MSS SP-134-2006a

Valves for Cryogenic Service Including Requirements for Body/Bonnet Extensions

Standard Practice
Developed and Approved by the
Manufacturers Standardization Society of the
Valve and Fittings Industry, Inc.
127 Park Street, NE
Vienna, Virginia 22180
Phone: (703) 281-6613
Fax: (703) 281-6671
e-mail: info@mss-hq.org

MSS

www.mss-hq.org

This MSS Standard Practice was developed under the consensus of the MSS Technical Committee 114 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.

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 B.)

U.S. customary units in this Standard Practice are the standard: the metric units are for reference only.

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

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.

Originally Approved December, 2005

TABLE OF CONTENTS

SECTION **PAGE**

TABLE

FIGURE

ANNEX

Valves for Cryogenic Service Including Requirements for Body/Bonnet Extensions

1. SCOPE

1.1 This Standard Practice covers requirements for design, dimensions, material, fabrication, non-destructive examination and pressure testing of stainless steel and other alloy cryogenic service valves with body/bonnet extensions. This Standard Practice applies to cryogenic gate, globe, butterfly and ball valves and may be used in conjunction with other valve-specific standards including the following identified in this Standard Practice as a parent standard:

ASME B16.34, Valves-Flanged, Threaded, and Welded End
API 600, Steel Gate Valves-Flanged and Buttwelding Ends
API 602, Compact Steel Gate Valves, Flanged Threaded, Welding and Extended Body Ends
API 603, Corrosion Resistant Bolted Bonnet Gate Valves-Flanged and Butt-Welding Ends
API 608, Metal Ball Valves-Flanged, Threaded and Welding End
API 609, Butterfly Valves: Double Flanged, Lug and Wafer Type
API 6D/ISO 14313, Petroleum and Natural Gas Industries Pipeline Transportation Systems-Pipeline Valves

1.2 The requirements in this Standard Practice are not intended to supersede or replace requirements of a parent valve standard.

1.3 This Standard Practice includes additional requirements specifically related to valves having body/bonnet extensions essential for cryogenic applications.

2. DEFINITIONS

2.1 ***General*** Definitions given in MSS SP 96 apply to this Standard Practice.

2.2 ***Cryogenics*** The science of materials at extremely low temperatures.

2.3 ***Cryogenic Fluid*** A gas that can be changed to a liquid by removal of heat by refrigeration methods to a temperature less than -100^{0}F (-73^{0}C).

2.4 ***Cryogenic Temperature*** For this Standard Practice a temperature range of -150^{0}F (-100^{0}C) to -425^{0}F (-255^{0}C) is cryogenic.

2.5 ***Cold Box*** An enclosure that insulates a set of equipment from the environment without the need for insulation of the individual components inside the cold box.

2.6 ***Cold Box Extension*** A valve body/bonnet extension section that removes the operating mechanism of the valve outside the cold box and is required to be longer than a non-cold box extension.

2.7 ***Non-Cold Box Extension*** A body/bonnet extension that is used for valves that are normally individually insulated.

2.8 ***Parent Valve Standard*** Endorses the ASME B16.34 construction requirements but has additional construction detail requirements exceeding or not addressed by ASME B16.34.

2.9 ***Gas Column*** That portion of body/bonnet extension that allows for the formation of an insulating column of vapor.

3. MATERIALS

3.1 Materials in contact with cryogenic fluid or exposed to cryogenic temperatures shall be suitable for use at the minimum temperature specified by the purchase order. ASME B31.3, Table A1 lists mechanical properties for materials at temperatures as low as -425^{0}F (-255^{0}C).

3.2 Body, bonnet, body/bonnet extension, and pressure retaining bolting shall be of materials listed in ASME B 16.34, Table 1 and also listed in ASME B31.3, Table A1 for the cryogenic valve design temperature. The body/bonnet extension shall be constructed of the same ASME B16.34 Table 1 group material as the valve body group material or a similar ASME B16.34 group material with the same cryogenic material compatibility as the valve body.

3.3 Internal wetted parts shall be made of material that is suitable for the specified cryogenic service temperature and has corrosion resistance at least equal to the valve body.

3.4 Packing and gasket materials in direct contact with the service fluid shall be capable of operating at temperatures from +150^{0}F (+65^{0}C) to the lowest cryogenic temperature of the service fluid specified in the purchase order.

3.5 When tube material is used for constructing body/bonnet extensions the tube material shall be seamless.

4. DESIGN

4.1 The requirements of ASME B16.34, paragraph 2.1.6, shall be met for weld fabricated body/bonnet extensions.

4.2 Valves shall have a body/bonnet extension tube that distants the stem packing and valve operating mechanism from the cryogenic fluid in the valve body/bonnet extension that might otherwise damage or impair the function of these items. The body/bonnet extension shall be of sufficient length to provide an insulating gas column that prevents the packing area and operating mechanism from freezing.

The purchaser shall provide the body/bonnet extension length when Table 1A or Table 1B extension lengths are not adequate.

4.2.1 Extension tube thickness shall take into account pressure stresses as well as operating torque, stem thrust and bending stresses induced by handwheels, gears and power actuators.

4.2.2 The body/bonnet extension shall meet the minimum wall thickness requirements of ASME B16.34, paragraph 6.1.3, for the applicable pressure class of the valve body unless a greater wall thickness is specified by the parent valve specification. If the body/bonnet extension is made from a different ASME B16.34, Table 1, material than the valve body and has an ASME B16.34 pressure/temperature rating less than the valve body, then the extension thickness must be increased proportionately to meet the pressure/temperature rating of the body at all applicable temperatures.

4.3 Valves shall be designed for operating at temperatures from +150^{0}F (+65^{0}C) to the lowest cryogenic temperature of the service fluid.

4.4 The pressure rating of the valve at service temperatures below -20^{0}F (-29^{0}C) shall not exceed the ASME B16.34 pressure rating at -20^{0}F (-29^{0}C) to 100^{0}F (38^{0}C) for the applicable valve body material and appropriate Class designation.

4.5 *Body/Bonnet Extensions*

4.5.1 Body/Bonnet Extensions should be used primarily for temperatures below -150^{0}F (-100^{0}C).

4.5.2 Stem to extension tube diametrical clearance should be minimized to help reduce convective heat losses.

4.5.3 For cold box applications, valves with extended body/bonnets shall be capable of operating with the stem oriented from 15^0 to 90^0 above the horizontal plane.

4.5.4 Valves with extended body/bonnets in cryogenic gas service shall be capable of operating in any stem orientation unless otherwise limited by the manufacturer.

4.6 *Valve Stems*

4.6.1 Gate and globe valve stems shall have a diameter to length ratio that precludes elastic buckling while under compressive loading.(1) Section 7.1 establishes a minimum extension length dimension that impacts on final stem length.

4.6.1.1 Gate and globe valves with a stem-disc connection serving as the lower stem support guide shall have, in the closed postion, a stem length to stem diameter ratio as follows:

Stem Guided Disc/Gate

$$\frac{L}{d} \leq \frac{\pi}{2}\sqrt{\frac{E}{2S_{PL}N}}$$

(1) See Theory of Elastic Stability by Timoshenko and Gere, McGraw Hill Publishers.

Where:

L = unsupported length of a uniformly straight stem span between the upper stem guide and stem-to-disc interface. See Figures 1 and 2.

d = stem diameter,

E = modulus of elasticity of the stem material,

S_{PL} = proportional limit of the stem material (generally less than the material yield strength),

N = allowance for effect assumptions in the deriviations, commonly assumed to be 2.

4.6.1.2 Gate or globe valves with a lower stem support guide independent of the stem disc connection shall have, in the closed position, a stem length to stem diameter ratio as follows:

Body Guided Disc/Gate

$$\frac{L}{d} \leq \frac{\pi}{2}\sqrt{\frac{E}{S_{PL}N}}$$

Where:

L = unsupported length of a uniformly straight stem span between the upper and lower stem guide, See Figures 1 and 2.

Other symbols are as defined in Section 4.6.1.1.

4.6.1.3 For stem unsupported spans that fit other column end restraint models, the manufacturer shall develop L/d equations that incorporate a factor of safety of two.

4.6.2 The buckling equations are applicable only for those applications where the elastic stress limits are below the proportional limit of the stem materials and for stem lengths of uniform diameter over the unsupported length. For stems not of uniform diameter, the manufacturer shall execute more extensive calculations or test to assure that stem buckling is prevented.

4.6.3 Extended stems in quarter-turn valves shall be proportioned so that, under torsional loading, the stem torque is limited by the stem angle of twist and as a result also limited by the critical shear stress of the stem material. Stem diameters and stem lengths shall be proportioned such that maximum applied torque meets the requirements of Sections 4.6.4 and 4.6.5.

4.6.4 Quarter-turn valve stem length and diameter combinations that limit stem torsional deflection or angle of twist to π/90 radians (2-degrees) as determined by the following equation:

$$\theta = \frac{TL}{GJ} \leq \frac{\pi}{90}$$

θ = angle of twist, radians,

T = maximum stem design torque,

L = length of stem from point of torque application to obturator attachment, See Figures 3 and 4,

G = modulus of rigidity = $E/2(1+\mu)$,

μ = Poisson's ratio,

J = polar movement of inertia of stem.

4.6.5 The stem torque shall not be greater than that which could cause the stem material to exceed its proportional limit in shear as limited by the following:

$$T_s < \frac{\pi\, d_s^3 \tau_{pl}}{12n}$$

Where:

T_s = the manufacturer's designated maximum stem torque,

τ_{pl} = the stem material shear stress proportional limit,

d_s = the stem diameter,

n = 2, a factor of safety.

5. GATE & GLOBE VALVES

5.1 Gate valves shall be provided with a means for allowing any pressure increase in the body/bonnet extension cavity to be vented to the high pressure side of the closed obturator, unless otherwise specified in the purchase order. Double block and bleed valves shall be vented to the low pressure side of the closed wedge unless otherwise specified by the purchase order.

5.2 An arrow indicating flow direction for uni-directional valves shall be cast, stamped, or etched on the valve body. Alternatively, an arrow tag may be attached by welding to the valve body.

5.3 The manufacturer shall provide a means of protection against over-pressurization of the body/bonnet extension cavity by providing a vent in the obturator. Backseats, when utilized, may be at the bottom or at the top of the body/bonnet extension. Backseats at the bottom of the extension may increase the risk of pressure buildup in the body/bonnet extension cavity if the valve is backseated and allowed to warm to ambient temperatures. In all cases the manufacturer shall provide a means of protecting against over pressurization.

6. BALL & BUTTERFLY VALVES

6.1 Ball valves shall be provided with a provision to vent the body and bonnet extension cavity to the upstream side of the closed ball, either by drilling a bleed hole in the ball or by other means of protection against over-pressurization of the body/bonnet extension cavity. Double block and bleed valves shall be vented to the low pressure side of the ball valve unless otherwise specified in the purchase order.

6.2 An arrow indicating flow direction shall be cast, stamped, or etched on the valve body. Alternatively, an arrow tag may be attached by welding to the valve body. For bi-directional ball valves, including block and bleed, an arrow indicating flow direction is not required.

6.3 Ball and butterfly valves shall be of a fire safe design and be fitted with an anti-static device when valve construction features may allow an electrical potential to develop between parts of valves.

7. EXTENSION LENGTH

7.1 Minimum extension lengths for rising stem gate/globe valves and for quarter-turn valves shall be per Tables 1A and 1B, unless otherwise specified in the purchase order.

7.2 Cold box valve dimesions are for valves with body/bonnet extensions on valves in cryogenic liquid/vapor service, which have installation orientation restrictions. See Section 4.5.3.

7.3 Non-cold box valve dimensions are for those valves with body/bonnet extensions for valves in cryogenic gas or liquid service, with the orientations of Sections 4.5.3 or 4.5.4 as applicable.

8. FABRICATION

8.1 Valves fabricated by welding shall be done in accordance with ASME B16.34, paragraph 2.1.6.

8.2 Welding procedures, welders, and welding operators, shall be qualified under the provisions of ASME Boiler and Pressure Code, Section VIII, Division 1. Welding requirements of the parent standard shall be met when specified in the purchase order.

8.3 The weld configuration of the bonnet extension tube to body/bonnet connections may be full penetration Vee groove, partial penetration Vee groove or fillet type. Full strength threaded joints with seal welds can also be used.

8.4 Non-destructive examination of welds shall be performed per ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 to achieve a joint efficiency as required by ASME B16.34, paragraph 2.1.6.

Weld quality requirements of the parent standard shall be met when specified in the purchase order.

9. **PRODUCTION PRESSURE TESTING**

9.1 Prior to testing, each valve shall be cleaned and degreased as specified in the purchase order.

9.2 Each valve shall be shell and closure tested as required by ASME B16.34. Each valve shall be tested in accordance with the parent standard when specified in the purchase order.

9.3 Following ASME B16.34 final testing, each valve shall be dried of all water test solution trapped in the valve.

9.4 Each fabricated body/bonnet extension shall be subjected to a supplemental pneumatic testing with inert gas at 80-100 psi (5.5-6.9 bar) for a minimum duration of 60 seconds. No visible bubble leakage is allowed through welds or the pressure boundary as determined by testing under water, with an applied foaming solution, or with a mass leak detection device.

Table 1A Body/Bonnet Extension Length U.S. Cutomary Units

Dimensions are in inches

Size NPS	Rising-Stem Valves		Quarter-turn Valves	
	Cold Box	Non-Cold Box	Cold Box	Non-Cold Box
1/2	17	12	16	7.5
3/4	17	12	16	7.5
1	17	12	16	7.5
1-1/2	21	14	20	8.5
2	21	16	20	10
3	24	18	22	13
4	26	22	24	14
6	30	24	24	17
8	34	27	26	18
10	40	32	28	25
12	45	36	32	28

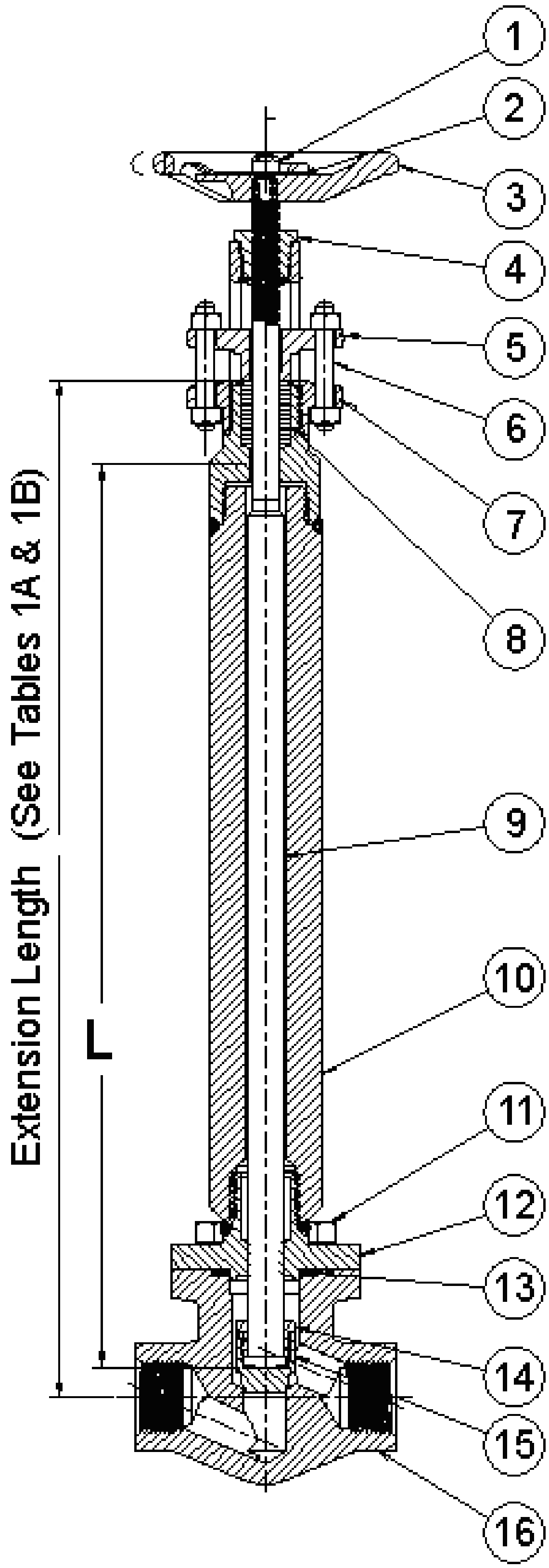
Dimensions – Centerline of valve to top of stuffing box
See Section 7 and Figures 1, 2, 3, & 4

Table 1B Body/Bonnet Extension Length Metric Units

Dimensions are in millimeters

Size DN	Rising-Stem Valves		Quarter-turn Valves	
	Cold Box	Non-Cold Box	Cold Box	Non-Cold Box
15	425	300	400	200
20	425	300	400	200
25	425	300	400	200
40	500	350	500	225
50	500	400	500	250
80	600	450	550	300
100	650	550	600	350
150	750	600	600	425
200	900	700	650	450
250	1000	800	700	600
300	1150	900	800	700

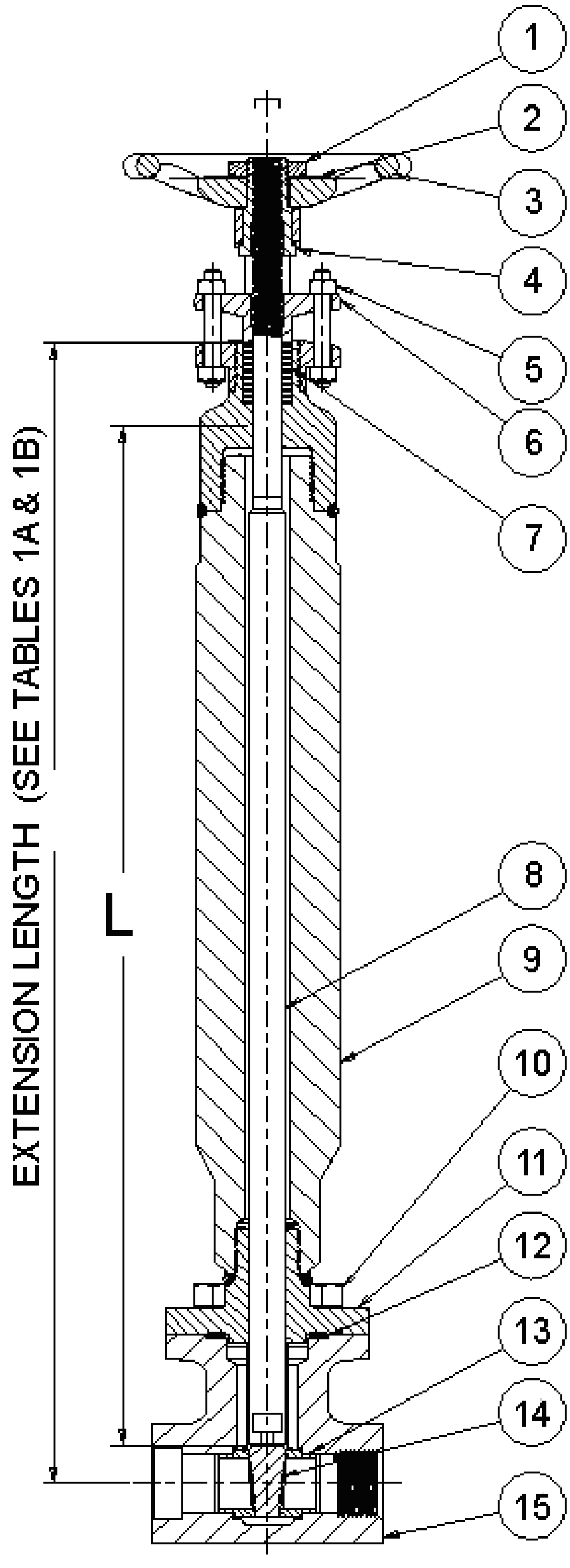
Dimensions – Centerline of valve to top of stuffing box
See Section 7 and Figures 1, 2, 3, & 4



PART NAMES

1. **Handwheel Nut**
2. **Identification Plate**
3. **Handwheel**
4. **Stem Nut**
5. **Gland**
6. **Gland Bolting**
7. **Yoke**
8. **Packing**
9. **Stem**
10. **Bonnet Extension**
11. **Bonnet Bolting**
12. **Bonnet**
13. **Gasket**
14. **Disc Nut**
15. **Disc**
16. **Body**

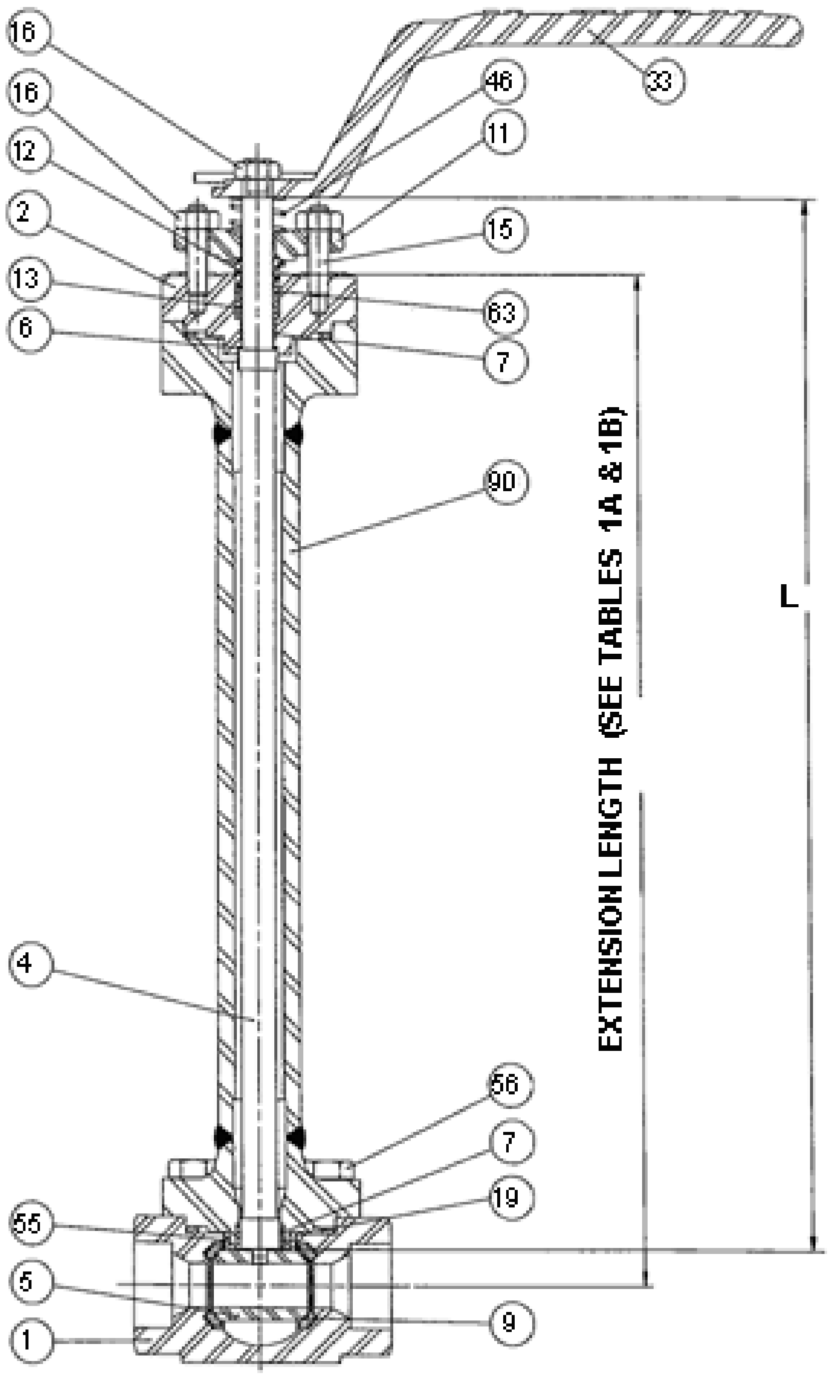
Figure 1 Typical Outside Screw and Yoke Cryogenic Globe Valve
(For Illustration only)



PART NAMES

1. Handwheel Nut
2. Identification Plate
3. Handwheel
4. Stem Nut
5. Gland Bolting
6. Gland
7. Packing
8. Stem
9. Bonnet Extension
10. Bonnet Bolting
11. Bonnet
12. Gasket
13. Seat Ring
14. Gate
15. Body

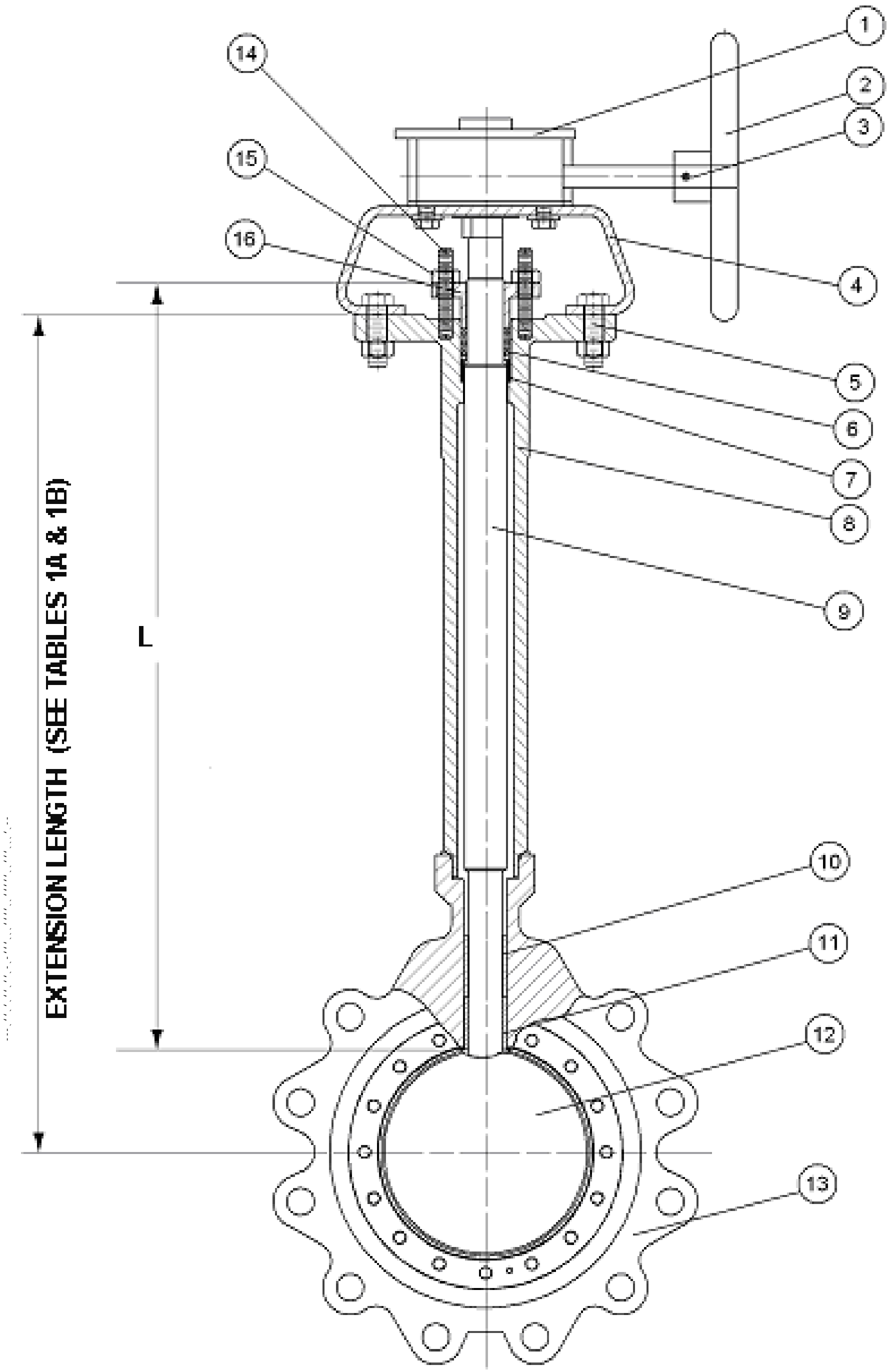
Figure 2 Typical Outside Screw and Yoke Cryogenic Gate Valve
(For Illustration only)



PART NAMES

1. **Body**
2. **Bonnet**
4. **Stem**
5. **Ball**
6. **Thrust Washer**
7. **Stem Bushing**
9. **Seat**
11. **Packing Flange**
12. **Gland Bushing**
13. **Packing Ring**
15. **Stud**
16. **Nut**
19. **Gasket**
33. **Handle**
46. **Spring**
55. **Bushing**
56. **Hex Head Caps Screw**
63. **Packing Washer**
90. **Extension**

Figure 3 Typical Cryogenic Ball Valve
(For Illustration only)



PART NAMES

1. Gear Actuator
2. Handwheel
3. Handwheel Pin
4. Mounting Bracket
5. Mounting Bolt
6. Upper Journal Bearing
7. Packing
8. Housing Extension
9. Stem
10. Stop Bearing
11. Thrust/Journal Bearing
12. Disk
13. Body
14. Packing Stud
15. Packing Bolt
16. Packing Follower

Figure 4 Typical Cryogenic Butterfly Valve
(For Illustration only)

ANNEX A
Low Temperature Cryogenic Testing

Note: Ths Annex is informative and does not include normative requirements

A1. Cryogenic qualification or production testing at temperatures as low as -320^{0}F (-195^{0}C) may be required by the purchase order. In these cases, liquid nitrogen shall be used as the immersion and cool down test fluid.

A2. **PRELIMINARY TEST PREPARATIONS**

A2.1 The valve or valves shall be pre-tested in accordance with parent valve standard at ambient temperature.

A2.2 The valve or valves shall be purged with clean dry nitrogen to remove any remaining moisture.

A3. **TEST EQUIPMENT**

A3.1 The valve to be tested shall be supported in an insulated stainless steel tank. The ends of the valve shall be blanked off with stainless steel blind flanges, plugs, or plates, to contain pressure during the test. Small diameter tubing shall be connected to each end of the valve. Tank, flange, plugs, plates, tubing, and fittings used for testing shall be 18-8 austentic stainless steel compatible with liquid nitrogen at -320^{0}F (-195^{0}C).

A3.2 At least (1) one thermocouple shall be attached to the valve body. A second thermocouple shall be attached to the valve packing area. A third thermocouple shall be attached to the outlet of the pressure tubing. The packing and pressure tubing thermocouples should be insulated from direct exposure to the liquid nitrogen to avoid false readings.

A4. **PURGING**

A4.1 Gate and globe valves shall be partially opened and ball and butterfly valves shall be fully opened prior to immersion in liquid nitrogen.

A4.2 A low pressure (15 psi) (1 bar) helium purge shall be started and maintained during immersion and cool-down.

A4.3 The valve shall be lowered into an insulated tank and liquid nitrogen shall be allowed to fill the insulated tank around valve, to a level approximately (1 in.) (25.4 mm) above the body/bonnet bolting or body/bonnet welded connection.

A4.4 After the valve has stabilized at the test temperature, the helium purge shall be turned off and the valve cycled open and closed (3) three times.

A4.5 To safeguard against inaccurate readings during testing, the helium purge flow through the valve prior to subsequent pressurization shall be verified to be zero.

A4.6 ***Low Pressure Seat Test***

A4.6.1 The valve shall be pressurized with 80 psi (5.5 bar) helium in the open postion.

A4.6.2 The valve shall be closed for a minimum of ten minutes to stabilize the pressure.

A4.6.3 The helium test temperature and leaking gas temperature shall be measured by test outlet tubing thermocouple (See Section A3.2) and recorded. After five minutes, the detected leakage rate shall be recorded and then converted to an actual leakage rate, as applicable, by multiplying the detected leakage rate by correcting factor in accordance with the Boyle-Charles rule. This calculation shall correct the measured leakage to standard conditions of 14.7 psig (1.01 bar) at 60^{0}F (15.6^{0}C).

ANNEX A (continued)
Low Temperature Cryogenic Testing

A4.6.4 The maximum allowable leakage rates shall not exceed those as listed in Table A1.

A4.6.5 Repeat the sequence described in Sections A4.6.1 through A4.6.4 on each seat for bi-directional valves.

A4.7 ***High Pressure Seat Test***

A4.7.1 Following the low pressure seat test and with valve in the open position, gradually increase the helium pressure until the pressure reaches 80 psi (5.5 bar), then close the valve and continue pressurization until the valve reaches the test pressure listed in Table A2. The valve shall be closed for a minimum of ten minutes to stabilize the pressure.

A4.7.2 The helium test temperature and leaking gas temperature shall be measured by test outlet tubing thermocouple (see Section A3.2) and recorded. After five minutes, the detected leakage rate shall be recorded and then converted to an actual leakage rate, as applicable, by multiplying the detected leakage rate by a correction factor in accordance with the Boyle-Charles rule. This calculation shall correct the measured leakage to standard conditions of 14.7 psig (1.01 bar) at 60^0F (15.6^0C).

A4.7.3 The maximum allowable leakage rates shall not exceed those listed in Table A1.

A4.7.4 Repeat the test sequence as described in Sections A4.7.1 through A4.7.3 on each seat for bi-directional valves.

A4.8 ***Shell Test***

A4.8.1 Shell test leakage shall be measured with a sniffing device sensitive only to helium.

A4.8.2 Shell test shall be performed while the valve is still at cryogenic temperatures from previous seat testing.

A4.8.3 Valve shall be partially opened and pressurized to the test pressures listed in Table A2.

A4.8.4 After the shell pressure has stabilized, the valve shall be lifted from the liquid nitrogen for access by the helium-sniffing device.

A4.8.5 Any leakage in excess of 1×10^{-4} std. cc/sec shall be cause for rejection.

A4.8.6 Packing leakage that can be corrected by packing adjustment shall not be cause for rejection.

A4.9 ***Ambient Low Pressure Seat Test***

A4.9.1 Remove valve from test apparatus and allow valve to warm up to ambient temperature.

A4.9.2 Perform a low pressure seat test using 80 psi (5.5 bar) nitrogen gas. Repeat test on opposite seat for bi-directional valves.

A4.9.3 Acceptable leakage rate shall be in accordance with parent valve testing standard.

A4.10 ***Ambient Shell Test***

A4.10.1 With the valve half open, and ports sealed, pressurize the valve with helium as required by ASME B16.34, or in accordance with the parent valve standard.

A4.10.2 Shell test pressure shall be maintained for ten minutes.

ANNEX A (continued)
Low Temperature Cryogenic Testing

A4.10.3 Utilizing a sniffing device, which is sensitive only to helium, the entire body, bonnet and gasket area shall be examined.

A4.10.4 At any time during the test, a reading of greater than 40 PPM (v) for longer than ten seconds shall be cause for rejection.

A4.10.5 If the stem packing shows signs of leakage and requires adjustment, the pressure shall be bled off, the packing tightened and the valve re-pressurized for ten minutes before resuming the test.

A5. **TEST REPORT**

The test report shall include the valve information, tester's name, date of test, temperatures, pressures, and durations. Pressure temperature charts shall be provided as required by any purchase order.

Table A1 Allowable Helium Seat Leakage Rates for Cryogenic Closure Tests

scc/min/NPS

Class	Gate	Globe	Butterfly	Ball
150	25	25	50	50
300	50	50	50	50
600	100	100	100	100
800	25	25	N/A	N/A
900	150	150	150	150
1500	150	150	150	150

Table A2 Test Pressures

Class	High Pressure Seat Test		Shell Test	
	(psi)	(bar)	(psi)	(bar)
150	230	15.8	230	15.8
300	600	41.4	600	41.4
600	1200	82.7	1200	82.7
800	1600	110.3	1600	110.3
900	1800	124.1	1800	124.1
1500	1800	124.1	1800	124.1

ANNEX B
Referenced Standards and Applicable Dates

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

Standard Name or Description

ASME, ANSI/ASME, ANSI, ASME/ANSI

B16.34	2004	Valves Flanged, Threaded and Welding End
B31.3	2002	Process Piping

ASME Boiler and Pressure Vessel Code
Section VIII, Division 1

API

6D/ISO 14313	2002	Petroleum and Natural Gas Industries Pipeline Transportation Systems-Pipeline Valves
600/ISO 10434	2004	Bolted Bonnet Steel Gate Valves for Petroleum and Natural Gas Industries
602	1998	Compact Steel Gate Valves, Flanged Threaded, Welding and Extended Body Ends
603	2001	Corrosion Resistant Bolted Bonnet Gate Valves-Flanged and Butt-Welding Ends
608	2002	Metal Ball Valves-Flanged, Threaded and Welding End
609	1997	Butterfly Valves: Double Flanged, Lug and Wafer Type

MSS

SP-96-2001 (R 2005)	Guidelines on Terminology for Valves and Fittings

Publications of the following organizations appear on the above list:

ASME	ASME International Three Park Avenue New York, NY 10016-5990
API	American Petroleum Institute 1220 L Street NW Washington, D.C. 20005-4070
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. 127 Park St. NE Vienna, VA 22180-4602

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	(R 05) Spot Facing for Bronze, Iron and Steel Flanges
SP-25-1998	Standard Marking System for Valves, Fittings, Flanges and Unions
SP-42-2004	Class 150 Corrosion Resistant Gate, Glove, Angle and Check Valves with Flanged and Butt Weld Ends
SP-43-1991	(R 01) Wrought Stainless Steel Butt-Welding Fittings
SP-44-2006	Steel Pipeline Flanges
SP-45-2003	Bypass and Drain Connections
SP-51-2007	Class 150LW Corrosion Resistant Flanges and Cast Flanged Fittings
SP-53-1999	(R 07) Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP-54-1999	(R 07) Quality Standard for Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Radiographic Examination Method
SP-55-2006	Quality Standard for Steel Castings for Valves, Flanges and 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-67-2002a	Butterfly Valves
SP-68-1997	(R 04) High Pressure Butterfly Valves with Offset Design
SP-69-2003	Pipe Hangers and Supports - Selection and Application (ANSI/MSS Edition)
SP-70-2006	Gray Iron Gate Valves, Flanged and Threaded Ends
SP-71-2005	Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-1999	Ball Valves with Flanged or Butt-welding Ends for General Service
SP-75-2004	Specification for High Test Wrought Butt Welding Fittings
SP-77-1995	(R 00) Guidelines for Pipe Support Contractual Relationships
SP-78-2005a	Gray Iron Plug Valves, Flanged and Threaded Ends
SP-79-2004	Socket-Welding Reducer Inserts
SP-80-2003	Bronze Gate, Globe, Angle and Check Valves
SP-81-2006	Stainless Steel, Bonnetless, Flanged, Knife Gate Valves
SP-83-2006	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 Operation of Valves
SP-92-1999	MSS Valve User Guide
SP-93-1999	(R 04) Quality Standard for Steel Castings and Forgings for Valves, Flanges, and Fittings and Other Piping Components - Liquid Penetrant Examination Method
SP-94-1999	(R 04) Quality Std for Ferritic and Martensitic Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Ultrasonic Examination Method
SP-95-2006	Swage(d) Nipples and Bull Plugs
SP-96-2001	(R 05) Guidelines on Terminology for Valves and Fittings
SP-97-2006	Integrally Reinforced Forged Branch Outlet Fittings - Socket Welding, Threaded and Buttwelding Ends
SP-98-2001	(R 05) Protective Coatings for the Interior of Valves, Hydrants, and Fittings
SP-99-1994	(R 05) 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-104-2003	Wrought Copper Solder Joint Pressure Fittings
SP-105-1996	(R 05) Instrument Valves for Code Applications
SP-106-2003	Cast Copper Alloy Flanges and Flanged Fittings, Class 125, 150 and 300
SP-108-2002	Resilient-Seated Cast-Iron Eccentric Plug Valves
SP-109-1997	(R 06) Welded Fabricated Copper Solder Joint Pressure Fittings
SP-110-1996	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-111-2001	(R 05) 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.
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-115-2006	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-117-2006	Bellows Seals for Globe and Gate Valves
SP-118-2007	Compact Steel Globe & Check Valves - Flanged, Flangeless, Threaded & Welding Ends (Chemical & Petroleum Refinery Service)
SP-119-2003	Factory-Made Belled End Socket Welding Fittings
SP-120-2006	Flexible Graphite Packing System for Rising Stem Steel Valves (Design Requirements)
SP-121-2006	Qualification Testing Methods for Stem Packing for Rising Stem Steel Valves
SP-122-2005	Plastic Industrial Ball Valves
SP-123-1998	(R 06) 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-128-2006	Ductile Iron Gate Valves
SP-129-2003	Copper-Nickel Socket-Welding Fittings and Unions
SP-130-2003	Bellows Seals for Instrument Valves
SP-131-2004	Metallic Manually Operated Gas Distribution Valves
SP-132-2004	Compression Packing Systems for Instrument Valves
SP-133-2005	Excess Flow Valves for Low Pressure Fuel Gas Appliances
SP-134-2006a	Valves for Cryogenic Service Including Requirements for Body/Bonnet Extensions
SP-135-2006	High Pressure Steel Knife Gate 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 Practices in such cases.

Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
127 Park Street, N.E., Vienna, VA 22180-4620 (703) • 281-6613 Fax # (703) 281-6671