6. Submerged piping hangers shall be manufactured from 316 stainless steel.

5.3 MANUFACTURED UNITS - MSS-SP-69 TYPES NOTED FOR PRODUCTS THAT ARE IN COMPLIANCE

A. Copper Tubing Hangers: Fig. Numbers.
1. CT65 Light Weight Adjustable Clevis.
2. CT69 Adjustable Swivel Ring, MSS-SP-69 (Type 10).
3. CT109 Split Tubing Ring (Ring Only), MSS-SP-69 (Type 11).
4. CT121 Copper Tubing Riser Clamp, MSS-SP-69 (Type 8).
5. CT121C Copper Tubing Riser Clamp.
6. CT128R Rod Threaded Ceiling Flange.
7. CT138R Extension Split Tubing Clamp (Rod Threaded), MSS-SP-69 (Type 12).
8. CT255 Copper Tubing Alignment Guide.
9. 67F Copper Tube Felt Lined Hanger.
10. 69F Adjustable Swivel Ring Felt Lined.

B. CPVC Hangers
1. 185 One Hole Pipe Strap
2. 186 Two Hole Pipe Strap
3. 187 Two Hole 90 Degree Side Mount Strap
4. 188 Two Hole Stand Off Strap

B. Pipe Rings: Fig. Numbers.
1. 67 Pipe or Conduit Hanger, MSS-SP-69 (Type 5).
2. 69 Adjustable Swivel Ring, Tapped per NFPA Standards, MSS-SP-69 (Type 10).
3. 104 Adjustable Swivel Ring, Split Ring Type, MSS-SP-69 (Type 6).
4. 108 Split Pipe Ring, MSS-SP-69 (Type 11).
5. 138R Extension Split Pipe Clamp (Rod Threaded), MSS-SP-69 (Type 12).

C. Clevis: Fig. Numbers.
1. 65 Light Duty Adjustable Clevis.
2. 67 Pipe or Conduit Hanger, MSS-SP-69 (Type 5).
3. 260 ISS (Insulation Saddle System) for support of insulated pipe operating between –40 degrees F to 200 degrees F.

See section 2.3.P.11 for additional information.

4. 260 Adjustable Clevis Hanger, MSS-SP-69 (Type 1).
5. 300 Adjustable Clevis for Insulated Lines, MSS-SP-69 (Type 1).
6. 590 Adjustable Clevis for Ductile or Cast Iron Pipe, MSS-SP-69 (Type 1).

D. Steel Pipe Clamps: Fig. Numbers.
1. 40 Riser Clamp - Standard, MSS-SP-69 (Type 42).
2. 100 Extended Pipe Clamp.
3. 103 Offset Pipe Clamp.
4. 212 Medium Pipe Clamp, MSS-SP-69 (Type 4).
5. 212FP Earthquake Bracing Clamp, MSS-SP-69 (Type 4).
6. 216 Heavy Pipe Clamp, MSS-SP-69 (Type 4).
7. 224 Alloy Steel Pipe Clamp, MSS-SP-69 (Type 2).
8. 246 Heavy Duty Alloy Steel Pipe Clamp, MSS-SP-69 (Type 2).
9. 261 Extension Pipe or Riser Clamp, MSS-SP-69 (Type 8).
10. 295 Double Bolt Pipe Clamp, MSS-SP-69 (Type 3).
11. 295A Alloy Double Bolt Pipe Clamp, MSS-SP-69 (Type 3).
12. 295H Heavy Duty Double Bolt Pipe Clamp, MSS-SP-69 (Type 3).

E. Steel Riser Clamps: Fig. Numbers.
1. 40 Riser Clamp - Standard, MSS-SP-69 (Type 42).
2. 261 Extension Pipe or Riser Clamp, MSS-SP-69 (Type 8).

F. Socket Clamps (AWWA/Ductile/Cast Iron Pipe Sizes Only): Fig. Numbers.
1. 594 Socket Clamp Washer.
2. 595 Socket Clamp for Ductile Iron or Cast Iron Pipe, MSS-SP-69 (Type 8).
3. 599 Socket Clamp Washer.
4. 600 Socket Clamp for Ductile Iron or Cast Iron Pipe, MSS-SP-69 (Type 8).

G. Beam Clamps: Fig. Numbers.
1. 14 Adjustable Side Beam Clamp, MSS-SP-69 (Type 27).
2. 86 C-Clamp with Set Screw & Lock Nut, MSS-SP-69 (Type 23).
3. 87 C-Clamp with Set Screw & Fig. 89 Retaining Clip, MSS-SP-69 (Type 23).
4. 88 C-Clamp with Set Screw Only, MSS-SP-69 (Type 23).
5. 89 Retaining Clip.
6. 89X Retaining Clip.
7. 92 Universal C-type Clamp (Standard Throat), MSS-SP-69 (Type 19 and 23).
8. 93 Universal C-type Clamp (Wide Throat), MSS-SP-69 (Type 19 and 23).
9. 94 Wide Throat Top Beam C-Clamp, MSS-SP-69 (Type 19).
10. 95 C-Clamp with Locknut, MSS-SP-69 (Type 23).
11. 133 Standard Duty Beam Clamp, MSS-SP-69 (Type 21).
12. 134 Heavy Duty Beam Clamp, MSS-SP-69 (Type 21).
13. 217 Adjustable Side Beam Clamp, MSS-SP-69 (Type 25).
14. 218 Malleable Beam Clamp without Extension Piece, MSS-SP-69 (Type 30).
15. 227 Top Beam Clamp, MSS-SP-69 (Type 25).
16. 228 Universal Forged Steel (UFS) Beam Clamp, MSS-SP-69 (Type 28 and 29).
17. 292 Beam Clamp Right Hand Thread with Weld less Eye Nut, MSS-SP-69 (Type 28 and 29).
18. 292L Beam Clamp Left Hand Thread with Weld less Eye Nut, MSS-SP-69 (Type 28 and 29).

H. Structural Attachments: Fig. Numbers.
1. 54 Two Hole Welding Beam Lug.
2. 55 Structural Welding Lug (Short), MSS-SP-69 (Type 57).
3. 55L Structural Welding Lug (Long), MSS-SP-69 (Type 57).
4. 60 Steel Washer Plate.
5. 66 Welded Beam Attachment, MSS-SP-69 (Type 22).
6. 112 Brace Fitting Complete.
7. 113 Brace Fitting (Pipe End Only).

I. Ceiling Plates and Ceiling Flanges: Fig. Numbers.
1. 127 Plastic Ceiling Plate.
2. 128 Pipe Threaded, Ceiling Flange.
3. 128R Rod Threaded, Ceiling Flange.

4. 153 Pipe Hanger Flange.
5. 395 Cast Iron Ceiling Plate.

J. Brackets: Fig. Numbers.
1. 194 Light Welded Steel Bracket, MSS-SP-69 (Type 31).
2. 195 Medium Welded Steel Bracket, MSS-SP-69 (Type 32).
3. 199 Heavy Welded Steel Bracket, MSS-SP-69 (Type 33).
4. 202 Iron Side Beam Bracket, MSS-SP-69 (Type 34).
5. 206 Steel Side Beam Bracket, MSS-SP-69 (Type 34).
6. 207 Threaded Steel Side Beam Bracket, MSS-SP-69 (Type 34).
7. 189 Straight Eye Socket UL, ULC and FM.
8. 190 Off-Set Eye Socket UL, ULC, FM

K. Concrete Inserts and Attachments: Fig. Numbers.
1. 47 Concrete Single Lug Plate.
2. 49 Concrete Clevis Plate.
3. 52 Concrete Rod Attachment Plate.
4. 152 Screw Concrete Insert.
5. 281 Wedge Type Concrete Insert, MSS-SP-69 (Type 18).
6. 282 Universal Concrete Insert, MSS-SP-69 (Type 18).
7. 285 Light Weight Concrete Insert, MSS-SP-69 (Type 19).
8. 286 Iron Cross Design, MSS-SP-69 (Type 18).

L. Hanger Rod and Rod Attachments: Fig. Numbers.
1. 110R Socket, Rod Threaded, MSS-SP-69 (Type 16).
2. 114 Turnbuckle Adjuster, MSS-SP-69 (Type 15).
3. 135 Straight Rod Coupling (With Sight-Hole).
4. 135E Straight Rod Coupling (Less Sight-Hole).
5. 135R Straight Rod Coupling (Reducing).
6. 136 Straight Rod Coupling, MSS-SP-69 (Type 40).
7. 136R Straight Rod Coupling (Reducing).
8. 140 Machine Threaded Rod. Threaded both ends with right-hand threads.
9. 142 Machine Threaded Coach Screw Rod. Plain finish.
10. 146 Continuous Machine Threaded Rods.
11. 148 Machine Threaded Rod with Eye End.
12. 157 Extension piece.
13. 230 Turnbuckle, MSS-SP-69 (Type 13).
14. 233 Turnbuckle, MSS-SP-69 (Type 13).
15. 248 Machine Threaded Rod with Eye End. Right-hand threads with un-welded eye.
16. 248L Machine Threaded Rod with Eye End. Left-hand threads with un-welded eye.
17. 248X Machine Threaded Rod with Linked Eye Ends. Un-welded eye.
18. 253 Machine Threaded Rod. Threaded both ends with right-hand and left-hand threads.
19. 278 Machine Threaded Rod with Eye End. Right-hand threads with welded eye.
20. 278L Machine Threaded Rod with Eye End. Left-hand threads with welded eye.
21. 278X Machine Threaded Rod with Linked Eye Ends. Welded eye.
22. 290 Thread Weld less Eye Nut (Right Hand Threads), MSS-SP-69 (Type 17).
23. 290L Thread Weld less Eye Nut (Left Hand Threads), MSS-SP-69 (Type 17).
24. 299 Forged Steel Clevis, MSS-SP-69 (Type 14).

M. U-Bolts and Straps: Fig. Numbers.
1. 120 Light Weight U-Bolt.
2. 126 One-Hole Clamp.
3. 137 Standard U-Bolts, MSS-SP-69 (Type 24).
4. 137C Plastic Coated U-Bolts, MSS-SP-69 (Type 24).
5. 137S Special U-Bolts (Non-Standard).
6. 243 Pipe Strap.
7. 244 Pipe Strap.
8. 262 Strap Short, MSS-SP-69 (Type 26).
9. 291 Clevis Pin with Cotters.

N. Pipe Supports: Fig. Numbers.

1. 62 Pipe Stanchion, Type A, B and C.
2. 63 Pipe Stanchion, Type A, B and C.
3. 191 Pipe Stanchion Saddle With U-Bolt, MSS-SP-69 (Type 37).
4. 192 Adjustable Pipe Saddle Support, MSS-SP-69 (Type 38).
5. 258 Pipe Saddle Support,MSS-SP-69 (Type 36).
6. 259 Pipe Stanchion Saddle Support, MSS-SP-69 (Type 37).
7. 264 Adjustable Pipe Saddle Support, MSS-SP-69 (Type 38).
8. 265 Adjustable Pipe Saddle Support with U-Bolt, MSS-SP-69 (Type 38).

O. Trapeze and Channel Support: Fig. Numbers.
1. 45 Channel Assembly.
2. 46 Universal Trapeze Assembly.
3. 50 Equal Leg Angle for Trapeze Assembly.

P. Pipe Shields and Saddles: Fig. Numbers.
1. 160 Pipe Covering Protection Saddle, MSS-SP-69 (Type 39A and 39B).
2. 161 Pipe Covering Protection Saddle, MSS-SP-69 (Type 39A and 39B).
3. 162 Pipe Covering Protection Saddle, MSS-SP-69 (Type 39A and 39B).
4. 163 Pipe Covering Protection Saddle, MSS-SP-69 (Type 39A and 39B).
5. 164 Pipe Covering Protection Saddle, MSS-SP-69 (Type 39A and 39B).
6. 165 Pipe Covering Protection Saddle, MSS-SP-69 (Type 39A and 39B).
7. 165A Pipe Covering Protection Saddle (Alloy),MSS-SP-69 (Type 39A and 39B).
8. 166A Pipe Covering Protection Saddle (Alloy), MSS-SP-69 (Type 39A and 39B).
9. 167 Insulation Protection Shield, MSS-SP-69 (Type 40).
10. 168 Rib-Lok Shield, MSS-SP-69 (Type 40).
11. 260 (ISS) Insulation Saddle System, Clevis with High Impact Glass Reinforced Poly-Propylene Saddle.

Q. Pipe Rolls: Fig. Numbers.
1. 171 Single Pipe Roll, MSS-SP-69 (Type 41).
2. 175 Roller Chair, MSS-SP-69 (Type 44).
3. 177 Adjustable Pipe Roll Support, MSS-SP-69 (Type 41).
4. 178 Spring Cushion Hanger, MSS-SP-69 (Type 49).
5. 181 Adjustable Steel Yoke Pipe Roll, MSS-SP-69 (Type 43).
6. 271 Complete Pipe Roll Stand, MSS-SP-69 (Type 44).
7. 274 Adjustable Pipe Roll Stand With Base Plate, MSS-SP-69 (Type 46).
8. 274P Adjustable Pipe Roll Stand, Base Plate Only.
9. 275 Adjustable Pipe Roll Stand Without Base Plate.
10. 277 Pipe Roll and Base Plate with Cast Iron Base Plate, MSS-SP-69 (Type 45).
11. 277S Pipe Roll and Base Plate with Steel Base Plate.

R. Guides and Slides: Fig. Numbers.
1. 212 Medium Pipe Clamp, use with slide assemblies.
2. 255 Pipe Alignment Guide, Single Clamp (MVT 4-8 in.)
3. 256 Pipe Alignment Guide, Double Clamp (MVT 6-10 in.)
4. 257 Pipe Slides Assembly, Structural Tee Slide Assembly, MSS-SP-69 (Type 35).
5. 257A Pipe Slides Assembly, Structural Tee.
6. 432 Special Clamp, use with slide assemblies.
7. 436 Pipe Slides Assembly, Fabricated Tee Slide Assembly, MSS-SP-69 (Type 35).
8. 436A Pipe Slides Assembly, Fabricated Tee.
9. 439 Structural “H” Slide Assembly, Complete, MSS-SP-69 (Type 35).
10. 439A “H” Section Only.

5.4 METAL FRAMING

A. Provide metal framing channel, fittings and hardware components as indicated or required for the structural support of piping systems and equipment.
1. Metal framing shall be Anvil Strut as manufactured by Anvil International.
2. Accessories: As indicated or required by application and location.
   a. Strut mounted pipe support, Klo-Shure insulated couplings with strut clamp, size range of 3/8 inch through 4 inch copper tube with 3/8 inch through 1 inch thick insulation.
   b. Strut mounted pipe clamps.
   c. Strut mounted pipe rollers.

d. Strut mounted Cushion Clamps (steel pipe and copper tube).

B. Materials Available: Provide materials and finishes to comply with locations and applications requirements as noted on drawings or schedules.
   1. Channels shall be produced from prime structural metals complying with the following specification as applicable:
      a. Pre-Galvanized Steel - ASTM A653.
      b. Plain Steel - ASTM A570.
         1) Finish: Hot-dip galvanized.
         2) Finish: Supr-Green powder coating.
         3) Finish: PVC coated.
      c. Aluminum (Type 6063-T6) - ASTM B221.
      d. Stainless Steel (Type 304 and 316) - ASTM A240.

5.5 EQUIPMENT SUPPORTS

A. Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 16 - Fabricated Fireproofed Steel Columns.

5.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

A. Provide templates to ensure accurate location of anchor bolts.

PART 6 EXECUTION

6.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

6.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

6.3 HANGER SPACING

A. Plumbing Piping: Most stringent requirements of Plumbing Code, or authority having jurisdiction.

B. Fire Protection: Comply with applicable fire code.

C. Gas and Fuel Oil Piping: Comply with pipe manufacturer’s recommendations and applicable codes.

D. Copper Piping: Comply with pipe manufacturer’s recommendations and applicable codes.

E. Flexible System Grooved Pipe: Minimum of one hanger required per the minimum recommended pipe length. Comply with groove manufacturer’s recommended average hangers per pipe length.

F. When practical located immediately adjacent to any change of direction of pipe. Total length of pipe between supports less than three-fourths the full hanger span.

G. In case of concentrated loads (such as valves) the supports shall be placed as close as possible.

6.4 HANGER INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Clamps on Riser Piping:
   1. Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
   2. Bolt tightening torques shall be to industry standards.
   3. Cast Iron Pipes: Install clamp below joint.
   4. Steel Pipes: Clamp is fitted preferably below coupling or welded pipe lug.

C. Use approved constant support type hangers where:
   1. For critical high temperature where vertical movement of pipe work is 1/2 inch or more.
   2. Transfer of load to adjacent hangers or connected equipment is not permitted.

D. Use variable support spring hangers where:
   1. Transfer of load to adjacent piping or to connected equipment is not critical.
   2. Variation in supporting effect does not exceed 25 percent of total load.

E. Adjust hangers to equalize load.

F. Support from Structural Members: Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

G. Field welding of supports should be done by qualified welders using qualified welding procedures.

H. Proper care and ventilation should be given when welding galvanized components.

6.5 HORIZONTAL MOVEMENT

A. Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

B. Where horizontal pipe movement is greater than 1/2 inch offset pipe hanger and support so that rod hanger is vertical in hot position.

6.6 FINAL ADJUSTMENT

A. Adjust Hangers and Supports:
   1. Ensure that rod is vertical under operating conditions.
   2. Equalize loads.

B. Adjustable Clevis:
   1. Tighten hanger load nut securely to ensure proper hanger performance.
   2. Tighten upper nut after adjustment.

C. C-Clamps:
   1. Follow manufacturer’s recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

D. Beam Clamps:
   1. Tighten all set screws and lock nuts.
   2. Hammer jaw firmly against underside of beam for Figure 127 only.

6.7 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION