MSS SP-69-2002

Pipe Hangers and Supports - Selection and Application

Standard Practice
Developed and Approved by the
Manufacturers Standardization Society of the
Valve and Fittings Industry, Inc.
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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.

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

Substantive changes in this 2002 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". All appendices appearing in this document are construed as "supplemental". "Supplemental" information does not include mandatory requirements.

Non-toleranced Dimensions in this Standard Practice are nominal, and, unless otherwise specified, shall be considered "for reference only".

Originally Approved July 1966

FOREWORD

This standard was developed by a cooperative effort of representatives of the pipe hanger manufacturers. It is based on the best practice current at this time and on the collective experience of the industry. There are three companion standards—MSS SP-58 and MSS SP-89 relate to hanger materials, design, manufacture, fabrication and installation; 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 Hanger Committee 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 — SELECTION AND APPLICATION

1. SCOPE

1.1 This standard presents the recommended practice for the selection and application of pipe hangers and supports for all service temperatures.

2. OBJECTIVE

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

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

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

2.4 To serve as a companion document to MSS SP-58 which provides recommendations for material, design and manufacture of standard types of pipe hanger components.

2.5 To serve as a companion document to MSS SP-89 which provides recommendations for fabrication and installation of pipe hangers and supports.

2.6 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. CLASSIFICATION OF PIPING SYSTEMS

For the purpose of pipe hanger and support selection, this document establishes an identification of piping systems according to the operating (service) temperatures of the piping contents as follows:

3.1 Hot Systems

A-1. 120° F (49° C) to 450° F (232° C)
A-2. 451° F (233° C) to 750° F (399° C)
A-3. Over 750° F (399° C)

3.2 Ambient Systems

B. 60°F (16°C) to 119°F (48°C)

3.3 Cold Systems

C-1. 33° F (1° C) to 59° F (15° C)
C-2. -19° F (-28° C) to 32° F (0° C)
C-3. -39° F (-39° C) to -20° F (-29° C)
C-4. -40° F (-40° C) and below (Cryogenic Range)

4. GENERAL REQUIREMENTS

4.1 Where applicable, selection and application of pipe hangers and supports may be required to conform to Codes and Standards, such as:

a) ASME B31 Codes for Pressure Piping
b) ASME Boiler and Pressure Vessel Codes
c) UL 203 Standard for Pipe Hanger Equipment for Fire Protection Service
d) Factory Mutual FM1951/1952/1953 Approval Standard for Pipe Hanger Components for Automatic Sprinkler Systems
e) NFPA 13
f) National and Local Building Codes
g) All Other Applicable Codes

4.2 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 supporting systems shall provide for, and control, the free or intended movement of the piping including its movement in relation to that of connected equipment.

4.3 A careful study shall be made of the piping layout in relation to the surrounding structure and adjacent piping and equipment before selecting the type of support to be used at each hanger point.

4.4 Hangers, supports, anchors and restraints shall be selected to withstand all static and specified dynamic conditions of loading to which the piping and associated equipment may be subjected.

4.5 When pipe hanger load and movement calculations are required by the design specification, the following must be considered:

a) Deadweight loads
b) Hydrostatic loads
c) Thermal loads
d) Loading due to expansion joint reaction forces

4.6 When occasional pipe hanger load calculations are required, they must be clearly defined in the design specification. Types of occasional loads are:

a) Safety valve thrust loads
b) Seismic loads
c) Wind, snow or ice loads
d) Turbine trip-out loads
e) Water hammer loads

4.7 Allowable stress levels listed in MSS SP-58 shall be used in the design of hanger assemblies with the following exceptions:

a) The load capacities for threaded hanger rods shall conform to Table 3 and Table A3 of MSS SP-58.

b) A 20% increase in allowable stress may be permitted for short time overloading conditions during operation.

c) For steels of known physical properties, an increase to 80% of minimum yield strength, at room temperature, during hydrostatic testing, is permissible. For steels of unknown physical properties, an increase to 80% of yield strength, as determined by physical test, is permissible, provided that the maximum allowable stress does not exceed 19,000 PSI (131 MPa).

d) Loading combination considerations and allowable stress levels to be applied shall be established by the Piping Design Engineer.

4.8 Hanger and support components shall be selected from Table 1 within the system classification.

4.9 Where additional structural framing members are required, they shall be designed for the specific loads they are to support in accordance with the AISC Manual of Steel Construction – Allowable Stress Design, 9th Edition. No increase in allowable stress is permitted for hydrostatic test periods.

4.10 Hangers for the suspension of size $2^{1}/_{2}$ and larger pipe and tubing shall be capable of vertical hanger component adjustment under load.

4.11 Building structure shall be adequate for supporting pipe hanger loads as generated in 4.5 and 4.6, including hydrostatic test loads, and shall be the responsibility of the Piping Design Engineer.

4.12 Installed hangers or hanger components shall be used only for their purpose. They shall not be used for rigging and erection purposes.

4.13 Pipes shall not be suspended directly from each other. The individual hanger for each horizontal pipe in a vertical bank shall have the load transmitted directly to the rods, not the pipe above. Care shall be taken to size the rod appropriately for the total load at the support point.

5. MATERIAL REQUIREMENTS

5.1 The materials of all pipe hanging and supporting elements shall be in accordance with MSS SP-58.

5.2 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.

5.3 Materials subject to corrosion or electrolysis shall be protected as specified by the engineering design and such protection shall be applied in accordance with the requirements of MSS SP-58.

6. DIMENSIONAL REQUIREMENTS

6.1 Hangers and supports shall be sized to fit the outside diameter of pipe, tubing, or, if specified, the outside diameter of insulation. Manufacturers' catalog hangers provide a nominal clearance over standard tolerance piping and tubing. Consideration for fit should be given by the user for large diameter and/or out of tolerance piping and tubing.

6.2 Dimensional tolerances shall be in accordance with Section 4 of MSS SP-89.

7. SELECTION OF HANGERS AND SUPPORTS FOR PIPE MOVEMENT

7.1 The selection of hangers and supports shall be made to provide the piping system with the degree of control that its operating characteristics require.

TABLE 1 - Hanger & Support Selections
(For Spring Hangers, See Table 2)

To find recommended hanger or support components,

1. Locate the system temperature and insulation condition in the two columns at left.
2. Read across the column headings for the type of component to be used.
3. Numbers in boxes refer to those types shown in Figure 1, which corresponds to Figure 1 of MSS SP-58.

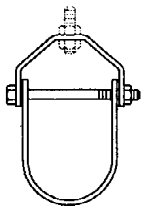
SYSTEM		HORIZONTAL PIPE ATTACHMENTS									
TEMP. RANGE DEG. F(C)	INSULATION	STEEL CLIPS A	MALLEABLE IRON RINGS B	STEEL BANDS C	STEEL CLAMPS D	CAST IRON HANGING ROLLS E	CAST IRON SUPPORTING ROLLS F	STEEL TRAPEZES G	STEEL PROTECTION SADDLES & SHIELDS H	STEEL OR CAST IRON STANCHIONS I	STEEL WELDED ATTACHMENTS J
HOT A-1 120 (49) to 450 (232)	COVERED NOTE 1	24 W/ 39	NONE	1, 5, 7, 9, 10 W/ 39 OR 40	2, 3	41, 43 W/ 39 OR 40	44, 45, 46 W/ 39 OR 40	59 W/ 39 OR 40	39, 40	36, 37, 38 W/ 39 OR 40	35 NOTE 3
	BARE	24, 26	6, 11, 12	1, 5, 7, 9, 10	3, 4	41, 43	44, 45, 46	59	NONE	36, 37, 38	
HOT A-2 451 (233) to 750 (399)	COVERED NOTE 1	24 W/ 39	NONE	1 W/ 39 OR 40	3	41 W/ 39 OR 40	44, 45, 46 W/ 39 OR 40	59 W/ 39 OR 40	39, 40	36, 37, 38 W/ 39 OR 40	35 NOTE 3
	BARE	NONE	NONE	NONE	3, 4	NONE	NONE	NOTE 3	NONE	NONE	
HOT A-3 OVER 750 (399)	COVERED NOTE 1	NONE	NONE	1 W/ 40	ALLOY 2, 3	41, 43 W/ 40 OR ALLOY 39	44, 45, 46 W/ 40 OR ALLOY 39	59 W/ 40 OR ALLOY 39	40 ALLOY 39	36, 37, 38 W/ 40 OR ALLOY 39	ALLOY 35 NOTE 3
	BARE	NONE	NONE	NONE	ALLOY 2, 3, 4	NONE	NONE	NOTE 3	NONE	NONE	
AMBIENT B 60 (16) to 119 (48)	COVERED NOTE 1	24, 26	NONE	1, 5, 7, 9, 10 W/ 39 OR 40	3, 4	41, 43 W/ 39 OR 40	44, 45, 46 W/ 39 OR 40	59 W/ 39 OR 40	39, 40	36, 37, 38 W/ 39 OR 40	35 NOTE 3
	BARE	24, 26	6, 11, 12	1, 5, 7, 9, 10	3, 4	41, 43	44, 45, 46	59	NONE	36, 37, 38	
COLD C-1 33 (1) to 59 (15)	COVERED NOTE 1	26 W/ 40	NONE	1, 5, 7, 9, 10 W/ 40	3, 4 W/ 40	41, 43 W/ 40 NOTE 4	44, 45, 46 W/ 40 NOTE 4	59 W/ 40	40	36, 37, 38 W/ 40	NOTE 3
	BARE	24, 26	6, 11, 12	1, 5, 7, 9, 10	3, 4	41, 43	44, 45, 46	NOTE 3	NONE	36, 37, 38	
COLD C-2 -19 (-28) to 32 (0)	COVERED NOTE 1	NONE	NONE	1, 5, 7, 9, 10 W/ 40	NONE	41, 43 W/ 40 NOTE 4	44, 45, 46 W/ 40 NOTE 4	NOTES 3 & 4 W/ 40	40	36, 37, 38 W/ 40	NOTE 3
	BARE	NONE	NONE	1, 5, 7, 9, 10	3, 4	41, 43	44, 45, 46	NOTE 3	NONE	36, 37, 38	
COLD C-3 & C4 BELOW -19 (-28)	COVERED NOTE 1	NONE	NONE	1, 5, 7, 9, 10 W/ 40	NONE	41, 43 W/ 40 NOTE 4	44, 45, 46 W/ 40 NOTE 4	NOTES 2, 3, 4 W/ 40	40	36, 37, 38 W/ 40	NOTES 2 & 3
	BARE	NONE	NONE	NOTES 2 & 3	NOTES 2 & 3	NONE	NONE	NOTES 2 & 3	NONE	NOTES 2 & 3	

TABLE 1 - Hanger & Support Selections (Continued)
(For Spring Hangers, See Table 2)

SYSTEM	VERTICAL PIPE ATTACHMENTS			HANGER ROD FIXTURES			BUILDING STRUCTURE ATTACHMENTS				
				STEEL OR MALLEABLE IRON			STEEL AND/OR MALLEABLE IRON				
TEMP. RANGE DEG. F(C)	STEEL RISER CLAMPS 2 BOLT	STEEL RISER CLAMPS 4 BOLT	WELDED ATTACHMENTS STEEL	TURN BUCKLES	SWING EYES	CLEVISES	INSERTS	C-CLAMPS	BEAM CLAMPS	WELDED ATTACHMENTS	BRACKETS
	K	L	M	N	O	P	Q	R	S	T	U
HOT A-1 120 (49) to 450 (232	8	42 NOTE 3	NOTE 3	13, 15	16, 17	14	18 NOTE 5	19, 23	20, 21, 25, 27 28, 29, 30	22, 57, 58 NOTE 3	31, 32, 33, 34
HOT A-2 451 (233) to 750 (399)	NONE	42 NOTE 3	NOTE 3	13, 15	16, 17	14	18 NOTE 5	NONE	20, 21, 25, 27 28, 29, 30	22, 57, 58 NOTE 3	31, 32, 33, 34
HOT A-2 451 (233) to 750 (399)	NONE	ALLOY 42 NOTE 3	ALLOY NOTE 3	13	17	14	NOTE 3 & 5	NONE	20, 21, 25, 27 28, 29, 30	22, 57, 58 NOTE 3	31, 32, 33, 34
AMBIENT B 60 (16) to 119 (48)	8	42 NOTE 3	NOTE 3	13, 15	16, 17	14	18 NOTE 5	19, 23	20, 21, 25, 27 28, 29, 30	22, 57, 58 NOTE 3	31, 32, 33, 34
COLD C-1 33 (1) to 59 (15)	8	42 NOTE 3	NOTE 3	13, 15	16, 17	14	18 NOTE 5	19, 23	20, 21, 25, 27 28, 29, 30	22, 57, 58 NOTE 3	31, 32, 33, 34
COLD C2 -19 (-28) to 32 (0)	8	42 NOTE 3	NOTE 3	13, 15	16, 17	14	18 NOTE 5	19, 23	20, 21, 25, 27 28, 29, 30	22, 57, 58 NOTE 3	31, 32, 33, 34
COLD C3 & C4 Below -19 (-28)	NOTES 2 & 3	NOTES 2 & 3	NOTES 2 & 3	13, 15	16, 17	14	18 NOTE 5	19, 23	20, 21, 25, 27 28, 29, 30	22, 57, 58 NOTE 3	31, 32, 33, 34

NOTES:

1. Hangers on insulated systems shall incorporate protection saddles, shields, pipe clamps or welded lugs which project through the insulation to provide external attachment. (See Section 10)
2. The selection of type and material shall be made by the Piping Design Engineer.
3. The design shall be in accordance with MSS SP-58 or as specified by the Piping Design Engineer.
4. For shields used with rollers or subject to point loading, see Table 5.
5. Continuous inserts, embedded plates, anchor bolts and concrete fasteners may be used as specified by the Piping Design Engineer.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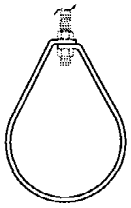
TYPE - 1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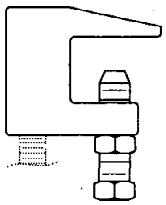
TYPE – 7


STEEL TURNBUCKLE
TYPE - 13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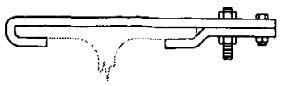
AS SHOWN OR INVERTED
TYPE - 19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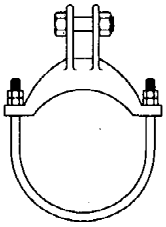
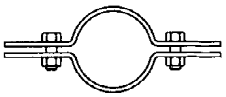
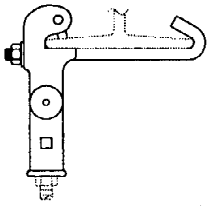
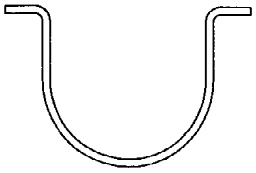
TYPE - 25

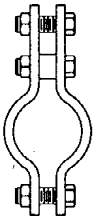

YOKE TYPE PIPE CLAMP
TYPE - 2

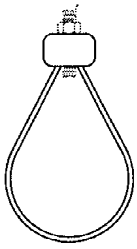

EXTENSION PIPE OR
RISER CLAMP
TYPE - 8


STEEL CLEVIS
TYPE - 14


SIDE BEAM OR CHANNEL
CLAMP
TYPE - 20


PIPE CLIP
TYPE - 26


CARBON OR ALLOY STEEL
THREE BOLT PIPE CLAMP
TYPE - 3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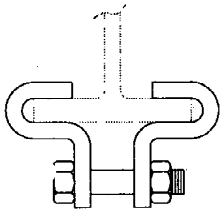
TYPE - 9


SWIVEL TURNBUCKLE
TYPE - 15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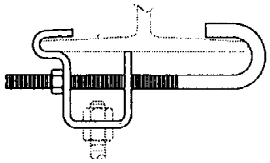
TYPE - 21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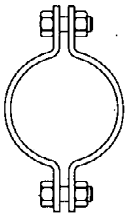
TYPE - 27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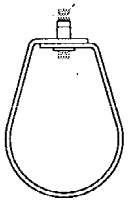
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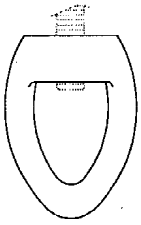
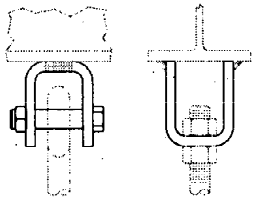
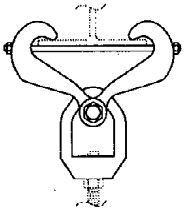
HANGER
TYPE - 10


MALLEABLE IRON SOCKET
TYPE - 16


WELDED BEAM ATTACHMENT
WITH OR WITHOUT BOLT
TYPE - 22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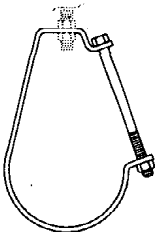
W / EYE NUT
TYPE - 28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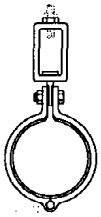
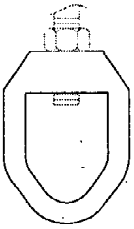
TYPE - 5


SPLIT PIPE RING WITH OR
WITHOUT TURNBUCKLE
TYPE - 11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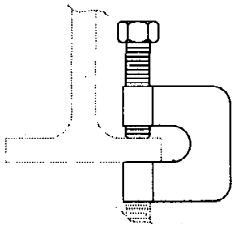
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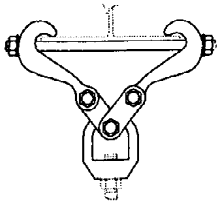
TYPE - 23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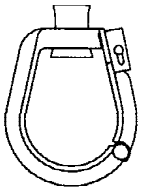
TYPE - 29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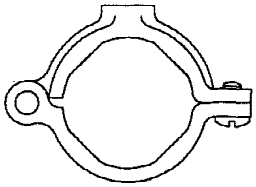
RING SPLIT RING OR SOLID
RING TYPE
TYPE - 6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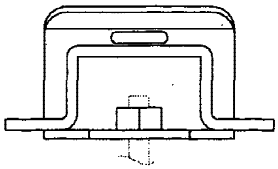
HINGED OR TWO BOLT
TYPE - 12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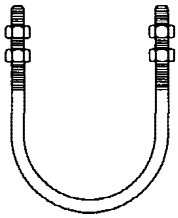
CONCRETE INSERT
TYPE - 18


U - BOLT
TYPE - 24

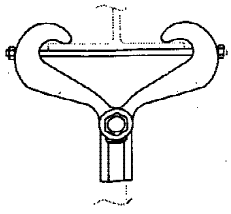
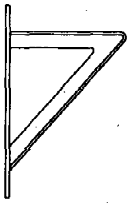
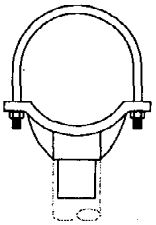
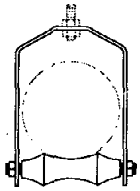
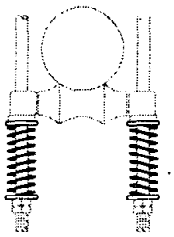

MALLEABLE BEAM CLAMP
W / EXTENSION PIECE
TYPE - 30

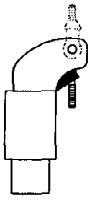
Figure 1 – Type Chart

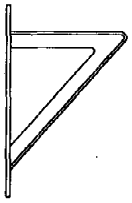

LIGHT WELDED STEEL BRACKET TYPE - 31

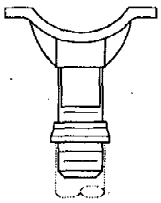

PIPE STANCHION SADDLE TYPE - 37

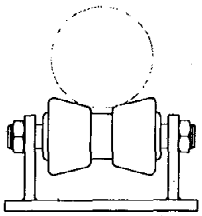

ADJUSTABLE ROLLER HANGER WITH OR WITHOUT SWIVEL TYPE - 43

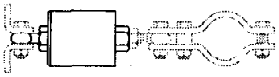

SPRING CUSHION ROLL TYPE - 49

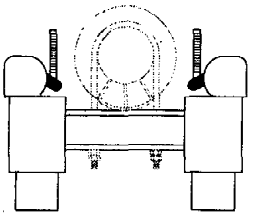

VERTICAL CONSTANT SUPPORT HANGER TYPE - 55

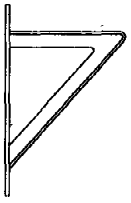

MEDIUM WELDED STEEL BRACKET TYPE - 32

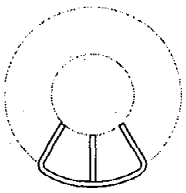

ADJUSTABLE PIPE SADDLE SUPPORT TYPE - 38

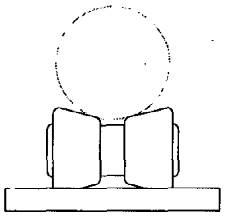

PIPE ROLL COMPLETE TYPE - 44

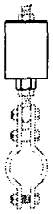

SPRING SWAY BRACE TYPE - 50


TRAPEZE CONSTANT SUPPORT HANGER TYPE - 56


HEAVY WELDED STEEL BRACKET TYPE - 33


STEEL PIPE COVERING PROTECTIVE SADDLE TYPE - 39


PIPE ROLL AND PLATE TYPE - 45


VARIABLE SPRING HANGER TYPE - 51

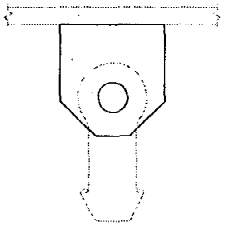
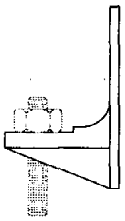
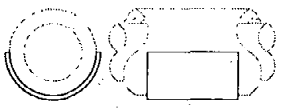
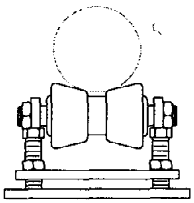
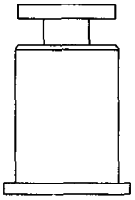


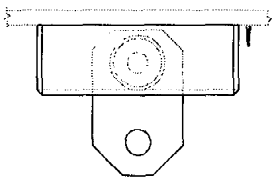
PLATE LUG TYPE - 57

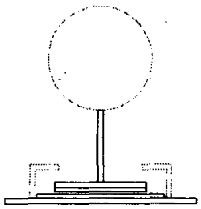

SIDE BEAM BRACKET TYPE - 34

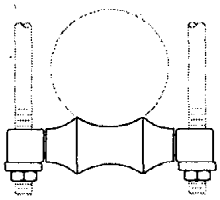

PROTECTION SHIELD TYPE - 40

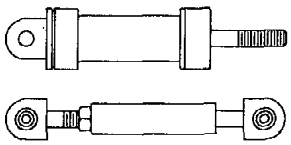

ADJUSTABLE PIPE ROLL AND BASE TYPE - 46

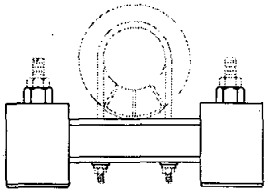

VARIABLE SPRING BASE SUPPORT TYPE - 52

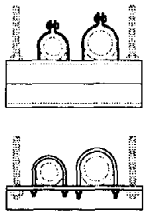

HORIZONTAL TRAVELER TYPE - 58

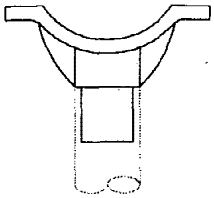

PIPE SLIDE & SLIDE PLATE TYPE - 35

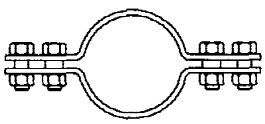

SINGLE PIPE ROLL TYPE - 41

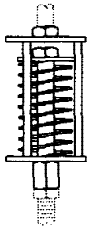

RESTRAINT CONTROL DEVICE TYPE - 47


VARIABLE SPRING TRAPEZE HANGER TYPE - 53


TRAPEZE HANGER TYPE - 59


PIPE SADDLE SUPPORT TYPE - 36


CARBON OR ALLOY STEEL RISER CLAMP TYPE – 42


SPRING CUSHION TYPE – 48

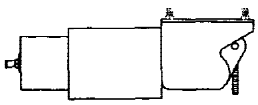

HORIZONTAL CONSTANT SUPPORT HANGER TYPE - 54

Figure 1 – Type Chart

7.2 Where negligible movement of pipe occurs at hanger locations, and no harmful loading on connecting equipment, piping, or structure would result, rod hangers may be used for suspended lines. For piping supported from below, bases, brackets or structural cross members may be used.

7.3 Where there is horizontal movement at a suspended type hanger location, hanger components shall be selected to allow for swing. 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. If the vertical angle of the hanger rod is greater than 4 degrees, a traveling device should be provided for horizontal movement. In special cases, vertical angles greater than 4 degrees may be used provided the resulting horizontal force and vertical deflection are considered in the piping and support design. For piping supported from below, slides, rollers, or roller carriages should be used.

7.4 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. 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.

TABLE 2 - Spring Support Selection

VERTICAL EXPANSION	ALLOWABLE VARIABILITY OR DEVIATION	SINGLE ROD HANGER	DOUBLE ROD HANGER	BASE SUPPORT
	NOTE (1)	NOTE (2) AND NOTE (3)		
MAX. 1/4 INCH (6 mm)	25% 6%	48,51SS 51SS	48,49,51SS,53SS 51S, 53S	52SS 52S
MAX. 1 INCH (25 mm)	25% 6%	51S 54,55	51S, 53S 54,55,56	52S 54,55
MAX. 3 INCH (76 mm)	25% 6%	51LS 54,55	51LS, 53LS 54,55,56	52LS 54,55
OVER 3 INCH (76 mm)	25% 6%	54,55 54,55	54,55,56 54,55,56	54,55 54,55

NOTE (1) VARIABLE SPRING HANGERS

$$\text{VARIABILITY FACTOR} = \frac{\text{Pipe Travel in. (mm) X Spring Rate lbs/in. (kg/mm)}}{\text{Operating Load lbs (kg)}}$$

CONSTANT SUPPORT HANGERS

$$\text{DEVIATION FROM SPECIFIED LOAD} = \frac{\text{Max Reading Moving Down - Min Reading Moving Up}}{\text{Max Reading Moving Down + Min Reading Moving Up}}$$

Max. Reading Moving Down and Min. Reading Moving Up shall be within 6% of specified load.

(2) - NUMBERS IN COLUMNS ARE TYPE NUMBERS FROM FIGURE 1.

(3) - VARIABLE SPRING TYPES 51, 52, AND 53, i.e., STANDARD SPRING, SHORT SPRING AND LONG SPRING MODELS ARE IDENTIFIED AS S, SS, AND LS, RESPECTIVELY.

7.4.1 Spring Cushion Hangers may be used where vertical movement does not exceed $^1/_4$ inch (6 mm), and where formal load and movement calculations are not required.

7.4.2 Variable Spring Hangers shall be used for all other resilient support requirements except as noted in Subsection 7.4.3.

7.4.3 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.

8. ATTACHMENTS MADE BY WELDING OR BOLTING

8.1 All attachments welded to the pipe shall be in accordance with MSS SP-58 and Pipe Fabrication Institute, Standard ES-26. The pipe support manufacturer is not responsible for local pipe wall stresses.

8.2 Welding or bolting or attachments to the building structural steel shall be in accordance with the AISC Manual of Steel Construction – Allowable Stress Design, 9th Edition. There shall be no drilling, punching or burning of holes in the building structural steel without prior approval by the Piping Design Engineer.

8.3 For attachment to concrete structure, poured in place anchor bolts or inserts are preferred whenever possible. When necessary, approved concrete fasteners may be used.

8.4 Recommended applied torque for set screws in C-clamps (Types 19 and 23) is listed below:

Thread size Inch	(mm)	Torque 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.

TABLE 3 - Maximum Horizontal Pipe Hanger and Support Spacing

NOMINAL PIPE OR TUBE SIZE		1		2		3		4	
		STD WT STEEL PIPE				COPPER TUBE			
		WATER SERVICE		VAPOR SERVICE		WATER SERVICE		VAPOR SERVICE	
in.	mm	ft	m	ft	m	ft	m	ft	m
1/4	(6)					5	1.5	5	1.5
3/8	(10)	7	2.1	8	2.4	5	1.5	6	1.8
1/2	(15)	7	2.1	8	2.4	5	1.5	6	1.8
3/4	(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
1 1/4	(32)	7	2.1	9	2.7	7	2.1	9	2.7
1 1/2	(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
2 1/2	(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
3 1/2	(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				

Col.	Type	Requirement
5	FIRE PROTECTION	FOLLOW REQUIREMENTS OF THE NATIONAL FIRE PROTECTION ASSOCIATION. SEE SECTION 14.
6	DUCTILE IRON PIPE	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.
7	CAST IRON SOIL	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	GLASS	8 ft (2.4 m) MAX SPACING, FOLLOW PIPE MANUFACTURER'S RECOMMENDATIONS SEE SECTION 17.
9	PLASTIC	FOLLOW PIPE MANUFACTURER'S RECOMMENDATIONS FOR MATERIAL AND SERVICE CONDITION. SEE SECTION 18.
10	FIBERGLASS REIN-FORCED	FOLLOW PIPE MANUFACTURER'S RECOMMENDATIONS FOR MATERIAL AND SERVICE CONDITION. SEE SECTION 19.

NOTE: (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.

9. HANGER AND SUPPORT SPACING

9.1 The maximum spacing of hangers and supports shall be as shown in Table 3.

9.2 Spacings less than shown in Table 3 may be required to conform with building structure loading limitations and standard product load ratings.

9.3 Recommended minimum rod diameters for rigid rod hangers are listed in Table 4.

9.4 When periodic dismantling of a piping system for cleaning, etc. is anticipated, the Piping Design Engineer shall specify any required additional supports.

9.5 For piping systems using Type 40 protection shields for insulated piping, see Table 5 for spacing.

10. PIPE ATTACHMENTS FOR INSULATED LINES

10.1 The connections to pipe attachments shall be outside the insulation so that movement of the line shall not cause damage to the insulation.

10.2 Insulation protection shields shall be provided to protect the vapor barrier of insulation on cold lines. Under no circumstances shall hangers, supports or guides be applied directly to horizontal pipe or tubing on vapor barriered lines. (See Table 5.)

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

NOMINAL PIPE OR TUBING SIZE		COLUMNS[3] 1, 2, 6, 7 NOMINAL ROD DIA.		COLUMNS[3] 3, 4, 8, 9, 10 NOMINAL ROD DIA.	
In	mm	in	mm	in	mm
1/4	(6)			3/8	M10
3/8	(10)	3/8	M10	3/8	M10
1/2	(15)	3/8	M10	3/8	M10
3/4	(20)	3/8	M10	3/8	M10
1	(25)	3/8	M10	3/8	M10
1 1/4	(32)	3/8	M10	3/8	M10
1 1/2	(40)	3/8	M10	3/8	M10
2	(50)	3/8	M10	3/8	M10
2 1/2	(65)	1/2	M12	1/2	M12
3	(80)	1/2	M12	1/2	M12
3 1/2	(90)	1/2	M12	1/2	M12
4	(100)	5/8	M16	1/2	M12
5	(125)	5/8	M16	1/2	M12
6	(150)	3/4	M20	5/8	M16
8	(200)	3/4	M20	3/4	M20
10	(250)	7/8	M20	3/4	M20
12	(300)	7/8	M20	3/4	M20
14	(350)	1	M24		
16	(400)	1	M24		
18	(450)	1	M24		
20	(500)	1 1/4	M30		
24	(600)	1 1/4	M30		
30	(750)	1 1/4	M30		

NOTE:
(1) For calculated loads, rod diameters may be sized in accordance with MSS SP-58, Table 3 provided Table 1 and paragraph 7.3 of MSS SP-58 are satisfied.
(2) Rods may be reduced one size for double rod hangers. Minimum rod diameter shall be 3/8 in. (M10).
(3) Columns noted refer to MSS SP-69, Table 3.

TABLE 5 - Type 40 Protection Shields for Insulated Pipe and Tubing

NOM. PIPE SIZE	SHIELD LENGTH		SHIELD THICKNESS			SPACING	
	in	mm	gage	in	mm	ft	m
1/2 (15) - 1 1/4 (32)	12	305	18	.048	1.22	7*	2.1*
1 1/2 (40)	12	305	18	.048	1.22	9*	2.7*
2 (50) - 3 1/2 (90)	12	305	18	.048	1.22	10	3.0
4 (100)	12	305	16	.060	1.52	10	3.0
5 (125) - 6 (150)	18	457	16	.060	1.52	10	3.0
8 (200) - 14 (350)	24	610	14	.075	1.91	10	3.0
16 (400) - 24 (600)	24	610	12	.105	2.67	10	3.0
NOM. TUBING SIZE	SHIELD LENGTH		SHIELD THICKNESS			SPACING	
	in	mm	gage	in	mm	ft	m
1/4 (6) - 3/4 (20)	12	305	18	.048	1.22	5*	1.5*
1 (25)	12	305	18	.048	1.22	6*	1.8*
1 1/4 (32)	12	305	18	.048	1.22	7*	2.1*
1 1/2 (40) - 2 (50)	12	305	18	.048	1.22	8*	2.4*
2 1/2 (65)	12	305	18	.048	1.22	9*	2.7*
3 (80) - 3 1/2 (90)	12	305	18	.048	1.22	10	3.0
4 (100)	12	305	16	.060	1.52	10	3.0
5 (125) - 6 (150)	18	457	16	.060	1.52	10	3.0
8 (200)	24	610	14	.075	2.67	10	3.0

NOTES: The listed spans and shield lengths are based on insulation with a compressive strength of 15 psi (103 kPa). For insulation with compressive strengths greater than 15 psi (103 kPa), span may be increased proportionately up to the maximum allowable as listed in Table 3. Spans marked * are the maximum allowable.
Protection shield gages listed are for use with band type hangers only. For point loading, increase shield thickness and length. When shields are used with rollers, shield thickness shall be adjusted accordingly and shield lengths shall be increased to keep rolling point of contact within the middle one-third of the shield length. For compressive strengths other than 15 psi (103 kPa), shield dimensions may be adjusted accordingly.

10.3 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 shown in Table 5 do not apply. Shields must be designed to accommodate loading conditions at both the installation and operating temperature.

11. MULTIPLE SUPPORTS

11.1 Horizontal banks of piping may be supported on a common base member without regard to the pipe centerline elevation. The particular method of support to be used shall be as required by the engineering design.

11.2 In the supporting of multiple pipe runs, provisions shall be made to keep the lines in their relative lateral positions, using clamps or clips as required. Lines subject to thermal expansion shall be free to roll axially or slide.

12. RISER SUPPORTS

12.1 The selection and location of riser supports shall take into consideration the entire weight of the riser, and adjacent piping, hydrostatic test load conditions, line temperature and available supporting structure. On a riser subject to expansion, only one support of the rigid type shall be used.

12.2 Riser clamps (Type 42) shall have a positive means of engagement (i.e. shear lugs) between the pipe and the clamp.

12.3 Rigid riser clamps (Type 42), when used for deadweight purposes, shall be designed for two times the calculated load.

13. ANCHORS, GUIDES AND RESTRAINTS

13.1 Anchors, guides and restraints shall be located by the Piping Design Engineer. 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 Piping Design Engineer for consideration and approval.

13.2 Anchors, guides and restraints shall be designed for imposed loadings as determined by the Piping Design Engineer. For guided systems, in the absence of specified lateral loads, the guide shall be designed for 20% of the dead weight load as a minimum.

13.3 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.

13.4 The necessity for, and the location of, shock suppressors and seismic control devices shall be as determined by the Piping Design Engineer.

13.5 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.

13.6 Refer to MSS SP-127 for the design, selection, and application of bracing piping systems subject to seismic – wind – dynamic loading.

14. FIRE PROTECTION SYSTEMS

14.1 Hangers and supports for fire protection systems shall conform to the following standards published by the National Fire Protection Association in the National Fire Codes for fixed extinguishing equipment:

NFPA-11—Foam Extinguishing Systems
NFPA-12—Carbon Dioxide Systems
NFPA-13—Installation of Sprinkler Systems
NFPA-14—Standpipe and Hose Systems
NFPA-15—Water Spray Systems
NFPA-16—Foam Water Systems
NFPA-17—Dry Chemical Extinguishing Systems

14.2 Hangers, in general, are covered in NFPA-13. If the system is other than a standard water sprinkler system, the applicable NFPA Standard shall also be consulted.

15. DUCTILE IRON PIPING

15.1 The size of hanger components shall be suitable for the O.D. of the pipe to be supported.

15.2 For buried lines, supporting means that may be required due to soil conditions or settlement of terminal points, shall be specified by the Piping Design Engineer.

16. CAST IRON SOIL PIPING

Requirements shall be as set forth in Section 15 except for spacing as noted in Table 3.

17. GLASS PIPING

17.1 Hangers shall be provided with pads or cushions on the bearing surfaces to prevent scratching the pipe. The hangers shall fit loosely around the pipe yet contact it through the pads or cushions in a manner to distribute the load over the largest possible area. Point loading shall be avoided. The system of hangers shall be designed with the least practical number of rigid anchor points. Supports for vertical piping and all anchors shall be as recommended by the pipe manufacturer.

17.2 Hangers shall be placed approximately one foot (305 mm) from each side of fittings or couplings. At least two hangers shall be used for each 10-foot (3.0 m) section.

18. PLASTIC PIPING

18.1 Rigid plastic piping shall normally be supported by the same type of hangers used with steel pipe.

18.2 In pressure applications, hangers shall be provided with pads or cushions on the bearing surfaces to prevent scratching the pipe. The hangers shall fit loosely around the pipe yet contact it through the pads or cushions in a manner to distribute the load over the largest possible area. Point loading shall be avoided. The system of hangers shall be designed with the least practical number of rigid anchor points. Supports for vertical piping and all anchors shall be as recommended by the pipe manufacturer.

18.3 Support spacing shall be based on the pipe manufacturer's recommendations for the service conditions.

18.4 Flexible plastic tubing or rigid plastic pipe operating at temperatures high enough to materially reduce its strength, shall be supported continuously.

19. FIBERGLASS REINFORCED PIPE (FRP)

19.1 The size of hanger shall be suitable for the O.D. of the pipe to be supported.

19.2 Support spacing shall be based on the pipe manufacturer's recommendations for the service condition.

19.3 FRP should not be point loaded and all shields and hangers in contact with the pipe shall be free of burrs.

ANNEX A
Referenced Standards and Applicable Dates

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

AISC

AISC-1989	Manual of Steel Construction – Allowable Stress Design, 9th Edition

ASME

B31.1-1992	Power Piping
B31.3-1993	Chemical Plant and Petroleum Refinery Piping
B31.4-1992	Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols
B31.5-1992	Refrigeration Piping
B31.8-1992	Gas Transmission and Distribution Piping Systems
B31.9-1988	Building Services Piping Code
ASME-1992	Boiler and Pressure Vessel Code

FM

FM1951/1952 /1953-1975	Approval Standard for Pipe Hanger Components for Automatic Sprinkler Systems

MSS

SP-58-2002	Pipe Hangers and Supports - Materials, Design and Manufacture
SP-89-1998	Pipe Hangers and Supports - Fabrication and Installation Practices
SP-127-2001	Bracing For Piping Systems Seismic – Wind – Dynamic Design, Selection, Application

NFPA

NFPA 11-1998	Low-Expansion Foam
NFPA 12-2000	Carbon Dioxide Extinguishing Systems
NFPA 13-1999	Installation of Sprinkler Systems
NFPA 14-2000	Installation of Standpipe, Private Hydrant, and Hose Systems
NFPA 15-2001	Water Spray Fixed Systems for Fire Protection
NFPA 16-1996	Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
NFPA 17-1998	Dry Chemical Extinguishing Systems

PFI

ES-26-1993/RA99	Welded Load-Bearing Attachments to Pressure Retaining Piping Materials

UL

UL203-1992	Pipe Hanger Equipment for Fire Protection Service

Publications of the following organizations appear in the above list:

AISC	American Institute of Steel Construction, Inc. 1 East Wacker Drive, Chicago, IL 60601, Phone: (312) 670-2400
ANSI	American National Standards Institute 25 West 43rd Street, New York, NY 10036, Phone: (212) 642-4900
ASME	The American Society of Mechanical Engineers Three Park Avenue, New York, NY 10016-5990, Phone: (800) 843-2763
FM	Factory Mutual Research Corporation 1151 Boston-Providence Turnpike, Norwood, MA 02062, Phone: (781) 762-4300
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. 127 Park Street, N.E., Vienna, VA 22180, Phone: (703) 281-6613
NFPA	National Fire Protection Association 1 Battery March Park, Quincy, MA 02269, Phone: (617) 770-3000
PFI	Pipe Fabrication Institute PMB 323, 611 Pennsylvania Ave, SE, Washington DC 20003, Phone: (514) 634-3434
UL	Underwriters Laboratories 333 Pfingsten Road, Northbrook, IL 60062, Phone: (847) 272-8800

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-45-1998	Bypass and Drain Connections
SP-51-2000	Class 150LW Corrosion Resistant Cast Flanges and Flanged Fittings
SP-53-1999	(R 02) Quality Standard for Steel Castings and Forgings for Valves. Flanges and Fittings and Other Piping Componets - 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-58-1993	Pipe Hangers and Supports - Materials, Design and Manufacture
SP-60-1999	Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
SP-61-1999	Pressure Testing of Steel Valves
SP-65-1999	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-73-1991	(R 96) 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-80-1997	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-85-1994	Cast 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-89-1998	Pipe Hangars 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-100-1997	Qualification Requirements for Elastomer Diaphragms for Nuclear Diaphragm Type 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-104-1995	Wrought Copper Solder Joint Pressure Fittings
SP-105-1996	(R 01) Instrument Valves for Code Applications
SP-106-1990	(R 96) 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	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 $25.00 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 Natural Gas Service
SP-116-1996	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-119-1996	Belled End Socket Welding Fittings, Stainless Steel and Copper Nickel
SP-120-1997	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

(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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