

Cryogenic and High Temperature Valve

U.S. Type 973 (Includes Sub-CFL)

DESCRIPTION

The U.S. Type 973 globe control valve is designed for modulating flow control in industrial or research applications at 1000° F (537° C) or less and at pressures less than 5000 psi (344 bar). The added bonnet length and fins serve to reduce the heat at the packing area. The reduction in heat allows the standard CV ring packing to be used at higher process temperatures than could normally be tolerated with the standard valve.

APPLICATIONS

Type 973 valves are widely used in high temperature applications where steam, hot water, hot hydraulic oil or other fluids and gases must be controlled precisely at temperatures exceeding the limits of the standard finned bonnet valve.

Follow the appropriate pressure and temperature rating of the body material and the packing and trim material. See "Pressure vs Temperature Ratings for Valve Superstructure" on page 2.

MATERIALS

Body – Bonnet	
Standard	316 stainless steel, carbon steel (WCB)
Optional	Monel®, Alloy 20, Hastelloy® C and B or ASTM equivalent
Innervalue	
Standard	316 stainless steel
Optional	Stellite®, Monel, Alloy 20, Hastelloy C and B or ASTM equivalent
Packing	
Standard	TFE chevron rings
Optional	Graphite
Actuator	
	Die cast aluminum
	316L stainless steel on standard 1/2 in. (12.7 mm) models

ACTUATOR CHOICES

Standard	Air-to-open, fail close Air-to-close, fail open
Optional	With integral top mounted positioner
Standard Signals	3-15#, 3-27#, 6-30#
Optional Signals	3-9#, 9-15#, with positioner
Accessories	Filter regulator, gauges, I/P converter, limit switches, handwheel, solenoids



Shown with Type 754 Actuator

STANDARD FEATURES

- 1/4 in. (6 mm), 1/2 in. (12 mm), 3/4 in. (19 mm) and 1 in. (25 mm) models
- Interchangeable trim sets
- Extended cooling fin bonnet
- Trim characteristics: Linear, equal percent, quick open or double taper
- TFE chevron packing
- ANSI Class IV shutoff (size O and larger)
- High temperature rating

OPTIONAL FEATURES

- Butt and socket weld ends, BSPP, tube connection and others
- Bellows packing solutions
- Angle pattern body
- Reduced Emissions Kalrez® (REK), graphite, spring-loaded chevron and others
- Exotic alloys for complete valves or trims
- Stellite trims & soft seats (PTFE & Kel-F)
- TiN coating of innervalue stem and seat

PRESSURE VS TEMPERATURE RATINGS FOR VALVE SUPERSTRUCTURE

The pressure/temperature ratings are based on material cross sections at the joint between the body and bonnet where a gasketed screwed type bonnet is used. When the proper torque levels are used, the valve should not experience rupture of the joint or the material. The torque levels were used in hydrostatic tests at the factory at 70° F (21.1° C) at maximum body rating and were found to provide acceptable seating. Other factors, such as high or cyclic temperatures, light process gases, or poor gasket surfaces can dictate the ability of a seal to be made. Under such conditions, the only way to be sure of tight sealing is to perform a test under the actual process conditions.

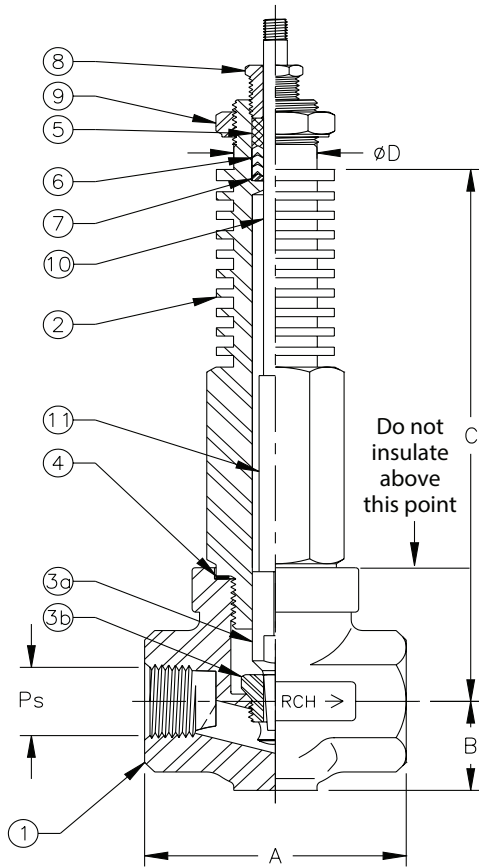
The following tables exclude packing or end fittings:

1/4 in. (6.4 mm) Research Control Valve						
Temp	316 S/S psi (bar)	Carbon Steel psi (bar)	Hastelloy B or = psi (bar)	Hastelloy C or = psi (bar)	Monel psi (bar)	Alloy 20 psi (bar)
100° F (37.8° C)	5000 (345)	4000 (276)	5000 (345)	5000 (345)	4000 (276)	5000 (345)
200° F (93.3° C)	5000 (345)	3700 (255)	5000 (345)	5000 (345)	4000 (276)	5000 (345)
300° F (148.9° C)	4750 (328)	3500 (241)	5000 (345)	5000 (345)	3880 (268)	4850 (334)
400° F (204.4° C)	4190 (289)	3200 (221)	5000 (345)	5000 (345)	3770 (260)	4700 (324)
500° F (260° C)	4000 (276)	2900 (200)	4900 (338)	4900 (338)	3740 (258)	4500 (310)
600° F (315.6° C)	3820 (263)	2600 (179)	4850 (334)	4850 (334)	3740 (258)	4200 (290)
700° F (371.1° C)	3640 (251)	2300 (159)	4800 (331)	4800 (331)	3640 (251)	3900 (269)
800° F (426.7° C)	3580 (267)	—	4750 (328)	4750 (328)	3580 (267)	3700 (255)
900° F (482.2° C)	2840 (196)	—	—	4500 (310)	2280 (157)	3000 (207)
1000° F (537.8° C)	1160 (80)	—	—	4000 (276)	940 (65)	1500 (103)
1100° F (593.3° C)	Consult factory for higher temperatures.			3500 (241)	—	—
1200° F (648.9° C)				3000 (207)	—	—
Recommended torque in ft-lb (Nm), +/- 2 ft-lb (2.71 Nm)						
	37 (50)	37 (50)	39 (53)	37 (50)	31 (42)	35 (47)

1/2 in. (12.7 mm) Research Control Valve						
Temp	316 S/S psi (bar)	Carbon Steel psi (bar)	Hastelloy B or = psi (bar)	Hastelloy C or = psi (bar)	Monel psi (bar)	Alloy 20 psi (bar)
100° F (37.8° C)	5000 (345)	4000 (276)	5000 (345)	5000 (345)	4000 (276)	5000 (345)
200° F (93.3° C)	4750 (328)	3800 (262)	5000 (345)	5000 (345)	3780 (261)	5000 (345)
300° F (148.9° C)	4310 (297)	3600 (248)	5000 (345)	5000 (345)	3520 (243)	4950 (341)
400° F (204.4° C)	3860 (266)	3300 (228)	5000 (345)	5000 (345)	3420 (236)	4850 (334)
500° F (260° C)	3640 (251)	3100 (2140)	4900 (338)	4900 (338)	3390 (234)	4600 (317)
600° F (315.6° C)	3470 (239)	2900 (200)	4870 (336)	4870 (336)	3390 (234)	4300 (296)
700° F (371.1° C)	3310 (228)	2700 (186)	4810 (332)	4610 (318)	3310 (228)	4200 (290)
800° F (426.7° C)	3255 (224)	—	4430 (305)	4430 (305)	2090 (144)	4000 (276)
900° F (482.2° C)	3190 (220)	—	—	4200 (290)	2070 (143)	3000 (207)
1000° F (537.8° C)	1860 (128)	—	—	4000 (276)	850 (59)	1500 (103)
1100° F (593.3° C)	Consult factory for higher temperatures.			3400 (234)	—	—
1200° F (648.9° C)				3000 (207)	—	—
Recommended torque in ft-lb (Nm), +/- 2 ft-lb (2.71 Nm)						
	122 (165)	122 (165)	131 (178)	124 (168)	102 (138)	117 (159)

3/4 in. (19.1 mm) and 1 in. (25.4 mm) Research Control Valve				
Temp	316 S/S		Carbon Steel	
	3/4 in. (19.1 mm)	1 in. (25.4 mm)	3/4 in. (19.1 mm)	1 in. (25.4 mm)
100° F (37.8° C)	1500 (103)	1500 (103)	1500 (103)	1500 (103)
200° F (93.3° C)	1450 (100)	1450 (100)	1350 (93)	1350 (93)
300° F (148.9° C)	1325 (91)	1325 (91)	1325 (91)	1325 (91)
400° F (204.4° C)	1175 (81)	1175 (81)	1275 (88)	1275 (88)
500° F (260° C)	1100 (76)	1100 (76)	1200 (83)	1200 (83)
600° F (315.6° C)	1070 (74)	675 (47)	1100 (76)	1100 (76)
700° F (371.1° C)	840 (58)	250 (17)	1075 (74)	1075 (74)
800° F (426.7° C)	575 (40)	—	—	—
3/4 in. (19.1 mm) and 1 in. (25.4 mm) Torque = 290 ft-lb (393 Nm)				

DIMENSIONS



1. Valve Body (Investment cast, NPT ends)
2. Valve Bonnet: 1/4 in. (6.4 mm) = 7/8 in. (22.2 mm) hex;
1/2 in. (12.7 mm) = 1-1/4 in. (31.8 mm) hex;
3/4 in. (19.1 mm) = 1-1/2 in. (38.1 mm) hex;
1 in. (25.4 mm) = 1-3/4 in. (44.5 mm) hex.
(Some exotic materials may use round material.)
3. Innavelve (trim set)
 - a. Plug
 - b. Seat: 1/4 in. (6.4 mm) = 3/8 in. (9.5 mm) hex;
1/2 in. (12.7 mm) = 5/8 in. (15.9 mm) hex;
3/4 in. (19.1 mm) = 3/4 in. (19.1 mm) hex ;
1 in. (25.4 mm) = 15/16 in. (23.8 mm) hex
4. Body Bonnet Gasket (may not be supplied in exotic material)
5. Packing Adaptor (CV ring packing only)
6. Packing (CV ring)
7. Packing Follower (CV ring packing only)
8. Packing Gland: 1/4 in. (6.4 mm) = 7/16 in. (11.1 mm) hex;
1/2 in. (12.7 mm) = 1/2 in. (12.7 mm) hex;
3/4 in. (19.1 mm) = 1/2 in. (12.7 mm) hex;
1 in. (25.4 mm) = 1/2 in. (12.7 mm) hex
9. Yoke Lock Nut: 1/4 in. (6.4 mm) = 7/8 in. (22.2 mm) hex;
1/2 in. (12.7 mm) = 1-1/8 in. (28.8 mm) hex;
3/4 in. (19.1 mm) = 1-1/8 in. (28.8 mm) hex;
1 in. (25.4 mm) = 1-1/8 in. (28.8 mm) hex
10. Stem connector: 1/4 in. (6.4 mm) = 1/4 in. (6.4 mm) hex;
1/2 in. (12.7 mm) = 3/8 in. (9.5 mm) hex;
3/4 in. (19.1 mm) = 3/8 in. (9.5 mm) hex;
1 in. (25.4 mm) = 3/8 in. (9.5 mm) hex
11. Upper Stem

PS	A	B	C	D	Stroke
0.25 in. (6.4 mm)	2.12 in. (53.8 mm)	0.68 in. (17.3 mm)	4.00 in. (101.6 mm)	0.625 in. (15.9 mm)	0.437 in. (11.1 mm)
0.50 in. (12.7 mm)	2.75 in. (69.8 mm)	1.00 in. (25.4 mm)	6.00 in. (152.4 mm)	0.875 in. (22.2 mm)	0.562 in. (14.3 mm)
0.75 in. (19.1 mm)	3.37 in. (85.6 mm)	1.18 in. (30.0 mm)			
1 in. (25.4 mm)	4.00 in. (101.6 mm)	1.50 in. (38.1 mm)			

INNERVALVE CHART

Valve Size	Trim Designation	Nominal Cv	Theoretical Turbulent Cv	Orifice Dia.	Orifice Area	Nominal Rangeability	
						Linear	Equal %
1 in. (25.4 mm)	6.0	6.0	6.0	0.6250 in. (15.9 mm)	0.3068 in. ² (197.9 mm ²)	50:1	60:1
	5.0	5.0	5.0	0.6250 in. (15.9 mm)	0.3068 in. ² (197.9 mm ²)	50:1	60:1
	4.5	4.5	4.5	0.5000 in. (12.7 mm)	0.1963 in. ² (126.6 mm ²)	50:1	60:1
3/4 in. (19.1 mm) and 1 in. (25.4 mm)	4.0	4.0	4.0	0.5000 in. (12.7 mm)	0.1963 in. ² (126.6 mm ²)	50:1	60:1
	3.5	3.5	3.5	0.5000 in. (12.7 mm)	0.1963 in. ² (126.6 mm ²)	50:1	60:1
1/2 in. (12.7 mm), 3/4 in. (19.1 mm) and 1 in. (25.4 mm)	A	2.5	2.5/2.2	0.3750 in. (9.5 mm)	0.1104 in. ² (71.2 mm ²)	40:1	50:1
	B	2.0	2.0	0.3750 in. (9.5 mm)	0.1104 in. ² (71.2 mm ²)	40:1	50:1
	C	1.25	1.25	0.2810 in. (7.1 mm)	0.0620 in. ² (40.0 mm ²)	40:1	50:1
	D	0.8	0.80	0.2500 in. (6.4 mm)	0.0491 in. ² (31.7 mm ²)	40:1	50:1
	E	0.5	0.50	0.2500 in. (6.4 mm)	0.0491 in. ² (31.7 mm ²)	40:1	50:1
1/4 in. (6.4 mm), 1/2 in. (12.7 mm), 3/4 in. (19.1 mm) and 1 in. (25.4 mm)	F	0.32	0.32	0.1560 in. (3.9 mm)	0.0191 in. ² (12.3 mm ²)	30:1	40:1
	G	0.2	0.20	0.1560 in. (3.9 mm)	0.0191 in. ² (12.3 mm ²)	30:1	40:1
	H	0.13	0.13	0.1560 in. (3.9 mm)	0.0191 in. ² (12.3 mm ²)	30:1	40:1
	I	0.08	0.08	0.1560 in. (3.9 mm)	0.0191 in. ² (12.3 mm ²)	30:1	40:1
	J	0.05	0.05	0.1560 in. (3.9 mm)	0.0191 in. ² (12.3 mm ²)	30:1	40:1
	K	0.03	4.8E-02	0.0860 in. (2.2 mm)	0.0058 in. ² (3.7 mm ²)	25:1	—
	L	0.02	3.4E-02	0.0860 in. (2.2 mm)	0.0058 in. ² (3.7 mm ²)	25:1	—
	M	0.01	1.6E-02	0.0860 in. (2.2 mm)	0.0058 in. ² (3.7 mm ²)	25:1	—
	N	0.006	1.0E-02	0.0860 in. (2.2 mm)	0.0058 in. ² (3.7 mm ²)	25:1	—
	O	0.003	5.3E-03	0.0860 in. (2.2 mm)	0.0058 in. ² (3.7 mm ²)	25:1	—
1/4 in. (6.4 mm) and 1/2 in. (12.7 mm)	P1	0.002	3.6E-03	0.0625 in. (1.6 mm)	0.0031 in. ² (2.0 mm ²)	15:1	—
	P2	0.0013	2.5E-03	0.0625 in. (1.6 mm)	0.0031 in. ² (2.0 mm ²)	15:1	—
	P3	0.001	2.0E-03	0.0625 in. (1.6 mm)	0.0031 in. ² (2.0 mm ²)	15:1	—
	P4	0.0006	1.4E-03	0.0625 in. (1.6 mm)	0.0031 in. ² (2.0 mm ²)	15:1	—
	P5	0.0004	1.0E-03	0.0625 in. (1.6 mm)	0.0031 in. ² (2.0 mm ²)	15:1	—
	P6	0.00027	8.3E-04	0.0625 in. (1.6 mm)	0.0031 in. ² (2.0 mm ²)	15:1	—
	P7	0.00018	6.8E-04	0.0625 in. (1.6 mm)	0.0031 in. ² (2.0 mm ²)	15:1	—
	P8	0.00012	5.6E-04	0.0625 in. (1.6 mm)	0.0031 in. ² (2.0 mm ²)	15:1	—
	P9	0.00008	4.6E-04	0.0625 in. (1.6 mm)	0.0031 in. ² (2.0 mm ²)	15:1	—
1/4 in. (6.4 mm)	P10	0.00005	1.9E-04	0.0420 in. (1.1 mm)	0.0014 in. ² (0.9 mm ²)	15:1	—
	P11	0.000036	1.6E-04	0.0420 in. (1.1 mm)	0.0014 in. ² (0.9 mm ²)	15:1	—
	P12	0.000024	1.3E-04	0.0420 in. (1.1 mm)	0.0014 in. ² (0.9 mm ²)	15:1	—
	P13	0.000016	1.1E-04	0.0420 in. (1.1 mm)	0.0014 in. ² (0.9 mm ²)	15:1	—
	P14	0.00001	8.4E-05	0.0420 in. (1.1 mm)	0.0014 in. ² (0.9 mm ²)	15:1	—
	P15	0.000006	6.6E-05	0.0420 in. (1.1 mm)	0.0014 in. ² (0.9 mm ²)	15:1	—
	P16	0.000004	5.3E-05	0.0420 in. (1.1 mm)	0.0014 in. ² (0.9 mm ²)	15:1	—
	P17	0.0000027	4.4E-05	0.0420 in. (1.1 mm)	0.0014 in. ² (0.9 mm ²)	15:1	—
	P18	0.0000018	3.6E-05	0.0420 in. (1.1 mm)	0.0014 in. ² (0.9 mm ²)	15:1	—

K...O and the P-series trims are considered reduced trims when installed in a 1/2 in. (12.7 mm) valve. Occasionally, P1...P9 trims are made on a 0.042 in. (1.1 mm) orifice.

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