

Pipe Hangers and Supports - Fabrication and Installation Practices

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 and the MSS Coordinating Committee. The content of this Standard Practice is the result of the efforts of competent and concerned volunteers to provide an effective, clear, and non-exclusive specification that will benefit the industry as a whole. This MSS Standard Practice 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 is established only by reference in a code, specification, sales contract, or public law, as applicable.

This document has been substantially revised from the previous 1998 edition. Substantive changes in this 2003 edition are “flagged” by parallel bars as shown on the margins of this paragraph. The specific detail of the change may be determined by comparing the material flagged with that in the previous edition.

Unless otherwise specifically noted in this MSS SP, any standard referred to herein is identified by the date of issue that was applicable to the referenced standard(s) at the date of issue of this MSS SP. (See Annex A.)

In this Standard Practice all notes, annexes, tables, and figures are construed to be essential to the understanding of the message of the standard, and are considered part of the text unless noted as “supplemental”. “Supplemental” information does not include mandatory requirements.

U.S. customary units in this SP are the standard; the metric (SI) units are only for reference.

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FOREWORD

This standard practice was developed by a cooperative effort of representatives of the pipe hanger manufacturers. It is based on the best current practice and on the collective experience of the industry. There are three companion standards - MSS SP-58 and MSS SP-69 relate to hanger materials, design, manufacture, selection and application; MSS SP-127 relates to the design, selection, and application of bracing for piping systems subject to seismic – wind – dynamic loading. In addition, the MSS Technical Committee 403 has developed guidelines for pipe supports contractual relationships and on hanger terminology as covered in MSS SP-77 and MSS SP-90 respectively.

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PIPE HANGERS AND SUPPORTS - FABRICATION AND INSTALLATION PRACTICES

1. SCOPE

1.1 This Standard Practice establishes recommended procedures for detailing, fabrication, and installation of pipe hangers and supports. These procedures supplement, but do not replace, those of the manufacturer.

2. OBJECTIVE

2.1 To serve as a guide to the fabricator and erector of pipe supports, so they may understand their mutual responsibilities.

2.2 To furnish the erector, who may not be familiar with engineered pipe supports, a guide for the proper installation of these supports.

2.3 To serve as a companion document to MSS SP-58 which provides recommendations for materials, design and manufacture of pipe hangers and supports.

2.4 To serve as a companion document to MSS SP-69 which provides recommendations for the selection and application of pipe hangers and supports.

2.5 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 - dynamic loading.

3. PIPE HANGER ASSEMBLY DRAWINGS

3.1 *Description*

3.1.1 This section contains recommendations for minimum data which should appear on hanger drawings to enable the fabricator to furnish, and the erector to install the hanger assembly, as intended by the job specification or purchase order conditions.

3.2 *General*

3.2.1 The conventional 8 ½ x 11 inch hanger drawing shall contain the information necessary for shop fabrication and field installation of the hanger assembly. In the case of complex assemblies, supplementary or larger, 11 x 17 inch sheets may be used.

3.2.2 The data shown on the hanger drawing should consist of:

- a) Drawing of the assembly (Section 3.3)
- b) Bill of material (Section 3.4)
- c) Load and movement data (Section 3.5)
- d) Supplementary steel (Section 3.6)
- e) Field and shop welds (Section 3.7)
- f) Protective coatings (Section 3.8)
- g) Location plan (Section 3.9)
- h) Identification (Section 3.10)
- i) Reference drawings (Section 3.11)

3.3 *Drawing of the Assembly*

3.3.1 Drawing shall be a pictorial representation of the assembly showing each component part identified to a bill of material item.

3.3.2 Dimensioning of the hanger assembly depends upon the complexity of the design. As a minimum, the following data should be shown:

- a) The overall dimension from the supporting structure to the centerline or bottom of the pipe.
- b) The orientation, elevation, size and type of supporting structure.
- c) Pipe size (nominal pipe size unless otherwise noted) and insulation thickness as applicable.
- d) Pipe elevation.
- e) Other dimensions necessary for the fabrication and installation of the complete hanger assembly.
- f) Unless otherwise required, all dimensions shall be to the nearest one-eighth inch (3 mm).

3.4 *Bill of Material*

3.4.1 An itemized bill of material shall be provided listing all components of the hanger assembly. Identification of standard catalog components shall be made by manufacturer's figure number, type and size. Appropriate material specification shall be shown for special components.

3.5 Load and Movement Data

3.5.1 When required, the maximum operating load to be supported by the assembly shall appear on the drawing. Hydrostatic test loads, greater than operating loads, shall also be shown. When special loading conditions are considered, these loads shall also be shown.

3.5.2 When variable spring or constant support hangers are used, the direction from cold to hot and amount of vertical movement shall be shown.

3.5.3 When applicable, the amount of movement in all three directions shall be shown.

3.6 Supplementary Steel

3.6.1 When supplementary steel is furnished as a part of the hanger assembly, it shall be listed in the bill of material.

3.6.2 When supplementary steel is required, but not furnished as part of the hanger contract, it should be so noted.

3.7 Field and Shop Welds

3.7.1 All shop welds of non-catalog items and all field welds shall be indicated on the drawing.

3.7.2 It is recommended that American Welding Society (AWS) standard weld symbols be used.

3.7.3 Welds required to provide final installation, access around pipe, or necessary to accommodate shipping and handling limitations, shall be specified as field welds.

3.8 Protective Coatings

3.8.1 Where required, the type and/or specification of protective coating shall be indicated on the drawing, or other referenced documents.

3.9 Location Plan

3.9.1 The location plan shows the relationship of the pipe and hanger to applicable reference lines, such as column lines, center lines of equipment, etc. (See Figures 1 and A1). The location of the structural attachment is usually indicated by an "X" and is dimensioned to the north-south and east-west reference lines. A north arrow is usually shown.

3.9.2 Where horizontal piping displacement exceeds 1 inch (25 mm), it is common practice to offset the pipe attachment or structural attachment by the amount of anticipated displacement or a percentage thereof (See Figures 1 and A1, Illustrations 2, 4, and 6).

3.10 Identification

3.10.1 Identification on the hanger drawing shall consist of, but not be limited to, the following:

- a) Project identification
- b) Piping system
- c) Hanger mark number
- d) Drawing and revision number

3.11 Reference Drawings

3.11.1 As a minimum, reference should be made to pertinent piping and/or structural drawings, including revision number.

4. DIMENSIONAL TOLERANCES

4.1 Description

4.1.1 This section provides recommended maximum tolerances for fabricated pipe hangers and supports, including those shown in Figure 1 Type Charts of MSS SP-58, SP-69, and SP-90, except for cast, forged or extruded products and cold wound springs.

4.2 General

4.2.1 Tolerances for raw materials such as strip, sheet, bar, plate, pipe, tubing, structural, and bar size shapes, bolting, hot wound springs and cold wound springs shall be in accordance with recognized standards or specifications.

4.2.2 Tolerances for castings, forgings and extrusions shall be to the individual manufacturer's standard.

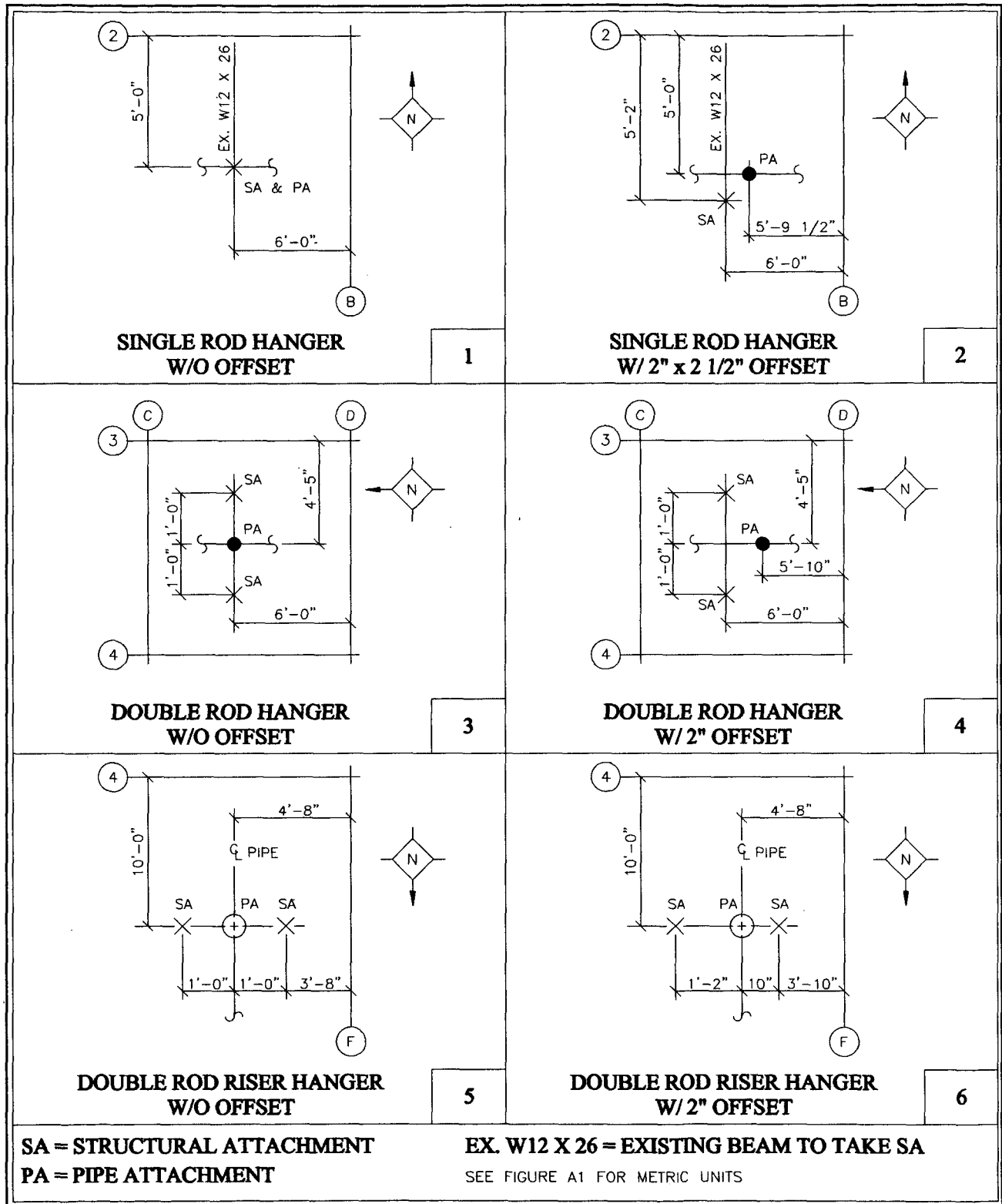


Figure 1 - Typical Hanger Location Plans

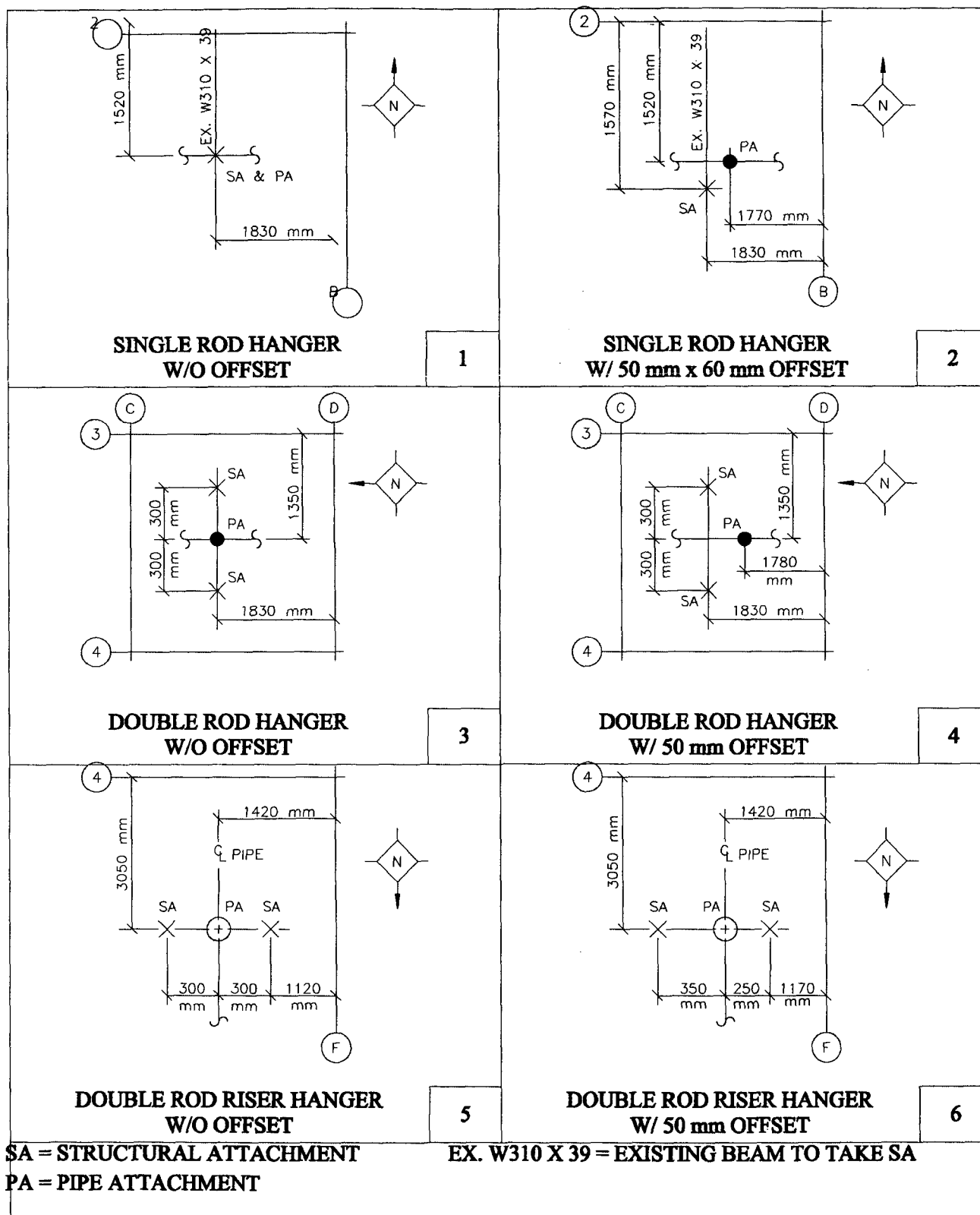


Figure A1 – Typical Hanger Location Plans, Metric Units

TABLE 1- Clamp Tolerances

Clamp, I.D.	Diameter	Pipe Centerline to Load Bolt Hole
up to 2 in. (51 mm)	$\pm \frac{1}{16}$ in. (2 mm)	$\pm \frac{1}{8}$ in. (3 mm)
over 2 in. to 4 in. (51 to 102 mm)	$\pm \frac{1}{8}$ in. (3 mm)	$\pm \frac{1}{8}$ in. (3 mm)
over 4 in. to 8 in. (102 to 203 mm)	$\pm \frac{3}{16}$ in. (5 mm)	$\pm \frac{1}{4}$ in. (6 mm)
over 8 in. to 18 in. (203 to 457 mm)	$\pm \frac{1}{4}$ in. (6 mm)	$\pm \frac{3}{8}$ in. (10 mm)
over 18 in. to 30 in. (457 to 762 mm)	$\pm \frac{3}{8}$ in. (10 mm)	$\pm \frac{1}{2}$ in. (13 mm)
over 30 in. (762 mm)	$\pm \frac{1}{2}$ in. (13 mm)	$\pm \frac{1}{2}$ in. (13 mm)
Notes: a) Clamp I.D. equals pipe or tubing O.D. plus suitable clearance as established by the clamp manufacturer. b) Clamp I.D. measured at one half of the clamp width.		

4.3 Fabricating Tolerances

4.3.1 Cut to length - linear

- a) Hanger rods: $\pm \frac{1}{2}$ in. (13 mm)
- b) Structural shapes, pipe, and tubing for critical assembly make-up dimensions: $\pm \frac{1}{8}$ in. (3 mm). Squareness of cut: 1 degree, not to exceed $\frac{1}{8}$ in. (3 mm) offset.
- c) Plates and bars for critical dimensions: $\pm \frac{1}{8}$ in. (3 mm). Squareness of cut: 1 degree, not to exceed $\frac{1}{8}$ in. (3 mm) offset.
- d) Tolerances for non-critical dimensions shall be to the individual manufacturer's standards.

4.3.2 Clamps for pipe and tubing, formed and fabricated, are shown in Table 1.

4.3.3 Threads

Thread tolerances shall be in accordance with recognized standards (see Section 5.6).

4.3.4 Weld Size

All welds: plus only, no minus.

4.3.5 Angularity

All forming operations: ± 4 degrees.

4.3.6 Punched Holes

- a) Location - center to edge, or center to center: $\pm \frac{1}{8}$ in. (3 mm).
- b) Diameter: plus 0.2 times metal thickness or minus $\frac{1}{32}$ in. (1 mm)

4.3.7 Drilled Holes

As specified on manufacturer's drawings.

4.3.8 Machined Parts

As specified on manufacturer's drawings.

5. FABRICATION

5.1 Description

5.1.1 This section covers shop fabrication of hanger components and assemblies.

5.1.2 Where service conditions necessitate consideration of special treatment not covered in this section, such requirements should be a matter for individual discussion and agreement between the purchaser and the fabricator.

5.2 General

5.2.1 Fabrication tolerances shall be in accordance with Section 4.3.

5.2.2 Material identification should be maintained during the fabrication process.

5.3 Material Cutting

5.3.1 Plates, rods, bars, etc. which are used for the fabrication of hanger assemblies may be cut to shape or size by shearing, sawing, machining, grinding, or thermal cutting.

5.3.2 When required, material identification for each piece of material cut shall be maintained by color coding, tagging, stamping, or other suitable means.

5.3.3 When thermal cutting is performed, the process shall be suitable for the material to which it is applied.

5.3.4 After thermal cutting, slag should be removed prior to further fabrication or use. Discoloration remaining on the cut surface is not considered to be detrimental.

5.4 Forming

5.4.1 Forming shall be performed in accordance with MSS SP-58, Section 5.

5.5 Machining, Drilling and Punching

5.5.1 These operations shall be performed as required by drawings and specifications.

5.6 Threading and Tapping

5.6.1 Inch screw threads shall be in conformance with ASME B1.1 or Federal Standard H28, UNC 2A/2B for the coarse thread series and 8UN 2A/2B for the eight thread series. Metric screw threads shall be in conformance with ASME B1.13M 6H/6g.

5.6.2 Pipe that is threaded for adjustment means shall be in accordance with ASME B1.20-1 NPSM and NPSL for Standard Straight Pipe Threads.

5.6.3 Tapered pipe threads shall be in conformance with ANSI ASME B1.20.1 NPT

5.6.4 Special thread forms and fits other than those specified by this subsection shall be used only when both male and female threaded members are furnished as part of a permanent assembly.

5.7 Welding

5.7.1 Welding shall be done in accordance with MSS SP-58, Sections 5.6 and 5.7.

6. PROTECTIVE COATINGS

6.1 Description

6.1.1 This section covers shop application of protective coatings.

6.1.2 Protective coatings fall into two general types: Metallic Coatings and Non-metallic Coatings.

6.1.3 The type of protective coating used for hanger material shall be the fabricator's standard coating unless otherwise specified.

6.2 Metallic Coatings

6.2.1 Electroplating, pre-galvanizing, hot dip galvanizing, and mechanical plating shall be in accordance with MSS SP-58, Section 6.1. Other metallic coatings may be selected for specific purposes.

6.3 Non-metallic Coatings

6.3.1 Non-metallic coatings for specific purposes shall be in accordance with the recommendations of MSS SP-58, Section 6.2.

6.3.2 When standard shop paint is required, fabricated hanger material shall receive one shop coat of good quality rust inhibitive primer (fabricator's standard paint).

6.3.3 Special shop paints and surface preparation shall be applied in accordance with approved procedures.

6.3.4 Material surfaces shall be prepared for coating by removal of loose scale, loose weld spatter, and other foreign material. Removal may be done by scraping, wire brushing, or other suitable means. Blasting or pickling need be done only when specified.

6.3.5 Application of coatings shall be in accordance with the coating manufacturer's recommendations.

6.3.6 Rod threads for field adjustment shall not be painted. Bolt threads in assembled components may be painted. When specified, external adjustment threads shall receive a coating of rust preventative compound.

6.3.7 Stainless steel or other corrosion resistant material need not be painted.

6.3.8 Small items such as beam attachments which are to be welded to existing steel need not be painted.

7. TESTING OF HANGER COMPONENTS

7.1 Description

7.1.1 This section defines the testing of hanger components and gives the purpose for tests in each category.

7.1.2 This section also recommends the type of records for each category of test.

7.2 Classification

7.2.1 Testing of hanger components falls into three categories:

- a) Design Proof Test
- b) Qualification Test
- c) Calibration Test

7.3 Design Proof Test

7.3.1 Design Proof Tests may consist of tests for both strength and function. Tests should be performed using calibrated test equipment.

7.3.2 Strength tests are performed to prove the adequacy of the final design as to allowable stress or safety factor criteria. Tests may be physical, analytical, or a combination of both.

7.3.2.1 Physical Test Method ("a" or "b")

Physical Test Method "a" shall consist of loading to destruction a sufficient number of hanger components of one size and design to establish a minimum failure load to which a factor can be applied for safe load rating purposes. A single test sample is permitted, but in this case, the load rating shall be decreased by 10%.

Physical Test Method "b" shall consist of loading to destruction a sufficient number of hanger components of one size and design to establish a failure mode that can be related to the results from standard test bars made from the same material as the hanger components. This test is used to establish a safe load rating at the allowable stress level of the hanger component material.

7.3.2.2 Analytical Test

Analytical Test shall consist of applying analytical methods and formulae to the structure of a hanger component to determine stress levels and conditions within that structure. This test is used to establish a safe load rating at the allowable stress level of the hanger component material.

7.3.2.3 Physical and Analytical Test

Combination Physical and Analytical Test shall consist of physical tests described in 7.3.2.1 test method "b" and applying these results analytically to a family of hanger components of the same design form. This test is used to establish a safe load rating for each component size at the allowable stress level of the hanger component material.

7.3.3 Functional tests are performed to prove the ability of a component to meet the design criteria at rated load.

7.3.4 Results of Design Proof Tests should be presented in report form. Since this report may contain proprietary information, a summary report is acceptable.

7.3.5 After Design Proof Tests are complete, they need not be repeated unless significant dimensional or material changes are made in the hanger component.

7.4 Qualification Test

7.4.1 Qualification Tests are performed to assure that hanger components meet or exceed the minimum requirements of particular codes or approval agencies. Test equipment should be of the same type and condition as for Design Proof Test. Design Proof Tests may serve as Qualification Tests. Qualification Tests may be performed by the hanger component manufacturer or by an approval agency.

7.4.2 Results of Qualification Tests should be presented in a report form suitable for distribution.

7.4.3 Except as required by the approval agency, Qualification Tests need not be repeated unless significant dimensional or material changes are made in the hanger component.

7.5 Calibration Test

7.5.1 Calibration Tests are performed on some types of individual hanger components, such as constant supports, to assure that they are properly calibrated to meet specific installation requirements. Calibration Test equipment may be the same used for Design Proof and Qualification Tests; or it may be specific equipment for the Calibration Tests performed. The test equipment shall be calibrated to insure reliable results.

7.5.2 Records of Calibration Tests should be retained by the manufacturer.

7.6 Quality Control

7.6.1 Quality Control should be exercised over the procurement of raw materials, fabrication procedures, and dimensions to assure the continued validity of Design Proof and Qualification Tests.

8. INSPECTION

8.1 Description

8.1.1 This section covers recommendations for quality control and inspection of pipe hanger components and assemblies.

Table 2- Inspection Check List

INSPECTION CATEGORIES	TYPES OF INSPECTION		
	Receiving	In-Process	Final
1. Drawings and/or Specifications		X	X
2. Material Identification	X	X	X
3. Fabrication Procedure		X	
4. Dimensions	X	X	X
5. Surface Finish	X	X	X
6. Surface Preparation		X	
7. Protective Coating	X	X	X
8. Performance		X	X
9. Marking	X	X	X
10. Documentation	X	X	X
11. Packaging		X	X

8.2 General

8.2.1 There should be an inspection program to ensure that all aspects of work performed comply fully with all specified requirements.

8.3 Inspection Program

8.3.1 Table 2 designates the suggested check points that should be included in an inspection program.

9. PACKAGING, MARKING, SHIPPING, RECEIVING AND STORAGE

9.1 Description

9.1.1 This section covers the recommendations for packaging, marking, shipping, receiving and storage of hanger components and assemblies.

9.1.2 Special requirements not covered in this section should be a matter for discussion and agreement between the purchaser and supplier.

9.2 Packaging

9.2.1 General

9.2.1.1 Hangers should be assembled to the degree practical, taking into account shipping and handling limitations. Constant supports, variable springs, and similar items may be packaged, skidded, or shipped loose, separate from the remaining assembly components.

9.2.1.2 Where possible, each hanger assembly should be shipped complete.

9.2.1.3 Hanger assemblies or subassemblies shall be properly marked with identifying numbers. Random material may be identified in bulk.

9.2.1.4 Each hanger shipment shall contain a packing list identifying the material included in the shipment, also noting the total number of boxes, bundles, bags, etc. making up the shipment.

9.2.2 Containers

9.2.2.1 Where size permits, hanger assemblies and subassemblies may be packed in the manufacturer's standard containers.

9.2.3 Bundles

9.2.3.1 Hanger assemblies, steel members, welded brackets, etc. which are too large for the standard containers should be bundled and banded for shipment.

9.2.4 Loose Components

9.2.4.1 Large rigid components, which do not require special protection during shipment, need not be packaged.

9.2.5 Bags

9.2.5.1 Small loose items may be placed in bags. The bags may be shipped separately or placed in containers for shipment.

9.2.6 Pallets and Skids

9.2.6.1 Hanger components may be palletized for shipment to facilitate handling as a compact unit.

9.3 Marking for Shipment

9.3.1 General

9.3.1.1 Marking shall be accomplished by use of labels, stamping, printing, or tagging.

9.3.1.2 Marking shall be applied with waterproof ink or paint.

9.3.1.3 Labels shall be of water resistant type.

9.3.1.4 Tags may be cloth, paper, plastic, or metal and affixed by waterproof adhesive, tacks, or wire.

9.3.2 Container marking by stenciling, printing, or labeling should appear in a minimum of two locations, preferably on one side and one end.

9.3.3 Bundles and bags shall be tagged.

9.3.4 Loose components, pallets, and skids may be stenciled, labeled, or tagged.

9.3.5 Marking should include the following information when applicable:

- a) Consignee name, street address, city, state, zip code, and country.
- b) Consignor name, street address, city, state, zip code, and country.
- c) Purchase order or contract number. Package number followed by the total number of packages in the shipment.
- d) Material identification number, e.g., hanger mark numbers or manufacturer's figure numbers and quantity. A packing list may be used in lieu of material identification. The container in which the packing list is enclosed shall be clearly identified.
- e) Special handling instructions, e.g., use no hooks, lift points, keep dry, stacking limitations, etc.
- f) Weight of package.
- g) Special instructions.

9.4 Shipping

9.4.1 Shipping shall be in accordance with the method, routing, and sequence as required by the purchase document.

9.4.2 The location of the packing list should be indicated on the bill of lading.

9.5 Consignee Receiving

9.5.1 The receiving clerk should be responsible for verifying agreement between the bill of lading and the shipment as received. Any damage or shortage should be noted on the bill of lading and the shipper and carrier immediately notified.

9.5.2 Unloading should be done with reasonable care, taking note of any precautionary notices on the containers. Items of shipment should not be dropped.

9.6 Consignee Storage

9.6.1 Storage should be in a dry area, enclosed for security purposes, and protected from the direct effects of weather and contaminants.

9.6.2 It is recommended that containers be opened and contents verified before they are placed in the storage area.

9.6.3 It is recommended that a system be established to facilitate retrieval of material from storage.

10. HANGER INSTALLATION PRACTICES

10.1 Description

10.1.1 This section outlines the recommended field practices for field personnel during hanger installation, adjustment, testing, and inspection.

10.2 General

10.2.1 Installation control shall be as defined in the owner's job specifications for each classification of piping.

10.2.2 Installation information may be in any of the following forms:

- a) Completely engineered: individual hanger assembly drawings.
- b) Semi-engineered: typical hanger type drawings and approximate locations for field fabricated supports using preselected bulk hanger material.
- c) Random: guidelines for location, hanger type selection, and installation of supports using preselected bulk hanger material where all operations are performed by the field forces.

10.2.3 Relocation and reorientation of any hanger or restraint from the specified location shall not be permitted beyond that which is established by the responsible hanger designer, without his expressed permission.

10.2.4 Installed hangers or hanger components shall be used for their intended purpose. They shall not be used for rigging or erection purposes.

10.2.5 Recommended maximum applied torque for set screws in C-clamps (Types 19 & 23) is listed below:

Thread Size		Torque	
Inch	(mm)	Inch Pound	(Nm)
1/4	6.4	40	4.5
3/8	9.6	60	6.8
1/2	12.7	125	14.1
5/8	15.8	250	28.2
3/4	19.0	400	45.2
7/8	22.2	665	75.1

Note: Caution should be taken not to overtighten the set screw.

10.2.6 Hangers that are installed with clearance for future insulation shall be properly supported with blocks at three points approximately 60 degrees apart around the lower circumference. These blocks shall be the thickness of the intended insulation to prevent distortion of the hanger assembly.

10.3 Planned Installation Sequence

10.3.1 The hanger designer assumes responsibility for avoiding hanger interference with all piping, electrical trays, ducts and equipment specifically dimensioned on drawings made available to him. Studies are made to avoid such interferences during the design phase of pre-engineered hangers; however, the hanger designer cannot assume responsibility for any resulting interference caused by field run piping, electrical conduits, instrumentation, added steel framing, etc.

10.3.2 The hanger installer should be cognizant of the total amount of piping and equipment to be installed in any given area. He should develop an installation sequence giving priority to major components and strata of piping closest to the supporting structure. The installer also should review routing of field run piping in order to reserve space for known components to be installed at some later date in order to minimize revamp work. He should coordinate erection of all piping with other trades to maintain erection clearances and availability of building structure for supporting functions.

10.4 Hanger Locations

10.4.1 Completely engineered hangers shall be located in strict accordance with the hanger design detail drawings. It is normal design practice to dimension the location of hanger attachments from the building structure column lines. Refer to Section 3.9 for complete description.

10.4.2 Semi-engineered hangers for which approximate locations are designated shall be so located.

10.4.3 Random hangers shall be located by the hanger installer in accordance with the allowable support spacing in MSS SP-69, Table 3.

10.4.4 When initially installed, all hangers shall be adjusted to establish the piping at the designated elevation.

10.5 Hanger Installation

10.5.1 Rod Hangers

10.5.1.1 Rod hangers, either rigid or spring type, are adjustable vertical assemblies consisting of structural attachment, hanger rod (with or without intermediate components), and pipe attachment.

10.5.1.2 Installation of rod hangers requires either direct attachment to building structure or to supplemental framing.

10.5.1.3 Attachment to the building structure may be by beam clamps, welding of clips to steel members or concrete embedded plates, and by use of concrete inserts or fasteners. Where there is a vibration or bending consideration, hanger rods should not be connected directly to driven or drilled concrete fasteners. In these instances an intermediate attachment should be used from which the rod can be suspended using a swing connection.

10.5.1.4 Supplemental framing may be angles, channels, tubular sections, or beams either bolted or welded to existing steel structure or attached to concrete.

10.5.2 Brackets

10.5.2.1 Brackets are cantilevered members with or without a kneebrace, designed to withstand the gravity load and horizontal forces.

10.5.2.2 When the installer has responsibility for design or selection of brackets, anticipated horizontal forces should be considered.

10.5.2.3 Brackets may be installed by welding or bolting to structure, poured in place embedments, or through the use of drilled concrete fasteners.

10.5.2.4 For bolted-on brackets, it is important to tighten threaded fasteners equally to assure proper load distribution.

10.5.3 Anchors

10.5.3.1 Anchors may be weldments or clamp type.

10.5.3.2 Anchors are used to fix selected points on a piping system in order to control forces, moments, and thermal movement in each section of the total pipe run. Location shall be accurately maintained for both horizontal and vertical piping to preserve the Piping Design Engineer's flexibility concept.

10.5.3.3 Anchors shall not be added or relocated without the approval of the Piping Design Engineer.

10.5.3.4 Installation of anchors may be by bolting or welding to a rigid structure capable of withstanding all the design forces. Pipe is secured to the anchor by clamping, welding or both.

10.5.4 Guides

10.5.4.1 Guides may be sliding, rolling, or spider types.

10.5.4.2 Guides are used to control piping movement, provide lateral stability, control sway, and assure proper piping alignment at expansion joints and loops. Spider guides used in the horizontal position are not normally considered to be pipe support elements.

10.5.4.3 Design is based upon thermal movement, load, direction of travel, and thickness of pipe insulation.

10.5.4.4 Installation of guides may be by bolting or welding the base, frame, or shroud to the supporting structure. Care must be taken at time of initial installation to maintain the proper alignment, elevation, and clearances. On insulated lines, saddles or fins should be attached to piping to prevent damage to insulation.

10.5.5 Base Type Support

10.5.5.1 Base type supports are used to support the piping from below. They encompass a family of supports, guides, slides, anchors, springs, etc.

10.5.5.2 Attachment to pipe may be by bolted-on clamps, U-bolts, or welding. Load is transferred through the use of a cradle, pipe, or structural member which may be fastened directly to building structure or provided with a base plate suitable for incorporation into the particular type support involved.

10.5.5.3 When attaching to steel structure, proper piping elevation can be established by custom fitting the vertical member, or by using telescoping pipe or other means of adjustment.

10.5.5.4 When attaching to concrete structure, the use of leveling bolts under the base plate with subsequent grouting is an additional means to provide proper piping elevation.

10.5.5.5 During installation, the supported pipe should be adequately braced to maintain stability until the system is completely installed.

10.6 Hanger Adjustment

10.6.1 To compensate for pipe elevation discrepancies, hangers are usually provided with means to permit vertical adjustment during and after installation. Threaded devices using turnbuckles, clevises, etc. provide this feature or the adjustment is inherently available in the hanger design. No adjustment shall be made that will result in less than full usable thread engagement.

10.6.2 Adjustability features also serve to facilitate pipe load distribution.

10.6.3 For small size piping, the necessity for adjustment can be detected visually. For large or heavy piping, the necessity for adjustment may not be as obvious and the installer must determine that each hanger or support substantially carries its proper load. Hanger drawings usually denote the operating and hydrostatic loads.

10.6.4 Upon completion of hanger installation, all adjustments having the possibility of turning shall be locked securely in place; double nutting being the most common means. It is not recommended to break threads or tack weld as a means of locking adjustment devices.

10.6.5 Hydrostatic testing, when required, should not be performed until all hanger assemblies have been properly installed, adjusted, and loaded in accordance with the hanger drawings. Built-in hydrostatic stops, or external means for supporting the added water weight, must be installed in accordance with the Hydro Test Procedures as typically found in project specifications.

10.6.6 After completion of hydrostatic tests of the piping system, any devices (e.g., spring travel stops, temporary supports, etc.) furnished for hydrostatic test purposes must be removed.

10.6.7 Hangers for certain piping systems may be required to be checked for adjustment during initial run at operating temperature. Particular attention should be given to spring hangers and spring supports.

10.6.8 Constant type springs have specific load adjustment devices, which can vary the spring effort by plus or minus some percentage from the factory set load. Variable type springs are usually provided with turnbuckles, threaded collars, or adjustment nuts to enable varying the spring effort. Load/travel scales on variable and constant type spring units are usually marked to show the position of the load/travel indicator in both the cold and hot positions. Reference should be made to the particular spring suppliers' catalog for the location and operation of these devices.

10.6.9 If, at operating temperature, the load/travel indicator does not line up with the hot position marking, further adjustment may be required. However, before any adjustment is considered, the position of the load/travel indicator on all spring units on the system should be

recorded (see Figure 2 for suggested form). The cause for the misalignment should then be investigated.

10.6.9.1 Prior to initial operation all spring hanger units are set to the cold position. This position of the load/travel indicator should be the initial entry in a permanent formal log. (See Figure 2 for suggested form)

10.6.9.2 When the system reaches operating temperature a second set of load/travel indicator position readings should be recorded.

10.6.9.3 If at operating temperature, the load/travel indicator does not line up with the hot position marking, it is recommended that a minor travel adjustment be made (either lengthen or shorten the hanger rod) to have the indicator line up with the hot marking. If the installation does not respond to this minor travel adjustment, then consult with an experienced hanger designer. A new set of load/travel position readings should be recorded with a notation on the log that adjustment has been made. This set of readings represents the system being supported in accordance with the designers initial design concept which is to have the piping properly supported in the hot position.

10.6.9.4 All future studies should use this final adjusted set of hot readings as the base line.

10.6.9.5 Subsequent sets of readings, taken after the system has been cycled through hot and cold conditions, will provide the opportunity to evaluate the possible need to make load adjustments on some group of adjacent hangers to bring a section of piping run to proper elevation. This evaluation should be made only by an experienced hanger designer.

10.6.9.6 The plant should establish a program to have a periodic inspection of critical piping support systems and load/travel indicator readings recorded and compared to the base line set of readings. Although the load/travel indicator may not line up exactly with the base line readings, the hanger may still be considered functional if the reading is close to the base reading.

10.6.9.7 Spring units must never be topped or bottomed out. This is an indication that the working travel range has been exceeded.

10.6.10 Some possible causes for improper alignment of the load/travel indicator at operating temperature include:

- a) Improper load adjustment of hanger.
- b) Improper load adjustment of adjacent hangers.
- c) System not at full operating temperature.
- d) Pipe fabrication error.
- e) Improper cold springing.
- f) Frictional effects of guides or sliding supports.
- g) Discrepancies between design and "as built" conditions affecting hanger loads or movement.
- h) Improper hanger installation or failure to remove temporary supports, restraints, or hanger traveler stops.
- i) Failure to clear piping system of obstructions.

10.7 Inspection

10.7.1 *Inspection after installation and prior to hydrostatic testing.*

10.7.1.1 Each hanger assembly should be verified against the hanger drawing to assure that all components have been installed and are in their proper position. This also includes temporary hangers and supports that may be required for hydrostatic testing and spacer blocks for lines still to be insulated.

10.7.1.2 Threaded components of each hanger should be checked for proper thread engagement.

10.7.1.3 Locking nuts on threaded components, cotter pins, temporary locking devices (travel stops), and other locking means furnished with spring units should be properly engaged.

10.7.1.4 When possible, springs should be oriented for convenient reading of load/travel scales. Scales found to be damaged should be removed and replaced. Prior to removal, the exact position of the scale should be noted and replacement installed in the same location.

10.7.1.5 Restraint control devices utilizing hydraulic fluids should be checked for tight seals and proper amount of fluid. If it is found necessary to add fluid, it must be of the type specified by the restraint supplier.

10.7.1.6 Sliding supports using teflon, graphite, bronze, or steel to steel slide plates must be installed in strict accordance with hanger detail drawings with particular attention to offset dimensions and clearances when such are specified. All sliding surfaces must be free of foreign matter.

10.7.2 *Inspection after hydrostatic testing and prior to heating up.*

10.7.2.1 Spring locking devices and any temporary hangers and supports required for hydrostatic testing shall be removed.

10.7.2.2 Spring hangers should be checked to insure that their load/travel indicators are approximately in their cold position setting and that the pipe is at the proper elevation.

10.7.2.3 Restraint control devices should be checked to insure that their travel indicators are approximately at their cold position setting.

10.7.2.4 Actual cold positions of the load/travel indicators on springs and restraint control devices should be recorded in a permanent formal log. See Figure 2 for suggested form.

10.7.3 *Inspection at operating conditions*

10.7.3.1 Piping systems should be inspected in their entirety to verify that no interference exists between the pipe and/or the pipe insulation and the building structure or equipment.

10.7.3.2 Spring hangers should be checked to insure that their load/travel indicators are approximately in their hot position setting and that the pipe is at the proper elevation.

10.7.3.3 Restraint control devices should be checked to insure that their travel indicators are approximately at their hot position setting.

10.7.3.4 Line temperature and actual hot positions of the load/travel indicators on springs and restraint control devices should be noted and recorded in a permanent formal log. See Figure 2 for suggested form. Upon completion of the work this log should be made available to the owner.

Figure 2 - Suggested Form for Hanger Record Sheet

ANNEX A
Referenced Standards and Applicable Dates

This Annex is an integral part of this standard practice which is placed after the main text for convenience.

ANSI

B1.20.1-1983 Pipe Thread, General Purpose (Inch)

ASME

B1.1-1989 (R 2001) Unified Inch Screw Threads (UN and UNR Thread Form)

B1.13M-2001 Metric Screw Thread – M Profile

MSS

SP-58-2002 Pipe Hangers and Supports - Materials, Design and Manufacture

SP-69-2002 Pipe Hangers and Supports - Selection and Application

SP-127-2001 Bracing For Piping Systems Seismic – Wind – Dynamic Design, Selection, Application

Federal Standard

H28-2001 Screw Thread Standards for Federal Service

AWS

D1.1/D1.1M-2002 Structural Welding Code Steel

Publications of the following organizations appear in the above list:

ANSI American National Standards Institute
25 West 43rd Street New York, NY 10036, Phone: (212) 642-4900

ASME American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990, Phone: (800) 843-2763

MSS Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
127 Park Street, N.E., Vienna, VA 22180, Phone: (703) 281-6613

AWS American Welding Society
550 NW LeJeune Road, Miami, FL 33126, Phone: (800) 443-9353

GSA Federal Standards care of the General Services Administration
Federal Supply Services, FSS Acquisition Management Center, Environmental Program &

List of MSS Standard Practices (Price List Available Upon Request)

Number	
SP-6-2001	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
SP-9-2001	Spot Facing for Bronze, Iron and Steel Flanges
SP-25-1998	Standard Marking System For Valves, Fittings, Flanges and Unions
SP-42-1999	Class 150 Corrosion Resistant Gate, Globe, Angle and Check Valves with Flanged and Butt Weld Ends
SP-43-1991	(R 01) Wrought Stainless Steel Butt-Welding Fittings
SP-44-1996	(R 01) Steel Pipeline Flanges
SP-45-2003	Bypass and Drain Connections
SP-51-2003	Class 150LW Corrosion Resistant Flanges and Cast Flanged Fittings
SP-53-1999	(R 02) Quality Standard for Steel Castings and Forgings for Valves, Flanges, and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP-54-1999	(R 02) Quality Standard for Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Radiographic Examination Method
SP-55-2001	Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components - Visual Method for Evaluation of Surface Irregularities
SP-58-2002	Pipe Hangers and Supports - Materials, Design, and Manufacture
SP-60-2004	Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
SP-61-2003	Pressure Testing of Steel Valves
SP-65-2004	High Pressure Chemical Industry Flanges and Threaded Stubs for Use with Lens Gaskets
SP-67-2002	Butterfly Valves
SP-68-1997	High Pressure Butterfly Valves with Offset Design
SP-69-2002	Pipe Hangers and Supports - Selection and Application
SP-70-1998	Cast Iron Gate Valves, Flanged and Threaded Ends
SP-71-1997	Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-1999	Ball Valves with Flanged or Butt Welding Ends for General Service
SP-73-2003	Brazing Joints for Copper and Copper Alloy Pressure Fittings
SP-75-1998	Specification for High Test Wrought Butt Welding Fittings
SP-77-1995	(R 00) Guidelines for Pipe Support Contractual Relationships
SP-78-1998	Cast Iron Plug Valves, Flanged and Threaded Ends
SP-79-1999a	Socket-Welding Reducer Inserts
SP-80-2003	Bronze Gate, Globe, Angle, and Check Valves
SP-81-2001	Stainless Steel, Bonnetless, Flanged Knife Gate Valves
SP-82-1992	Valve Pressure Testing Methods
SP-83-2001	Class 3000 Steel Pipe Unions, Socket Welding and Threaded
SP-85-2002	Gray Iron Globe & Angle Valves, Flanged and Threaded Ends
SP-86-2002	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings, and Actuators
SP-88-1993	(R 01) Diaphragm Valves
SP-89-2003	Pipe Hangers and Supports - Fabrication and Installation Practices
SP-90-2000	Guidelines on Terminology for Pipe Hangers and Supports
SP-91-1992	(R 96) Guidelines for Manual Operations of Valves
SP-92-1999	MSS Valve User Guide
SP-93-1999	Quality Standard for Steel Castings and Forgings for Valves, Flanges, and Fittings and Other Piping Components-Liquid Penetrant Examination Method
SP-94-1999	Quality Std for Ferritic and Martensitic Steel Castings for Valves, Flanges, and Fittings and Other Piping Components-Ultrasonic Examination Method
SP-95-2000	Swage(d) Nipples and Bull Plugs
SP-96-2001	Guidelines on Terminology for Valves and Fittings
SP-97-2001	Integrally Reinforced Forged Branch Outlet Fittings-Socket Welding, Threaded, and Buttwelding Ends
SP-98-2001	Protective Coatings for the Interior of Valves, Hydrants, and Fittings
SP-99-1994	(R 01) Instrument Valves
SP-100-2002	Qualification Requirements for Elastomer Diaphragms for Nuclear Service Diaphragm Valves
SP-101-1989	(R 01) Part-Turn Valve Actuator Attachment-Flange and Driving Component Dimensions and Performance Characteristics
SP-102-1989	(R 01) Multi-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-103-1995	(R 00) Wrought Copper and Copper Alloy Insert Fittings for Polybutylene Systems
SP-104-2003	Wrought Copper Solder Joint Pressure Fittings
SP-105-1996	(R 01) Instrument Valves for Code Applications
SP-106-2003	Cast Copper Alloy Flanges and Flanged Fittings, Class 125, 150 and 300
SP-107-1991	(R 00) Transition Union Fittings for Joining Metal and Plastic Products
SP-108-2002	Resilient-Seated Cast-Iron Eccentric Plug Valves
SP-109-1997	Welded Fabricated Copper Solder Joint Pressure Fittings
SP-110-1996	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-111-2001	Gray-Iron and Ductile-Iron Tapping Sleeves
SP-112-1999	(R 04) Quality Standard for Evaluation of Cast Surface Finishes - Visual and Tactile Method. This SP must be sold with a 10-surface, three dimensional Cast Surface Comparator, which is a necessary part of the Standard. Additional Comparators may be sold separately at \$70.00 each. Same quantity discounts apply on total order.
SP-113-2001	Connecting Joint between Tapping Machines and Tapping Valves
SP-114-2001	Corrosion Resistant Pipe Fittings Threaded and Socket Welding, Class 150 and 1000
SP-115-1999	Excess Flow Valves 1 1/4 NPS and Smaller, for Fuel Gas Service
SP-116-2003	Service-Line Valves and Fittings for Drinking Water Systems
SP-117-2002	Bellows Seals for Globe and Gate Valves
SP-118-2002	Compact Steel Globe & Check Valves - Flanged, Flangeless, Threaded, & Welding Ends (Chemical & Petroleum Refinery Service)
SP-119-2003	Factory-Made Wrought Belled End Socket-Welding Fittings
SP-120-2002	Flexible Graphite Packing System for Rising Stem Steel Valves (Design Requirements)
SP-121-1997	(R 02) Qualification Testing Methods for Stem Packing for Rising Stem Steel Valves
SP-122-1997	Plastic Industrial Ball Valves
SP-123-1998	Non-Ferrous Threaded and Solder-Joint Unions for Use With Copper Water Tube
SP-124-2001	Fabricated Tapping Sleeves
SP-125-2000	Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves
SP-126-2000	Steel In-Line Spring-Assisted Center Guided Check Valves
SP-127-2001	Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application
SP-129-2003	Copper-Nickel Socket-Welding Fittings and Unions
SP-130-2003	Bellows Seals for Instrument Valves
(R YEAR)	Indicates year standard reaffirmed without substantive changes

A large number of former MSS Practices have been approved by the ANSI or ANSI Standards, published by others. In order to maintain a single source of authoritative information, the MSS withdraws its Standard Practice in such cases.

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