FLOWSERVE

TECHNICAL BULLETIN

Worcester® Cryogenic
Reduced-port, Three-piece and Flanged Floating Ball Valves

Experience In Motion

Exceptional fugitive emissions control for cryogenic gas applications

The Worcester Cryogenic series of reduced-port, quarter-turn floating ball valves from Flowserve offers superior reliability in liquefied natural gas (LNG), industrial gas and other cryogenic applications.

Available in three-piece (CF44 series) and flanged (CF51/CF52 series) configurations, Worcester Cryogenic valves feature a high-strength stem and provide exceptional fugitive emissions control from an improved live-loaded stem seal. They also incorporate a modular bolted bonnet design, which provides customers with cost-effective flexibility and enables them to reduce spare parts inventories. Total cost of ownership (TCO) is reduced as a result.

Worcester Cryogenic CF44 three-piece ball valve

Global fire-safe and fugitive emissions compliance

Worcester Cryogenic ball valves meet global fire-safe and fugitive emissions standards, including testing with hydrogen. As a result, they support energy transition initiatives and hydrogen production while ensuring fugitive emissions containment.

In addition, the global certifications compliance ensures reliability and peace of mind in all cryogenic applications.

Industries and applications

Liquefied natural gas (LNG)	Industrial gases	Other industries
• Gasification • Loading and unloading • Processing • Refrigeration • Transportation	• Hydrogen • Nitrogen • Oxygen • Energy • Ammonia	• Aerospace • Food and beverage • Defense • Pharmaceutical • Petrochemical • Steel • Biofuels

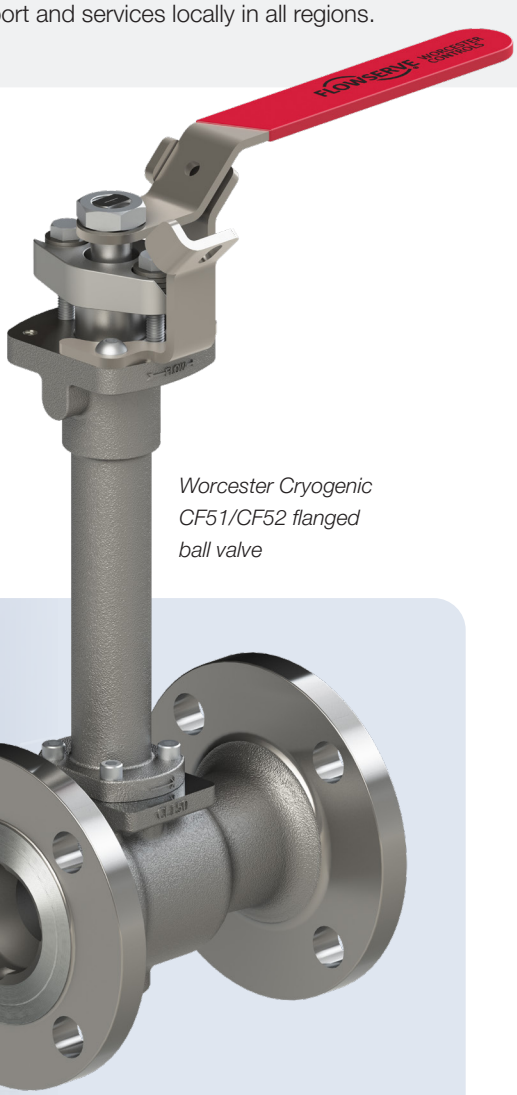
Features and benefits

- **Reduced fugitive emissions —** The redesigned bonnet configuration offers robust stem sealing for fugitive emissions compliance throughout the thermal ranges. Live loading ensures a long service life and continued compliance.
- **Improved reliability and uptime —** The high-strength stem improves reliability, extends service life, and allows for increased maximum allowable stem torque (MAST) while complying with API 608.
- **Cost-effective flexibility —** The cryogenic bolted bonnet provides a modular design that's standardized globally for flanged and three-piece valve models, enabling companies to reduce spare parts inventories and TCO.
- **Fire-safety and fugitive emissions compliance —** Both models meet global certification requirements for API 607, API 641, ISO 15848 and PED.
- **Supports energy transition initiatives —** Third-party tested to latest fugitive emissions standards using hydrogen, Worcester Cryogenic ball valves help support sustainability efforts and reduce greenhouse gas emissions. They also are well-suited for use in many applications and markets that are critical to the energy transition, including LNG and hydrogen production.
- **Ease of maintenance —** In addition to providing cost-effective flexibility and reduced spare parts, the modular bolted design also simplifies maintenance compared to the previous conventional welded design.

Harmonized design for worldwide distribution

Worcester Cryogenic ball valves have been engineered for worldwide availability and competitive lead times by standardizing their design, materials and construction. The valve meets critical certifications and standards in all jurisdictions. End users, particularly those with a multinational footprint, are able to lower inventory and maintenance costs owing to the global availability and interchangeability of parts.

In addition, Flowserve's worldwide network of Quick Response Centers provides engineering expertise, technical support and services locally in all regions.



Worcester Cryogenic CF51/CF52 flanged ball valve

Worcester Cryogenic CF44 reduced-port, three-piece ball valve series

The Worcester Cryogenic CF44 series three-piece ball valve is ideal for demanding applications involving all types of cryogens, such as ammonia, deuterium, fluorine, hydrogen, liquefied natural gas (LNG), methane, nitrogen and oxygen.

The Worcester Cryogenic CF44 series valve incorporates many of the performance- and maintenance-enhancing features of our Series 44 line of valves. Three-piece construction makes it easy to install, versatile in application and simple to maintain.

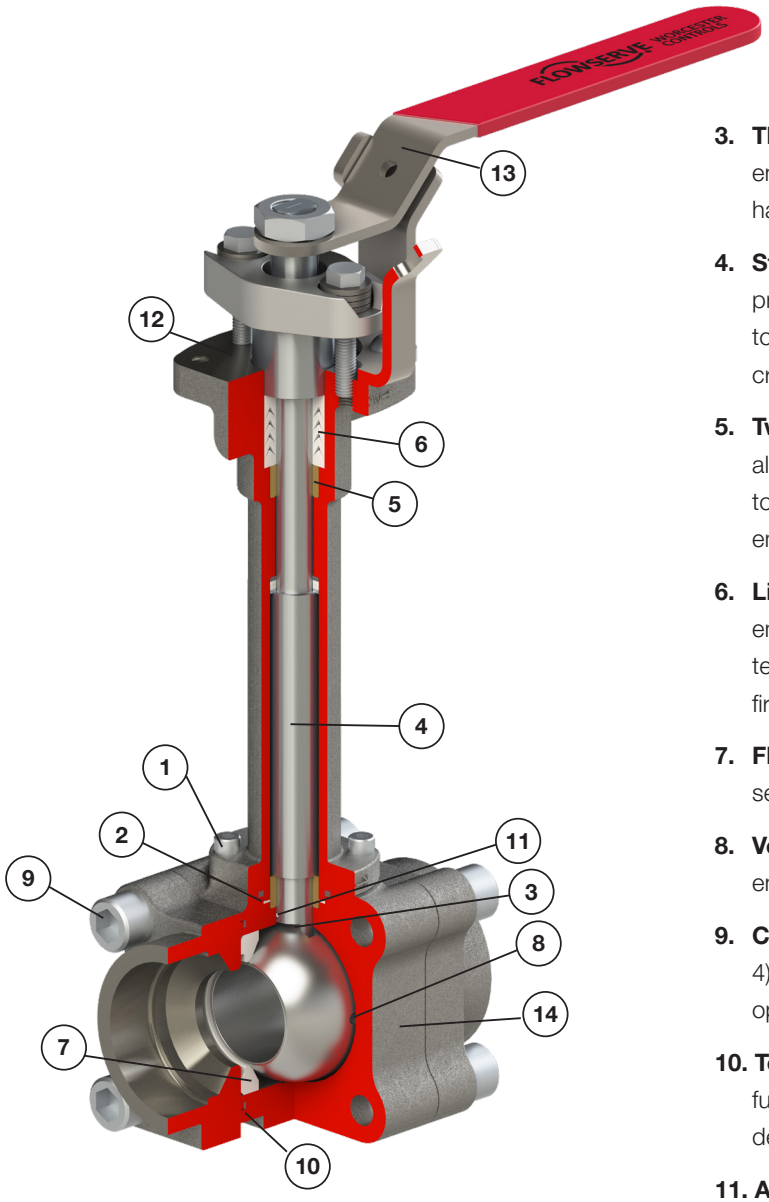
By removing three of the body bolts and loosening the fourth, the valve may be swung out of line to facilitate maintenance. In welded or soldered piping systems, all four body bolts may be removed and the center section lifted out for easy maintenance.

A variety of connections is available, including screwed end, socket weld, buttweld and solder/sweat ends.

Standards of compliance and certifications

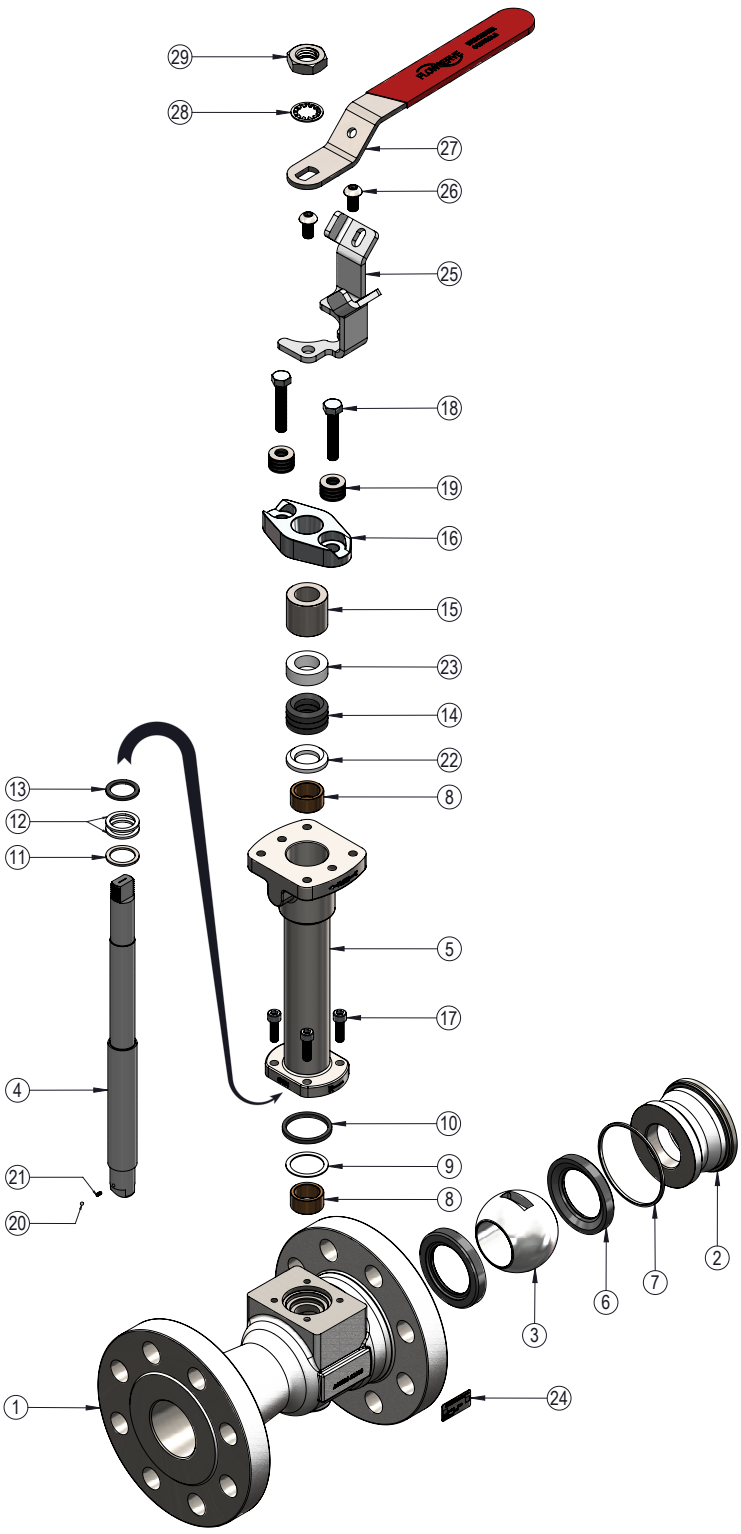
Specifications and certifications	• BS EN ISO 17292 and API 608 • ASME B16.34, Class 600 • MSS SP-134, BS 6364 and ISO 28921 • Pressure Equipment Directive 2014/68/EU • Pressure Equipment Regulations SI 2016 • Assessment Category: Pressure Accessory, Group 1 GAS, Table 6, Module 'H', Category III • SIL 3 Capable • TSG, CRN
Face-to-face	Manufacturer standard
End connections	• Socket weld - ASME B3610/B16.11 • Buttweld - ASME B16.25 • Screwed end - ASME B1.20.1
Fugitive emissions	ISO 15848: Class BH and API 641
Surface quality	MSS SP-55
Fire test	API 607 and ISO 10497
Pressure test	BS EN 12266-1, ISO 5208 and API 598
Sour service	NACE MR0175 and ISO 15156 or MR0103

CF44 features and benefits



1. **Bolt-on cryogenic bonnet extension** protects packing and external sealing integrity from the cryogenic temperatures. It also reduces assembly complexity and greatly simplifies valve maintenance.
2. **PTFE and graphite bonnet seal** achieves API 607/ISO 10497 fire-safe and API 641/ISO 15848 fugitive emissions compliance without welding.
3. **The robust drive train** uses a single piece stem and an enhanced stem-to-ball connection for improved torque handling capability, reliability and service longevity.
4. **Standard strain-hardened 316 stainless steel stem** provides a 2X safety factor on cryogenic valve operating torque while meeting the ductility requirements at cryogenic temperatures.
5. **Two graphite bronze stem bearings** maintain stem alignment under manual or automated torque loading to ensure long term stem seal performance and fugitive emissions compliance.
6. **Live loaded PTFE chevron packing** maintains fugitive emissions compliance across the full valve operating temperature range. Secondary stem seals further enhance fire safety and fugitive emissions performance.
7. **Fluorofill/Polyfill seats** provide excellent cryogenic sealing performance.
8. **Vented ball** balances pressure with the upstream side for enhanced safety in expansive media applications.
9. **Cap head screws** (qty. 8) replace the through-bolts (qty. 4) for increased clamping load and consistency across operating temperature ranges.
10. **Tongue and groove body and piping connection** fully contains PTFE coated graphite body seal to provide dependable performance across all temperature ranges.
11. **Anti-static stem assembly** ensures electrical continuity among ball, stem and body.
12. **Actuator mounting** conforms to ISO 5211 and Shell MESC SPE 77/300 for ease of automation.
13. **Locking wrench** is standard on all sizes.
14. **Impact testing is standard.** Pressure containing materials are tested to comply with PED requirements at typical cryogenic temperatures, i.e., -196°C (-321°F).

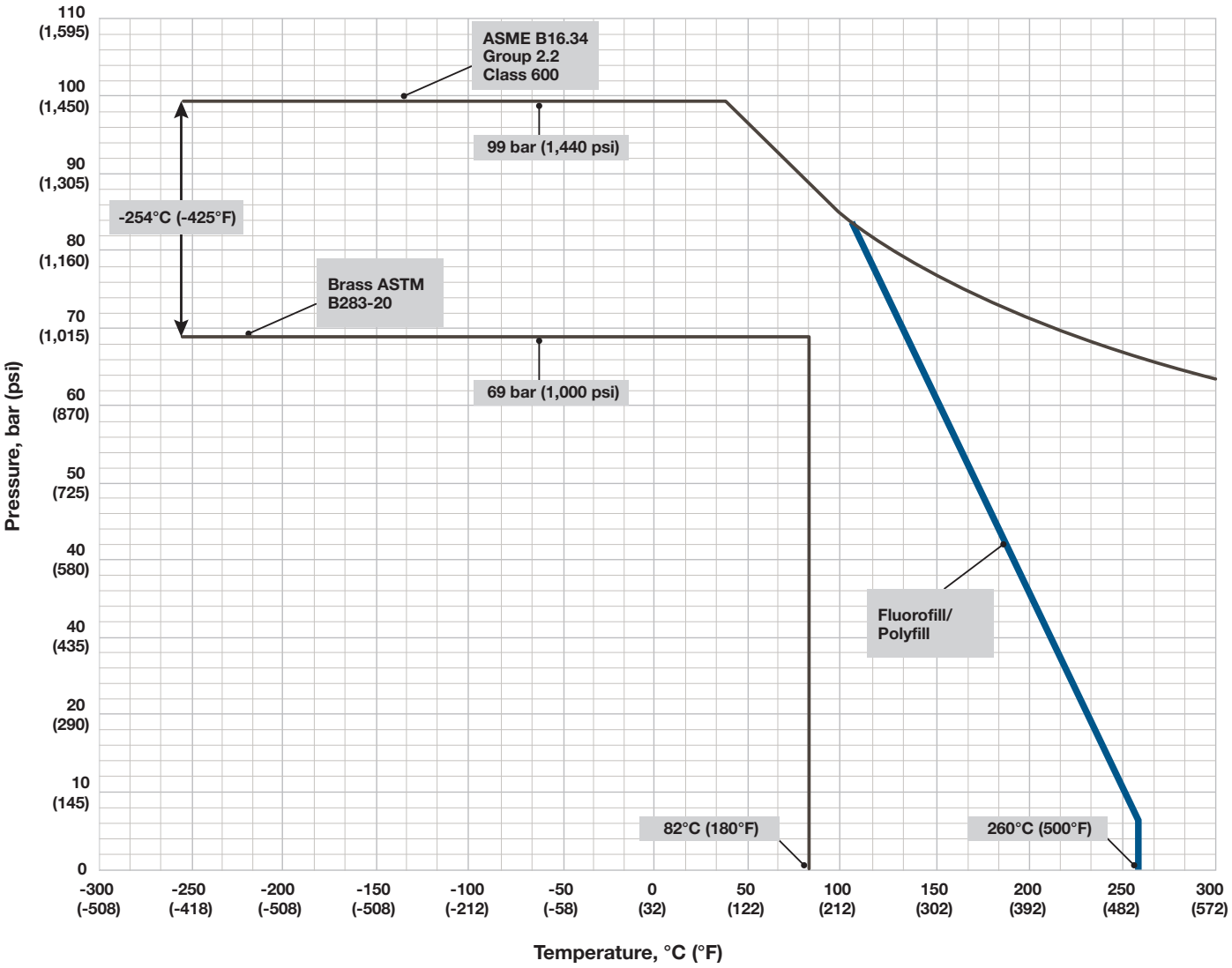
CF44 parts and materials



Item	Description	Material
1	Body	ASTM A351 CF8M stainless steel[1]
2	Pipe End	ASTM A351 CF8M stainless steel[1]
3	Ball	ASTM A351 CF8M stainless steel
4	Stem	ASTM A479 316 SH1 stainless steel
5	Bonnet	ASTM A351 CF8M stainless steel
6	Seat	Fluorofill
7	Body Seal	Flexible graphite/ PTFE coated
8	Stem Bearing	Graphite-filled 841 bronze
9	Bonnet Seal	Virgin PTFE
10	Fire-Safe Bonnet Seal	Flexible graphite
11	Support Washer	ASTM 316 stainless steel
12	Thrust Seal	Virgin PTFE
13	Fire-Safe Seal	Flexible graphite
14	Chevron Packing	Virgin PTFE
15	Gland Follower	ASTM 316 stainless steel
16	Gland Flange	ASTM A890 Grade CD4MCuN duplex stainless steel
17	Socket Head Cap Screw	ASTM A193 Grade B8M Class 2
18	Gland Bolt	ASTM A193 Grade B8M Class 2
19	Belleville Washers	Stainless steel
20	Body Socket Head Cap Screw	ASTM A193 Grade B8M Class 2
21	Anti-Static Ball	Stainless steel
22	Anti-Static Spring	Stainless steel
23	Packing Ring Bottom	Virgin PTFE
24	Packing Ring Top	Virgin PTFE
25	Nameplate	ASTM 304 stainless steel
26	Locking Bracket	ASTM A666 UNS S30400 - SS304
27	Button Head Screw	ASTM 300 grade stainless steel
28	Locking Handle	ASTM A666 UNS S30400 - SS304/vinyl plastisol coated
29	Lockwasher	ASTM 300 grade stainless steel
30	Handle Nut	ASTM 300 grade stainless steel

[1] Body and pipe ends are also available in brass.

CF44 pressure/temperature ratings



Material groupings

Material group pressure-temperature ratings are taken from ASME B16.34.

- Group 2.2 represents our CF8M material.
- Brass is rated to 69 bar (1,000 psi).

Fluorofill/Polyfill (P) seat material

Seats made from PTFE reinforced with carbon, glass and graphite have outstanding dimensional stability across a broad temperature range. This material is well-suited for a variety of thermal services, including steam and cryogenic applications. Due to its high cycling capabilities, Fluorofill seats are recommended for modulating control applications.

Temperature range: -254°C to 260°C (-425°F to 500°F)

For temperatures below -196°C (-321°F), consult factory for seat material selection and performance criteria.

CF44 technical information

Flow coefficients for CF44 series

Valve Size		Flow Coefficients		Equivalent Length of Pipe	
DN	NPS	Cv [1]	Kv [2]	m	ft
15	½	8	7	0.94	3.1
20	¾	12	10	1.92	6.3
25	1	32	28	0.94	3.1
40	1½	82	71	1.31	4.3
50	2	120	104	2.28	7.5

[1] Cv: Flow in US gpm (measured with a pressure drop across the valve of 1 psi)

[2] Kv: Flow in m^3/h (measured with a pressure drop across the valve of 1 bar)

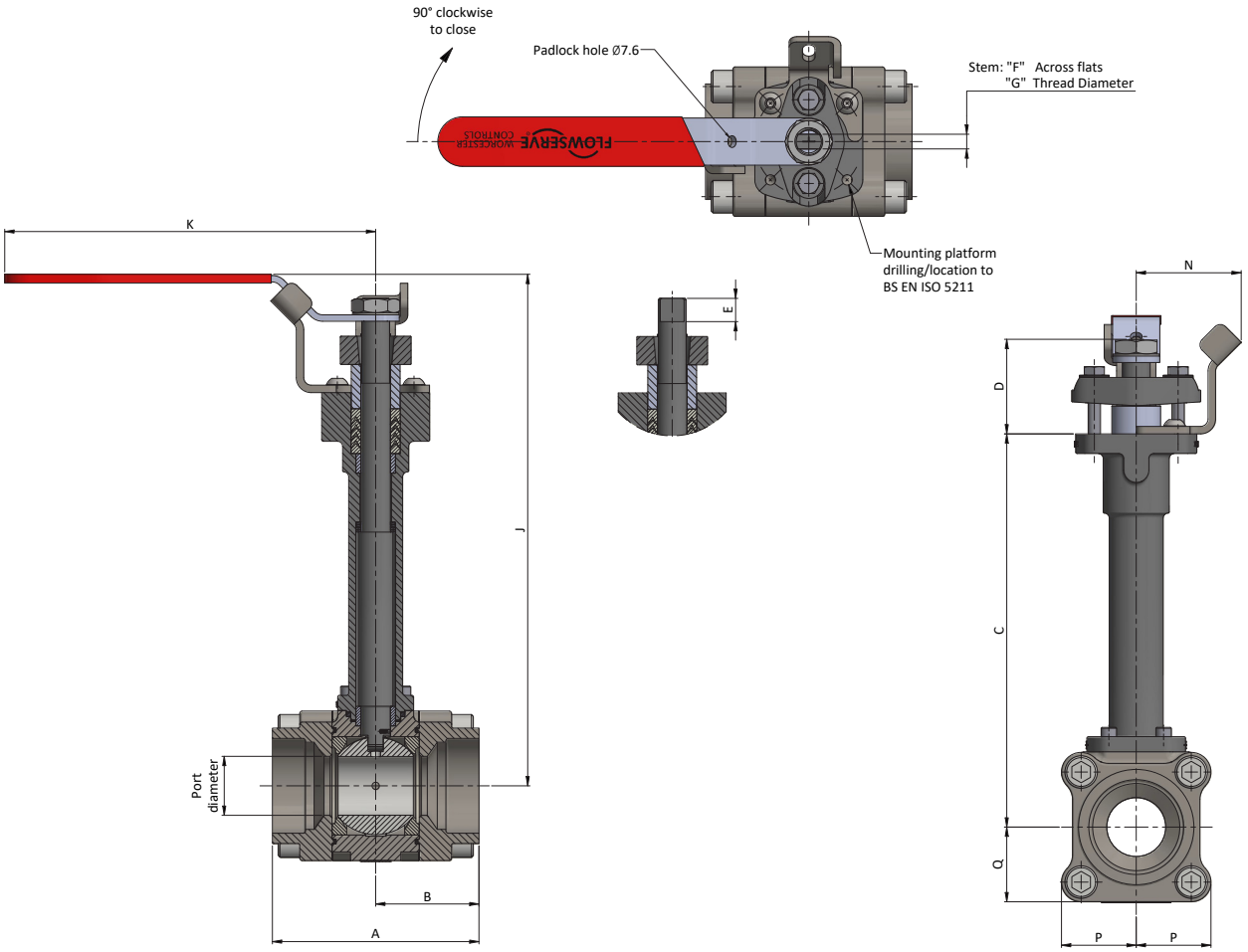
Torque values[3] for CF44 series

Valve Size		Valve Series	Maximum Alllowable Stem Torque (MAST)		Break-to-Open Torque With Polyfill Seat		Gland Bolt Tightening Torque	
DN	NPS		Nm	lb-in.	Nm	lb-in.	Nm	lb-in.
15	½	CF44	36	319	10.0	89	4 to 5	35 to 45
20	¾	CF44	36	319	16.0	142	4 to 5	35 to 45
25	1	CF44	63	558	20	177	4 to 5	35 to 45
40	1½	CF44	168	1,487	41	363	4 to 5	35 to 45
50	2	CF44	168	1,487	56	496	4 to 5	35 to 45

[3] Torque values are break to open torque with Fluorofill/Polyfill seat, as per AutoSize 4.3. CF44 @ 100 bar.

CF44 dimensions

Sizes DN15 to DN50 (NPS ½ to 2)



Dimensions, mm (in.)

Valve Size		Valve Series	Min. Port Ø	A	B	C[1]	D[1]	E Min.	Stem		J	K	N	P	Q	ISO Size[2]	Approx. Weight, kg (lb)
DN	NPS								F[1] (Across flats)	G Thread							
15	½	CF44	11.18 (0.44)	65.8 (2.59)	32.89 (1.295)	208.29 (8.20) 207.77 (8.18)	49.19 (1.937) 47.69 (1.878)	12.0 (0.472)	6.02 (0.237) 5.98 (0.235)	M10 X 1.5p	274.8 (10.82)	163.3 (6.43)	67.69 (2.665)	22.35 (0.88)	22.35 (0.88)	F04	2.2 (4.9)
20	¾	CF44	14.22 (0.56)	69.3 (2.73)	34.67 (1.365)	211.08 (8.31) 210.56 (8.29)	49.19 (1.937) 47.69 (1.878)	12.0 (0.472)	6.02 (0.237) 5.98 (0.235)	M10 X 1.5p	"277.6 (10.93)	163.3 (6.43)	67.69 (2.665)	25.53 (1.005)	25.53 (1.005)	F04	2.4 (5.3)
25	1	CF44	20.57 (0.81)	92.2 (3.63)	46.10 (1.815)	206.51 (8.13) 205.99 (8.11)	54.64 (2.151) 53.14 (2.092)	15.0 (0.591)	7.27 (0.286) 7.23 (0.284)	M12 X 1.75p	275.3 (10.84)	163.3 (6.43)	67.69 (2.665)	30.23 (1.19)	30.23 (1.19)	F04	3.2 (7.1)
40	1½	CF44	31.75 (1.25)	113.5 (4.47)	56.77 (2.235)	249.43 (9.82) 248.91 (9.80)	61.85 (2.435) 60.35 (2.376)	15.0 (0.591)	9.50 (0.374) 9.46 (0.372)	M18 X 2.5p	325.6 (12.82)	239.5 (9.43)	67.79 (2.669)	40.64 (1.6)	40.64 (1.6)	F07	6.8 (15.0)
50	2	CF44	38.1 (1.5)	133.4 (5.25)	66.68 (2.625)	254.26 (10.01) 253.74 (9.99)	61.85 (2.435) 60.35 (2.376)	15.0 (0.591)	9.50 (0.374) 9.46 (0.372)	M18 X 2.5p	330.5 (13.01)	239.5 (9.43)	67.79 (2.669)	48.26 (1.9)	48.26 (1.9)	F07	8.4 (18.5)

[1] Dimensions C, D and F are indicated for the minimum and maximum tolerances to support mounting kits and automation. All other dimensions indicate their centerline.

[2] ISO platform dimensions as per ISO 5211.

Worcester Cryogenic CF51/CF52 reduced-port, flanged ball valve series

Flowserve engineered Worcester Cryogenic CF51/CF52 series valves to provide bubble-tight shut-off and superior fugitive emissions controls in a wide variety of cyrogenic applications, including LNG, hydrogen and other industrial gases.

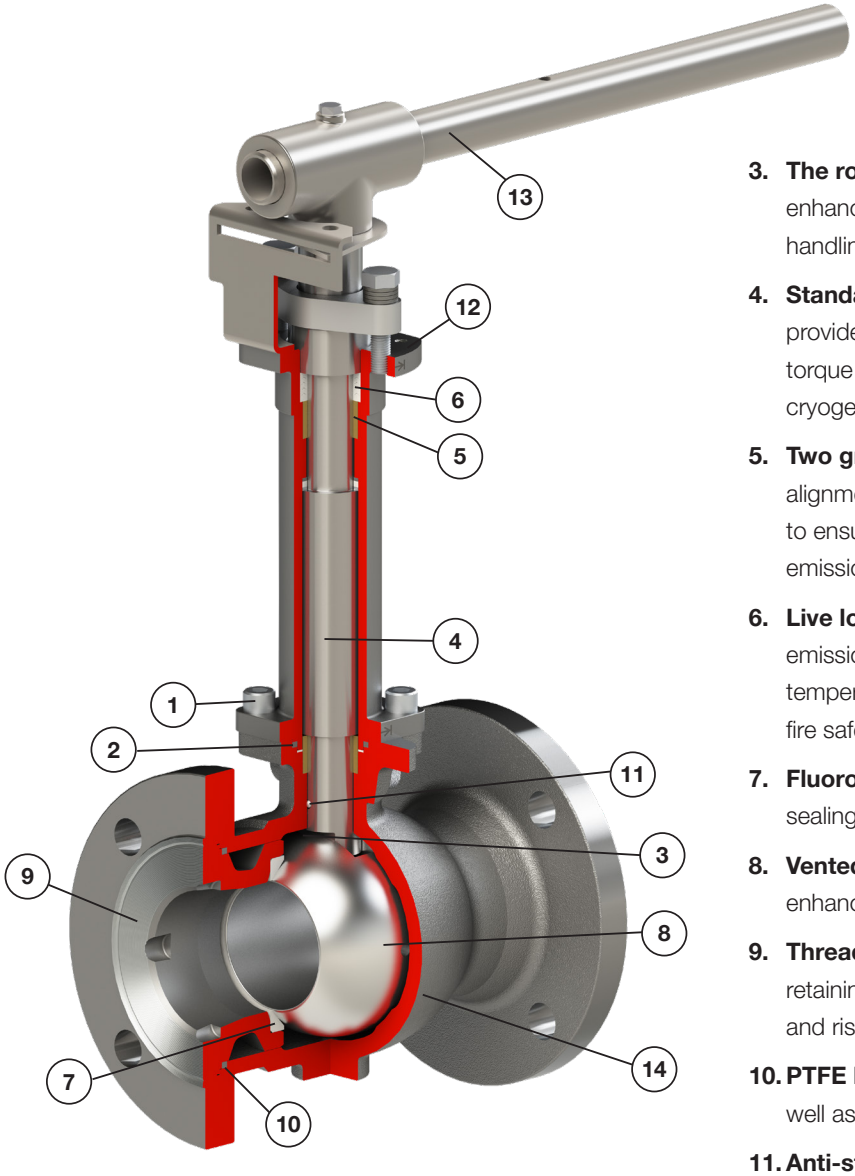
Their robust, live-loaded packing design ensures compliance with ISO 15848 fugitive emissions requirements.

The valves provide enhanced safety as well. In addition to being certified to API 607 and ISO 10497 fire safety standards, the threaded end plug design ensures positive retention and eliminates any blowout risk.

Standards of compliance

Specifications	• BS EN ISO 17292 and API 608 • ASME B16.34 • MSS SP-134, BS 6364 and ISO 28291 • Pressure Equipment Directive 2014/68/EU • Pressure Equipment Regulations SI 2016 • Assessment Category: Pressure Accessory, Group 1 GAS, Table 6, Module 'H', Category III • SIL 3 Capable • TSG, CRN
Face-to-face	• CF51 series: BS EN 558-2 and ASME B16.10 • CF52 series: BS EN 558-2 and ASME B16.10
Flanged connections	• CF51 series: BS EN 1759-1 and ASME B16.5 CL150 • CF52 series: BS EN 1759-1 and ASME B16.5 CL300
Fugitive emissions	ISO 15848: Class BH and API 641
Surface quality	MSS SP-55
Fire test	API 607 and ISO 10497
Pressure test	BS EN 12266-1, ISO 5208 and API 598
Sour service	NACE MR0175 and ISO 15156 or MR0103

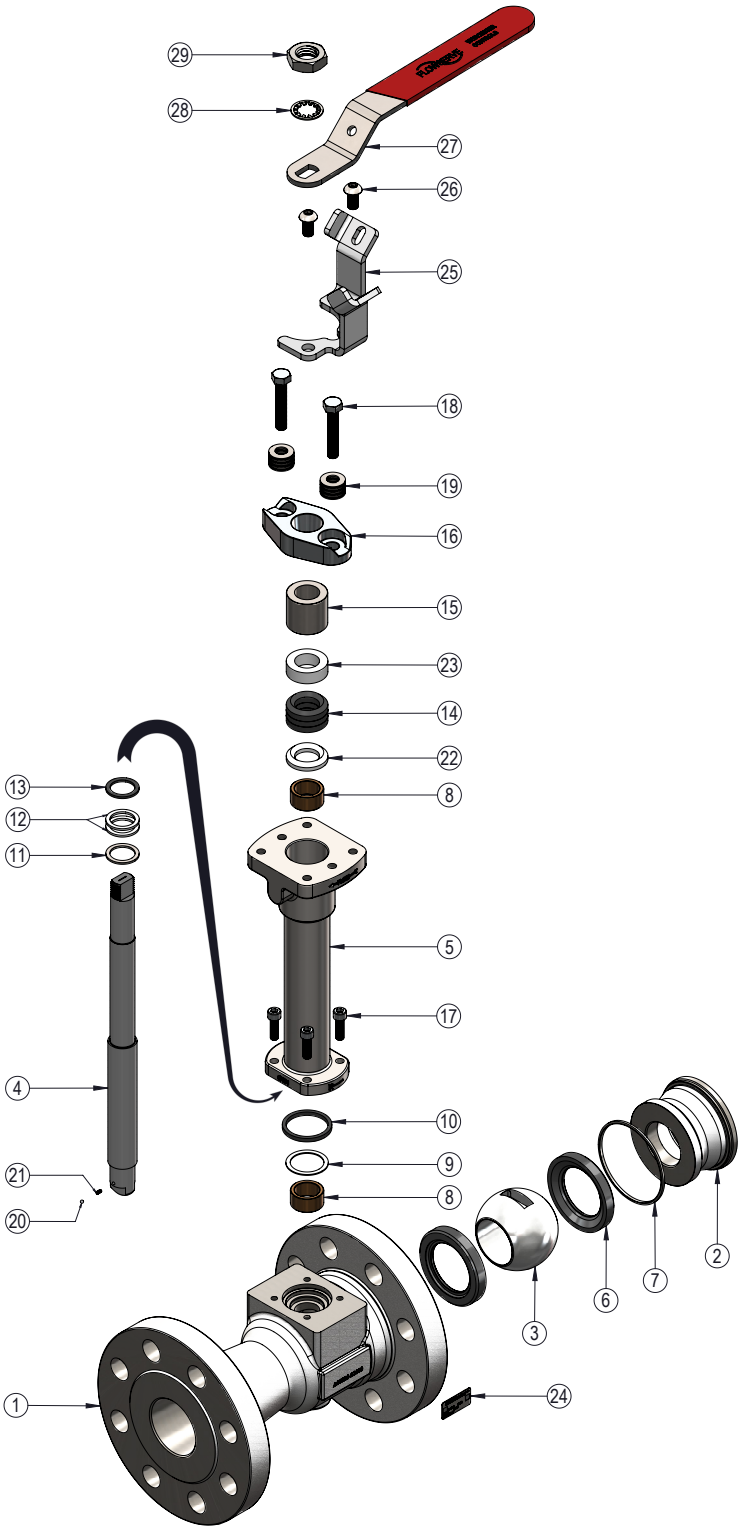
CF51/CF52 features and benefits



1. **Bolt-on cryogenic bonnet extension** protects packing and external sealing integrity from the cryogenic temperatures. It also reduces assembly complexity and greatly simplifies valve maintenance.
2. **PTFE and graphite bonnet seal** achieves API 607/ISO 10497 fire-safe and API 641/ISO 15848 fugitive emissions compliance without welding.
3. **The robust drive train** uses a single piece stem and an enhanced stem-to-ball connection for improved torque handling capability, reliability and service longevity.
4. **Standard strain-hardened 316 stainless steel stem** provides a 2X safety factor on cryogenic valve operating torque while meeting the ductility requirements at cryogenic temperatures.
5. **Two graphite bronze stem bearings** maintain stem alignment under manual or automated torque loading to ensure long term stem seal performance and fugitive emissions compliance.
6. **Live loaded PTFE chevron packing** maintains fugitive emissions compliance across the full valve operating temperature range. Secondary stem seals further enhance fire safety and fugitive emissions performance.
7. **Fluorofill/Polyfill seats** provide excellent cryogenic sealing performance.
8. **Vented ball** balances pressure with the upstream side for enhanced safety in expansive media applications.
9. **Threaded insert** provides a safe and simple method of retaining the valve contents while eliminating leak paths and risks associated with using retaining screws.
10. **PTFE body seals** comply with fire safety requirements as well as fugitive emissions standards.
11. **Anti-static stem assembly** ensures electrical continuity among ball, stem and body.
12. **Actuator mounting** conforms to ISO 5211 and Shell MESC SPE 77/300 for ease of automation.
13. **Locking wrench** is standard on sizes through NPS 4. NPS 6 and 8 are bare stem with gear or other operators available.
14. **Impact testing is standard.** Pressure-containing materials are tested to comply with PED requirements at typical cryogenic temperatures, i.e., -196°C (-321°F).

CF51/CF52 parts and materials

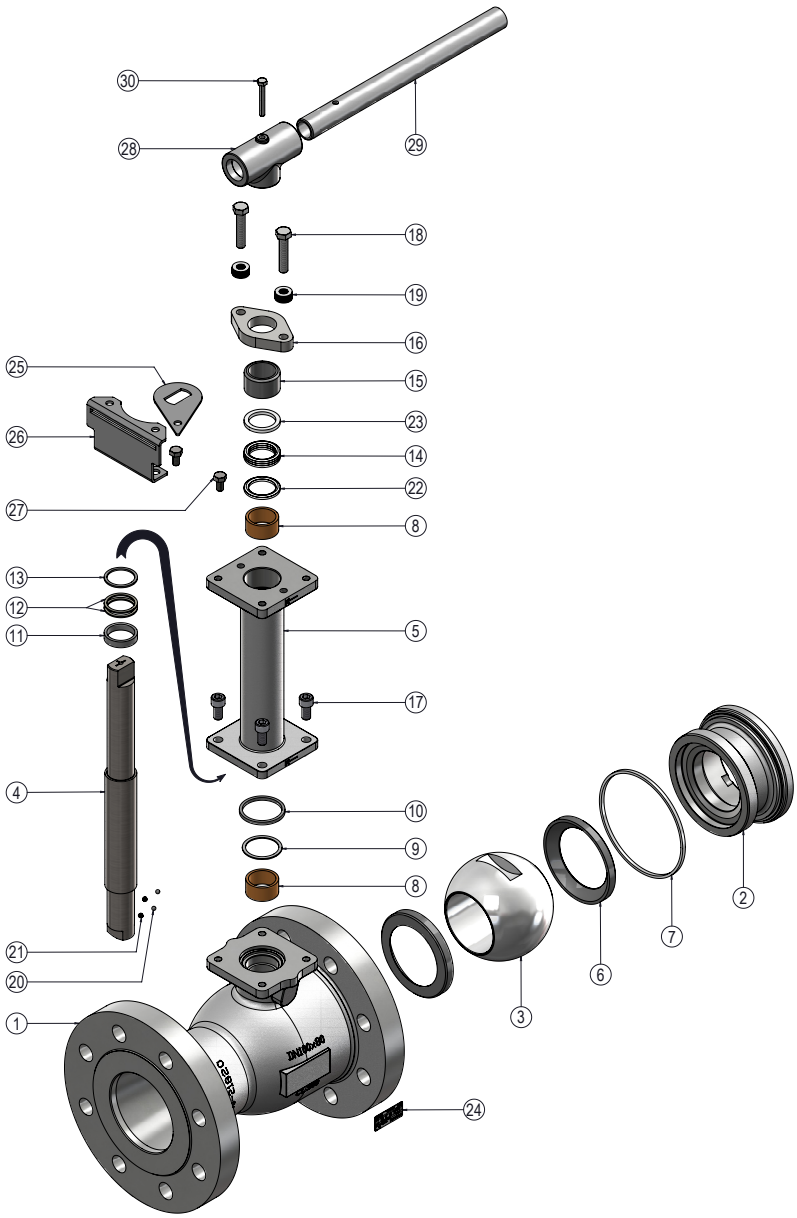
Sizes DN15 to DN50 (NPS ½ to 2)



Item	Description	Material
1	Body	ASTM A351 CF8M stainless steel
2	Insert	ASTM A351 CF8M stainless steel
3	Ball	ASTM A351 CF8M stainless steel
4	Stem	ASTM A479 316 SH1 stainless steel
5	Bonnet	ASTM A351 CF8M stainless steel
6	Seat	Fluorofill
7	Body Seal	Virgin PTFE
8	Stem Bearing	Graphite-filled 841 bronze
9	Bonnet Seal	Virgin PTFE
10	Fire-Safe Bonnet Seal	Flexible graphite
11	Support Washer	ASTM 316 stainless steel
12	Thrust Seal	Virgin PTFE
13	Fire-Safe Seal	Flexible graphite
14	Chevron Packing	Virgin PTFE
15	Gland Follower	ASTM 316 stainless steel
16	Gland Flange	ASTM A890 Grade CD4MCuN duplex stainless steel
17	Socket Head Cap Screw	ASTM A193 Grade B8M Class 2
18	Gland Bolt	ASTM A193 Grade B8M Class 2
19	Belleville Washer	Stainless steel
20	Anti-Static Ball	Stainless steel
21	Anti-Static Spring	Stainless steel
22	Packing Ring Bottom	Virgin PTFE
23	Packing Ring Top	Virgin PTFE
24	Nameplate	ASTM 304 stainless steel
25	Locking Bracket	ASTM A666 UNS S30400- SS304
26	Button Head Screw	ASTM 300 grade stainless steel
27	Locking Handle	ASTM A666 UNS S30400 - SS304/ vinyl plastisol coated
28	Lockwasher	ASTM 300 grade stainless steel
29	Handle Nut	ASTM 300 grade stainless steel

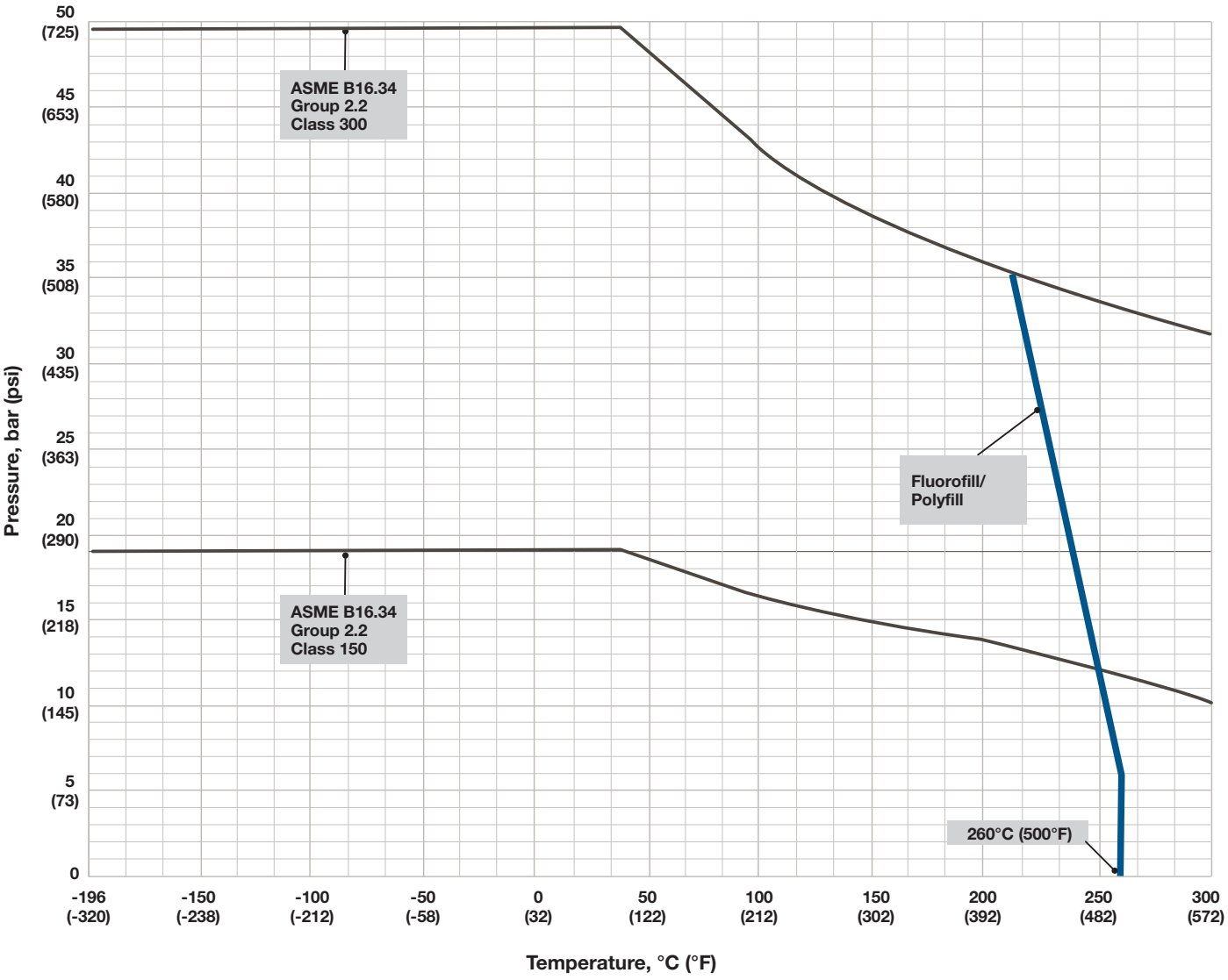
CF51/CF52 parts and materials

Sizes DN80 to DN200 (NPS 3 to 8)



Item	Description	Material
1	Body	ASTM A351 CF8M stainless steel
2	Insert	ASTM A351 CF8M stainless steel
3	Ball	ASTM A351 CF8M stainless steel
4	Stem	ASTM A479 316 SH1 stainless steel
5	Bonnet	ASTM A351 CF8M stainless steel
6	Seat	Fluorofill
7	Body Seal	Virgin PTFE
8	Stem Bearing	Graphite-filled 841 bronze
9	Bonnet Seal	Virgin PTFE
10	Fire-Safe Bonnet Seal	Flexible graphite
11	Support Washer	ASTM 316 stainless steel
12	Thrust Seal	Virgin PTFE
13	Fire-Safe Seal	Flexible graphite
14	Chevron Packing	Virgin PTFE
15	Gland Follower	ASTM 316 stainless steel
16	Gland Flange	ASTM A890 Grade CD4MCuN duplex stainless steel
17	Socket Head Cap Screw	ASTM A193 Grade B8M Class 2
18	Gland Bolt	ASTM A193 Grade B8M Class 2
19	Belleville Washers	Stainless steel
20	Anti-Static Ball	Stainless steel
21	Anti-Static Spring	Stainless steel
22	Packing Ring Bottom	Virgin PTFE
23	Packing Ring Top	Virgin PTFE
24	Nameplate	ASTM 304 stainless steel
25	Lock Plate - Moving	ASTM 316 stainless steel
26	Lock Plate - Fixed	ASTM 316 stainless steel
27	Hex. Head Screw	Stainless steel - SS304
28	Wrench	ASTM A351 CF8 stainless steel
29	Wrench Extension	ASTM 304 stainless steel
30	Hex. Head Screw	Stainless steel

CF51/CF52 pressure/temperature



Material groupings

Material group pressure-temperature ratings are taken from ASME B16.34. Group 2.2 represents our CF8M material.

Fluorofill/Polyfill (P) seat material

Seats made from PTFE reinforced with carbon, glass and graphite have outstanding dimensional stability across a broad temperature range. This material is well-suited for a variety of thermal services, including steam and cryogenic applications. Due to its high cycling capabilities, Fluorofill seats are recommended for modulating control applications.

Temperature range: -254°C to 260°C (-425°F to 500°F)

For temperatures below -196°C (-321°F), consult factory for seat material selection and performance criteria.

CF51/CF52 technical information

Flow coefficients

Valve Size		Flow Coefficients		Equivalent Length of Pipe	
DN	NPS	Cv [1]	Kv [2]	m	ft
15	½	8	7	1.19	3.9
20	¾	12	10	2.65	8.7
25	1	32	28	1.10	3.6
40	1½	82	71	1.13	3.7
50	2	120	104	1.98	6.5
80	3	350	303	2.16	7.1
100	4	720	623	2.10	6.9
150	6	1,020	882	6.22	20.4
200	8	1,800	1,557	11.49	37.7

[1] Cv: Flow in US gpm (measured with a pressure drop across the valve of 1 psi)

[2] Kv: Flow in m^3/h (measured with a pressure drop across the valve of 1 bar)

Torque values[3]

Valve Size		Valve Series	Maximum Allowable Stem Torque (MAST)		Break-to-Open Torque With Polyfill Seat		Gland Bolt Tightening Torque	
DN	NPS		Nm	lb-in.	Nm	lb-in.	Nm	lb-in.
15	½	CF51	36	319	10.0	89	4 to 5	35 to 45
		CF52	36	319	10.0	89	4 to 5	35 to 45
20	¾	CF51	36	319	12.0	106	4 to 5	35 to 45
		CF52	36	319	13.0	115	4 to 5	35 to 45
25	1	CF51	63	558	14	124	4 to 5	35 to 45
		CF52	63	558	17	150	4 to 5	35 to 45
40	1½	CF51	168	1,487	27	239	4 to 5	35 to 45
		CF52	168	1,487	32	283	4 to 5	35 to 45
50	2	CF51	168	1,487	37	327	4 to 5	35 to 45
		CF52	168	1,487	44	389	4 to 5	35 to 45
80	3	CF51	950	8,408	99	876	6 to 8	55 to 68
		CF52	950	8,408	133	1,177	6 to 8	55 to 68
100	4	CF51	950	8,408	148	1,310	6 to 8	55 to 68
		CF52	950	8,408	193	1,708	6 to 8	55 to 68
150	6	CF51	2,161	19,125	228	2,018	13 to 16	115 to 138
		CF52	2,161	19,125	271	2,398	13 to 16	115 to 138
200	8	CF51	3,642	32,232	341	3,018	13 to 16	115 to 138
		CF52	3,642	32,232	422	3,735	13 to 16	115 to 138

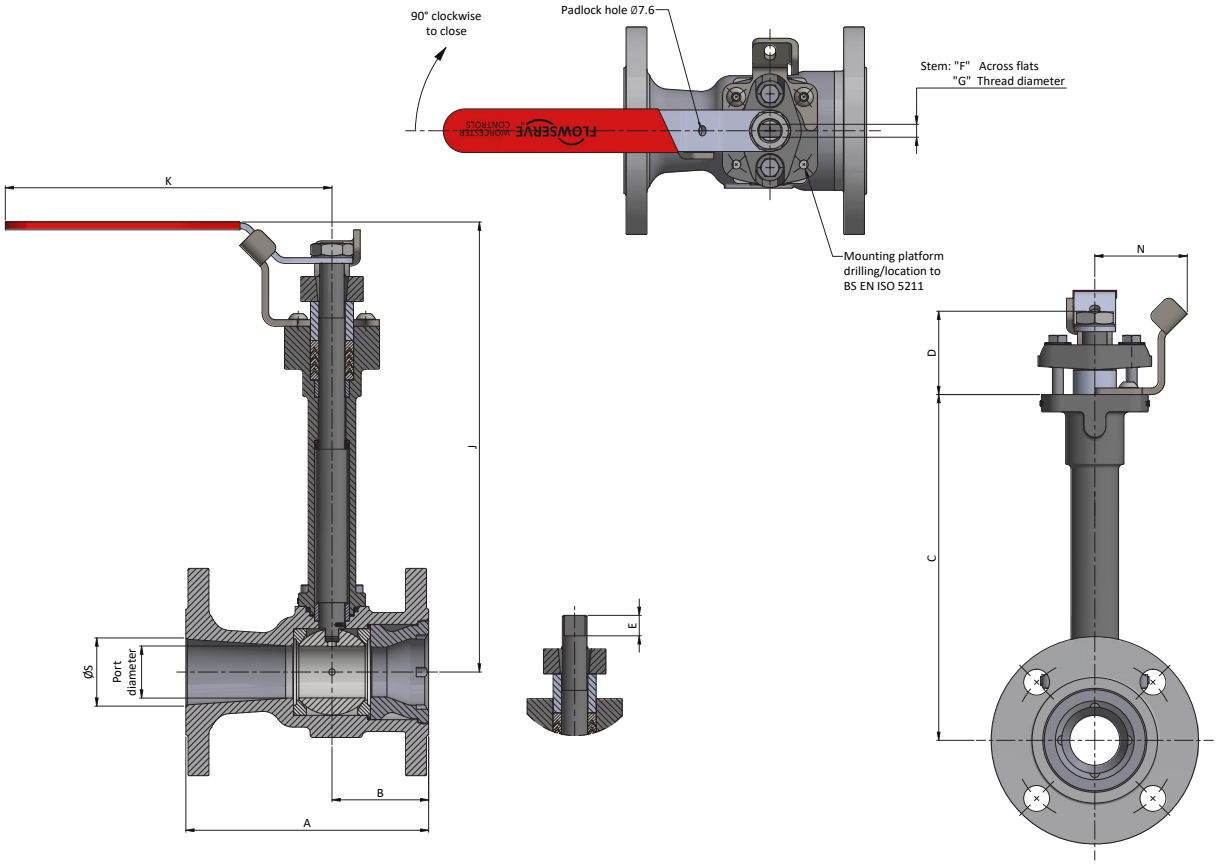
[3] Torque values are break to open torque with Fluorofill/Polyfill seat, as per AutoSize 4.3.

Duty factor = 0

CF51 @ 20 bar; CF52 @ 50 bar

CF51/CF52 dimensions

Sizes DN15 to DN50 (NPS ½ to 2)



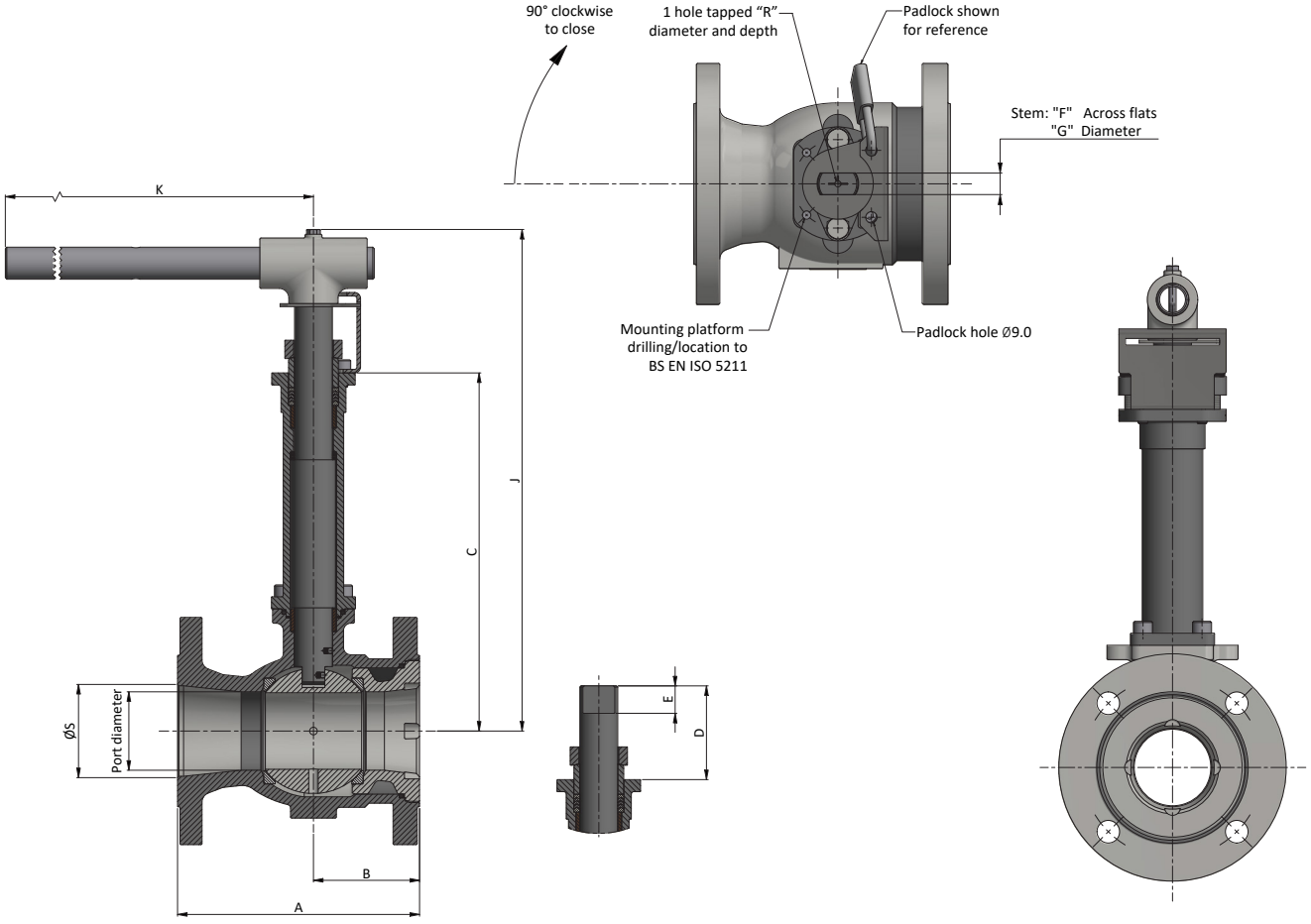
Dimensions, mm (in.)

Valve Size		Valve Series	Min. Port Ø	A	B	C (1)		D (1)		E Min.	Stem			J	K	N	S Ø	ISO Size (2)	Approx. Weight, kg (lb)
DN	NPS										F (1) (Across flats)		G Thread						
15	½	CF51	11.1 (0.437)	108 (4.252)	52.5 (2.067)	200.67 200.15	(7.90) (7.88)	49.19 47.69	(1.937) (1.878)	12.0 (0.472)	6.02 5.98	(0.237) (0.235)	M10 x 1.5p	267.2 (10.519)	163.3 (6.43)	67.69 (2.665)	15.0 (0.591)	F04	3.1 (6.8)
		CF52	11.1 (0.437)	140 (5.512)	52.5 (2.067)	200.67 200.15	(7.90) (7.88)	49.19 47.69	(1.937) (1.878)	12.0 (0.472)	6.02 5.98	(0.237) (0.235)	M10 x 1.5p	267.2 (10.519)	163.3 (6.43)	67.69 (2.665)	15.0 (0.591)	F04	3.7 (8.2)
20	¾	CF51	14.4 (0.567)	117 (4.606)	54.6 (2.15)	200.67 200.15	(7.90) (7.88)	49.21 47.71	(1.937) (1.878)	12.0 (0.472)	6.02 5.98	(0.237) (0.235)	M10 x 1.5p	267.2 (10.52)	163.3 (6.43)	67.69 (2.665)	20.0 (0.787)	F04	3.6 (7.9)
		CF52	14.4 (0.567)	152 (5.984)	54.6 (2.15)	200.67 200.15	(7.90) (7.88)	49.21 47.71	(1.937) (1.878)	12.0 (0.472)	6.02 5.98	(0.237) (0.235)	M10 x 1.5p	267.2 (10.52)	163.3 (6.43)	67.69 (2.665)	20.0 (0.787)	F04	4.9 (10.8)
25	1	CF51	20.7 (0.815)	127 (5.0)	57.2 (2.252)	200.56 200.04	(7.896) (7.876)	54.64 53.14	(2.151) (2.092)	15.0 (0.591)	7.27 7.23	(0.286) (0.284)	M12 x 1.75p	269.4 (10.607)	163.3 (6.43)	67.69 (2.665)	27.0 (1.063)	F04	4.6 (10.1)
		CF52	20.7 (0.815)	165 (6.496)	68.2 (2.685)	200.56 200.04	(7.896) (7.876)	54.64 53.14	(2.151) (2.092)	15.0 (0.591)	7.27 7.23	(0.286) (0.284)	M12 x 1.75p	269.4 (10.607)	163.3 (6.43)	67.69 (2.665)	27.0 (1.063)	F04	6.3 (13.9)
40	1½	CF51	31.8 (1.252)	165 (6.496)	66.6 (2.622)	249.03 248.51	(9.804) (9.784)	61.85 60.35	(2.435) (2.376)	15.0 (0.591)	9.50 9.46	(0.374) (0.372)	M18 x 2.5p	325.2 (12.803)	239.5 (9.43)	67.79 (2.669)	40.0 (1.575)	F07	8.6 (18.6)
		CF52	31.8 (1.252)	190 (7.48)	66.6 (2.622)	249.03 248.51	(9.804) (9.784)	61.85 60.35	(2.435) (2.376)	15.0 (0.591)	9.50 9.46	(0.374) (0.372)	M18 x 2.5p	325.2 (12.803)	239.5 (9.43)	67.79 (2.669)	40.0 (1.575)	F07	11.8 (26.0)
50	2	CF51	38.2 (1.504)	178 (7.008)	70.9 (2.791)	253.76 253.24	(9.991) (9.970)	61.85 60.35	(2.435) (2.376)	15.0 (0.591)	9.50 9.46	(0.374) (0.372)	M18 x 2.5p	329.9 (12.989)	239.5 (9.43)	67.79 (2.669)	50.0 (1.969)	F07	11.1 (24.5)
		CF52	38.2 (1.504)	216 (8.504)	70.9 (2.791)	253.76 253.24	(9.991) (9.970)	61.85 60.35	(2.435) (2.376)	15.0 (0.591)	9.50 9.46	(0.374) (0.372)	M18 x 2.5p	329.9 (12.989"	239.5 (9.43)	67.79 (2.669)	50.0 (1.969)	F07	14.0 (30.9)

(1) Dimensions C, D and F are indicated for the minimum and maximum tolerances to support mounting kits and automation. All other dimensions indicate their centerline.

(2) ISO platform dimensions as per ISO 5211.

Sizes DN80 to DN200 (NPS 3 to 8)



Dimensions, mm (in.)

Valve Size		Valve Series	Min. Port Ø	A	B	C [1]		D [1]		E Min.	Stem				J	K	S Ø	R Thread and Depth	ISO Size [2]	Approx. Weight, kg (lb)
DN	NPS										F [1] (Across flats)		G [1] Thread							
80	3	CF51	65.8 (2.591)	203.0 (7.992)	89.0 (3.504)	300.79 (11.843)		79.62 (3.135)		23.0 (0.906)	17.02 (0.671)		31.81 (1.253)		420.8 (16.568)	349.0 (13.74)	78.2 (3.079)	M6 x 1.0p x 12.0 (0.472) Min.	F07	22.5 (49.6)
						300.13 (11.817)		77.62 (3.056)			16.98 (0.669)		31.65 (1.247)							
		CF52	64.2 (2.528)	282.0 (11.102)	89.0 (3.504)	300.79 (11.843)		79.62 (3.135)		23.0 (0.906)	17.02 (0.671)		31.81 (1.253)		420.8 (16.568)	349.0 (13.74)	78.5 (3.09)	M6 x 1.0p x 12.0 (0.472) Min.	F07	30.7 (67.7)
						300.13 (11.817)		77.62 (3.056)			16.98 (0.669)		31.65 (1.247)							
100	4	CF51	76.5 (3.012)	229.0 (9.016)	107.0 (4.213)	351.33 (13.832)		83.37 (3.283)		23.0 (0.906)	17.02 (0.671)		31.81 (1.253)		475.1 (18.706)	349.0 (13.74)	104.4 (4.11)	M6 x 1.0p x 12.0 (0.472) Min.	F10	33.9 (74.7)
						350.67 (13.806)		81.37 (3.204)			16.98 (0.669)		31.65 (1.247)							
		CF52	76.5 (3.012)	305.0 (12.008)	107.0 (4.213)	358.83 (14.128)		76.87 (3.027)		23.0 (0.906)	17.02 (0.671)		31.81 (1.253)		476.1 (18.745)	557.0 (21.929)	104.5 (4.114)	M6 x 1.0p x 12.0 (0.472) Min.	F10	47.5 (104.7)
						358.17 (14.102)		74.87 (2.948)			16.98 (0.669)		31.65 (1.247)							
150	6	CF51	102.3 (4.028)	267.0 (10.512)	129.0 (5.079)	426.33 (16.785)		113.63 (4.474)		32.0 (1.26)	23.99 (0.945)		38.18 (1.504)		-	-	154.0 (6.063)	-	F12	57.3 (126.3)
						425.67 (16.759)		111.63 (4.395)			23.94 (0.943)		38.02 (1.497)							
		CF52	102.3 (4.028)	403.0 (15.866)	129.0 (5.079)	432.83 (17.041)		107.13 (4.218)		32.0 (1.26)	23.99 (0.945)		38.18 (1.504)		-	-	154.0 (6.063)	-	F12	87.6 (193.1)
						432.17 (17.015)		105.13 (4.139)			23.94 (0.943)		38.02 (1.497)							
200	8	CF51	153 (6.024)	292.0 (11.496)	144.5 (5.689)	451.14 (17.762)		130.2 (5.126)		40.0 (1.575)	29.02 (1.143)		44.51 (1.753)		-	-	206.5 (8.13)	-	F14	102.3 (225.5)
						450.48 (17.736)		128.2 (5.048)			28.98 (1.141)		44.35 (1.747)							
		CF52	153 (6.024)	419.0 (16.496)	144.5 (5.689)	463.33 (18.242)		118.2 (4.654)		40.0 (1.575)	29.02 (1.143)		44.51 (1.753)		-	-	206.5 (8.13)	-	F14	147.0 (324.0)
						462.67 (18.216)		116.2 (4.575)			28.98 (1.141)		44.35 (1.747)							

[1] Dimensions C, D, F and G are indicated for the minimum and maximum tolerances to support mounting kits and automation. All other dimensions indicate their centerline.

[2] ISO platform dimensions as per ISO 5211.

Product code

Example 1:	**20**	**CF**	**44**	**1**	**1**	**6**	**6**	**P**	**Z**	**T**	**-**	**T**	**BW4**	_____
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Example 2:	**40**	**CF**	**52**	**6**	**6**	**6**	**6**	**P**	**T**	**T**	**-**	**T**	**300**	_____
	1	2	3	4	5	6	7	8	9	10	11	12	13	14

1. Size

Code	DN	NPS
05	15	½
07	20	¾
10	25	1
15	40	1½
20	50	2
30	80	3
40	100	4
60	150	6
80	200	8

2. Variant

CF Cryogenic fire-safe, with extension

3. Series

51 Class 150 one-piece valve
52 Class 300 one-piece valve
44 Class 600 three-piece valve

4. Body

1 Brass
6 CF8M

5. Connector/insert

1 Brass
6 CF8M

6. Ball

1 Brass
6 CF8M

7. Stem

6 316

8. Seat

P Fluorofill/Polyfill

9. Body seal

T Virgin PTFE
Z PTFE coated graphite

10. Thrust seal

T Virgin PTFE

11. Secondary stem seal

- No Option

12. Stem packing

T V-PTFE
Z Graphite

13. Gland packing

SEN Screwed — NPT
SET Screwed — BSPT
SEP Screwed — BSPP
SWE Socket weld end
BW5 Buttweld schedule 5
BW1 Buttweld schedule 10
BW4 Buttweld schedule 40
BW8 Buttweld schedule 80
150 ANSI B16.5 Class 150
300 ANSI B16.5 Class 300
SAE Female SAE threaded
SWO Socket weld OD tube

14. Special

Consult factory for “special” options.

Notes:

- 44 series have PTFE-coated graphite body seals as standard, whereas the 51/52 series has virgin PTFE body seals as standard.
- Worcester Cryogenic fire-safe valves do not have secondary stem seals as a standard option.
- Fire-safe, non-extended versions available upon request. Please consult factory for availability and coding options.
- Common end connector/flange variants are available upon request. Please consult factory for availability and coding options.

Digitize operations to improve uptime and yield at lower cost

Get the insights and tools needed to monitor, analyze and predict the performance of Worcester Cryogenic series valves with RedRaven from Flowserve, an end-to-end predictive maintenance solution.

Pairing Worcester Cryogenic series valves with a smart digital positioner from Flowserve enables plant operators to leverage the internet of things (IoT) for a connected platform of smart products, software and services. They can quickly respond to equipment issues in order to minimize disruptions and downtime.

Smart digital positioners from Flowserve are RedRaven Ready. That means they are designed and built to accept RedRaven wired or wireless sensors using cloud architecture for condition monitoring and predictive analytics services.

RedRaven provides clear insights that can enable companies to significantly improve equipment, process and system efficiency, productivity and reliability.

Contact your Flowserve representative or visit https://www.flowserve.com/redraven for more information.

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