

## **1. PART 1 – GENERAL**

### **1.1 Related Sections**

- .1 Section 230548E - Vibration and seismic controls for HVAC piping and equipment.

### **1.2 References**

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1-1989, Power Piping (SI Edition).
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A 125-81 (1998), Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A 307-94, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A 563-94, Specification for Carbon and Alloy Steel Nuts.
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP 58-1993, Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 ANSI/MSS SP69-1991, Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP 89-1991, Pipe Hangers and Supports - Fabrication and Installation Practices.

### **1.3 Design Requirements**

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support piping, air ducts and mechanical equipment under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments of supports and hangers after erection and during commissioning. Amount of adjustment in accordance with MSS SP 58.

### **1.4 Submittals**

- .1 Submittals: in accordance with Section 230500E – Common Work Results for Mechanical.
- .2 Submit shop drawings and product data for following items:
  - .1 Bases, hangers and supports.
  - .2 Connections to equipment and structure.
  - .3 Structural assemblies.

### **1.5 Closeout Submittals**

- .1 Provide maintenance data for incorporation into manual specified in Section 230500E – Common Work Results for Mechanical.

## **2. PART 2 – PRODUCTS**

### **2.1 General**

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP 58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

### **2.2 Pipe hangers**

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized after manufacture.
  - .2 Use electro-plating galvanizing process or hot dipped galvanizing process.
  - .3 Ensure steel hangers in contact with copper piping are epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and galvanized steel retaining clip.
    - .1 Rod: 9 mm UL listed.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP 58 and MSS-SP 69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP 69.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut, UL listed.
- .4 Upper attachment to concrete:
  - .1 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP 69.
- .5 Hanger rods: threaded rod material to MSS SP 58:
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
  - .3 Do not use 22 mm or 28 mm rod.
- .6 Pipe attachments: material to MSS SP 58:
  - .1 Attachments for steel piping: carbon steel galvanized.
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for hot pipework.
  - .4 Oversize pipe hangers and supports.
- .7 Adjustable clevis: material to MSS SP 69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
  - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP 69.
- .9 U-bolts: carbon steel to MSS SP 69 with 2 nuts at each end to ASTM A 563.
  - .1 Finishes for steel pipework: galvanized.
  - .2 Finishes for copper, glass, brass or aluminum pipework: galvanized with formed portion plastic coated or epoxy coated.
- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP 69.

### 2.3 Riser clamps

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP 58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.
- .3 Bolts: to ASTM A 307.
- .4 Nuts: to ASTM A 563.

### 2.4 Insulation protection shields

- .1 Insulated cold piping:
  - .1 64 kg/m<sup>3</sup> density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
  - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 69.

### 2.5 Constant support spring hangers

- .1 Springs: alloy steel to ASTM A 125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

### 2.6 Variable support spring hangers

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.
- .4 Steel alloy springs: to ASTM A 125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

### 2.7 Equipment supports

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of details and specifications of drawings.

### 2.8 Equipment anchor bolts and templates

- .1 Provide templates to ensure accurate location of anchor bolts.

### 3. PART 3 – EXECUTION

#### 3.1 Installation

- .1 Install in accordance with:
  - .1 manufacturer's instructions and recommendations.
- .2 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 to industry standards.
  - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: install below joint.
- .3 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .4 Support from structural members. Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .5 Use approved constant support type hangers where:
  - .1 vertical movement of pipework is 13 mm or more,
  - .2 transfer of load to adjacent hangers or connected equipment is not permitted.
- .6 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 % of total load.

#### 3.2 Hangers spacing

- .1 Plumbing piping: to most stringent of Canadian Plumbing Code, Provincial Code or authority having jurisdiction.
- .2 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .3 Copper piping: up to NPS 1/2: every 1.5 m.
- .4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
- .5 Within 12" of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel – in feet	Maximum Spacing Copper – in feet
Up to 1-1/4	7	6
Up to 1-1/2	9	8
Up to 2	10	9
Up to 2-1/2	12	10
Up to 3	12	10
Up to 3-1/2	13	11
Up to 4	14	12
Up to 5	16	
Up to 6	17	
Up to 8	19	
Up to 10	22	
Up to 12	23	

- .6 PVC plastic pipework: as per table above, with one support on each side of elbow and/or fitting.
- .7 Pipework greater than NPS 12: to MSS SP 69.

### 3.3 Hanger installation

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

### 3.4 Horizontal movement

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

### 3.5 Final adjustment

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.