

GROVE B4, B5, and B7 Side-Entry Ball Valves

TECHNOLOGY



GROVE B4, B5, & B7 Side-entry Ball Valves

FEATURES AND BENEFITS

Cameron's Valves & Measurement business segment is a leading provider of valves, valve automation, and measurement systems to the oil and gas industry.

We provide large-diameter valves for use in natural gas, LNG, crude oil, and refined products transmission lines as well as in many other general industrial applications.

Rigorously tested, field-proven, and backed by our services team, Cameron's GROVE® valves are among the best known valves in the world.

Applications

GROVE split-body side-entry ball valves are manufactured in a wide range of diameters and pressure classes.

In the standard versions, the valves are specified for transmission pipelines, pumping, compression and reinjection units, offshore platforms, onshore terminals, pig traps, measuring stations, and surge-relief skids.

These valves also can be built for speciality applications, such as subsea installations and LNG plants.

Split-body construction allows the use of forged materials in various grades of carbon steel, stainless steel, and high alloys, equipping the valves for some of the most severe service conditions.



Size		ASME CLASS						
(in.)	(mm)	150	300	400	600	900	1500	2500
1-1/2	(40)	●	●	●	●	●	●	▲
2	(50)	●	●	●	●	●	●	▲
3	(80)	●	●	●	●	●	●	▲
4	(100)	●	●	●	●	●	●	▲
6	(150)	■	■	■	■	■	■	▲
8	(200)	■	■	■	■	■	■	◆
10	(250)	■	■	■	■	■	■	◆
12	(300)	■	■	■	■	■	■	◆
14	(350)	■	■	■	■	■	■	◆
16	(400)	■	■	■	■	■	■	◆
18	(450)	■	■	■	■	■	■	◆
20	(500)	■	■	■	■	■	■	◆
22	(550)	■	■	■	■	■	■	
24	(600)	■	■	■	■	■	■	
26	(650)	■	■	■	■	■	■	
28	(700)	■	■	■	■	■	■	
30	(750)	■	■	■	■	■	■	
32	(800)	■	■	■	■	■	■	
34	(850)	■	■	■	■	■	■	
36	(900)	■	■	■	■	■	■	
40	(1000)	■	■	■	■	■	■	
42	(1050)	■	■	■	■	■	■	
46	(1150)	■	■	■	■	■	■	
48	(1200)	■	■	■	■	■	■	
56	(1400)	■	■	■	■	■	■	
60	(1500)	■	■	■	■	■	■	

B4 ● B5 ■ B7.1 ▲ B7.B ◆

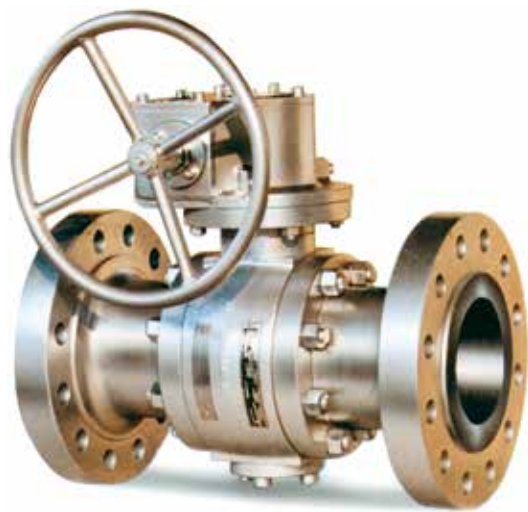
GROVE B4

DESIGN FEATURES

Standard Features

The standard design valve code is B4.D.

- Double-barrier stem seals (the upper seal can be replaced with the valves in-line, under pressure, with the ball in the closed position)
- Short coupled trunnions reduce unit bearing loads and operating torque
- Factory-positioned external stops
- Stem separated from the ball; anti-blowout design; side load on stem
- Plastic polymer insert for seat sealing
- Self-relieving seats for ASME Classes 150 and 300
- Metal-backed, self-lubricating PTFE sleeve bearing and thrust washers reduce torque and extend service life
- Nickel plating for trim parts
- Fire-safe graphite rings for protection against external leakage



Options

According to the design impact of the optional features, the valve code may change to B4.B, B4.C, etc.

B4 – ALL TYPES

- PTFE various grades of reinforced gaskets, spring energized, for stem and seat sealing
- Antistatic device
- Metal-to-metal seats
- Double-sealing barrier in both directions (DPE) for ASME Classes 600, 900, and 1500; body relief valve for overpressure due to liquid thermal expansion
- Double block-and-bleed capabilities
- Explosive decompression-resistant seals

B4.B TYPE

When the valve design includes one or more of the following variations with respect to the standard design, the denomination becomes B4.B.

- Triple-barrier stem seals; upper stem seal O-ring replaceable with pressure in-line with the ball in the closed position
- Self-relieving seats

B4.C TYPE

This version of the B4 valves (in ASME Classes 600, 900, and 1500) features:

- O-ring seat seal
- Double-sealing barrier in both directions (DPE) and body pressure relief valve



Body Construction

The body is made of three forged parts, and the bolted construction allows disassembly in the field for repairs. The body drain is located in the lowest part of the body cavity and consists of a 1/4" NPT drain valve with safety plug. Graphite rings are provided for compliance with API 6FA and BS 6755 Part 2 fire-safe standards.

Stem Construction

The stem function is to transmit torque and to absorb the line pressure thrust together with the trunnion. The stem of Cameron's GROVE B4 valves has an anti-blowout design and incorporates a double-barrier system. The pressure thrust on the stem is supported by a thrust washer in antifriction material.

Seat Seal

The soft sealing between the seat and the ball is achieved by a plastic insert on B4.B, B4.D valves and by an O-ring on B4.C valves.

The block-and-bleed and double block-and-bleed capabilities are available as per API 6D definition on all types of B4 valves.

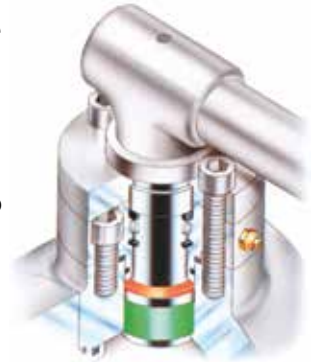
Self-relieving seats are standard on all B4.B, B4.C, and B4.D ASME Classes 150 and 300.

Independent sealing on upstream and downstream seats is available on B4.C and B4.D ASME Classes 600, 900, and 1500.

Ball Position

For valves normally mounted with lever, the ball open and closed positions are ensured by corresponding stops on the bearing housing. The lever position parallel to the line flow means the valve is open.

For valves with gears or actuators, the stops are set at the factory as primary stops. An "open/closed" indicator also is provided.



MATERIALS SPECIFICATIONS

Materials Selection

The design of the valve also depends on the materials of construction selected.

After examination of service conditions, the selection criteria are based on the verification of the physical and chemical characteristics of the materials or product.

For the soft sealing (O-rings, inserts, and lip seal gaskets), the guidelines to be followed are relevant for hardness, tensile strength, modulus, compression set, swelling, and fluid suitability.

The process is qualified so that the final thickness after machining can verify the chemical composition as per the relevant ASTM standard. The final check is carried out by the liquid penetrant method.

Weld Overlays

Sealing areas and other critical parts of the valve can be weld overlaid in case of corrosive service.

More frequently used materials are AISI 316L and Alloy 625.



Duplex Stainless Steels Metallurgy

On duplex (22 Cr to 2 Ni) and superduplex (25 Cr to 5 Ni) stainless steels, corrosion-resistance qualification check can be as follows:

- Chloride corrosion as per ASTM G48 (104° F or 40° C, 72 hours)
- Cracking as per ASTM G36 (302° F or 150° C, 500 hours)
- Pitting corrosion PRE = 33 min. for duplex, 40 min. for superduplex
- Ferrite content 40% to 60%, as per ASTM E562

NACE Requirements

On request, GROVE side-entry ball valves can be supplied in accordance with NACE MR0175.

Severe Wet Sour Gas Service

In addition to NACE MR0175, the additional qualifications can be:

- Sulfur \leq 0.015%
- Hydrogen-induced cracking as per NACE TM-02-84 (96 hours)
- Sulfide stress corrosion cracking as per NACE TM-01-77 (720 hours)



OPTIONAL FEATURES

Metal-to-Metal Seats

The contact area between the seats and the ball can be completely metallic. This feature is required when tight sealing is needed and the standard soft seal is no longer suitable due to the unfavorable combination of pressure, temperature, and chemical composition of the medium and/or when solid particles are present and when operating conditions prevail.

In case of metal-to-metal seats, the ball and seats coating can be obtained by means of various materials and processes, such as:

- Electroless nickel plating
- High-velocity application of carbide powder

When utilizing the metallic seats, it is necessary to verify the structure of the stem/ball coupling and the actuator choice, as there is an increase in the valve torque.

Transition Pieces

Cameron can weld transition pieces to the valve during the manufacturing process. Transition can be supplied by the customer or by Cameron to suit the customer's specifications.

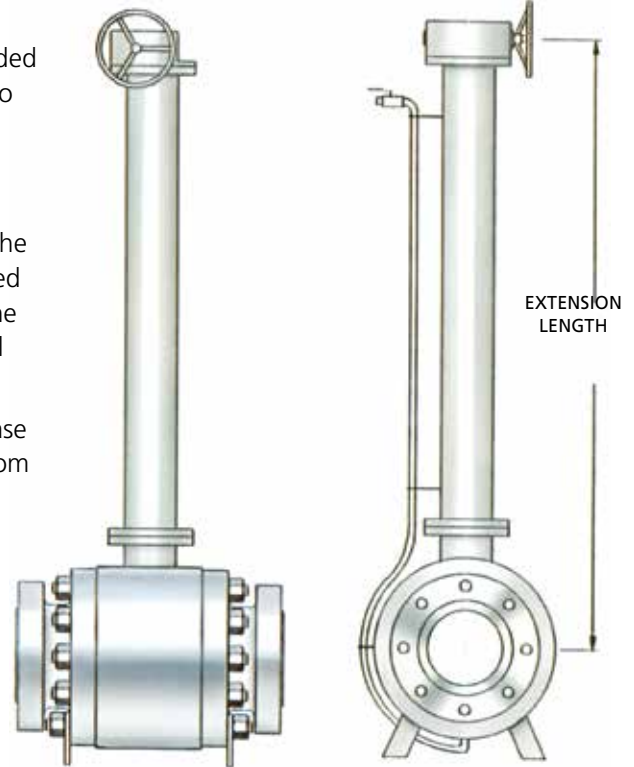
Cameron offers a wide variety of weld procedures in accordance with international standards.

Stem Extensions

GROVE ball valves can be provided with optional stem extensions to permit buried or underground installations in remote or inaccessible areas.

When used for buried service, the stem extensions can be furnished watertight, and the piping of the grease injection system also will be extended.

When ordering extensions, please specify the distance required from the valve centerline to the handwheel centerline.



Other

Upon request, the valve can be furnished with specific adjustments for the installation with the horizontal stem.

Also upon request, the wrenches, gearboxes, and actuators can be supplied with locking devices to suit the customer's specifications.



SPECIAL APPLICATIONS

“S” Design for Subsea Service

The “S” valves are the subsea versions of the B4, B5, and B7 ball valves, specifically designed to suit subsea service conditions.

The “S” design takes into consideration the restrictive criteria used in the definition of safety coefficients relative to both pressure-retaining components and the stem connection between the valve and actuator, making the “S” valve suitable for EDS service.

The critical internal sealing surfaces are protected from corrosion resistance by the overlay, generally dictated by customer specifications and checked by chemical analysis of test specimens and the part(s).

The body is coated with special products and the body/ bonnet bolts are protected with special protective coatings and special sealing caps. The stem and external sealing areas are protected with additional seawater sealing gaskets.

The “S” valve is designed to be reliable and to provide optimum service with reduced maintenance. It usually is installed on modular rigs placed on the seafloor, complete with necessary components. When necessary, substitution or complete removal of these modules is possible.



“L” Design For Low-temperature Service

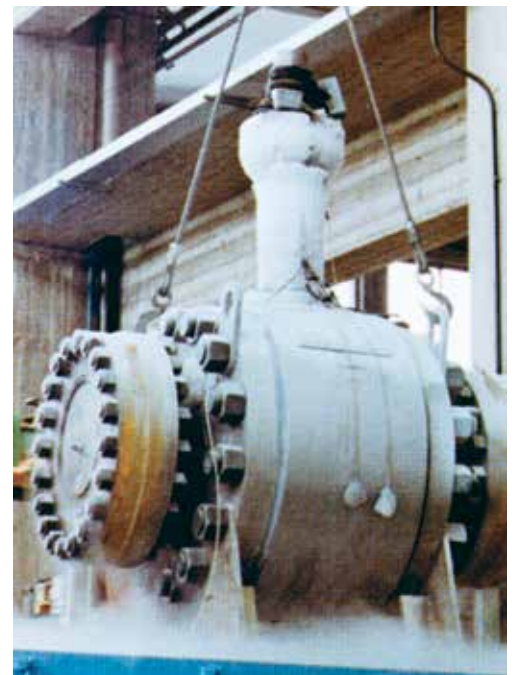
For certain gas treatment processes (e.g., LNG) and blowdown conditions, the valve must be able to limit the leakage within specified value and to ensure the maneuverability at a low temperature. The B4-L, B5-L, and B7-L valves are suitable for temperatures down to -184° F (-120° C).

The valves are referred to the respective standard types, but materials, parts dimensions, surface finishing, gaskets, and stem connections are specifically designed to suit low temperatures.

Epoxy-Phenolic Internal Coating

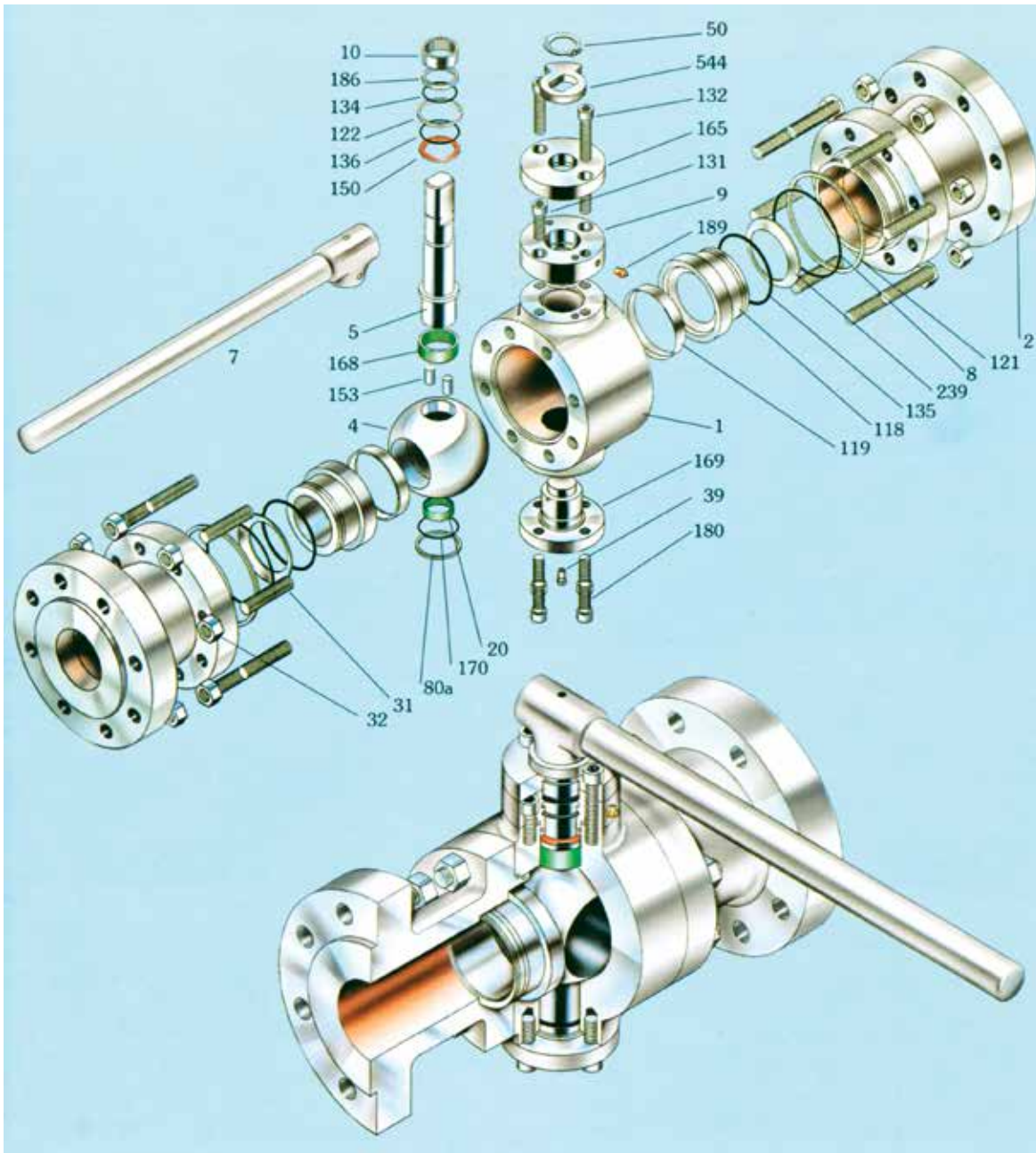
Cameron has developed a technology for anti-corrosive internal coatings. The products have been designed for oil brine, seawater and drinking water service, sour and corrosive applications.

The final thickness can be 180 to 350 microns. Hydrostatic shell testing is conducted before and after coating and thickness and holiday testing records are maintained.



GROVE B4-B4.D

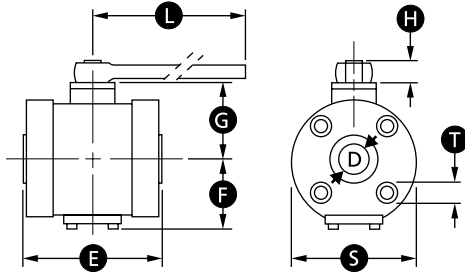
VALVE ASSEMBLY AND CROSS SECTION



Item	Description	Item	Description	Item	Description
1	Body	39	Drain Valve	150	Upper Thrust Washer
2	Closure	50	Seeger Ring	153	Drive Pin
4	Ball	80a	Lower Trunnion Fire-safe Seal	165	Bearing Housing
5	Stem	118	Standard Seat Ring	168	Stem Bearing
7	Wrench Unit	119	Seat Insert	169	Lower Trunnion
8	Closure O-ring	121	Closure Fire-safe Seal	170	Trunnion O-ring
9	Gland Plate	122	Gland Plate Fire-safe Seal	180	Lower Trunnion Capscrew
10	Gland Bushing	131	Gland Plate Capscrew	186	Stem Fire-safe Packing
20	Trunnion Bearing	132	Bearing Housing Capscrew	189	Gland Vent
31	Body Stud	134	Stem O-ring	239	Spring Washer
32	Body Stud Nut	135	Seat Gasket O-ring	544	Stop Collar
		136	Gland Plate O-ring		

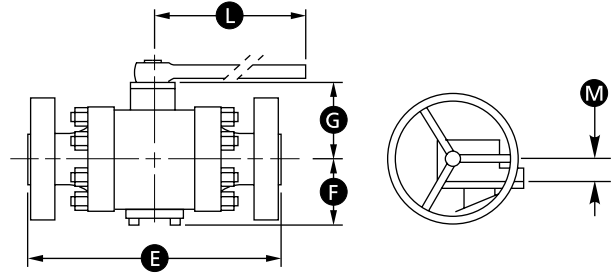
DIMENSIONS AND WEIGHTS

ASME CLASS 150



Size (in.)	Thread	T (in.) Depth	Flange Holes (No.)
1-1/2	1/2 UNC	13/16	4
2	5/8 UNC	15/16	4
3	5/8 UNC	15/16	4
4	5/8 UNC	15/16	8

ASME CLASS 300



ASME CLASS 150

SIZE	in. (mm)	D	E			F	G	S	H	L	A	K	M	WEIGHT	
			WE	RF	RTJ									WE	RF/RTJ
1-1/2	(40)	1-1/2 (38)	7-1/2 (191)	6-1/2 (165)	7 (178)	3-7/8 (98)	4-1/4 (108)	5 (127)	7/8 (22)	10-3/4 (273)	-	-	-	29 (13)	31 (14)
2 x 1-1/2 x 2	(50 x 40 x 50)	1-1/2 (38)	8-1/2 (216)	7 (178)	7-1/2 (191)	3-7/8 (98)	4-1/4 (108)	5 (127)	7/8 (22)	10-3/4 (273)	-	-	-	31 (14)	40 (18)
2	(50)	2 (51)	8-1/2 (216)	7 (178)	7-1/2 (191)	4-1/8 (105)	4-5/8 (118)	5-5/8 (143)	7/8 (22)	12-5/8 (321)	-	-	-	37 (17)	51 (23)
3 x 2 x 3	(80 x 50 x 80)	2 (51)	11-1/8 (283)	8 (203)	8-1/2 (216)	4-1/8 (105)	4-5/8 (118)	5-5/8 (143)	7/8 (22)	12-5/8 (321)	-	-	-	53 (24)	60 (27)
3	(80)	3 (76)	11-1/8 (283)	8 (203)	8-1/2 (216)	5-1/8 (130)	5-5/8 (143)	7-3/4 (197)	1-1/8 (28)	16-1/2 (419)	-	-	-	84 (38)	95 (43)
4 x 3 x 4	(100 x 80 x 100)	3 (76)	12 (305)	9 (229)	9-1/2 (241)	5-1/8 (130)	5-5/8 (143)	7-3/4 (197)	1-1/8 (28)	16-1/2 (419)	-	-	-	86 (39)	104 (47)
4	(100)	4 (102)	12 (305)	9 (229)	9-1/2 (241)	6-1/8 (155)	6-5/8 (168)	9-3/8 (238)	1-1/8 (28)	20-1/4 (514)	-	-	-	123 (56)	146 (66)
6 x 4 x 6	(150 x 100 x 150)	4 (102)	18 (457)	15-1/2 (394)	16 (406)	6-1/8 (155)	6-5/8 (168)	9-3/8 (238)	1-1/8 (28)	20-1/4 (514)	-	-	-	152 (69)	161 (73)

ASME CLASS 300

SIZE	in. (mm)	D	E			F	G	S	H	L	A	K	M	WEIGHT	
			WE	RF	RTJ									WE	RF/RTJ
1-1/2	(40)	1-1/2 (38)	7-1/2 (191)	7-1/2 (191)	8 (203)	3-7/8 (98)	4-1/4 (108)	5 (127)	7/8 (22)	10-3/4 (273)	-	-	-	29 (13)	40 (18)
2 x 1-1/2 x 2	(50 x 40 x 50)	1-1/2 (38)	8-1/2 (216)	8-1/2 (216)	9-1/8 (232)	3-7/8 (98)	4-1/4 (108)	5 (127)	7/8 (22)	10-3/4 (273)	-	-	-	31 (14)	44 (20)
2	(50)	2 (51)	8-1/2 (216)	8-1/2 (216)	9-1/8 (232)	4-1/8 (105)	4-5/8 (118)	5-5/8 (143)	7/8 (22)	14-5/8 (372)	-	-	-	37 (17)	51 (23)
3 x 2 x 3	(80 x 50 x 80)	2 (51)	11-1/8 (283)	11-1/8 (283)	11-3/4 (298)	4-1/8 (105)	4-5/8 (118)	5-5/8 (143)	7/8 (22)	14-5/8 (372)	-	-	-	53 (24)	75 (34)
3	(80)	3 (76)	11-1/8 (283)	11-1/8 (283)	11-3/4 (298)	5-1/8 (130)	5-5/8 (143)	7-3/4 (197)	1-1/8 (28)	22-3/8 (568)	-	-	-	88 (40)	117 (53)
4 x 3 x 4	(100 x 80 x 100)	3 (76)	12 (305)	12 (305)	12-5/8 (321)	5-1/8 (130)	5-5/8 (143)	7-3/4 (197)	1-1/8 (28)	22-3/8 (568)	-	-	-	90 (41)	123 (56)
4	(100)	4 (102)	12 (305)	12 (305)	12-5/8 (321)	6-1/8 (155)	6-5/8 (168)	9-3/8 (238)	1-1/8 (28)	26-1/8 (664)	-	-	-	128 (58)	170 (77)
6 x 4 x 6	(150 x 100 x 150)	4 (102)	18 (457)	15-7/8 (403)	16-1/2 (419)	6-1/8 (155)	6-5/8 (168)	9-3/8 (238)	1-1/8 (28)	26-1/8 (664)	-	-	-	165 (75)	223 (101)

Flanges in accordance with ASME B16.5

Shaded bore sizes (D) according to API 6D

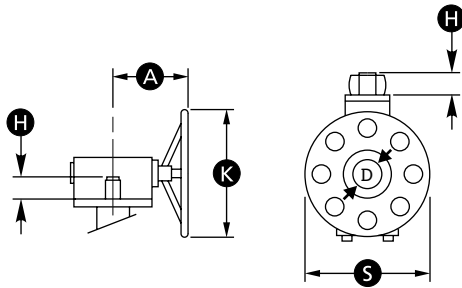
Shaded end-to-end dimensions (E) according to API 6D

Butt welding ends according to ASME B16.25

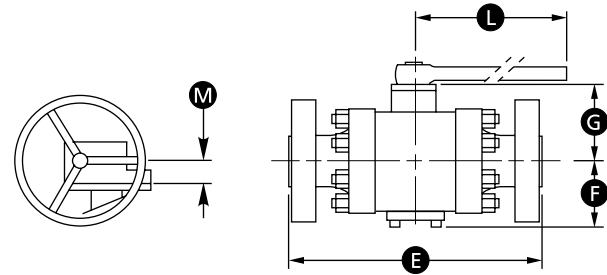
Outlined end-to-end dimensions (E) according to ASME B16.10

DIMENSIONS AND WEIGHTS (CONT.)

ASME CLASS 400



ASME CLASS 600



ASME CLASS 400

SIZE	in. (mm)	D	E			F	G	S	H	L	A	K	M	WEIGHT	
			WE	RF	RTJ									WE	RF/RTJ
1-1/2 (40)	1-1/2 (38)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	3-7/8 (98)	4-1/4 (108)	5 (127)	7/8 (22)	10-3/4 (273)	-	-	-	30 (13)	43 (20)	
2 x 1-1/2 x 2 (50 x 40 x 50)	1-1/2 (38)	11-1/2 (292)	11-1/2 (292)	11-5/8 (295)	3-7/8 (98)	4-1/4 (108)	5 (127)	7/8 (22)	10-3/4 (273)	-	-	-	33 (15)	49 (22)	
2 (50)	2 (51)	11-1/2 (292)	11-1/2 (292)	11-5/8 (295)	4-1/8 (105)	4-5/8 (118)	5-5/8 (143)	7/8 (22)	14-5/8 (372)	-	-	-	41 (19)	56 (25)	
3 x 2 x 3 (80 x 50 x 80)	2 (51)	14 (356)	14 (356)	14-1/8 (359)	4-1/8 (105)	4-5/8 (118)	5-5/8 (143)	7/8 (22)	14-5/8 (372)	-	-	-	56 (25)	80 (36)	
3 (80)	3 (76)	14 (356)	14 (356)	14-1/8 (359)	5-1/8 (130)	5-5/8 (143)	7-3/4 (197)	1-1/8 (28)	22-3/8 (568)	-	-	-	93 (42)	123 (56)	
4 x 3 x 4 (100 x 80 x 100)	3 (76)	16 (406)	16 (406)	16-1/8 (410)	5-1/8 (130)	5-5/8 (143)	7-3/4 (197)	1-1/8 (28)	22-3/8 (568)	-	-	-	103 (47)	146 (47)	
4 (100)	4 (102)	16 (406)	16 (406)	16-1/8 (410)	6-1/8 (155)	6-5/8 (168)	9-3/8 (238)	1-1/8 (28)	26-1/8 (664)	-	-	-	146 (66)	198 (90)	
6 x 4 x 6 (150 x 100 x 150)	4 (102)	19-1/2 (495)	19-1/2 (495)	19-5/8 (499)	6-1/8 (155)	6-5/8 (168)	9-3/8 (238)	1-1/8 (28)	26-1/8 (664)	-	-	-	179 (81)	279 (127)	

ASME CLASS 600

SIZE	in. (mm)	D	E			F	G	S	H	L	A	K	M	WEIGHT	
			WE	RF	RTJ									WE	RF/RTJ
1-1/2 (40)	1-1/2 (38)	9-1/2 (241)	9-1/2 (241)	9-1/2 (241)	3-7/8 (98)	4-1/4 (108)	5 (127)	7/8 (22)	11-7/8 (302)	-	-	-	31 (14)	46 (21)	
2 x 1-1/2 x 2 (50 x 40 x 50)	1-1/2 (38)	11-1/2 (292)	11-1/2 (292)	11-5/8 (295)	3-7/8 (98)	4-1/4 (108)	5 (127)	7/8 (22)	11-7/8 (302)	-	-	-	35 (16)	53 (24)	
2 (50)	2 (51)	11-1/2 (292)	11-1/2 (292)	11-5/8 (295)	4-1/8 (105)	4-5/8 (118)	5-5/8 (143)	7/8 (22)	16-7/8 (429)	-	-	-	44 (20)	62 (28)	
3 x 2 x 3 (80 x 50 x 80)	2 (51)	14 (356)	14 (356)	14-1/8 (359)	4-1/8 (105)	4-5/8 (118)	5-5/8 (143)	7/8 (22)	16-7/8 (429)	-	-	-	60 (27)	86 (39)	
3 (80)	3 (76)	14 (356)	14 (356)	14-1/8 (359)	5-1/8 (130)	5-5/8 (143)	7-3/4 (197)	1-1/8 (28)	26-1/4 (667)	-	-	-	97 (44)	130 (59)	
4 x 3 x 4 (100 x 80 x 100)	3 (76)	17 (432)	17 (432)	17-1/8 (435)	5-1/8 (130)	5-5/8 (143)	7-3/4 (197)	1-1/8 (28)	26-1/4 (667)	-	-	-	115 (52)	168 (76)	
4 (100)	4 (102)	17 (432)	17 (432)	17-1/8 (435)	6-1/8 (155)	6-5/8 (168)	9-3/8 (238)	1-1/8 (28)	30-1/8 (765)	-	-	-	192 (87)	335 (152)	
6 x 4 x 6 (150 x 100 x 150)	4 (102)	22 (559)	22 (559)	22-1/8 (562)	6-1/8 (155)	6-5/8 (168)	9-3/8 (238)	1-1/8 (28)	30-1/8 (765)	-	-	-	192 (87)	335 (152)	

Flanges in accordance with ASME B16.5

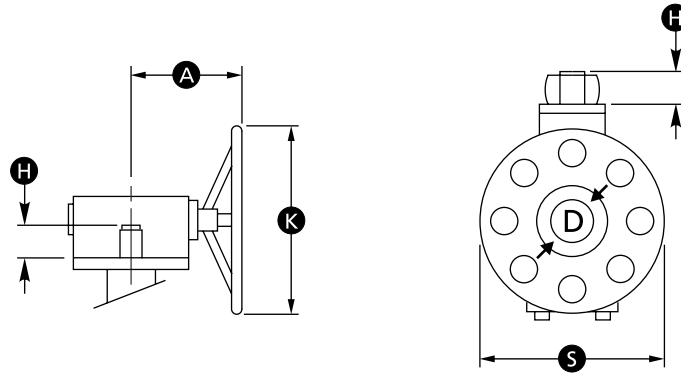
Shaded bore sizes (D) according to API 6D

Shaded end-to-end dimensions (E) according to API 6D

Butt welding ends according to ASME B16.25

Outlined end-to-end dimensions (E) according to ASME B16.10

ASME CLASS 900 AND 1500



ASME CLASS 900

SIZE	in. (mm)	D	E			F	G	S	H	L	A	K	M	WEIGHT	
			WE	RF	RTJ									WE	RF/RTJ
1-1/2 (40)	1-1/2 (38)	12 (305)	12 (305)	12 (305)	4 (102)	4-1/2 (114)	5-1/8 (130)	7/8 (22)	13-1/2 (343)	-	-	-	44 (20)	68 (31)	
2 x 1-1/2 x 2 (50 x 40 x 50)	1-1/2 (38)	14-1/2 (368)	14-1/2 (368)	14-5/8 (372)	4 (102)	4-1/2 (114)	5-1/8 (130)	7/8 (22)	13-1/2 (343)	-	-	-	49 (22)	95 (43)	
2 (50)	2 (51)	14-1/2 (368)	14-1/2 (368)	14-5/8 (372)	4-1/2 (114)	4-7/8 (124)	6-3/8 (162)	7/8 (22)	22 (559)	-	-	-	77 (35)	130 (59)	
3 x 2 x 3 (80 x 50 x 80)	2 (51)	15 (381)	15 (381)	15-1/8 (359)	4-1/2 (114)	4-7/8 (124)	6-3/8 (162)	7/8 (22)	22 (559)	-	-	-	108 (49)	143 (65)	
3 (80)	3 (76)	15 (381)	15 (381)	15-1/8 (359)	5-5/8 (143)	6-1/8 (156)	8-3/8 (213)	1-1/8 (28)	35-7/8 (911)	-	-	-	157 (71)	187 (85)	
4 x 3 x 4 (100 x 80 x 100)	3 (76)	18 (457)	18 (457)	18-1/8 (460)	5-5/8 (143)	6-1/8 (156)	8-3/8 (213)	1-1/8 (28)	35-7/8 (911)	-	-	-	159 (72)	240 (109)	
4 (100)	4 (102)	18 (457)	18 (457)	18-1/8 (460)	6-7/8 (175)	7-1/2 (191)	11-1/2 (292)	2-1/8 (54)	-	10-7/8 (276)	23-5/8 (600)	1-3/4 (44)	353 (160)	390 (177)	
6 x 4 x 6 (150 x 100 x 150)	4 (102)	24 (610)	24 (610)	24-1/8 (613)	6-7/8 (175)	7-1/2 (191)	10-1/4 (260)	2-1/8 (54)	-	10-7/8 (276)	23-5/8 (600)	1-3/4 (44)	357 (162)	489 (222)	

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SIZE	in. (mm)	D	E			F	G	S	H	L	A	K	M	WEIGHT	
			WE	RF	RTJ									WE	RF/RTJ
1-1/2 (40)	1-1/2 (38)	12 (305)	12 (305)	12 (305)	4 (102)	4-1/2 (114)	5-1/8 (130)	7/8 (22)	15-7/8 (403)	-	-	-	44 (20)	68 (31)	
2 x 1-1/2 x 2 (50 x 40 x 50)	1-1/2 (38)	14-1/2 (368)	14-1/2 (368)	14-5/8 (372)	4 (102)	4-1/2 (114)	5-1/8 (130)	7/8 (22)	15-7/8 (403)	-	-	-	49 (22)	95 (43)	
2 (50)	2 (51)	14-1/2 (368)	14-1/2 (368)	14-5/8 (372)	4-1/2 (114)	4-7/8 (124)	6-3/8 (162)	7/8 (22)	24-1/4 (616)	-	-	-	77 (35)	130 (59)	
3 x 2 x 3 (80 x 50 x 80)	2 (51)	18-1/2 (470)	18-1/2 (470)	18-5/8 (473)	4-1/2 (114)	4-7/8 (124)	6-3/8 (162)	7/8 (22)	24-1/4 (616)	-	-	-	108 (49)	168 (76)	
3 (80)	3 (76)	18-1/2 (470)	18-1/2 (470)	18-5/8 (473)	5-5/8 (143)	6-1/8 (156)	8-3/8 (213)	2-1/8 (54)	-	6-3/4 (171)	11-3/4 (298)	1-1/4 (32)	179 (81)	240 (109)	
4 x 3 x 4 (100 x 80 x 100)	3 (76)	21-1/2 (546)	21-1/2 (546)	21-5/8 (549)	5-5/8 (143)	6-1/8 (156)	8-3/8 (213)	2-1/8 (54)	-	6-3/4 (171)	11-3/4 (298)	1-1/4 (32)	185 (84)	311 (141)	
4 (100)	4 (102)	21-1/2 (546)	21-1/2 (546)	21-5/8 (549)	6-7/8 (175)	7-1/2 (191)	12-1/4 (311)	2-1/8 (54)	-	10-7/8 (276)	23-5/8 (600)	1-3/4 (44)	355 (161)	399 (181)	
6 x 4 x 6 (150 x 100 x 150)	4 (102)	27-3/4 (705)	27-3/4 (705)	28 (711)	6-7/8 (175)	7-1/2 (191)	10-1/4 (260)	2-1/8 (54)	-	10-7/8 (276)	23-5/8 (600)	1-3/4 (44)	366 (166)	628 (285)	

Flanges in accordance with ASME B16.5

Shaded bore sizes (D) according to API 6D

Shaded end-to-end dimensions (E) according to API 6D

Butt welding ends according to ASME B16.25

Outlined end-to-end dimensions (E) according to ASME B16.10