Fisher™ HP Cryogenic Sliding-Stem Control Valves

Fisher HP cryogenic valves are high-pressure, single-port, globe-style valves featuring stainless steel construction materials and fabricated extension bonnets. The HPT-C valve is a balanced design, whereas the HPS-C valve is an unbalanced design. These cryogenic valves are designed to provide throttling or on/off control of liquids and gases at cryogenic temperatures as low as -198°C (-325°F).

When required, these rugged valves can reliably provide tight shutoff for special applications within the chemical and hydrocarbon processing industries, such as certain liquefied natural gas services.

The HPT-C valve with pressure-balanced trim allows smooth control at high pressure drops in a cryogenic environment.

X1367

FISHER HP-C VALVE WITH 657 ACTUATOR

HP Cryogenic Valves

- HPT-C: These valves use a balanced valve plug with ultra high molecular weight polyethylene (UHMWPE) seal ring for excellent shutoff at low temperature. Different cage/plug styles provide particular flow characteristics for highly-specialized applications. Available flow characteristics are ■ equal percentage, ■ linear, and ■ modified equal percentage.

- HPS-C: These valves use an unbalanced valve plug and provide excellent shutoff. Interchangeable, restricted-capacity trims and full-sized trims match a variety of process flow demands for highly-specialized applications. Available flow characteristics include ■ equal percentage, ■ linear, and ■ modified equal percentage.

Features

- Cryogenic Spring-Loaded Seal Ring--The seal ring and associated valve parts in the HPT-C valve is specifically designed and manufactured for excellent performance at low temperatures.

- Stable Control--Rugged cage guiding in the HPT-C and HPS-C valves stabilizes the valve plug at all points in its travel to reduce vibration, mechanical noise, and the need for hydraulic snubbers.

- Cost Effective Operation and Economical Maintenance--Increased wear resistance of hardened stainless steel trim means long-lasting service. Balanced valve plug construction in the HPT-C valve permits use of spring and diaphragm Fisher actuators.

(continued on page 3)

Specifications

Available Configurations[1] and Valve Sizes

HPT-C: Single-port, globe-style control valve with cage-guiding, balanced valve plug, and push-down-to-close valve plug action (figures 1, 2, and 3)
HPS-C: Single-port, globe-style control valve with cage-guiding, unbalanced valve plug, and push-down-to-close valve plug action (figure 4)

Valve Sizes

HPS-C: ■ NPS 1 to 3 (CL900 and CL1500) ■ NPS 1 to 2 (CL2500)
HPT-C: ■ NPS 4 through 12 (CL900 and CL1500)

End Connections Styles[1]

CL900, 1500, and 2500 raised-face and ring-type-joint flanges per ASME B16.5.
Buttweld end connection per ASME B16.25.
PN160 and PN250 flanges per EN1092-1.

Maximum Inlet Pressure[1]

Consistent with CL900, 1500, and 2500 pressure/temperature ratings per ASME B16.34

Maximum Pressure Drop[1]

Consistent with CL900, 1500, and 2500 pressure/temperature ratings per ASME B16.34

Trim Material

See table 1

Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4

HPT-C and HPS-C
Metal Seat: ■ Class IV is standard ■ Class V Air Test is optional (Test will be at 50 psid air) [2]
Cryogenic Leak Test per SPE 77/306
HPT-C and HPS-C: Class C (optional)
Cryogenic Leak Test per BS6364: 1984
HPS-C: Available through CL2500 (optional)

Maximum Actuator Thrust

See table 4

Flow Characteristics

HPT-C and HPS-C
■ Equal percentage, ■ linear, ■ modified equal percentage

Flow Direction

HPT-C: Normally flow down for linear and equal percentage trims. Flow up for Whisper Trim™
HPS-C: Normally flow up

Construction Materials

Valve Body and Bonnet: CF8M
Body-bonnet Bolting: See table 2
Bonnet Bushing: S31600/filled PTFE
Spiral Wound Gasket: N06600/graphite
Packing Studs and Nuts: ■ S31600 SST, ■ B7, ■ B8M Class 2, and ■ B7M
Seal Ring (HPT-C): ■ UHMWPE with R30003 spring, ■ Modified PTFE with R30003 spring
Back-Up Ring (HPT-C): S31600 (316 SST)
Retaining Ring (HPT-C): ■ S30200 (302 SST), ■ 18-8 SST
Packing Follower, Lantern Ring, Packing Spring[3] and Packing Box Ring: S31600 SST

Material Temperature Capabilities[1]

HPT-C: -198 to 66°C (-325 to 150°F)
HPS-C: -198 to 316°C (-325 to 600°F)

Bonnet Extension Length

See figure 6 and tables 8 and 9 for standard valve dimensions

Flow Coefficients and Noise Level Prediction

See Fisher Catalog 12

Port Diameters, Valve Plug Travel, Yoke Boss, and Stem Diameters

See tables 5, 6, and 7

Packing Arrangements

Standard Material
■ Single PTFE V-ring. See figures 1 and 4
Optional Material
■ Double PTFE V-ring and
■ Graphite ribbon/filament
ENVIRO-SEAL™ Packing Systems
Packing Material: ■ PTFE V-ring and ■ Graphite ULF. See figure 5. Also see Fisher bulletin 59.1:061, ENVIRO-SEAL and HIGH-SEAL Packing System for Sliding-Stem Valves (D101633X012)

Options

HPT-C: ■ Whisper Trim III and WhisperFlo™ trim for aerodynamic noise attenuation, and ■ Cavitrol™ III cages for liquid cavitation protection are available. Contact your Emerson sales office for information
HPS-C: ■ Micro-Flute and ■ Micro-Flow trim

1. Do not exceed the pressure/temperature limits in this bulletin and any applicable code limits
2. Class V shutoff cannot be performed with water. The residual trapped moisture from testing with water can cause valve and trim damages from the ice crystals formed at below freezing service temperatures.
3. A spring is used only with PTFE V-ring packing. Lantern rings replace the spring in other packing arrangements.

Features (continued)

- Piping Economy--Expanded end connections on NPS 4 and 6 HP valves may reduce the need for line swages. while accommodating oversized piping arrangements used to limit fluid flow velocities.

- Cryogenic Design Features--The stainless steel valve body and bonnet with fabricated or one-piece extension are designed to meet low temperature requirements. The unique metal-to-metal seat design provides repeatable tight shutoff, reducing maintenance costs.

- Rugged Metal Seat--The metal-to-metal seat is designed and manufactured to provide long-lasting, reliable, tight shutoff at both ambient and cryogenic temperatures without the need for periodic lapping. This reduces the need for soft seats, even in applications with stringent shutoff requirements.

- Thoroughly Tested--Extensive cryogenic testing during the development of the valve design reduces the need for expensive cold testing for most applications, which results in quicker delivery and greater value.

- Fugitive Emission Protection--The optional ENVIRO-SEAL packing systems provide an improved stem seal to help prevent the loss of valuable or hazardous process fluids, and keep emissions below the EPA limit of 100 ppm. Additionally, these live-loaded packing systems can provide long life and reliability at low temperatures to help reduce maintenance costs and downtime.

- Easy Maintenance--Quick-change trim, with a clamped-in seat ring, reduces the disassembly/ assembly time. The valve body can stay in the pipeline during removal of trim parts for inspection or maintenance.

- Sour Service Capability--For NACE applications, consult your Emerson sales office.

- Smooth Control at High Pressure Drops--HPT-C available on NPS 4 through 12, balanced trim provides smooth control at high pressure drops.

- Extension Bonnet--Standard Style III extension bonnet to meet the low temperature requirements. Optional drip plate and special designs for cold box are available for different applications.

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Table 1. Fisher HPT-C and HPS-C Typical Trim Material

VALVE	TRIM CONSTRUCTION	VALVE PLUG	VALVE STEM	BACKUP RING	CAGE RETAINER	CAGE	SEAT RING
HPT-C	219	S31600 with CoCr-A seat and guide	S20910	316 SST	---	S31600/ Chrome Plate	S31600
	220						S31600 with CoCr-A seat
	223(1)				S31600/ Chrome Plate	S31600	---
HPS-C	221			---	---	S31600/ Chrome Coat	S31600
	222						S31600 with CoCr-A seat

1. Trim construction only available for NPS 4 through 12 (short).

Table 2. Bolting Material

VALVE	VALVE SIZE, NPS	RATING	BODY-BONNET BOLTING	
			Studs	Nuts
HPS-C	1 to 3	CL900 and 1500	SA-193-B8M Strain Hardened	SA-194-8M
			S20910/Chrome Coat	S20910
	1 and 2	CL2500	SA-193-B8M Strain Hardened	SA-194-8M
			S20910/Chrome Coat	S20910
HPT-C	4 and 6 (long)(2)	CL900	SA-193-B8M Strain Hardened	SA-194-8M
		CL1500	S20910/Chrome Coat	S20910
	4 to 12 (short)(3)	CL900 and 1500	S20910/Chrome Coat	S20910
			SA-193-B8M2(1)	SA-194-8M(1)

1. Short HP constructions are derated with this bolt material. Consult your Emerson sales office for information.
2. (Long) indicates industry standard long face-to-face.
3. (Short) Indicates industry standard short face-to-face.

Table 3. Approximate Weights (Valve and Bonnet Assemblies)

VALVE	VALVE SIZE, NPS	RATING	END CONNECTION			
			Flange		SWE, BWE	
			kg	lb	kg	lb
HPS-C	1	CL900 and 1500	51	113	48	105
		CL2500	55	120	44	96
	2	CL900 and 1500	81	178	61	135
		CL2500	113	249	84	184
	3	CL900	135	296	---	---
		CL1500	138	304	106	233
HPT-C with fabricated extension bonnet	4 (long)(1)	CL900	240	527	---	---
		CL1500	258	568	211	464
	6 (long)(1)	CL900	521	1147	---	---
		CL1500	567	1248	465	1023
	8 (short)(2)	CL900	809	1779	644	1417
		CL1500	999	2198	781	1718
	10 (short)(2)	CL900	1087	2392	887	1951
		CL1500	1560	3432	1193	2625
	12 (short)(2)	CL900	1349	2967	1044	2297
		CL1500	1953	4296	1425	3134
HPT-C with one-piece extension bonnet	4 (short)(2)	CL900	211	465	163	359
		CL1500	264	582	197	434
	6 (short)(2)	CL900	398	877	300	661
		CL1500	549	1210	389	858
	8 (short)(2)	CL900	725	1598	540	1190
		CL1500	964	2125	698	1539
	10 (short)(2)	CL900	1080	2381	833	1836
		CL1500	1574	3470	1115	2458
	12 (short)(2)	CL900	1433	3159	1053	2321
		CL1500	2133	4702	1494	3294

1. (Long) indicates industry standard long face-to-face.
2. (Short) Indicates industry standard short face-to-face.

Figure 1. Fisher HPT-C Valve Assembly Detail with Fabricated Extension Bonnet NPS 4 and 6 (Long)

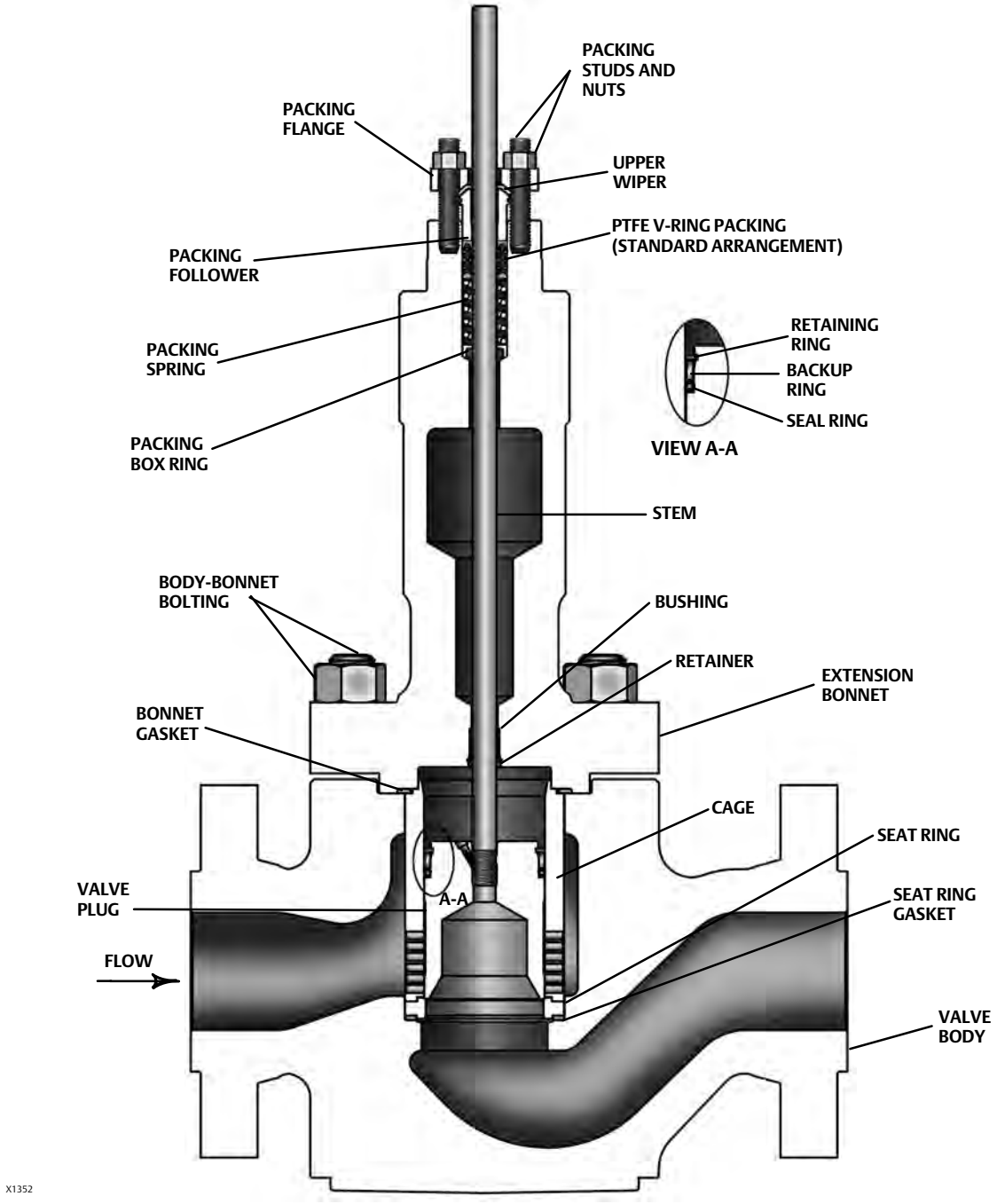


Figure 2. Fisher HPT-C Valve Assembly Detail with One-Piece Extension Bonnet NPS 4 and 6 (Short)

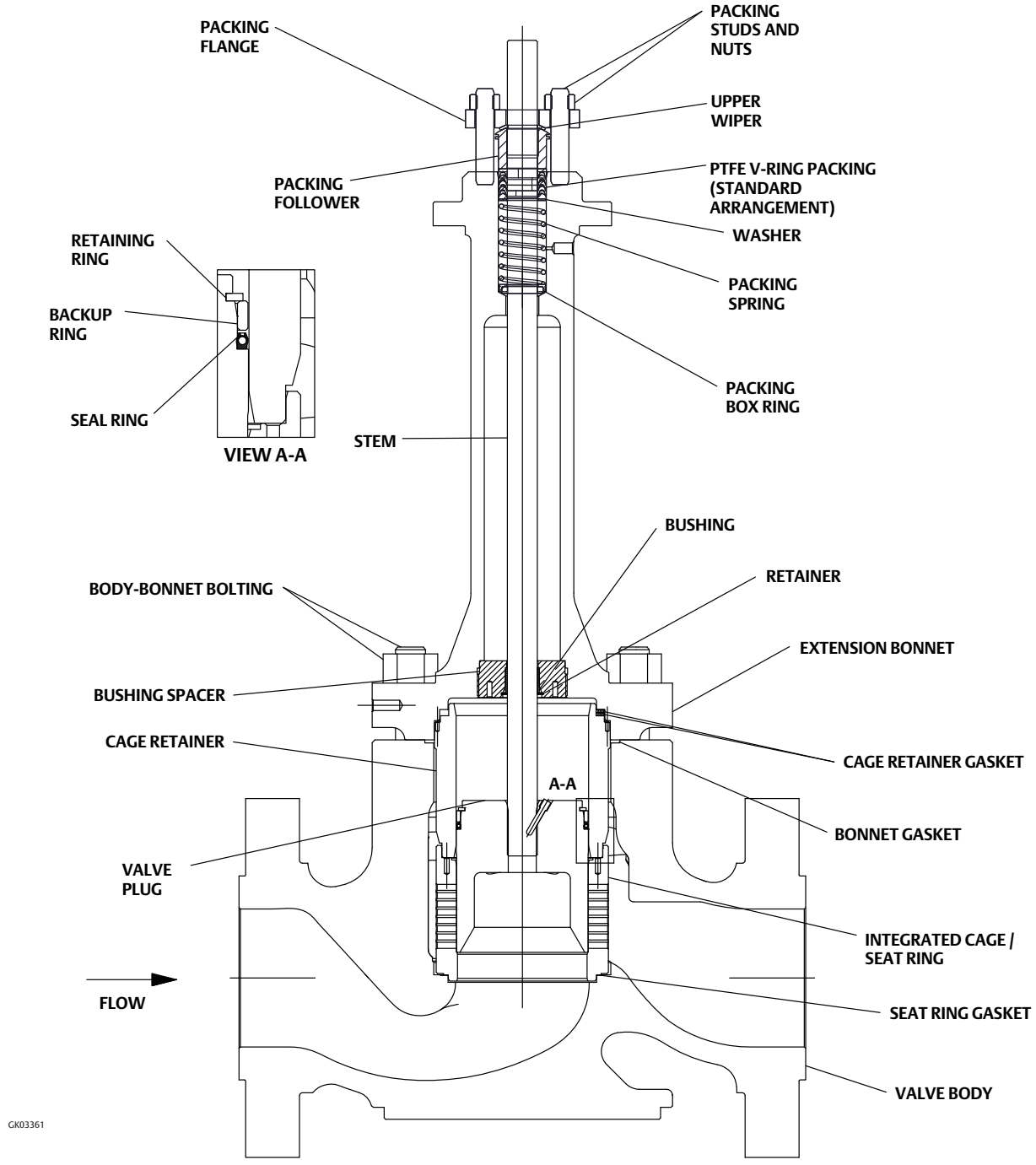
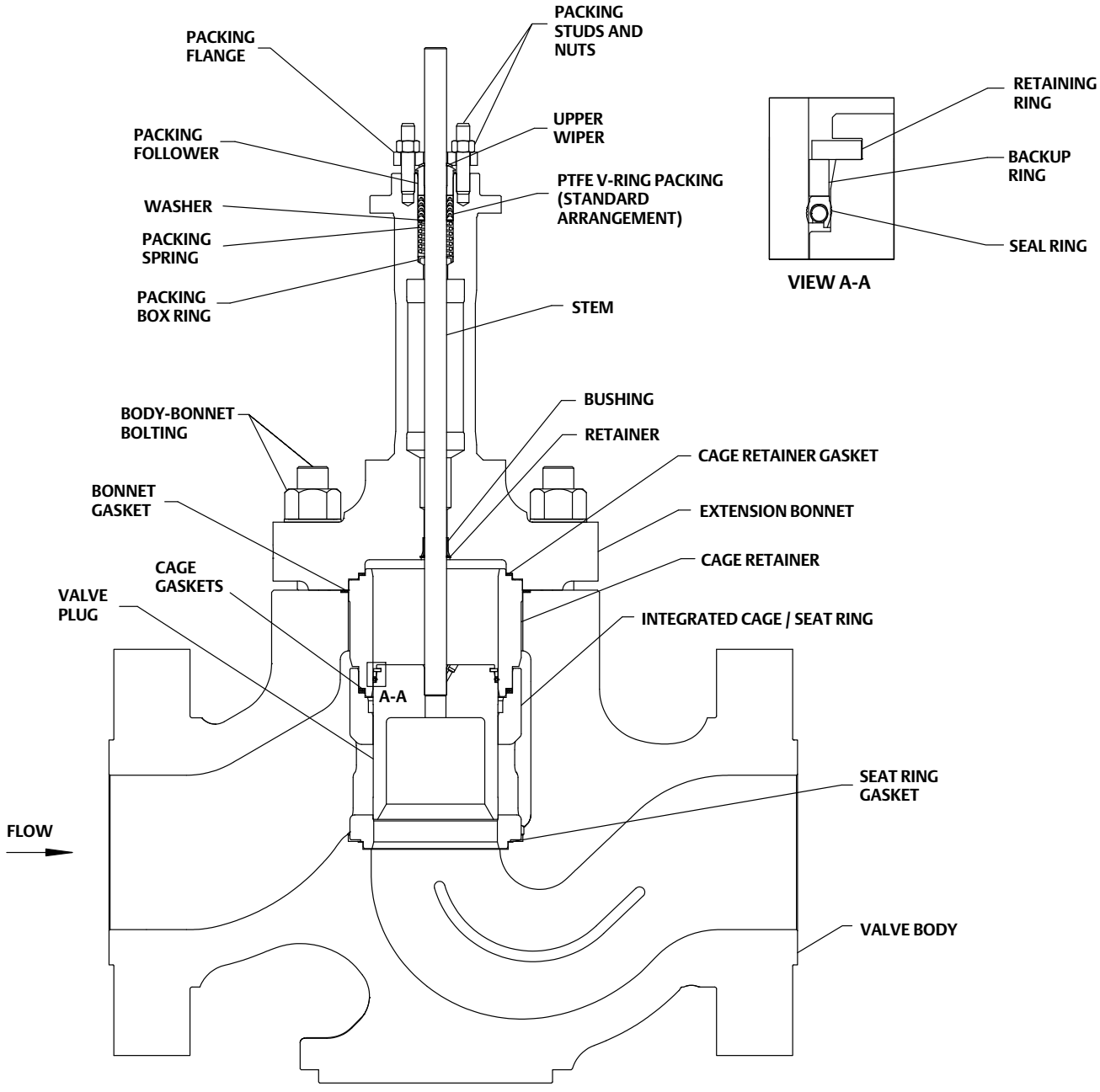


Figure 3. Fisher HPT-C Valve Assembly Detail with Fabricated Extension Bonnet NPS 8 through 12 (Long)



NOTE: One-piece extension bonnet option is also available for HPT-C NPS 8 through 12.

Figure 4. Fisher HPS-C Valve Assembly Detail NPS 1 through 3

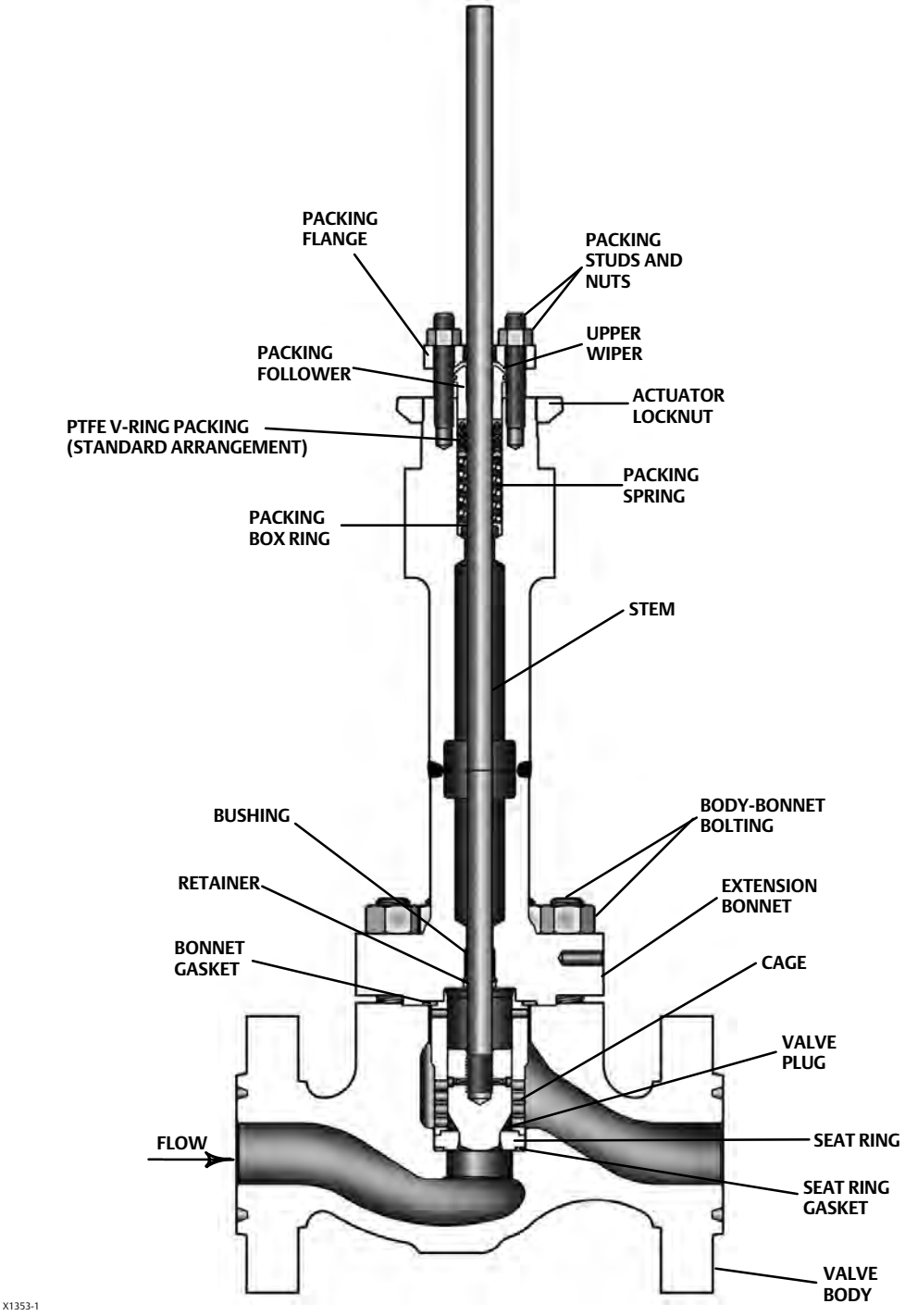


Table 4. Maximum Allowable Thrust for Style III Bonnet Extension Length

VALVE	VALVE SIZE	STEM DIAMETER		MAXIMUM ALLOWABLE STEM LOAD FOR S20910 STEM MATERIAL	
		mm	Inch	N	lb
HPS-C	1	12.7	1/2	15413	3465
		19.1	3/4	45176	10156
	2	12.7	1/2	16458	3700
		19.1	3/4	46738	10507
		25.4	1	95130	21386
	3	19.1	3/4	48873	10987
		25.4	1	89956	20223
HPT-C with fabricated extension bonnet	4 (long)(1)	19.1	3/4	48055	10803
		25.4	1	89956	20223
	6 (long)(1)	25.4	1	83382	18745
		31.8	1-1/4	139185	31290
	8 (short)(2)	25.4	1	83840	18848
		31.8	1-1/4	139741	31415
	10 (short)(2)	25.4	1	77662	17459
		31.8	1-1/4	133393	29988
	12 (short)(2)	25.4	1	80446	18085
		31.8	1-1/4	136280	30637
		50.8	2	378326	85051
HPT-C with one-piece extension bonnet	4 (short)(2)	19.1	3/4	46070	10357
		25.4	1	87158	19594
	6 (short)(2)	19.1	3/4	43348	9745
		25.4	1	84049	18895
		31.8	1-1/4	139941	31460
	8 (short)(2)	25.4	1	86118	19360
		31.8	1-1/4	142014	31926
	10 (short)(2)	25.4	1	82595	18568
		31.8	1-1/4	138469	31129
	12 (short)(2)	25.4	1	82154	18469
		31.8	1-1/4	138024	31029
		50.8	2	380029	85434

1. (Long) indicates industry standard long face-to-face.
2. (Short) Indicates industry standard short face-to-face.

Table 5. Fisher HPS-C CL900 and 1500 Port Diameters, Valve Plug Travel, Stem and Yoke Diameters

VALVE SIZE, NPS	FLOW CHARACTERISTIC	VALVE BODY DESIGN AND PLUG STYLE	PORT DIAMETER		VALVE PLUG TRAVEL		YOKE BOSS DIAMETER		VALVE STEM DIAMETER	
			mm	Inches	mm	Inches	mm	Inches	mm	Inches
1	Equal percentage	HPS w/Micro-Form	6.4	0.25	19	0.75	71	2-13/16	12.7	1/2
			12.7	0.5	19	0.75	71	2-13/16	12.7	1/2
			19.1	0.75	19	0.75	71, 90	2-13/16, 3-9/16	12.7, 19.1	1/2, 3/4
	Modified Equal percentage	HPS w/Micro-Form	19.1	0.75	29	1.125	71, 90	2-13/16, 3-9/16	12.7, 19.1	1/2, 3/4
			25.4	1	29	1.125	71, 90	2-13/16, 3-9/16	12.7, 19.1	1/2, 3/4
2	Equal percentage	HPS w/Micro-Form	6.4	0.25	19	0.75	71	2-13/16	12.7	1/2
			12.7	0.5	19	0.75	71	2-13/16	12.7	1/2
			19.1	0.75	19	0.75	71, 90	2-13/16, 3-9/16	12.7, 19.1	1/2, 3/4
		HPS	47.6	1.875	29	1.125	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
	Linear	HPS	47.6	1.875	38	1.5	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
	Modified Equal percentage	HPS w/Micro-Form	25.4	1	29	1.125	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
			31.8	1.25	29	1.125	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
			38.1	1.5	38	1.5	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
		HPS	47.6	1.875	38	1.5	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
3	Equal percentage	HPS	73	2.875	38	1.5	90, 127	3-9/16, 5	19.1, 25.4	3/4, 1
	Linear				51	2	90, 127	3-9/16, 5	19.1, 25.4	3/4, 1
	Modified Equal percentage						90, 127	3-9/16, 5	19.1, 25.4	3/4, 1

Table 6. Fisher HPS-C CL2500 Port Diameters, Valve Plug Travel, Stem and Yoke Diameters

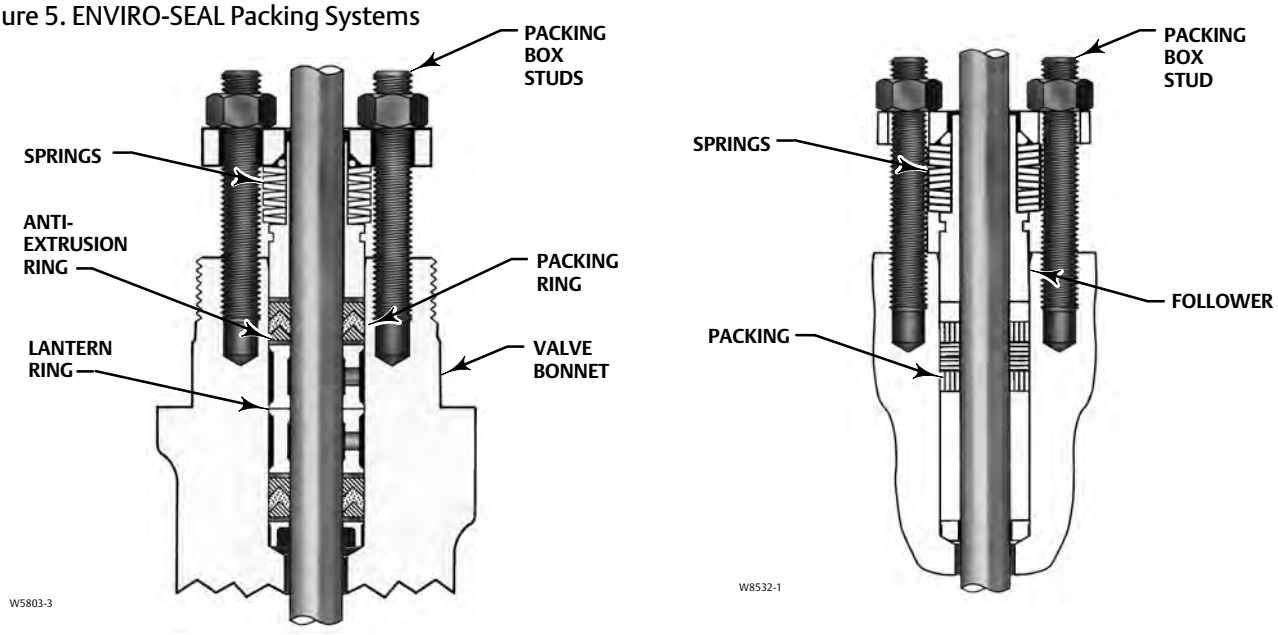
VALVE SIZE, NPS	FLOW CHARACTERISTIC	VALVE BODY DESIGN AND PLUG STYLE	PORT DIAMETER		VALVE PLUG TRAVEL		YOKE BOSS DIAMETER		VALVE STEM DIAMETER	
			mm	Inches	mm	Inches	mm	Inches	mm	Inches
1	Equal percentage	HPS w/Micro-Form	6.4	0.25	19	0.75	71	2-13/16	12.7	1/2
			12.7	0.5	19	0.75	71	2-13/16	12.7	1/2
			19.1	0.75	19	0.75	71, 90	2-13/16, 3-9/16	12.7, 19.1	1/2, 3/4
	Modified Equal percentage	HPS w/Micro-Form	19.1	0.75	29	1.125	71, 90	2-13/16, 3-9/16	12.7, 19.1	1/2, 3/4
			25.4	1	29	1.125	71, 90	2-13/16, 3-9/16	12.7, 19.1	1/2, 3/4
2	Equal percentage	HPS w/Micro-Form	6.4	0.25	19	0.75	71	2-13/16	12.7	1/2
			12.7	0.5	19	0.75	71	2-13/16	12.7	1/2
			19.1	0.75	19	0.75	71, 90	2-13/16, 3-9/16	12.7, 19.1	1/2, 3/4
		HPS	47.6	1.875	25.4	1	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
	Linear	HPS	47.6	1.875	25.4	1	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
	Modified Equal percentage	HPS w/Micro-Form	25.4	1	29	1.125	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
			31.8	1.25	29	1.125	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
			38.1	1.5	38	1.5	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1
		HPS	47.6	1.875	29	1.125	71, 90, 127	2-13/16, 3-9/16, 5	12.7, 19.1, 25.4	1/2, 3/4, 1

Table 7. Fisher HPT-C Port Diameters, Valve Plug Travel, Stem and Yoke Diameters

VALVE BODY DESIGN AND PLUG STYLE	VALVE SIZE, NPS	FLOW CHARACTERISTIC	PORT DIAMETER		VALVE PLUG TRAVEL		YOKE BOSS DIAMETER		VALVE STEM DIAMETER	
			mm	Inches	mm	Inches	mm	Inches	mm	Inches
HPT	4 (short)(1)	Linear	91.4	3.6	51	2	90, 127	3-9/16, 5	19.1, 25.4	3/4, 1
		Modified Equal percentage								
	4 (long)(2)	Equal percentage	92.1	3.625	38	1.5	90, 127	3-9/16, 5	19.1, 25.4	3/4, 1
		Linear			51	2				
		Modified Equal percentage								
	6 (short)	Linear	136.2	5.4	76	3	90, 127	3-9/16, 5, 5H	19.1, 25.4, 31.8	3/4, 1, 1-1/4
		Modified Equal percentage								
	6 (long)	Equal percentage	136.5	5.375	64	2.5	127.0	5.0	25.4, 31.8	1, 1-1/4
		Linear			76	3				
		Modified Equal percentage								
	8 (short)	Linear	152.4	6	76	3	127, 127	5, 5H	25.4, 31.8	1, 1-1/4
		Equal Percentage								
	10 (short)	Linear	177.8	7	102	4	127, 127	5, 5H	25.4, 31.8	1, 1-1/4
		Equal Percentage								
	12 (short)	Linear	203.2	8	102	4	127, 127, 178	5, 5H, 7	25.4, 31.8, 50.8	1, 1-1/4, 2
		Equal Percentage								

1. (Short) indicates industry standard short face-to-face.
2. (Long) indicates industry standard long face-to-face.

Figure 5. ENVIRO-SEAL Packing Systems



PTFE PACKING **GRAPHITE ULF PACKING**

Figure 6. Valve Dimensions

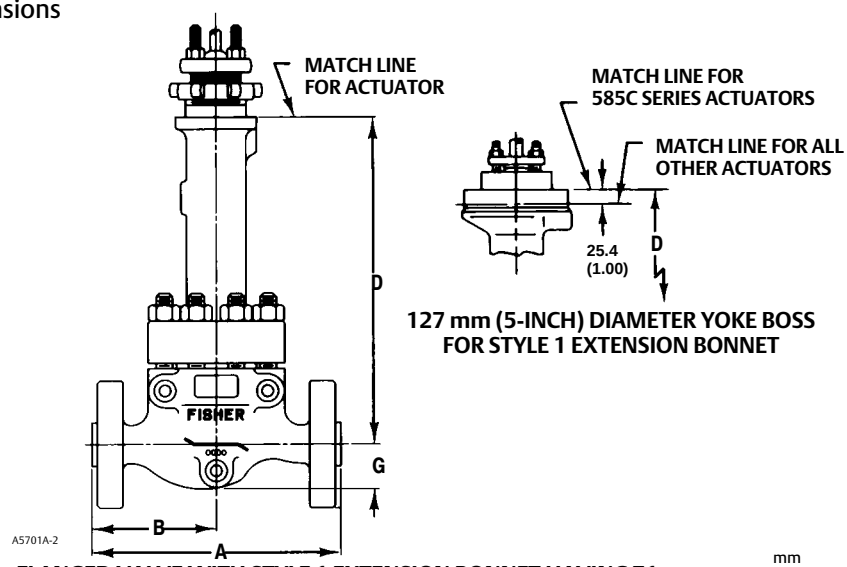


Table 8. Fisher HPS-C CL2500 Valve Dimensions

VALVE SIZE, NPS	A		B		G	D		
	CL2500		CL2500		CL2500	Yoke Boss Diameter, mm (inches)		
	RF	RTJ	RF	RTJ		71 (2-13/16)	90 (3-9/16)	127 (5)
mm								
1	318	318	159	159	63	533	533	---
2	413	416	206	208	84	470	470	445
Inches								
1	12.5	12.5	6.25	6.25	2.47	21	21	---
2	16.25	16.38	8.12	8.19	3.31	18.53	18.53	17.5

Table 9. Fisher HPT-C and HPS-C CL900 and 1500 Valve Dimensions NPS 1 though 6 (Long)[1][2]

VALVE SIZE, NPS	A						B						G	D		
	ASME				EN		ASME				EN			Yoke Boss Diameter, mm (inches)		
	CL900		CL1500		PN160	PN250	CL900		CL1500		PN160	PN250	CL900 and CL1500	71 (2-13/16)	90 (3-9/16)	127 (5)
	RF	RTJ	RF	RTJ			RF	RTJ	RF	RTJ						
mm																
1	292	292	292	292	269	277	146	146	146	146	134	138	52	553	553	---
2	375	378	375	378	344	360	187	189	187	189	172	180	77	553	553	445
3	442	445	460	464	442	460	221	222	230	232	192	202	121	---	553	CF
4	511	514	530	533	511	530	229	230	238	240	218	232	175	---	553	CF
6	714	718	768	775	714	768	310	311	337	340	298	316	248	---	---	402
Inches																
1	11.5	11.5	11.5	11.5	10.58	10.9	5.75	5.75	5.75	5.75	5.29	5.45	2.06	21	21	---
2	14.75	14.88	14.75	14.88	13.56	14.18	7.38	7.44	7.38	7.44	6.78	7.09	3.06	21	21	17.5
3	17.38	17.5	18.12	18.25	17.38	18.12	8.69	8.75	9.06	9.12	7.54	7.94	4.75	---	21	CF
4	20.12	20.25	20.88	21	20.12	20.88	9	9.06	9.38	9.44	10.75	9.13	6.88	---	21	CF
6	28.12	28.25	30.25	30.5	28.12	30.25	12.19	12.3	13.3	13.38	11.72	12.43	9.75	---	---	30

1. NPS 1 to 3 for HPS-C and NPS 4 to 6 for HPT-C.
2. Use with fabricated bonnet.

Table 10. Fisher HPT-C CL900 and 1500 Valve Dimensions NPS 4 though 12 (Short)(1)

VALVE SIZE, NPS	A						B						G		D		
	ASME														Yoke Boss Diameter, mm (inches)		
	CL900			CL1500			CL900			CL1500			CL 900	CL 1500	90 (3-9/16)	127 (5, 5H)	178 (7)
	RF	RTJ	BWE	RF	RTJ	BWE	RF	RTJ	BWE	RF	RTJ	BWE					
mm																	
4	464	467	406	483	486	406	232	233.5	203	241.5	243	203	107.4	108.8	676.8	721.2	---
6	600	603	559	692	698	559	300	301.5	282	340	343	282	149.6	158.7	777.5	821.9	---
8	781	784	653	838	848	685	402	404	349	431	436	370	260	281	---	892.5	---
10	864	867	762	991	1001	822	458	459	407	521	526	437	313	332	---	969.7	---
12	1016	1019	914	1130	1146	989	559	561	503	616	624	536	355	377	---	1030.3	1030.3
Inches																	
4	18.27	18.39	15.98	19.02	19.13	15.98	9.13	9.19	7.99	9.51	9.57	7.99	4.23	4.28	26.65	28.39	---
6	23.62	23.74	22.01	27.24	27.48	22.01	11.81	11.87	11.10	13.39	13.50	11.10	5.89	6.25	30.61	32.36	---
8	30.75	30.87	25.71	32.99	33.39	26.97	15.83	15.91	13.74	16.97	17.17	14.57	10.24	11.06	---	35.14	---
10	34.02	34.13	30.00	39.02	39.41	32.36	18.03	18.07	16.02	20.51	20.71	17.20	12.32	13.07	---	38.18	---
12	40.00	40.12	35.98	44.49	45.12	38.94	22.01	22.09	19.80	24.25	24.57	21.10	13.98	14.84	---	40.56	40.56

1. Use with one-piece extension bonnet.

Table 11. Fisher HPT-C CL900 and 1500 Valve Dimensions NPS 8 though 12 (Short)(1)

VALVE SIZE, NPS	A						B						G		D	
	ASME														Yoke Boss Diameter, mm (inches)	
	CL900			CL1500			CL900			CL1500			CL900	CL1500	127 (5, 5H)	178 (7)
	RF	RTJ	BWE	RF	RTJ	BWE	RF	RTJ	BWE	RF	RTJ	BWE				
mm																
8	781	784	653	838	848	685	402	404	349	431	436	370	260	281	846	---
10	864	867	762	991	1001	822	458	459	407	521	526	437	313	332	946	---
12	1016	1019	914	1130	1146	989	559	561	503	616	624	536	355	377	946	946
Inches																
8	30.75	30.87	25.71	32.99	33.39	26.97	15.83	15.89	13.74	16.97	17.17	14.57	10.22	11.06	33.31	---
10	34.02	34.13	30.00	39.02	39.41	32.36	18.01	18.07	16.00	20.51	20.71	17.19	12.30	13.07	37.24	---
12	40.00	40.12	35.98	44.49	45.12	38.94	22.01	22.07	19.80	24.25	24.57	21.10	13.98	14.85	37.24	37.24

1. Use with fabricated bonnet.

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