

MSS SP-102-1989

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(FA-MOUNTING)

Multi-Turn Valve Actuator Attachment

Flange and Driving Component Dimensions and Performance Characteristics

**COMPLIMENTARY
COPY**

Standard Practice
Developed and Approved by the
Manufacturers Standardization Society of the
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Dimensions and performance characteristics are shown in both U.S. customary and SI units. American product dimensions are shown in inches with the metric equivalent in parenthesis. The conversion factors are:

<u>Conversion</u>	<u>Factor</u>
Inches to Millimetres	25.4
Pound Feet to Newton Metres	1.356
Pounds to Kilonewtons	.0044
Psi to Newton/mm ²	.006895

Other standards documents referred to herein are identified by their most recent date of issue that was applicable to this standard at the date of issue of this standard. See Section 2.

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FOREWORD

This MSS Standard Practice is based, in part, on ISO International Standard 5210, Multi-turn Valve Actuator Attachment. It also reflects the common practice of the valve and valve actuator industries in North America today. Therefore, the ratings, sizes, and/or number of flange types in the MSS Standard Practice for the North American market may differ from those of ISO. The MSS flange types use the ISO designation, with the addition of an "A", to distinguish them as American product.

When assembling an actuator to a valve, a user is concerned with performance and mechanical interface. In regards to performance, he needs in part:

- Adequate output torque for valve breakaway and seating loads, and for dynamic loads at rated flow.
- A specified speed so closing and opening can be accomplished in a prescribed time.
- Sufficient power rating of the actuator so the valve may be cycled as required.
- Input power requirements.

For mechanical interface, he is concerned in part with:

- The dimensional mating of the actuator's mounting surface to the "valve" mounting flange.
- The dimensional compatibility of the actuator's driving components to the valve stem.
- Size and location of electrical and/or pressure connections.
- Sufficient space and capability to install and service the actuator.

This Standard Practice will only concern itself with flange and driving component dimensions and performance characteristics.

CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1. SCOPE	1
2. REFERENCES	1
3. DEFINITIONS	1
4. FLANGE SIZE DESIGNATION	1
5. ACTUATOR/VALVE INTERFACE REQUIREMENTS	1
6. FLANGE SIZE AND PERFORMANCE	1
7. BASIS OF FLANGE PERFORMANCE SELECTION	2
8. ACTUATOR DRIVING COMPONENTS	3
TABLE 1 — FA MOUNTING FLANGE TORQUE VALUES AND FLANGE DIMENSIONS	2
2 — GROUP A — DRIVING COMPONENT DIMENSIONS	4
3 — GROUP B — DRIVING COMPONENT DIMENSIONS	5
FIGURE 1 — ACTUATOR FLANGE	1
2 — GROUP A — DRIVING COMPONENTS	3
3 — GROUP A — COMPONENTS - RISING VS. NON-RISING STEMS	3
4 — GROUP B — DRIVING COMPONENTS	5

MULTI-TURN VALVE ACTUATOR ATTACHMENT

FLANGE AND DRIVING COMPONENT DIMENSIONS AND PERFORMANCE CHARACTERISTICS

1. SCOPE

This standard practice is intended to provide a basis for the standardization of multi-turn actuator mounting dimensions and performance characteristics necessary for their attachment to general purpose industrial valves. It covers only those actuators supplied by manufacturers as separate components.

2. REFERENCES

ANSI B4.1-1979, American National Standard for Preferred Limits and Fits for Cylindrical Parts.

ANSI B17.1-1973, American National Standard for Keys and Keyseats.

ISO 5210-1977, Multi-turn Valve Actuator Attachment.

DEFINITIONS

Actuator: Any device designed for attachment to general purpose industrial valves in order to provide for the operation of the valve. Motive energy to the actuator can be electrical, pneumatic, manual, etc., or a combination of these. The movement is limited by travel, torque, thrust, or a combination of these.

Multi-Turn Actuator: An actuator which transmits a torque to the valve for at least one revolution.

Torque: A turning moment transmitted through the mounting flanges and driving components,

expressed in Pounds Foot or Newton Metres.

Thrust: An axial force transmitted through the mounting flanges and driving components, expressed in Pounds or Kilonewtons.

4. FLANGE SIZE DESIGNATION

Flange sizes are designated by the letters "FA". The next two digits in the classification represent the bolt circle diameter, expressed in millimetres, appropriately rounded and divided by ten. As an example, a flange designated "FA30" represents:

- A) One intended for the American market.
- B) One with a bolt circle diameter (BCD) (D_3) of approximately 300mm (exactly 298.5mm or 11.75 in.).

5. ACTUATOR/VALVE INTERFACE REQUIREMENTS

When mating an actuator with a valve flange, the primary features of concern are the bolt pattern, type of bolt, the pilot, the performance (both thrust and torque), and driving component dimensions. Care must be taken in defining the driving components as there are numerous configurations.

6. FLANGE SIZE AND PERFORMANCE

6.1 Typical actuator flanges (tapped or through bolting) are shown in Figure 1.

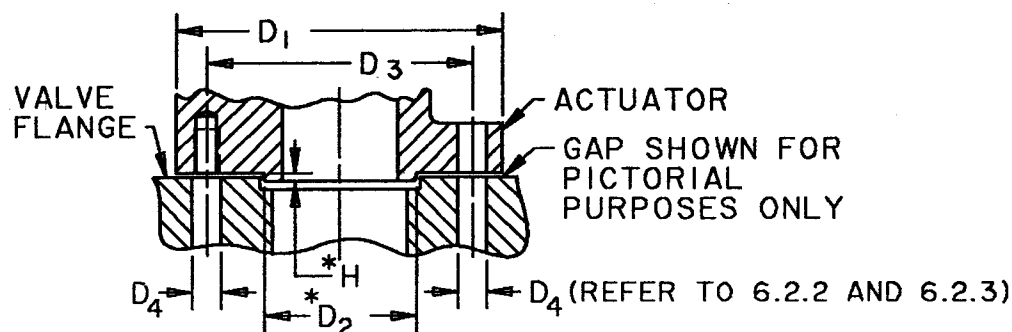


FIGURE 1 — ACTUATOR FLANGE

*Refer to 6.2.4.

6.2 The torque, thrust, and flange dimensions for FA mounting flanges can be found in Table 1.

6.2.1 The torque and thrust values listed in Table 1 represent the maximum values which can be transmitted through the mounting flanges and driving components.

6.2.2 The mounting holes (D_4) shall be equispaced and the hole pattern must straddle the centerline of the actuator and the valve. Depth of threaded holes shall be consistent with the strength limitations of actuator material.

6.2.3 For cases where the actuator flange design incorporates through bolting (refer to mounting holes (D_4), the diameter of the clearance holes shall provide clearance consistent with ANSI or ISO requirements for the bolt sizes listed as D_4 .

6.2.4 The counterbore in the mounting surface of the valve, corresponding to D_2 is mandatory; however, the pilot on the actuator (D_2 and H) is optional on ISO and is required on American products. Dimension D_2 refers to both the actuator and valve flange. Clearance shall conform to ANSI B4.1, Class F7.

6.2.5 Dimension D_1 provides minimum land area for nuts and bolt heads. The shape of the actuator and valve outside of these areas is optional.

7. BASIS OF FLANGE PERFORMANCE SELECTION

7.1 In determination of the torque values, shown in Table 1, the following design considerations were made:

A) The stress limits for flange bolting is as follows:

Material: ASTM A 449 (equal to or better than)

Yield Strength: 92,000 psi min. (less than 1")
81,000 psi min. (1" and larger)

Working Stress: 30,000 psi

B) Coefficient of friction between mounting flanges is assumed to be 0.3.

C) Bolts in tension only; no allowance is made for stresses induced by bolt tightening.

TABLE 1 — FA MOUNTING FLANGE TORQUE VALUES AND FLANGE DIMENSIONS

(See Figure 1)

Flange Type	Thrust		Torque		D_1 Min.		D_2		D_3		D_4^*	H Max.		No. of Bolts
	LB	KN	LB FT	NM	IN	MM	IN	MM	IN	MM		IN	MM	
FA07	4,500	(20)	30	(41)	3.54	(90.0)	2.166	(55.0)	2.75	(69.9)	5/16-18	.12	(3)	4 ✓
FA10	9,000	(40)	100	(136)	4.92	(125.0)	2.312	(58.7)	4.00	(101.6)	3/8-16	.12	(3)	4 ✓
FA14	25,000	(110)	400	(542)	6.89	(175.0)	3.750	(95.25)	5.50	(139.7)	5/8-11	.16	(4)	4 ✓
FA16	35,000	(154)	800	(1,085)	8.25	(209.6)	5.000	(127.0)	6.50	(165.1)	3/4-10	.19	(5)	4 ✓
FA25	50,000	(220)	1,200	(1,627)	11.38	(289.1)	6.000	(152.4)	10.00	(254.4)	5/8-11	.19	(5)	8 ✓
FA30	75,000	(330)	2,000	(2,712)	13.50	(342.9)	7.000	(177.8)	11.75	(298.5)	3/4-10	.19	(5)	8 ✓
FA35	140,000	(616)	4,500	(6,102)	16.00	(406.4)	8.500	(215.9)	14.00	(355.6)	1-8	.19	(5)	8 ✓
FA40	230,000	(1,012)	8,500	(11,526)	18.70	(475.0)	9.000	(228.6)	16.00	(406.4)	1 1/4-7	.32	(8)	8 ✓

*Refer to text for clarification of alternate clearance hole dimensions.

ISO
5210
↓

M8 .31
M10 .39
M16 .63
M20 .79
M16 .63
M20 .79
M30 1.18
M36 1.4

8. ACTUATOR DRIVING COMPONENTS

8.1 Some valves require torque and thrust, while others require torque only. The geometry of the specific connection design will vary in diameter, thread detail, key size, etc. Care must be taken to properly define the interface details. To simplify the identification of the connection, the driving components are categorized as follows:

A) Group A Actuators — Multi-turn actuators which produce torque and thrust.

B) Group B Actuators — Multi-turn actuators which produce torque only.

8.2 Group A Actuators

8.2.1 Figure 2 illustrates a typical driving component configuration for an actuator which delivers both thrust and torque.

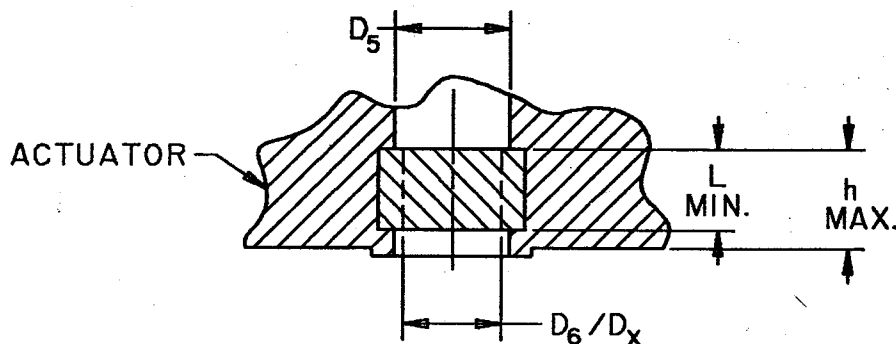


FIGURE 2 — GROUP A — DRIVING COMPONENTS

8.2.2 Group A actuators can be defined more completely by separating them between applications with non-rising stems and rising stems (See Figure 3).

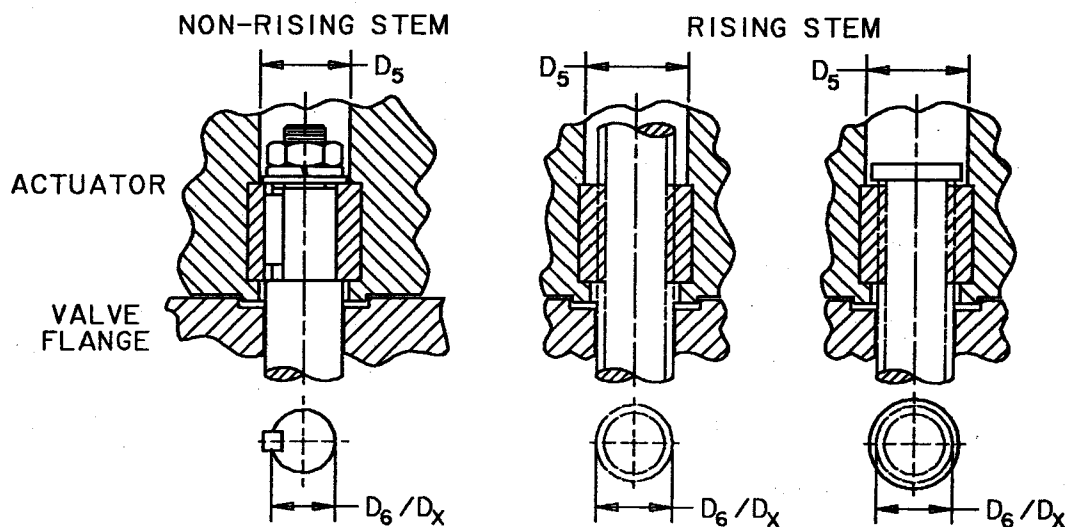


FIGURE 3 — GROUP A — COMPONENTS - RISING VS. NON-RISING STEMS

8.2.3 The dimensions for Group A driving components can be found in Table 2.

8.2.3.1 The actuator driving component shall accept a diameter up to and including D_6 . Even though not a requirement of this standard practice, the driving component may accept larger diameters up to D_x . Note that D_6 and D_x are derived from ISO 5210, while D_x reflects the present American Practice.

8.2.3.2 Dimension D_5 , Figure 3, shall equal or exceed 1.05 times either valve stem diameter or largest stem attachment. Diameter D_5 , allows for clearance between rising and non-rotating valve stems and any device intended to restrict the downward travel of the valve stem. Also, it permits clearance for locking and thrust absorbing devices used with non-rising and rotating stems.

TABLE 2 — GROUP A — DRIVING COMPONENT DIMENSIONS

(See Figures 2 and 3)

Flange Type	FA07	FA10	FA14	FA16	FA25	FA30	FA35	FA40
D_6 IN (MM)	.079 (20)	1.10 (28)	1.42 (36)	1.73 (44)	2.35 (60)	3.15 (80)	3.94 (100)	4.72 (120)
D_x IN (MM)	1.02 (26)	1.57 (40)	2.17 (55)	2.95 (75)	3.35 (85)	3.94 (100)	5.91 (150)	6.89 (175)
L IN (MM)	0.98 (25)	1.57 (40)	2.17 (55)	2.76 (70)	3.54 (90)	4.33 (110)	5.91 (150)	7.09 (180)
h max								
For top-entry stem nut IN (MM)	2.36 (60)	4.04 (103)	6.2 (157)	7.1 (179)	8.00 (203)	9.3 (235)	10.4 (264)	13.0 (330)
For bottom-entry stem nut IN (MM)	2.36 (60)	3.15 (80)	4.33 (110)	5.31 (135)	5.91 (150)	6.89 (175)	9.34 (250)	12.80 (325)

8.3 Group B Actuators

8.3.1 Multi-turn actuators, which produce torque only, are categorized as Group B type. In this application, the valve absorbs thrust (typically through thrust bearings) prior to the actuator. The actuator driving component is normally a keyed bore.

8.3.2 ISO-5210 further classifies the Group B actuators into four types (i.e. B_1 - B_4). Since B_1 and B_3 types do not represent current practice in America, they are not included in this standard practice. For details on B_1 and B_3 type, refer to ISO 5210.

8.3.3 Further, Group B actuators are defined as Type B_2 , applicable to rising stem valves, and Type B_4 , applicable to non-rising stem valves. Refer to Figure 4.

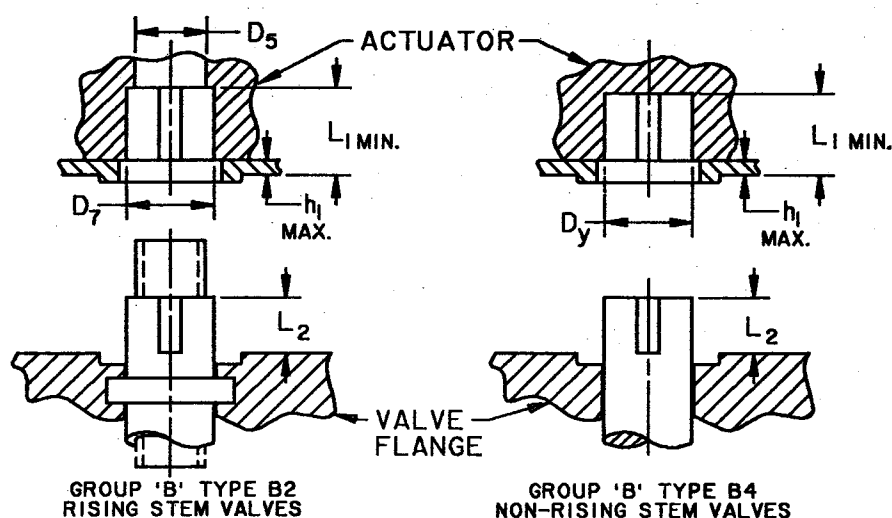


FIGURE 4 — GROUP B — DRIVING COMPONENTS

8.3.4 The dimensions for Type B₂ and B₄ driving components are found in Table 3.

8.3.4.1 The driving component for Type B₄, Figure 4, shall have a bore diameter up to and including D_y.

8.3.4.2 For Type B₂, the driving component may accept larger diameters up to D₇. It is intended that new products have bore diameters up to D_y.

8.3.4.3 The length of L₂ shall be limited so there is no interference between the driving and driven components.

TABLE 3 — GROUP B — DRIVING COMPONENT DIMENSIONS
(See Figure 4)

Flange Type	FA07	FA10	FA14	FA16	FA25	FA30	FA35	FA40
D ₅ (Min) IN (MM)	0.87 (22)	1.18 (30)	1.57 (40)	1.97 (50)	2.56 (65)	3.35 (85)	4.33 (110)	5.12 (130)
D ₇ IN (MM)	1.10 (28)	1.65 (42)	2.35 (60)	3.15 (80)	3.94 (100)	4.72 (120)	6.30 (160)	7.09 (180)
D _y IN (MM)	0.98 (25)	1.38 (35)	1.77 (45)	2.36 (60)	2.95 (75)	3.54 (90)	4.72 (120)	6.30 (160)
h ₁ (Max) IN (MM)	0.12 (3)	0.12 (3)	0.16 (4)	0.19 (5)	0.19 (5)	0.19 (5)	0.19 (5)	0.32 (8)
L ₁ (Min) IN (MM)	1.38 (35)	1.77 (45)	2.56 (55)	3.15 (90)	4.33 (110)	5.12 (130)	7.09 (180)	7.87 (200)

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	Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP-54-1999	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-67-1995	Butterfly Valves
SP-68-1997	High Pressure Butterfly Valves with Offset Design
SP-69-1996	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 Wrought and Cast Copper Alloy Solder Joint 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-86-1997	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators
SP-87-1991	(R 96) Factory-Made Butt-Welding Fittings for Class 1 Nuclear Piping Applications
SP-88-1993	(R 01) Diaphragm Valves
SP-89-1998	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-100-1997	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 Polyethylene 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-108-1996	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 for Natural Gas Service
SP-116-1996	Service Line Valves and Fittings for Drinking Water Systems
SP-117-1996	Bellows Seals for Globe and Gate Valves
SP-118-1996	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	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

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