ANSI/MSS SP-58-2018

Pipe Hangers and Supports

Materials, Design, Manufacture, Selection, Application, and Installation

Standard Practice
Developed and Approved by the
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This MSS Standard Practice was developed under the consensus of the MSS Technical Committee 403, *Pipe Hangers and Supports*, and the MSS Coordinating Committee. In addition, this Standard Practice was approved by an ANSI/MSS Consensus Committee and by ANSI as a revised American National Standard. The content of this Standard Practice is the resulting efforts of competent and experienced volunteers to provide an effective, clear, and non-exclusive standard that will benefit the industry as a whole. This MSS Standard Practice describes minimal requirements and is intended as a basis for common practice by the manufacturer, the user, and the general public. The existence of an MSS Standard Practice does not in itself preclude the manufacture, sale, or use of products not conforming to the Standard Practice. Mandatory conformance to this Standard Practice is established only by reference in other documents such as a code, specification, sales contract, or public law, as applicable. MSS has no power, nor does it undertake, to enforce or certify compliance with this document. Any certification or other statement of compliance with the requirements of this Standard Practice shall not be attributable to MSS and is solely the responsibility of the certifier or maker of the statement.

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The U.S. customary units and SI (metric) units in this Standard Practice are regarded separately and each should be used independently of the other. Combining or converting values between the two systems may result in non-conformance with this Standard Practice. U.S. customary units in this Standard Practice are the originating standard, in cases of conflict or incongruity.

> **This Standard Practice has been revised from the previous 2009 edition. It is suggested that if the user is interested in knowing what changes have been made, that a direct page by page comparison should be made of this document and that of the previous edition.**

Non-toleranced dimensions in this Standard Practice are nominal unless otherwise specified.

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FOREWORD

This Standard Practice was developed by a cooperative effort of representatives of pipe hanger manufacturers. It is based on "best practice" current at this time and on the collective experience of the industry. There is a companion Standard Practice, MSS SP-127, which relates to the design, selection, and application of bracing for piping systems subject to seismic, wind, and dynamic loading.

The 2009 edition of SP-58 was originally ANSI-approved and published in 2011 as an American National Standard. Since 2009, the SP-58 Standard Practice has integrated the content of the original SP-58, along with the final editions of SP-69, SP-77, SP-89, and SP-90 to create a comprehensive single-source document that enables the user to specify a minimum level of acceptance for pipe hanger and support design and performance, in addition to defining the types of hangers and supports.

This 2018 revision of ANSI/MSS-SP-58 contains several editorial and formatting changes, new inclusions, and updates based on the prior ANSI canvas committee comments and subsequent proposals brought forward to the committee. New materials and allowable stresses have been added. Allowable stress has been updated for metal framing channel to maintain consistency with the general safety factor stated within the Standard Practice. Post-weld heat treatments have been updated to remain in compliance with ASME B31.1. Revisions have been made to the insulated piping and protection shield sections. For the first time, rooftop supports are addressed in the document. The type chart has been updated to current standard products and enlarged for readability. The information within Table 4 has also been expanded, and the references in Annex C have been updated.

Notice:

This revised ANSI/MSS SP-58-2018 comprehensive edition continues to integrate the content of five MSS Standard Practices, including ANSI/MSS SP-69-2003, into a single source document that enables the user to specify a minimum level of acceptance for pipe hanger and support design and performance, in addition to defining the types of hangers and supports. The aforementioned ANSI/MSS SP-69 was withdrawn in 2014, and SP-77, SP-89, and SP-90 were withdrawn in 2010. The standard ANSI/MSS SP-58-2009, and subsequently revised editions, shall be officially utilized and referenced in place of ANSI/MSS SP-69.

Note that all previous Standard Practices mentioned will remain available from MSS as historical documents.

In Memory of:
Harold Erikson
1923 – 2016
Fifty-eight years of dedicated service as a member of MSS Committee 403.
He served as a mentor and inspiration to all within the industry.

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Manufacturers Standardization Society of the Valve and Fittings Industry

PIPE HANGERS AND SUPPORTS – MATERIALS, DESIGN, MANUFACTURE, SELECTION, APPLICATION, AND INSTALLATION

1. SCOPE

1.1 This Standard Practice establishes an industry accepted basis for Manufacturers, Engineers, Erectors, Purchasers, Inspectors, Draftsmen, and others involved in the Materials, Design, Manufacture, Selection, Application, Inspection, and Installation of pipe hangers and supports and their components for piping systems of all service temperatures.

1.2 This Standard Practice establishes the minimum requirements for materials, allowable stresses, product design, testing, and load ratings for pipe hanger and support assemblies for standard and unique pipe hangers and supports.

1.3 This Standard Practice establishes the inspection criteria for the manufacture and installation of pipe hangers and supports.

1.4 This Standard Practice establishes the required procedures for packing, marking, shipping, receiving, and storage of pipe hangers and supports.

1.5 This Standard Practice establishes the minimum requirements for pipe hanger and support assembly drawings.

1.6 This Standard Practice establishes the field practices for installation, adjustment, testing, and inspection of pipe hangers and supports.

1.7 This Standard Practice establishes the terminology and identification of pipe hangers and supports, along with recommended contractual relationship structures.

2. OBJECTIVE

2.1 To serve as a guide for pipe hanger and support design, manufacture, selection, and installation.

2.2 To enable the user to specify a minimum level of acceptance for pipe hanger and support design and performance.

2.3 To define types of hangers and supports that are illustrated in the Type Chart, Figure A1. Hangers and Supports shown on the Type Chart indicate general types only and manufacturers' other standard products shall be acceptable under this Standard Practice if they meet dimensional and load rating limitations set forth in this Standard Practice.

2.4 To serve as a pipe hanger and support specification for selection and application, by being referenced in whole or in part.

2.5 To serve as a guide to proven industry practice during engineering design and writing of job specifications covering the hanging, supporting and controlling movement of piping systems.

2.6 To provide the erector with information on types of hangers and support components to be used for specific applications and installations, where such information is not otherwise provided.

2.7 To serve as a companion document to MSS SP-127 which provides recommendations for the design, selection, and application of bracing for piping systems subject to seismic, wind, and dynamic loading.

3. MATERIALS

3.1 Materials commonly used in manufacturing pipe hangers and supports are listed in Tables A2 and A2M.

3.2 Other metallic materials may be used provided they comply with the allowable stress requirements of Sections 4.5, 4.6, 4.7, or 4.8.

3.3 Non-metallic materials may be used to transfer the compressive loading from the piping and equipment to the metallic components of a piping support or to structure. Material shall comply with the requirements of Section 4.1.

3.4 The material in contact with the pipe shall be compatible with the piping material so that neither shall have a deteriorating action on the other.

3.5 Materials subject to corrosion or galvanic action shall be protected as specified by the engineering design and such protection shall be applied in accordance with the coating requirements of Section 10.

TABLE 1
Minimum Design Load Ratings for Pipe Hanger and Support Assemblies

Applicable to All Components of Complete Assembly (including pipe attachment, rod, fixtures, and building attachment)			
Nominal Pipe or Tube Size		Minimum Design Load Ratings at Normal Temperature Range [a]	
NPS – in.	DN – mm	lbf	kN
3/8	10	150	0.67
1/2	15	150	0.67
3/4	20	150	0.67
1	25	150	0.67
1¼	32	150	0.67
1½	40	150	0.67
2	50	150	0.67
2½	65	150	0.67
3	80	200	0.89
3½	90	210	0.93
4	100	250	1.11
5	125	360	1.60
6	150	480	2.14
8	200	760	3.38
10	250	1120	4.98
12	300	1480	6.58
14	350	1710	7.61
16	400	2130	9.47
18	450	2580	11.48
20	500	3060	13.61
24	600	3060	13.61
30	750	3500	15.57
36	900	3500	15.57

NOTE: (a) Normal temperature range is:

- Carbon Steel: -20 °F to 650 °F (-29 °C to 343 °C)
- Malleable Iron: -20 °F to 450 °F (-29 °C to 232 °C)
- Gray Iron: -20 °F to 400 °F (-29 °C to 204 °C)
- Stainless Steel: -20 °F to 650 °F (-29 °C to 343 °C)

GENERAL NOTES:

1. See Section 4 for allowable stresses and temperatures.
2. See Section 7.2.1 for minimum rod diameter restrictions.
3. For loads greater than those tabulated, hanger component load ratings shall be established by the manufacturer. Design shall be in accordance with all criteria as outlined in this document.

4. ALLOWABLE STRESSES, LOAD RATINGS, AND TEMPERATURES

4.1 The Maximum Allowable Stress in Tension for materials commonly used in the design of pipe hangers and supports are listed in Tables A2 and A2M. Allowable values for the types of stress stated in Sections 4.1.1 through 4.1.5 shall be computed by multiplying the Maximum Allowable Stress in Tension by the applicable factor. Materials should not be used above the highest temperature for which a stress value appears.

Allowable Bending or Compression stress must be reduced on the basis of structural stability and/or buckling (column action).

		Factor
4.1.1	***Tension:***	
	a) On the gross area	1.0
	b) On the net section at pin holes	0.9
4.1.2	***Bending***	1.0 (max.)
4.1.3	***Shear***	0.8
4.1.4	***Bearing***	1.5
4.1.5	***Compression***	1.0 (max.)
4.1.6	***Combined Stress Check***	

$$\frac{\text{Stress in Tension or Compression}}{\text{Allowable Tension or Compression}} + \frac{\text{Stress in Bending}}{\text{Allowable Bending}} \leq 1.0$$

4.2 Maximum allowable shear stress in welds shall be limited to 80% of the Maximum Allowable Stress in Tension of the weaker of the base metals being joined. Maximum allowable tension and bending stresses in welds shall be limited to the Maximum Allowable Stress in Tension of the weaker of the base metals being joined.

4.3 Higher allowable stresses under well-defined short-term loading conditions shall be as designated by the applicable codes.

4.4 Steel metal framing channel conforming to MFMA *Metal Framing Standards Publication - 4,* (MFMA-4) shall have a maximum design stress in accordance with Tables A2 and A2M or Section 4.5.

4.5 Allowable stresses for steel materials other than castings not listed in Tables A2 and A2M, produced in accordance with a recognized specification and with known physical properties shall be determined as the lower of the following values:

a) 29% of minimum tensile strength at service temperature.

b) 67% of minimum yield strength at service temperature.

c) Such materials shall not be used where temperatures are outside the Normal Temperature Range provided in Table 1 and shall not be welded to the piping or piping component.

d) Refer to Section 6 for application specific considerations.

4.6 Allowable stresses for cast materials not listed in Table A2 and A2M produced in accordance with a recognized specification and with known physical properties, shall be limited to the following values:

a) Allowable stress for steel castings shall be limited to 20% of specified minimum tensile strength. Such materials shall not be used where temperatures are outside the Normal Temperature Range of -20 ºF to 650 °F (-29 °C to 343 °C).

b) Allowable stress for ductile or malleable iron castings shall be limited to 20% of specified minimum tensile strength. Such materials shall not be used where temperatures are outside the Normal Temperature Range of -20 °F to 450 °F (-29 °C to 232 °C).

c) Allowable stress for gray iron castings shall be limited to 10% of specified minimum tensile strength. Such materials shall not be used where temperatures are outside the Normal Temperature Range of -20 °F to 400 °F (-29 °C to 204 °C).

d) Allowable stress for zinc castings shall be limited to 20% of the specified minimum tensile strength. Such materials shall not be used where the temperatures are outside the Normal Temperature Range of -40 °F to 230 °F (-40 °C to 110 °C).

4.7 For steel materials of unknown specification, a Maximum Allowable Stress in Tension of 30% of yield strength (0.2% offset) at room temperature may be used. The yield strength shall be established by tensile testing a sample of material in accordance with ASTM A370. The value corresponding to a 0.2% permanent strain (offset) is the material yield strength. The Maximum Allowable Stress in Tension so established shall not exceed 9500 psi (65.5 MPa). Such materials shall not be used where temperatures are outside the Normal Temperature Range of -20 ºF to 650 °F (-29 °C to 343 °C)

4.8 Maximum Safe Load in Tension ratings for the threaded hanger rods made from carbon steel are shown in Tables 2 and 2M. Load ratings for hanger rods made from all other materials shall be based on the thread root area with a 25% reduction of the allowable stress. Note the 25% reduction is to allow for normal installation and service conditions.

4.9 Forged eye rods and formed and welded eye rods shall have load rating at least equal to those determined in accordance with Section 4.8 for the same nominal diameter and same thread specification. Formed but not welded eye rods shall have load ratings not greater than 40% of those determined in accordance with Section 4.8 for the same nominal diameter.

4.10 Maximum Safe Load in Tension for U-bolts, loaded in tension, shall be limited to twice the load rating of hanger rods, in accordance with Section 4.8, and be of the same material, nominal diameter, and thread specification.

4.11 All threaded items, both external and internal, not covered by Sections 4.8, 4.9, or 4.10 need not be subjected to the 25% stress reduction.

4.12 Design temperature of metallic hanger components in direct contact with the pipe shall be the temperature of the contained fluid. For hot system piping installations, a reduction in temperature of 100 °F/in. (2.2 °C/mm) as measured from the outer pipe surfaces may be applied for strength calculations and material requirements. Alloy bolting within insulation may be furnished with ASTM A194/A194M, Grade 2H nuts for line temperatures not exceeding 1050 °F (566 °C).

4.13 Design temperature of metallic hanger or support components in contact with the outside layer of insulation inserts shall be the surface temperature of the insulation.

4.14 The compressive loading of non-metallic material (including, but not limited to, insulation inserts, vibration control pads, and stanchion thermal break pads) shall be limited to the compression capacity of the material, as rated in accordance with the governing ASTM specification for the specific material utilized, with an appropriate safety factor for the specific material used; including a minimum safety factor of 3.5. For each location in a pipe hanger or support, service criteria limiting the potential for unsatisfactory performance shall be satisfied when subject to design loads. Examples of service criteria are limits of deformation of a pipe hanger or support causing rotation of a mating flange pair to avoid possible flange leakage concerns and limits on deformation to avoid interference with adjacent piping and equipment.

TABLE 2
Load Ratings of Carbon Steel Threaded Hanger Rods
(for metric rod sizes, see Table 2M)

Nominal Rod Diameter	Root Area of Thread [a]	Maximum Safe Load in Tension	
in.	in^2	lbf	kN
3/8	0.0678	730	3.25
1/2	0.126	1350	6.01
5/8	0.202	2160	9.61
3/4	0.302	3230	14.4
7/8	0.419	4480	19.9
1	0.551	5900	26.2
1¼	0.890	9500	42.3
1½	1.29	13800	61.4
1¾	1.74	18600	82.7
2	2.30	24600	109
2¼	3.02	32300	144
2½	3.72	39800	177
2¾	4.62	49400	220
3	5.62	60100	267
3¼	6.72	71900	320
3½	7.92	84700	377
3¾	9.21	98500	438
4	10.6	114000	507
4¼	12.1	129000	574
4½	13.7	146000	649
4¾	15.4	165000	734
5	17.2	184000	818

NOTE: (a) Root Area referenced from ASME B1.1.

GENERAL NOTES:

1. For materials other than carbon steel, see requirements of Section 4.8 and Table A2.
2. Tabulated loads are based on a minimum actual tensile stress of 50 ksi (345 MPa), for temperature range -20 ºF to 650 °F (-29 °C to 343 °C), divided by a safety factor of 3.5, reduced by 25%*, resulting in an allowable stress of 10.7 ksi (73.9MPa). Note that the 25% reduction is to allow for normal installation and service conditions.

   * The 25% reduction takes into account thread production method (cut, rolled, etc.) and field installation conditions (misalignment, bending, etc.).
3. Root area threads are based upon the following thread series:
   - Diameter 4 in. and below – coarse thread (UNC)
   - Diameter above 4 in. – 4-thread (4-UN)
4. See Section 7.9 for additional thread requirements.