PO3-DP

PO3-D SERIES: SINGLE SEAT CONTROL VALVE

PO3-DP Series: PNEUMATIC SINGLE SEAT CONTROL VALVE

DESCRIPTION

PO3-D pneumatic single seat control valve consists of POD multi-spring diaphragm type actuator and low flow resistance straight through single seat valve.

After the external signal air pressure is input into the membrane chamber, this pressure acts on the membrane to generate thrust, which compresses the spring set and moves the push rod to drive the valve stem to open/close the valve trim, until the thrust and the reaction force of the spring set after compression are balanced and stabilized on a certain stroke. According to the above principle, the stroke of the valve trim is proportional to the input signal pressure.

The straight through single seat valve with low flow resistance has a simple and compact structure and a considerable flow coefficient. The valve adopts the valve body type of straight single seat without bottom cover and top guide structure, which is small in size, light in weight, smooth in flow passage design, and highly efficient. The connection form of valve body and piping adopts RF Flange and Recess(MFM) Flange to adapt to different nominal pressures. The valve body is divided into two types: ordinary type and high temperature type, which are used for different working temperatures. The single seat valve trim is an upper guide plunger valve, which has accurate flow characteristics and meets the slope deviation assessment requirements specified in IEC standards and national standards. The standard type packing is PTFE, and special fillers such as flexible graphite can also be selected according to the site use requirements.

FEATURES

- Compact structure and Small dimensions
- Valve Body: Straight through、Low flow resistance、Large flow coefficient
- Actuator and Valve body are connected in Standard mount pad and Replacable
- Various applicable Pressures Rating
- Available with various End connection by: Flange、Thread end、Butt Welding and Socket Welding
- Bonnet with Stanadrd type and Extension type for various temperature and type fluid
- Extension Bonnet available with High-temperature type, Low-temperature type and Bellow seal type
- Top-guide Plunger type valve trim, providing precise flow control
- A variety of valve trim caliber options, providing a variety of KV/CV values for client's application
- Equal percentage or Linear flow characteristics according to client flow control requirements
- Multiple effective area film actuators, Multiple spring ranges, and Multiple strokes for various pressure difference situation
- Adjustment error range less than 1%
- Leakage ANSI CLASS IV to VI
- Soft sealing PTFE、Hard sealing Stainless steel Alloy、Stellite Alloy overlay
- Available with multiple options of accessory like, E-P Positioner、Smart Positioner、Air filter、Handwheel and so on

PO3-DP

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

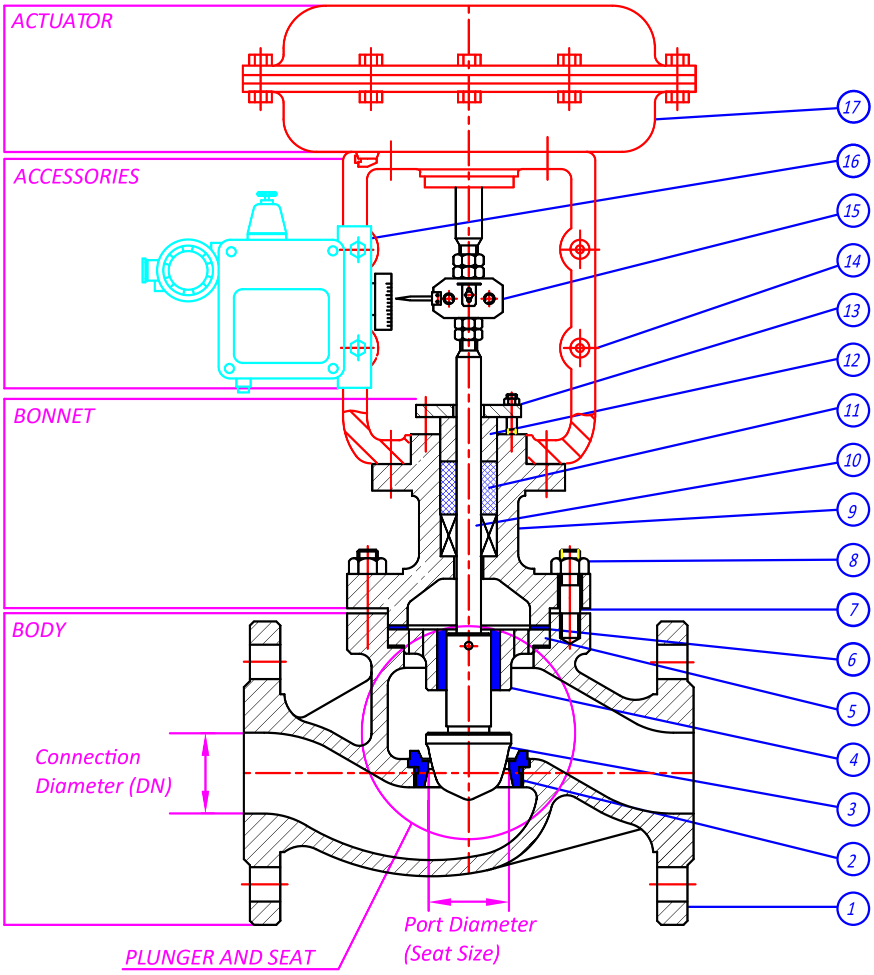
TECHNICAL PARAMETERS

<table>
<tr><td>Valve Type:</td><td colspan="4">Casting Type Straight type 2-Way Globe type Single Seat Control Valve</td></tr>
<tr><td>Nominal Size:</td><td colspan="4">DN20-DN300</td></tr>
<tr><td rowspan="3">Pressure Rating:</td><td colspan="4">PN1.6MPa、PN2.5MPa、PN4.0MPa、PN6.4MPa、PN10MPa</td></tr>
<tr><td colspan="4">Class 150LBs、Class 300LBs、Class 600LBs</td></tr>
<tr><td colspan="4">JIS 10K、JIS 20K</td></tr>
<tr><td rowspan="9">End Connection:</td><td rowspan="3">GB/JB/HG Flange</td><td>GB9113.1~4</td><td>PN16~PN100</td><td>RF Flange、MF Flange</td></tr>
<tr><td>JB79.1~4</td><td>PN16~PN100</td><td>RF Flange、MF Flange、RTJ Flange</td></tr>
<tr><td>HG/T20592</td><td>PN16~PN100</td><td>RF Flange、MF Flange</td></tr>
<tr><td>DIN Flange</td><td>EN1092-1</td><td>PN16~PN100</td><td>Type B: Raised Face
Type F: Recess Face</td></tr>
<tr><td>ANSI Flange</td><td>ANSI B16.5</td><td>Class150~600LBS</td><td>RF Flange、RTJ Flange</td></tr>
<tr><td>JIS Flange</td><td>JIS B2220</td><td>JIS10K~ JIS20K</td><td>RF Flange</td></tr>
<tr><td rowspan="2">Welding</td><td rowspan="2">ANSI B16.11</td><td>SW</td><td>Size DN ≤ 50</td></tr>
<tr><td>BW</td><td>Size DN ≥ 50</td></tr>
<tr><td>Thread</td><td colspan="2">G、 NPT、 BSP</td><td>Size DN ≤ 25</td></tr>
<tr><td>Face to Face Dimension:</td><td colspan="4">Accroding to IEC 60534-3 Standard</td></tr>
<tr><td rowspan="4">Bonnet Type:</td><td colspan="2">Standard Bonnet</td><td>-20℃ ~ 230℃</td><td>General use like Oil, Various Chemical, Acid, Alkali, Water</td></tr>
<tr><td colspan="2">Extension High-Temp Type</td><td>-20℃ ~ 450℃</td><td>High-Temperature use like Steam, Thermal Oil</td></tr>
<tr><td colspan="2">Extension Low-Temp Type</td><td>-196℃ ~ -60℃</td><td>Low-Temperature use like Various Chemical, Acid, Alkali, LNG</td></tr>
<tr><td colspan="2">Extension Bellow Seal Type</td><td>-20℃ ~ 450℃</td><td>High-Temperature and Low leakage like High- toxic, High-corrosive, Radioactive</td></tr>
<tr><td rowspan="2">Packing Type:</td><td colspan="2">V-Shaped PTFE Packing</td><td>-20℃ ~ 230℃ / 10Mpa Max</td><td>General use like Oil, Various Chemical, Acid, Alkali, Water</td></tr>
<tr><td colspan="2">Expanded Graphite Packing</td><td>-20℃ ~ 450℃ / 43Mpa Max</td><td>High-Temperature use like Steam, Thermal Oil</td></tr>
<tr><td rowspan="2">Actuation:</td><td colspan="2" rowspan="2">POD Series Pneumatic Diaphragm type actuator</td><td>Direct action type POD-D</td><td>Air-To-Close</td></tr>
<tr><td>Reverse action type POD-R</td><td>Air-To-Open</td></tr>
<tr><td>Trim Type:</td><td colspan="4">Single seat Plunger Type</td></tr>
<tr><td>Flow Characteristic:</td><td colspan="4">Equal Percentage Type、Linear type</td></tr>
<tr><td>Body Material:</td><td colspan="4">A216 WCB、A351 CF8、A351 CF8M、A351 CF3M、Duplex S.S. 2205、Other material</td></tr>
<tr><td>Trim Material:</td><td colspan="4">SUS304、SU316、1Cr18Ni9Ti、1Cr18Ni12Mo2Ti、17-4PH、 9Cr18、 316L、 Stainless steel + STL Hardening treatment、Titanium Alloy</td></tr>
<tr><td>Seat Material:</td><td colspan="4">SS304, SS316, 316L, or other special material, can be treated with hardening by STL、PTFE</td></tr>
<tr><td>Inherent range ability:</td><td colspan="4">50:1</td></tr>
<tr><td>Available Accessory:</td><td colspan="4">Mechnical E-P Positioner、Intelligent E-P Positioner、P-P Positioner、Lock-up valve、Air filter Regulator、Top-Mounted Handwheel、Side-Mounted Handwheel</td></tr>
</table>

PO3-DP

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

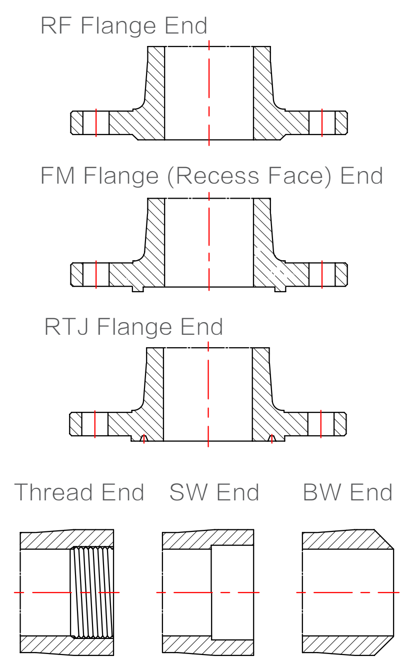
MAIN PARTS STRUCTURE - STANDARD TYPE



No.	Parts
1	BODY
2	SEAT
3	TRIM
4	GUIDE
5	GUIDE SEAT
6	GASKET
7	BOLT
8	NUT
9	BONNET
10	STEM
11	PACKING
12	PACKING GLAND
13	PACKING PLATE
14	SUPPORT
15	POSITION INDICATOR
16	POSITIONER
17	ACTUATOR

END CONNECTION TYPE

Type	Standard	Pressure Rating	Flange type
GB/JB/HG Flange	GB9113.1~4	PN16~PN100	RF Flange、MF Flange
	JB79.1~4	PN16~PN100	RF Flange、MF Flange、RTJ Flange
	HG/T20592	PN16~PN100	RF Flange、MFM Flange
DIN Flange	EN1092-1	PN16~PN100	Type B: Raised Face Type F: Recess Face
ANSI Flange	ANSI B16.5	Class150~600LBS	RF Flange、RTJ Flange
JIS Flange	JIS B2220	JIS10K~ JIS20K	RF Flange
Welding	ANSI B16.11	Socket Welding	Size DN ≤ 50
		Butt Welding	Size DN ≥ 50
Thread	G、NPT、BSP		Size DN ≤ 25



PO3-DP

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

CONNECTION DIAMETER AND PORT DIAMETER AND KV VALUE

<table>
<tr><th rowspan="2">Norminal Diameter (DN)</th><th rowspan="2">Port Diameter (mm)</th><th colspan="2">Rated Flow Coefficient</th><th rowspan="2">Rated Travel</th><th rowspan="2">Effective Area of Diaphragm</th><th rowspan="2">Actautor Model</th></tr>
<tr><th>Linear Characteristic</th><th>Equal Percentage Characteristic</th></tr>
<tr><td>G3/4"</td><td>3、4、5、6、7、8</td><td colspan="2">0.08、0.12、0.20、0.32、0.50、0.80</td><td>10</td><td>220</td><td>POD-D(R)-11</td></tr>
<tr><td rowspan="4">DN20-3/4"</td><td>10</td><td>18.0</td><td>1.6</td><td rowspan="6">16</td><td rowspan="15">350</td><td rowspan="6">POD-D(R)-22</td></tr>
<tr><td>12</td><td>2.8</td><td>25.0</td></tr>
<tr><td>15</td><td>4.4</td><td>4.0</td></tr>
<tr><td>20</td><td>6.9</td><td>6.3</td></tr>
<tr><td rowspan="2">DN25-1"</td><td>20</td><td>6.9</td><td>6.3</td></tr>
<tr><td>25</td><td>11.0</td><td>10.0</td></tr>
<tr><td rowspan="3">DN32-1.25"</td><td>20</td><td>6.9</td><td>6.3</td><td rowspan="9">25</td><td rowspan="9">POD-D(R)-23</td></tr>
<tr><td>25</td><td>11.0</td><td>10.0</td></tr>
<tr><td>32</td><td>17.6</td><td>16.0</td></tr>
<tr><td rowspan="3">DN40-1.5"</td><td>25</td><td>11.0</td><td>10.0</td></tr>
<tr><td>32</td><td>17.6</td><td>16.0</td></tr>
<tr><td>40</td><td>27.5</td><td>25.0</td></tr>
<tr><td rowspan="3">DN50-2"</td><td>32</td><td>17.6</td><td>16.0</td></tr>
<tr><td>40</td><td>27.5</td><td>25.0</td></tr>
<tr><td>50</td><td>44.0</td><td>40.0</td></tr>
<tr><td rowspan="3">DN65-2.5"</td><td>40</td><td>27.5</td><td>25.0</td><td rowspan="9">40</td><td rowspan="9">560</td><td rowspan="9">POD-D(R)-34</td></tr>
<tr><td>50</td><td>44.0</td><td>40.0</td></tr>
<tr><td>65</td><td>69.0</td><td>63.0</td></tr>
<tr><td rowspan="3">DN80-3"</td><td>50</td><td>44.0</td><td>40.0</td></tr>
<tr><td>65</td><td>69.0</td><td>63.0</td></tr>
<tr><td>80</td><td>110.0</td><td>100.0</td></tr>
<tr><td rowspan="3">DN100-4"</td><td>65</td><td>69.0</td><td>63.0</td></tr>
<tr><td>80</td><td>110.0</td><td>100.0</td></tr>
<tr><td>100</td><td>176.0</td><td>160.0</td></tr>
<tr><td rowspan="3">DN125-5"</td><td>80</td><td>110.0</td><td>100.0</td><td rowspan="9">60</td><td rowspan="9">900</td><td rowspan="9">POD-D(R)-45</td></tr>
<tr><td>100</td><td>176.0</td><td>160.0</td></tr>
<tr><td>125</td><td>275.0</td><td>250.0</td></tr>
<tr><td rowspan="3">DN150-6"</td><td>100</td><td>176.0</td><td>160.0</td></tr>
<tr><td>125</td><td>275.0</td><td>250.0</td></tr>
<tr><td>150</td><td>440.0</td><td>400.0</td></tr>
<tr><td rowspan="3">DN200-8"</td><td>125</td><td>275.0</td><td>250.0</td></tr>
<tr><td>150</td><td>440.0</td><td>400.0</td></tr>
<tr><td>200</td><td>690.0</td><td>630.0</td></tr>
<tr><td>DN250-10"</td><td>250</td><td>1000.0</td><td>900.0</td><td rowspan="2">100</td><td rowspan="2">1400</td><td rowspan="2">POD-D(R)-56</td></tr>
<tr><td>DN300-12"</td><td>300</td><td>1600.0</td><td>1440.0</td></tr>
</table>

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

VALVE BODY MATERIAL

The selection of material for valve body is depends on operating temperature/pressure and fliud corrosiveness.

Please check the below temperature-pressure table, and check if the selection material can work under operation pressure and temperature.

Check with POV Engineer for more suggestion on valve material selection, and see Appendix I for the Temperature-Pressure table to check if the selected valve body material can perfected hold the medium pressure under specific pressure.

CONTROL VALVE BODY MATERIAL OPTIONS AND COMPARASION

Material Type	GB Standard	ANSI/ASME Standard	DIN Standard		JIS Standard
			Number	Name	
Carbon Steel	WCB / ZG230-450	A216 WCB	1.0619	GS-C25N	SCPH2
	LCB	A216 LCB	-	-	SCPL
	WCC	A216 WCC	-	-	WCC
	-	A217 WC5	1.7363	GS-12CrMo 19 5	SCPH21
	ZG15Cr1Mo1V	A217 WC9	1.7380	GS-12CrMo 9 10	SCPH32
	ZG20CrMoV	A217 WC6	1.7357	GS-17CrMo 5 5	-
S.S. 304	ZG07Cr20Ni10	A351 CF8	1.4301	X5CrNi1810	SCS13A
S.S. 316	ZG07Cr19Ni11Mo2	A351 CF8M	1.4401	X5CrNiMo1712	SCS14A
S.S. 316L	ZG03Cr19Ni11Mo2	A351 CF3M	1.4435	X2CrNiMo18143	SCS16A
S.S. 321	ZG1Cr18Ni9Ti	AISI 321	1.4541	X6CrNiTi1810	SUS321
S.S. 316Ti	ZG1Cr18Ni12Mo2Ti	AISI 316Ti	1.4571	X6CrNiMoTi17122	-
Duplex 2205	00Cr22Ni5Mo3N	ASTM A240/A240M—01	1.4462	X2CrNiMoN 22.5.3	-

★★★★★ Important Note:
This table is the closest material comparison table of various standard steel materials in terms of composition and performance. The steel materials of different standards, due to the differences in production and standards, have slight differences in material composition proportion and performance, and cannot be completely corresponding.

VALVE TRIM

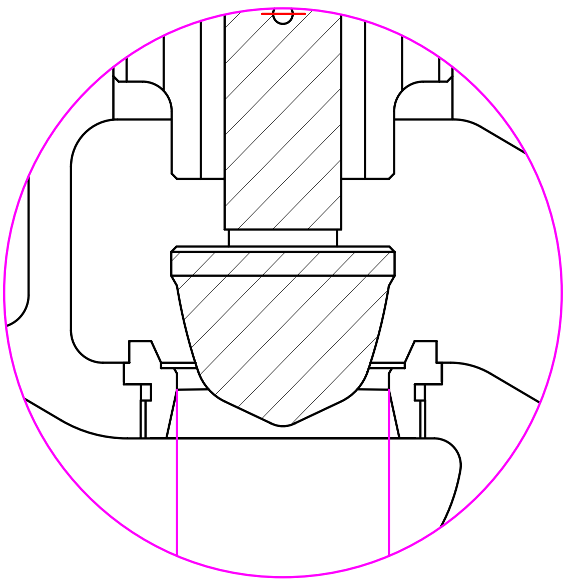
The PO3-DP type penumatic control valve trim is combined of plunger and seat ring.

Customer can choose the trim material according to the material temperaure resistance, anti-corrosive ability and customer requirements. The common control valve trim material is SUS410, SUS304 and SUS316, customer can also order the special material as below material table.

The PO3-DP type penumatic control valve's plunger is Parabolic type pluger, like a plunger a plug to block the valve passage. With the plunger moves up and down, the flow of the valve passage can be adjusted to achieve the purpose of adjusting the flowrate.

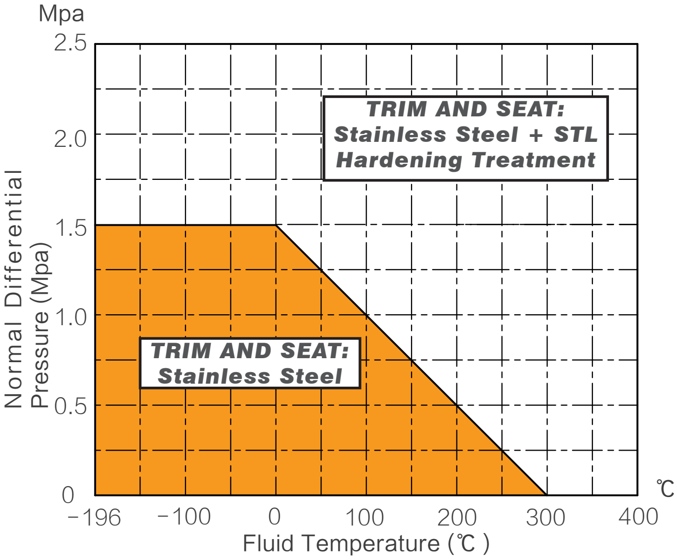
The design of PO3-DP valve trim can achieve the valve flow characteristic into EQUAL PERCENTAGE TYPE and LINEAR TYPE, which can customers' requirements for flow regulation performance.

The valve seat is an important component of the valve, which is installed on the valve body and is used as the contact surface between the valve plunger and the valve body when the valve is closed. PO3-DP pneumatic control valve mainly has two types of valve seats: HARD SEAL and SOFT SEAL, and their corresponding temperature resistance range, pressure range and sealing performance are different.

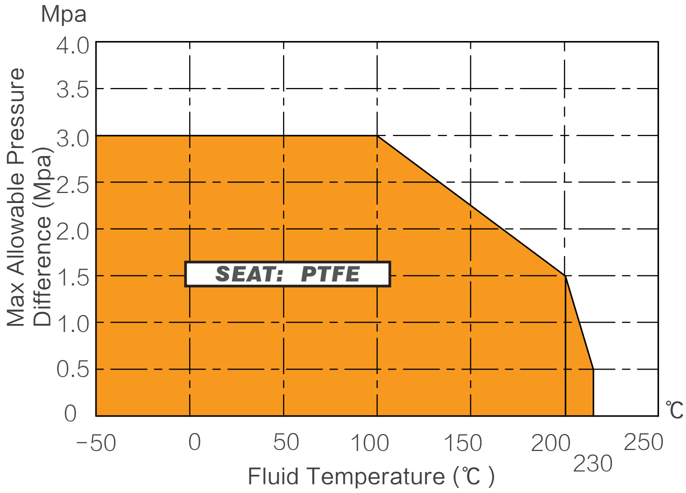


PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

TRIM COMBINATION - PRESSURE AND TEMPERATURE TABLE



Temperature and Normal Differential Pressure Ranges FOR Hard Seat



Temperature and Maximum Differential Pressure Ranges For Soft Seat

VALVE TRIM MATERIAL OPTIONAL TABLE

Code	ANSI Standard Code	Code	ANSI Standard Code	Code	ANSI Standard Code	Code	ANSI Standard Code
SUS302	302,S30200	SUS316Ti	S31635/316Ti	SUS316N	316N	Monel	Monel K-500
SUS304	304,S3400	SUS321	321	SUS630	17-4PH	ST31	Stellite31
SUS304L	304L,S30403	SUS347	S34700/347	SUS631		S25554	S32550/255
SUS310S	310S,S31008	SUS410	410,S41000	SUS347	S34700/347	Incoloy	Incoloy800
SUS316	316,S31600	SUS410S	410S	STBA25	S50200/502	904L	904L
SUS316L	316L,S31603	SUS420	20S,S42000	Has B-2	Hastelloy B-2		
SUS317	317/S31700	SUS420J2	431,S43100	Has C-276	Hastelloy c-276		
SUS317L	317L/S31703	SUS440C	440S,S44000	Has C-22	Hastelloy c-22		

SEAT LEAKAGE CLASS

When the valve is fully closed, the fliud will leak from the seat sealing part, depends on the seat type and differential pressure.

<table>
<tr><th>Seat Type</th><th colspan="4">Max Allowable Leakage Amount</th><th>Test Medium</th><th>Standard / Leakage Class</th></tr>
<tr><td rowspan="12">HARD SEAL</td><td colspan="4">< 0.01% of Rated CV value (Unit: L/h)</td><td>Water in 10~52℃</td><td>ANSI B16.104-1976 Class IV</td></tr>
<tr><td colspan="4">< 0.0005ml/min x △ P(LBS/in) x Port size (Unit: ml/min)</td><td>Water in 10~52℃</td><td>ANSI B16.104-1976 Class V</td></tr>
<tr><td colspan="2">Valve Norminal Diameter</td><td rowspan="2">ml/mm</td><td rowspan="2">Bubble-Nos./min</td><td rowspan="10">Air in 10~52℃</td><td rowspan="10">ANSI B16.104-1976 Class VI</td></tr>
<tr><td>INCH</td><td>DIAMETER</td></tr>
<tr><td>1</td><td>25</td><td>0.15</td><td>1</td></tr>
<tr><td>1.5</td><td>38</td><td>0.30</td><td>2</td></tr>
<tr><td>2</td><td>51</td><td>0.45</td><td>3</td></tr>
<tr><td>2.5</td><td>64</td><td>0.60</td><td>4</td></tr>
<tr><td>3</td><td>76</td><td>0.90</td><td>6</td></tr>
<tr><td>4</td><td>102</td><td>1.70</td><td>11</td></tr>
<tr><td>6</td><td>152</td><td>4.00</td><td>27</td></tr>
<tr><td>8</td><td>203</td><td>6.75</td><td>45</td></tr>
<tr><td>SOFT SEAL</td><td colspan="4">< 0.00001%</td><td>Water in 10~52℃</td><td>ANSI B16.104-1976 Class VI</td></tr>
</table>

PO3-DP

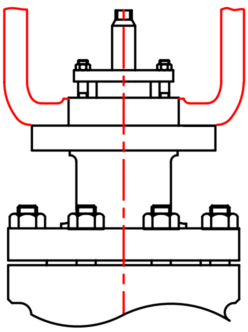
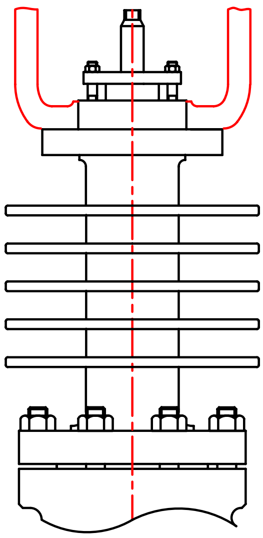
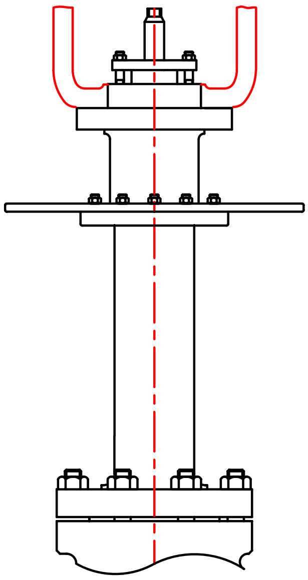
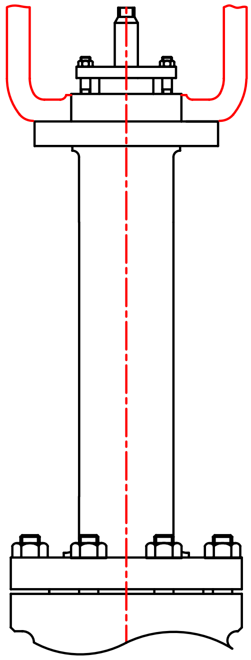
PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

BONNET TYPE

Bonnet is an important part for the control valve, which can stop the fliud leakage from stem and top side of valve.

The bonnet can provide the actuator、accessory and environment from the damage of high-temperature、low-temperature、steam、corrosive fluid and toxic fluid.

The valve bonnet is connected by bolted to the valve body. The bonnet type have an important influence to the valve application temperature and pressue. It mainly have standard type, Extension High-Temperature type、Extension Low-Temperature type and Extension Bellow Seal Type.

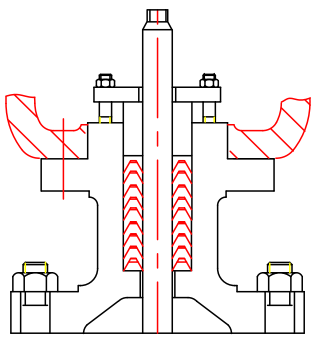
Type	Standard Bonnet / Plain Bonnet	Extension High-Temperature type	Extension Low-Temperature type	Extension Bellow Seal Type
Structure				
Temperature Range	-20℃ ~ 230℃	-20℃ ~ 450℃	-196℃ ~ -60℃	-20℃ ~ 450℃
Medium Application	General use like Oil, Various Chemical, Acid, Alkali, Water	High-Temperature use like Steam, Thermal Oil	Low-Temperature use like Various Chemical, Acid, Alkali, LNG	High-Temperature and Low leakage like High- toxic, High-corrosive, Radioactive

PACKING TYPE

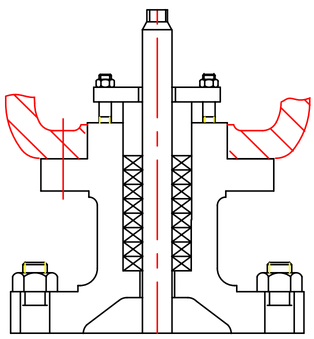
The main function of the packing is to prevent the medium from leaking from the connection between the valve stem and bonnet, so as to prevent the medium from affecting the actuator and the surrounding environment. Such as high temperature liquid, low temperature liquid, highly corrosive medium, high temperature steam, toxic medium, etc.

The PO3-DP pneumatic control valve mainly have 2 types of packing type: V-Shaped PTFE Packing and Expanded Graphite Packing, for different application and solution.

Type	Specification	Application
V-Shaped PTFE Packing	-20℃ ~ 230℃ / 10Mpa Max	General use like Oil, Various Chemical, Acid, Alkali, Water
Expanded Graphite Packing	-20℃ ~ 450℃ / 43Mpa Max	High-Temperature use like Steam, Thermal Oil



V-Shaped PTFE Packing



Expanded Graphite Packing

PO3-DP

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

VALVE PERFORMANCE

The performance spcification of pneumatic control valve include: Basic error, Return difference, Dead zone, Start/End Position offset, Rated Stroke offset, Leakage, Sealing, Pressure resistance, Appearance, Rated flow coefficient, Flow characteristics, Vibration resistance, and Action life.

Basic error is tested by inputing the specified input SIGNAL into the actuator (or positioner) steadily in the increasing and decreasing directions, measure the STROKE value corresponding to each point, and calculate the error of each point between the actual " SIGNAL-STROKE " relationship and the theoretical relationship. The maximum value is the basic error. The test points shall at least include 5 points of signal range 0, 25%, 50%, 75% and 100%. The basic error limit of the measuring instrument shall be less than 1/4 of the basic error limit of the valve under test.

No.	Technical Specification			Standard Type		Extension Bonnet Type	
				Without Positioner	With Positioner	Without Positioner	With Positioner
1	Basic Error %			±5	±1	±15	±4
2	Return Difference %			3	1	10	3
3	Dead Zone %			3	0.4	8	1
4	Start/End Position offset %	Air Open	Start	±2.5	±1	±6	±2.5
			End	±5	±1	±15	±2.5
		Air Close	Start	±5	±1	±15	±2.5
			End	±2.5	±1	±6	±2.5
5	Rated Stroke offset%			±2.5	±2.5	±6	±2.5
6	Rated flow coefficient of deviation %			±10	±10	±10	±10
7	The intrinsic flow feature			Ratio±30		Ratio±30	
8	Inherent range ability			50:1		50:1	

PERFORMANCE TESTING PRESSURE

Pressure Rating		PN16	PN25	PN40	PN64	PN100
Hydraulic Pressure Testing	Shell Testing	2.4MPa	3.8Mpa	6.0MPa	9.6MPa	15MPa
	Seal Testing	1.76MPa	2.75MPa	4.4MPa	7.04MPa	11MPa
Air Pressure Testing	Seal Testing	0.6Mpa	0.6Mpa	0.6Mpa	0.6Mpa	0.6Mpa

Note:
1. The Hydraulic pressure testing should be tested by fliud of water or oil under the temperature from 5~40℃ .
2. All the POV's valve will be pressure tested and approved before the delivery.
3. All the POV Testing process is carried according to the GB/T 13927--2008 Standard.

PRESSURE RATING AND PERFORMANCE AND CONVERSION TABLE

Rating Type	Low-Pressure Type	Mid-Pressure Type	High-Pressure Type	Hyper-Pressure Type
PN	1.6Mpa	2.5/4.0Mpa	6.4/10MPa	15MPa
ANSI	150LBS	300LBS	600LBS	900LBS
JIS	10K	20K	40K	63K

PO3-DP

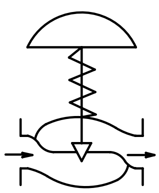
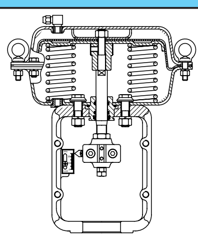
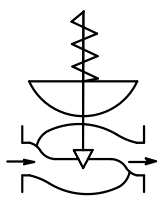
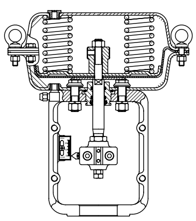
PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

ACTUATOR

INTRODUCE

Pneumatic Actuator has two kinds of Direct Action type (POD-D) and Reverse Action type (POD-R).

Pneumatic multi spring membrane actuator can be divided into two types according to the action mode: Direct action type and Reverse action type. When the signal increases, the actuator that the push rod acts in the direction of extending out of the membrane chamber is a Direct action type, and the model is POD-D. When the signal increases, the actuator that the push rod acts in the direction of retreating into the membrane chamber is Reverse action type, and the model is POD-R.

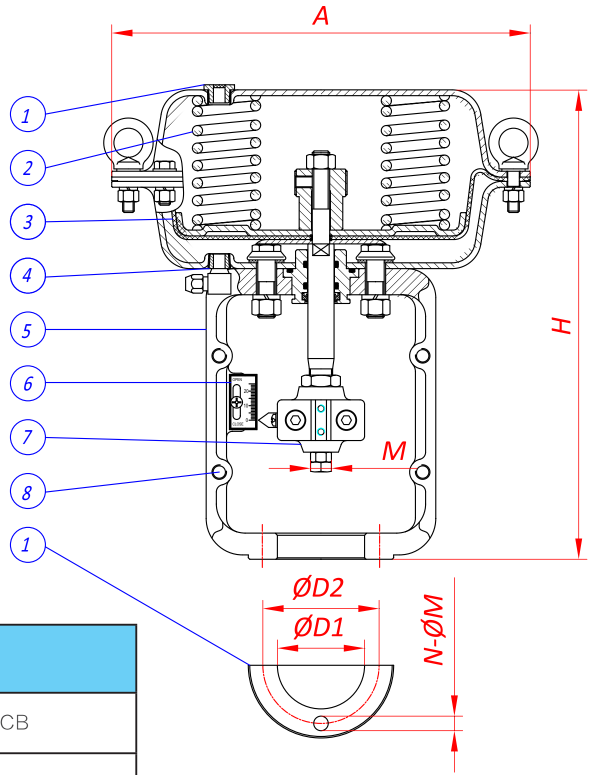
Model	Symbol	Structure	Action Type	Air / Spring / Fail Position	Description
POD-D			Direct Action type	Air-To-Close Spring-To-Open Air Fail Open Normally Open Type	Actuator action when the valve closes as the input signal increases.
POD-R			Reverse Action type	Air-To-Open Spring-To-Close Air Fail Close Normally Close Type	Actuator action when the valve opens as the input signal increases.

PO3-DP Series: PNEUMATIC SINGLE SEAT CONTROL VALVE

PO3-DP

SPECIFICATION

The pneumatic multi spring diaphragm actuator is low in height, light in weight and easy to install and calibrate. The utility model is composed of a diaphragm, a compression spring, a tray, a push rod, a bracket, a shaft sleeve, a diaphragm cover and other main parts. The diaphragm is of deep basin shape, with little change in effective surface. It is made of high-quality rubber. It is used at -40 ℃ to+85 ℃ , and the operation is normal. The compression spring adopts the form of multiple combinations. In order to reduce the height and fine machining of the guide surface of the push rod, improve the hardness and reduce the roughness, so as to reduce the backlash and increase the sealing performance. The reaction actuator adopts the O-ring type, which is matched with the push rod and shaft sleeve. It is simple in structure and reliable in sealing. Through correct design and accurate processing, this mechanism eliminates the adjustment structure of the compression spring and can be assembled at one time to reduce the trouble of adjustment.



STURCTURE

No.	Parts	No.	Parts
1	Air supply Connection end of POD-D	5	Yoke: Carbon Steel A216 WCB
2	Multi-Springs	6	Scale Plate: Stainless steel
3	Diaphragm: A. EPDM+Nylon cloth B. NBR+Nylon cloth	7	Stem Connector
		8	Standard Connect pad for Accessories
4	Air supply Connection end of POD-R	9	Standard Connect pad for Valve

DATAS AND DIMENSIONS

Model		POD-D(R)-11	POD-D(R)-22	POD-D(R)-23	POD-D(R)-34	POD-D(R)-45	POD-D(R)-56
Material	Cover	Carbon Steel					
	Diaphragm	EPDM rubber +Nylon cloth, NBR rubber +Nylon cloth					
Area		220	350	350	560	960	1400
Travel		10	10/16	16/25	40	40/60	100
Spring Range		0.02~0.10、0.04~0.20、0.08~0.24MPa					
Air supply pressure		0.14~0.25MPa					
Air Port Size		M10x1				M12x1.25	M16x1.5
Working Temp.		-30~60℃					
Diameter A		236	285	285	360	470	620
L		80/70	100/84	100/75	154/114	180/115	260/160
H		220	270	300	375	490	720
D1		/	80	80	105	122	130
D2		32	60	60	80	95	100
A		236	285	285	360	470	620
N-ΦM		/	2-Φ10	2-Φ10	4-Φ12	4-Φ14	4-Φ18
M		M8	M8	M8	M12×1.25	M16×1.5	M20×1.5
Weight (Kg)		10	12	16	22	52	125

PO3-DP

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

FLOW CHARATERISTIC

The flow characteristic of the control valve refers to the relationship between the RELATIVE FLOW and the RELATIVE OPENING, of the regulated medium through the control valve, that is, the static characteristic of the control valve.

The relative flow refers to the ratio of the flow of the control valve at a certain opening degree to the flow at a full opening degree.

$$\text{RELATIVE FLOW} = \frac{\text{FLOW RATE OF VALVE OPEN AT CERTAIN DEGREE}}{\text{FLOW RATE OF VALVE AT FULL OPENING}}$$

The relative opening refers to the ratio of the stroke of the control valve to the full stroke at a certain opening.

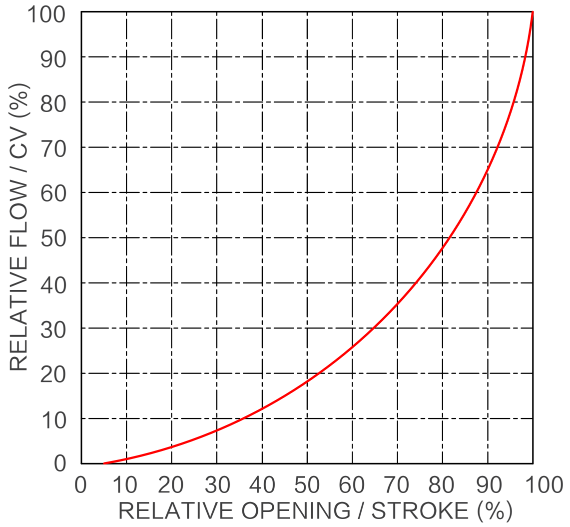
$$\text{RELATIVE OPENING} = \frac{\text{VALVE OPENING STOKE}}{\text{VALVE FULL STROKE}}$$

The flow characteristic of the control valve is the functional relationship between the relative flow and the relative opening.

FLOW CHARATERISTIC = f (RELATIVE FLOW , RELATIVE OPENING)

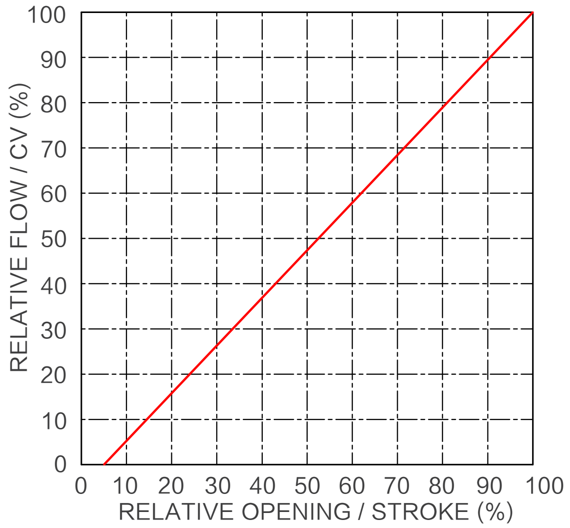
1. EQUAL PERCENTAGE CHARACTERISTIC

The equal percentage characteristic is also called logarithmic characteristic, which means that when the opening of the valve increases by the same value, the flow through the control valve increases by an equal percentage. At the same opening change value of the control valve, when the flow is small, the flow change is small, and the regulating effect is gentle and stable; When the flow is large, the flow changes greatly, and the regulation is sensitive and effective. The control accuracy of valves with equal percentage characteristics in the full stroke valve is unchanged.



2. LINEAR CHARACTERISTICS

The linear characteristic refers to the ratio of the relative flow and the relative opening of the control valve, which is a constant. Under the same opening change value of the control valve, when the flow is small, the change value of the flow is relatively large, the regulating effect is strong, and it is easy to cause overshoot and oscillation; When the flow is large, the change value of the flow is relatively small, and the regulation is not sensitive enough.



PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

CV VALUE AT % OPENING DEGREE UNDER PORT SIZES AND RATE TRAVEL FOR POD-3 CONTROL VALVE

Size	Inch	Port Size (mm)	Rated Travel (mm)	Rated CV Value									
				Valve opening degree									
				Equal Percentage					Lieaner				
				10%	30%	50%	70%	100%	10%	30%	50%	70%	100%
DN20	3/4"	10	16	0.09	0.17	0.34	0.95	1.6	0.27	0.68	1.09	1.49	1.8
		12		0.14	0.27	0.53	1.48	2.5	0.42	1.06	1.69	2.32	2.8
		15		0.22	0.43	0.85	2.37	4	0.67	1.66	2.65	3.65	4.4
		20		0.34	0.68	1.35	3.74	6.3	1.05	2.6	4.16	5.72	6.9
DN25	1"	15	16	0.22	0.43	0.85	2.37	4	0.67	1.66	2.56	3.65	4.4
		20		0.34	0.68	1.35	3.74	6.3	1.05	2.6	4.16	5.72	6.9
		25		0.55	1.08	2.14	5.93	10	1.67	4.15	6.64	9.11	11
DN32	1-1/4"	20	25	0.34	0.68	1.35	3.74	6.3	1.05	2.6	4.16	5.72	6.9
		25		0.55	1.08	2.14	5.93	10	1.67	4.15	6.64	9.11	11
		32		0.87	1.73	3.42	9.49	16	2.67	6.63	10.62	14.58	17.6
DN40	1-1/2"	25	25	0.55	1.08	2.14	5.93	10	1.67	4.15	6.64	9.11	11
		32		0.87	1.73	3.42	9.49	16	2.67	6.63	10.62	14.58	17.6
		40		1.36	2.72	5.35	14.82	25	4.17	10.37	16.59	22.79	27.5
DN50	2"	32	25	0.87	1.73	3.42	9.49	16	2.67	6.63	10.62	14.58	17.6
		40		1.36	2.72	5.35	14.82	25	4.17	10.37	16.59	22.79	27.5
		50		2.18	4.32	8.54	23.71	40	6.67	16.68	26.56	36.46	44
DN65	2-1/2"	40	40	1.36	2.72	5.35	14.82	25	4.17	10.37	16.59	22.79	27.5
		50		2.18	4.32	8.54	23.71	40	6.67	16.58	26.56	36.46	44
		65		3.34	6.81	13.45	37.35	63	10.47	20.01	41.63	57.17	69
DN80	3"	50	40	2.18	4.32	8.54	23.71	40	6.67	16.58	26.56	36.46	44
		65		3.34	6.81	13.45	37.35	63	10.47	26.01	41.63	57.17	69
		80		5.45	10.81	21.36	59.28	100	16.69	41.46	66.37	91.14	110
DN100	4"	65	40	3.34	6.81	13.45	37.35	63	10.47	26.01	41.63	57.17	69
		80		5.45	10.81	21.36	59.28	100	16.69	41.46	66.37	91.14	110
		100		8.72	17.29	34.17	94.85	160	26.7	66.34	106.2	145.8	176
DN125	5"	80	60	5.45	10.81	21.36	59.28	100	16.69	41.46	66.37	91.14	110
		100		8.72	17.29	34.17	94.85	160	26.7	66.34	106.2	145.8	176
		125		13.62	27.06	53.4	148.2	250	41.72	103.7	165.9	227.9	275
DN150	6"	100	60	8.72	17.29	34.17	94.85	160	26.7	66.34	106.2	145.8	176
		125		13.62	27.06	53.4	148.2	250	41.72	103.7	165.9	227.9	275
		150		21.8	43.23	85.42	237.1	400	66.75	165.85	265.5	364.6	440
DN200	8"	125	60	13.62	27.06	53.4	148.2	250	41.72	103.7	165.9	227.9	275
		150		21.8	43.23	85.42	237.1	400	66.75	165.85	265.5	364.6	440
		200		34.34	68.08	134.5	373.5	630	104.7	260.1	416.3	571.7	690
DN250	10"	250	100	49.1	97.3	192.1	533.6	900	151.7	377.0	603.3	828.6	1000
DN300	12"	300	100	78.5	155.6	307.4	853.7	1440	242.8	603.1	965.3	1325.7	1600

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

MAX ALLOABLE PRESSURE DIFFERENCE

The maximum allowable differential pressure refers to the static or dynamic differential pressure applied to the shaft trim when the valve is operating. The maximum closing differential pressure refers to the differential pressure on both sides of the valve trim when the valve is closed. Therefore, the maximum allowable differential pressure must be higher than the maximum closing differential pressure. The maximum allowable differential pressure of the control valve is determined by the actuator model, the air supply pressure, the spring range, the valve seat form and the valve trim size. Please check below table for reference.

Since there is a pressure difference between the between and after of the control valve, if the valve can operate normally, the push pressure of the valve produced by its actuator must be able to overcome the maximum value of this pressure difference. That is, when selecting the valve model, the maximum allowable pressure difference must be higher than the pressure before the valve.

UNIT: Mpa

Actuator Model	Air Supply (Kpa)	Spring Range (Kpa)	Port Size - mm															
			10	12	15	20	25	32	40	50	65	80	100	125	150	200	250	300
POD-D-22 Direct Action NO	140	20 ~ 100	6.4	6.19	3.96	2.23	2.14											
	250	20 ~ 100	6.4	6.4	6.4	6.4	6.4											
	400	40 ~ 200	6.4	6.4	6.4	6.4	6.4											
POD-D-23 Direct Action NO	140	20 ~ 100						0.87	0.56	0.35								
	250	20 ~ 100						5.68	3.64	2.3								
	400	40 ~ 200						6.5	5.04	3.18								
POD-D-34 Direct Action NO	140	20 ~ 100									0.34	0.22	0.14					
	250	20 ~ 100									2.21	1.43	0.91					
	400	40 ~ 200									3.06	1.98	1.26					
POD-D-45 Direct Action NO	140	20 ~ 100												0.15	0.1	0.06		
	250	20 ~ 100												0.95	0.66	0.37		
	400	40 ~ 200												1.32	0.92	0.52		
POD-D-56 Direct Action NO	140	20 ~ 100															0.06	0.04
	250	20 ~ 100															0.37	0.25
	400	40 ~ 200															0.51	0.36
POD-R-22 Reverse Action NC	140	20 ~ 100	4.46	3.09	1.98	1.16	0.7											
	250	40 ~ 200	6.4	6.4	5.94	3.34	2.14											
	400	80 ~ 240	6.4	6.4	6.4	6.4	4.99											
POD-R-23 Reverse Action NC	140	20 ~ 100						0.44	0.28	0.18								
	250	40 ~ 200						1.31	0.84	0.53								
	400	80 ~ 240						3.05	1.95	1.25								
POD-R-34 Reverse Action NC	140	20 ~ 100									0.17	0.11	0.07					
	250	40 ~ 200									0.51	0.33	0.21					
	400	80 ~ 240									1.18	0.78	0.5					
POD-R-45 Reverse Action NC	140	20 ~ 100												0.07	0.05	0.03		
	250	40 ~ 200												0.22	0.15	0.09		
	400	80 ~ 240												0.51	0.36	0.21		
POD-R-56 Reverse Action NC	140	20 ~ 100															0.03	0.02
	250	40 ~ 200															0.09	0.06
	400	80 ~ 240															0.2	0.14

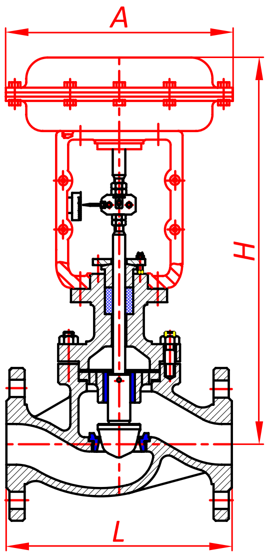
PO3-DP

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

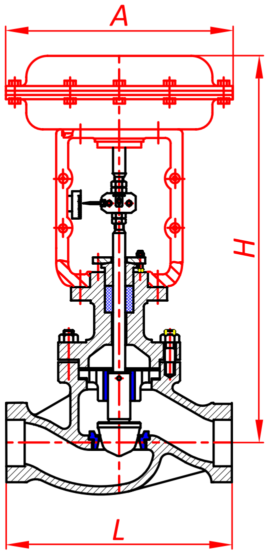
DIMENSIONS

The PO3- DP control valve is manfuactured by casting, and the Face-to-face is according to the standard IEC 60534-3. The POV Valve can also manfuactured the valve face-to-face length according to other standards. Please consult with POV Valve for more details.

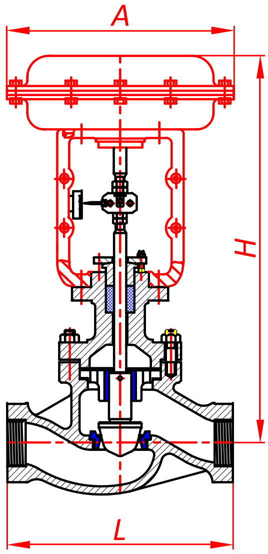
For the valve end connection dimensions, please check Appendix II for more information.



FLANGE TYPE



BW&SW TYPE



THREAD TYPE

Size	inch	Series No.	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	5"	6"	8"	10"	12"
	mm		20	25	32	40	50	65	80	100	125	150	200	250	300
L	PN16	Series A	181	184	200	222	254	276	298	352	–	451	543	673	737
		Series B	150	160	180	200	230	290	310	350	400	480	600	730	850
	PN25	Series A	194	197	–	235	267	292	317	368	425	473	568	708	775
		Series B	150	160	180	200	230	290	310	350	400	480	600	730	850
	PN40	Series A	194	197	–	235	267	292	317	368	425	473	568	708	775
		Series B	150	160	180	200	230	290	310	350	400	480	600	730	850
	PN63	Series A	206	210	230	251	286	311	337	394	450	508	610	752	819
		Series B	230	230	260	260	300	340	380	430	500	550	650	775	900
	PN100	Series A	206	210	–	251	286	311	337	394	–	508	610	752	819
		Series B	230	230	260	260	300	340	380	430	500	550	650	775	900
	CL150	Series A	181	184	200	222	254	276	298	352	–	451	543	673	737
		Series B	150	160	180	200	230	290	310	350	400	480	600	730	850
	CL300	Series A	194	197	–	235	267	292	317	368	425	473	568	708	775
		Series B	150	160	180	200	230	290	310	350	400	480	600	730	850
	CL600	Series A	206	210	–	251	286	311	337	394	–	508	610	752	819
		Series B	230	230	260	260	300	340	380	430	500	550	650	775	900
	JIS10K	Series A	181	184	200	222	254	276	298	352	–	451	543	673	737
		Series B	150	160	180	200	230	290	310	350	400	480	600	730	850
	JIS20K	Series A	194	197	–	235	267	292	317	368	425	473	568	708	775
		Series B	150	160	180	200	230	290	310	350	400	480	600	730	850
	BW	–	–	–	–	–	–	311	337	394	–	–	–	–	–
	SW	–	206	210	230	251	286	–	–	–	–	–	–	–	–
	TRD.	–	206	210	–	–	–	–	–	–	–	–	–	–	–
H	Standard Bonnet		398.5	410.5	455	455	457.5	610	622	640	718	870	890	1203	1234
	Extension Bonnet		548.5	650.5	632	620	627.5	790	807	850	980	1130	1150	1523	1554
Actuator Diameter A			285	285	285	285	285	360	360	360	470	470	470	580	580
Weight (kgs)			23	24	26	35	40	66	78	99	140	195	256	470	600

PO3-DP

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

ACCESSORY

(1) Positioner: Improve the valve position accuracy, and can realize the process control, positive and reaction, etc

(2) Hand wheel: When the control system failure or insufficient air supply, can be manually operation, do not affect production

(3) Air filter pressure valve: Accept air pressure from compressor, through filter clean stable voltage, input valve positioned.

1. POSITIONER

Mechnical Positioner - Non-Exp.-Proof

Smart Positioner - Non-Exp.-Proof

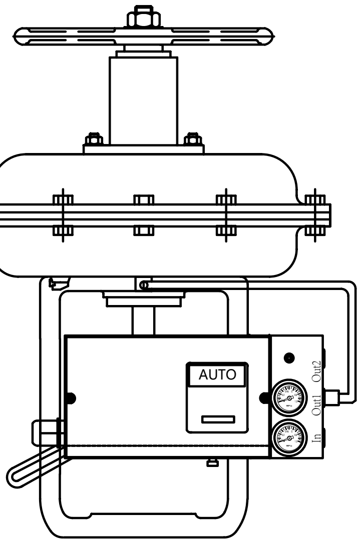
Siemens Positioner - Non-Exp.-Proof

Mechnical Positioner - Exp.-Proof

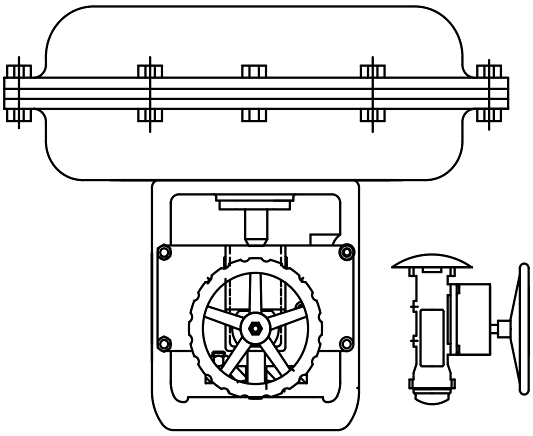
Smart Positioner - Exp.-Proof

Siemens Positioner - Exp.-Proof

2. TOP-MOUNTED HANDWHEEL



3. SIDE-MOUNTED HANDWHEEL



4. AIR FILTER

PO3-DP

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

ORDERING CODE

PO 3 6 ☐ ☐ – 1 ☐ ☐ ☐ – D P

End Connection	
4	Flange
1	Thread
6	Welding

Seal Material	
4	PTFE
6	Metallic

Body Material	
3	A216 WCB
A	A351 CF8
B	A351 CF8M
F	Others

Trim Material	
3	A216 WCB
A	A351 CF8
B	A351 CF8M
F	Others

Pressure Rating	
3	PN16
4	PN25
5	PN40
6	PN65
7	PN100
A	Class150LBS
B	Class300LBS
C	Class600LBS
F	JIS10K
H	JIS20K

– ☐ ☐ ☐ ☐ –

Action Type	
D	Direct Type
R	Reverse Type

Explosion-Proof Grade	
0	NA
1	EXd II CT6
3	EX ia IICT6

Bonnet Type	
S	Stanadard Bonnet
H	High-Temp
L	Low-Temp
B	Bellow Seal

Characteristic	
Q	Equal Percentage
L	Linear

– ☐ ☐ ☐

Accessory	
BLANK	NA
M	Mechnical Positioner
I	Intelligent Positioner

Accessory	
BLANK	NA
A	Air Set

Accessory	
BLANK	NA
T	Top-mounted Handwheel
S	Side-mounted Handwheel

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

INSTALLATION

(1) Check whether nameplate, physical is in conformity with the design;

(2) Check whether the machine parts defect and loose, for special occasions, again carries on the strength, sealing, leakage and precision test.

(3) Pipe should be washed, before installation, the valve at the entrance of straight pipe to have enough, and is equipped with a filter. The valve and pipeline valve LAN connection, should pay attention to alignment .

(4) Installation area should consider the safety of the equipment, convenient for operation, and for disassembling and maintenance.

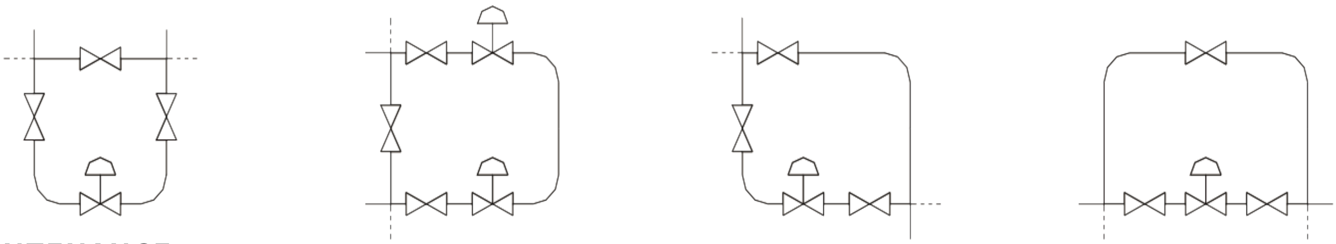
(5) Valve should be vertical installed in horizontal pipe, valve since the weight is bigger with vibration of the occasion with a support frame, try to avoid horizontal installation.

(6) Medium flow direction should be in line with arrow on valve body pointing in the direction. Air should be dry, no oil. Ambient temperature -25 ~ 55 ℃ occasions.

(7) In order to make automatic control system failure or repair valve, still can continuous production, bypass valve should be set up. Flow characteristic of the by-pass valve, the stroke should be consistent with the original valve selection.

Valve group installation scheme

Note: Dotted line in the graph represent another allows direction of pipe exports



MAINTENANCE

(1) The general medium, as long as wash with water. But the cleaning medium is bad for your health, must first understand its nature, choose the corresponding way to clean again.

(2) Valve disassembly: The exposed surface rust parts cleaning first, but in front of the rust removal, to protect the seat, valve core, valve stem and push rod and other precision parts machining surface. Remove the seat should use a special tool .

(3) Core and seat: Sealing surface with smaller rusty spot and wear available machining method to repair, such as badly damaged must be replaced. But no matter after the repair or replacement of the hard sealing surface, must be for grinding.

(4) Stem: Surface damage, can only change

(5) Push rod, guide and sealing surface damage : The reaction actuator must be change new, but the positive effect actuator, can be used after proper repair.

(6) Compressor spring: Impact strength of the defects such as cracks, if any, must be replaced.

(7) Wear part: Packing, sealing gaskets and o-ring, each time maintenance change all new. Diaphragm must check whether there is a predictor of the future possible crack corrosion, aging and trace, according to the results of the inspection to decide whether to change, but could diaphragm is commonly 2 ~ 3 years.

(8) Valve assembly should pay attention to the bolt to tighten on the diagonal, sliding part to add lubricating oil. After assembly shall be according to the product factory test program and method of debugging, and during that time, packing pressure force can be adjusted more accurately, closed position valve core and valve locator.

(9) You may refer to common faults method ruled out

PO3-DP

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

FAULTS AND SOLUTIONS

Fault	Reason	Solutions
1.With the input signal but no action	1.Actuator fault 2.Stem bend and break 3.Valve core loss 4.Core and bushing or seat stuck 5.The locator amplifier constant orifice in the jam	1.Check actuator 2.Change stem 3.Reset valve core 4Check the alignment and installation again 5.Removal constant orifice sundry
2.Valve fully closed large leakage	1.Valve or valve seat corrosion, wear and tear 2.Seat thread corrosive	1.Mild abrasive valve core and valve seat, serious requires replacement of valve trim and valve seat 2.Change seat
3.Valve can"t to full close position	1.Medium pressure difference is greater than the valve to allow the differential pressure 2.Inner valve with other matter	1.Choose one of large output force actuator. 2.Clean other matter
4.Valve movement unstable vibration phenomenon	1.Actuator stiffness is too small 2.Stem high friction 3.Valve size selection is too large, valve work in a small open 4.Support the instability 5.There is vibration source nearby	1.Choose bigger one 2.Reduce stem friction 3.Reduce seat diameter 4. Strengthening support 5.Eliminate the vibration source
5.Packing leakage	1.Packing gland not compressed 2.Packing damage 3.Stem damage	1.Compressed gasket gland 2.Chang packing 3.Change stem
6.Leakage on the valve body and valve connection	1.Gasket damage 2.Hexagonal nut loose	1.Change gasket 2.Fastening hexagonal nut
7.Valve moves slow	1.Body with mud or sticky stuff 2.PTFE packing damage 3.Diaphragm damage 4.Actuator leakage	1.Clean 2.Change packing 3.Change diaphragm 4.Repair the flat place
8.Small adjustable range	1.Corrode valve core, make the minimum flow	1.Change the valve trim

PO3-DP

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

ORDERING FORMAT

Thank you for ordering the control valve of POV VALVE and your support to us. We will provide you with the most comprehensive technical support.

Before giving you a quotation, we need to confirm the following technical parameters with you, such as COLUMN 1, so that we can confirm the valve cost.

Before manufacturing the order, we need to confirm the medium parameters, such as COLUMN 2, so that we can produce appropriate valves according to your medium parameters.

If you need our technicians to recommend valve types for you, please complete COLUMN 2.

PROJECT: ____________	**LOCATION:** ____________
TAG NO.: ____________	**PIPE & ID NO.:** ____________
SERVICE: ____________	**PIPE MATERIAL:** ____________
QUANTITY: ____________	**PIPE SIZE:** ____________

For any special needs or questions, having completed the form below, contact our technical office to obtain updated information on the related valve type.

PO3-DP PNEUMATIC 2-WAY SINGLE SEAT CONTROL VALVE / SINGLE SEAT PLUNGER TRIM

COLUMN 1. DATA NEED TO KNOW:

NORMINAL SIZE: DN__________ x **PORT DIAMETER:** __________ mm

PRESSURE RATING: ☐ PN16 ☐ PN25 ☐ PN40 ☐ PN65 ☐ PN100
☐ Class150LBS ☐ Class300LBS ☐ Class600LBS
☐ JIS10K ☐ JIS20K

END CONNECTION: ☐ RF Flange ☐ MF Flange ☐ RTJ Flange
☐ Thread ☐ SW ☐ BW

BONNET TYPE: ☐ Standard Bonnet
☐ Extension High- Temperature Type
☐ Extension Low- Temperature Type
☐ Extension Bellow Seal Type
☐ Vendor Recommend

PACKING TYPE: ☐ V- Shaped PTFE Packing ☐ Expanded Graphite Packing
☐ Vendor Recommend

BODY MATERIAL: ☐ WCB ☐ LCB ☐ WCC ☐ WC5 ☐ WC9 ☐ WC6
☐ CF8 ☐ CF8M ☐ CF3M
☐ AISI 321 ☐ AISI 316Ti ☐ Duplex 2205
☐ Vendor Recommend

TRIM MATERIAL: ☐ SUS410 ☐ SUS304 ☐ SUS316 ☐ SUS316L
☐ Others______________ ☐ Vendor Recommend

ACTION TYPE: ☐ POD- D / Air- To- Close / Spring- To- Open / Air Fail Open / Normally Open Type
☐ POD- R / Air- To- Open / Spring- To- Close / Air Fail Close / Normally Close Type

AIR SUPPLY PRESSURE: ☐ 140Kpa ☐ 250Kpa ☐ 400Kpa

FLOW CHARACTERISTIC: ☐ Equal Percentage Type ☐ Linear Type

EXPLOSION-PROOF GRADE: ☐ NA ☐ EXd II CT6 ☐ EX ia IICT6 ☐ Vendor Recommend

ACCESSORIES:

1. POSITIONER ☐ Mechnical YT Series ☐ Smart Positioner TORLEO ☐ Smart Positioner SIEMENS
☐ Other Brand/Model ________ / ________

CONTROL Input Signal: ☐ 4-20mA ☐ 3-15PSI

FEEDBACK Feedback Signal: ☐ NA ☐ 4-20mA ☐ OPEN-CLOSE

2. HANDWHEEL ☐ NA ☐ Top- Mounted ☐ Side- Mounted

3. AIR FILTER ☐ NA ☐ AFC2000 ☐ BFC2000 ☐ YT- 200 ☐ YT- 205 ☐ YT- 220 ☐ YT- 225

4. OTHER REQUIRES ______________________

If you cannot confirm the above specification for ordering, please consult with POV engineer. Before consulting, please check below data for the valve for our engineer recommen.

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

ORDERING FORMAT (2)

If you cannot confirm the above specification for ordering, please consult with POV engineer. Before consulting, please check below data for the valve for our engineer recommend.

COLUMN 2. DATA NEED FOR MANUFACTURING / RECOMMEND:

A : MEDIUM TYPE : LIQUID

OPERATING FLUID NAME: ____________________
OPERATING DENSITY: ____________________ ☐ g/cm^3 ☐ kg/m^3 (unit)
VISCOSITY: ____________________ ☐ mm^2/s ☐ cst (unit)(For liquid only)
FLOW RATE: MAX________ NOR________ MIN________ ☐ m^3/h (unit)
PRESSURE UPSTREAM OF THE VALVE: MAX________ NOR________ MIN________ ☐ bar ☐ Mpa ☐ kPa (unit)
PRESSURE DOWNSTREAM OF THE VALVE: MAX________ NOR________ MIN________ ☐ bar ☐ Mpa ☐ kPa (unit)
TEMPERATUR OF THE FLUID: ____________________ ☐℃ ☐℉ (unit)
VAPOUR PRESSURE AT INLET TEMPERATURE: ____________________ ☐ bar ☐ Mpa ☐ kPa (unit)
CRITICAL PRESS: ____________________ ☐ bar ☐ Mpa ☐ kPa (unit)

B : MEDIUM TYPE : GAS

OPERATING FLUID NAME: ____________________
MOLECULAR MASS OF GAS: ____________________ ☐ kg/kmol
OPERATING DENSITY: ____________________ ☐ g/cm^3 ☐ kg/m^3 (unit)
VISCOSITY: ____________________ ☐ mm^2/s ☐ cst (unit)(For liquid only)
MAS FLOW RATE: MAX________ NOR________ MIN________ ☐ kg/h (unit)
PRESSURE UPSTREAM OF THE VALVE: MAX________ NOR________ MIN________ ☐ bar ☐ Mpa ☐ kPa (unit)
PRESSURE DOWNSTREAM OF THE VALVE: MAX________ NOR________ MIN________ ☐ bar ☐ Mpa ☐ kPa (unit)
TEMPERATUR OF THE FLUID: ____________________ ☐℃ ☐℉ (unit)

C : MEDIUM TYPE : STEAM

OPERATING FLUID NAME: ☐ Steam ☐ Superheated Steam
MAS FLOW RATE: MAX________ NOR________ MIN________ ☐ kg/h (unit)
PRESSURE UPSTREAM OF THE VALVE: MAX________ NOR________ MIN________ ☐ bar ☐ Mpa ☐ kPa (unit)
PRESSURE DOWNSTREAM OF THE VALVE: MAX________ NOR________ MIN________ ☐ bar ☐ Mpa ☐ kPa (unit)
TEMPERATUR OF THE FLUID: ____________________ ☐℃ ☐℉ (unit)

Other Requirements:
____
____
____
____
____

CUSTOMER COMPANY: ____________________
CUSTOMER NAME: ____________________
CONTACT NUMBER: ____________________
MAIL ADDRESS: ____________________
DATE: ____________________
SIGN: ____________________

PO3-DP Series:
PNEUMATIC SINGLE SEAT CONTROL VALVE

DATASHEET

POV Pov Fluid Control Technology (Wuhu) Co., Ltd.	PROJECT		COMPANY	
	LOCATION		CLIENT	
	CONT.NO		CONTACT	
	DES.STAGE		MAIL	

1	Prepared By:		SPECIFICATION OF CONTROL VALVE				Series No.:	PO3-DP
2	Checked By:							
3	Review By:		Page No.:		Total Pages:		Datasheet No.:	

4	TAG No.			
5	Quantity			
6	Service			
7	P & ID No.			
8	Line Material			
9	Line Size			
10	**OPERATION CONDITION**			
11	Fluid Name			
12	Fluid State			
13	**PARAMETER**		**UNIT**	**DATA**
14	Operating Temperature		℃	
15	Flow Rate	Max	kg/h	
16		Nor	kg/h	
17		Min	kg/h	
18	Upstream Inlet Pressure	Max	kPa	
19		Nor	kPa	
20		Min	kPa	
21	Downstream Outlet Pressure	Max	kPa	
22		Nor	kPa	
23		Min	kPa	
24	Different Pressure - ΔP	Max	kPa	
25		Nor	kPa	
26		Min	kPa	
27	Shut-off Pressure		kPa	
28	Operating Density		Kg/m^2	
29	Standard Density		Kg/m^2	
30	Specific Gravity		-	
31	Molecular Weight Of Gas		kg/kmol	
32	Dynamic Viscosity		cp	
33	Specific Heats Ratio		-	
34	Compressibility Factor		-	
35	Absolute Vapour Pressure		kPa	
36	Absolute Critical Pressure		kPa	
37	Calculate Cv	Max	-	
38		Nor	-	
39		Min	-	
40	Selected Cv		-	
41	Open Degree/ Travel	Max	%	
42		Nor	%	
43		Min	%	
44	Noise Level		dB	
45	Air Fail Posion		-	
46	Stroke Time		Seconds	
47	Special Demands			
48	Remarks:			

VALVE BODY	49	Valve Type	
	50	Mode No.	
	51	Body Size	
	52	Ports Size	
	53	Pressure Rating	
	54	End Connection / Standard	
	55	Body Material	
	56	Plug Material	
	57	Seat Material	
	58	Stem Material	
	59	Leakage Class	
	60	Flow Characteristic	
	61	Bonnet Type	
	62	Packing Type	
	63	Valve Rated Cv	
	64	Rated stroke (mm)	
	65	Temperature Rating (℃)	
ACTUATOR	66	Type	
	67	Model No.	
	68	Action Type	
	69	Fail Position	
	70	Spring Range (KPa)	
	71	Air Supply (kPa)	
	72	Effective Area	
	73	Pneumatic Conn. Size	
	74	Hand Wheel	
	75	Max Allowable Pressure	
POSITIONER	76	Type	
	77	Model No.	
	78	Input Signal	
	79	Feedback Signal	
	80	Air Supply (KPa)	
	81	Pneumatic Connection Size	
	82	Explosion-Proof Grade	
	83	Protection Class	
	84	Power Supply	
	85	Electric Connection Size	
	86	Communication Protocol	
	87	Shell Material	
	88	Open/Close Posi. Feedback	
	89	Pressure Gauge Quantity	
ACC.	90	Air Set	
	91	Air-Speed Controller	
	92	Quick Exhaust Valve	
	93	Stem Position Transmitter	
	94	Matching Flanges	
REVISIONS			SIGN
CHECK			DATE

APPENDIX I
TEMPERATURE- PRESSURE TABLE FOR MATERIALS

CAST STEEL WCB

UNIT: Bar

Carbon steel ASTM A216 grade WCB, SCPH2, ZG230-450
Operating temperature: -30 ≤ t ≤ 425 ℃ , P ≤ 25MPa
(As per ASME B16.34-1996)

Composition (%)	C ≤ 0.30	Mn ≤ 1.00	Si ≤ 0.06	S ≤ 0.045
	P ≤ 0.40	Cr ≤ 0.40	Ni ≤ 0.50	Mo ≤ 0.25

WCB is the steel material most often used for valve body under medium working conditions such as air, saturated or superheated steam, non corrosive liquid or gas. WCB cannot be used in the situation where the temperature exceeds 427 ℃ , because the high carbon layer may be converted into graphite. It can be welded without heat treatment unless the nominal thickness exceeds 32mm.

℃ ANSI	150	300	600	900
-29 to 38	19.6	51.1	102.1	153.2
50	19.2	50.1	100.2	150.4
100	17.7	46.6	93.2	139.8
150	15.8	45.1	90.2	135.2
200	13.8	43.8	87.6	131.4
250	12.1	41.9	83.9	125.8
300	10.2	39.8	79.6	119.5
325	9.3	38.7	77.4	116.1
350	8.4	37.6	75.1	112.7
375	7.4	36.4	72.7	109.1
400	6.5	34.7	69.4	194.2
425	5.5	28.8	57.5	86.3

STAINLESS STEEL CF8

UNIT: Bar

Cast 304 stainless steel ASTM A351 Grade CF8
Operating temperature: -268 ≤ t ≤ 649℃
(As per ASME B16.34-1996)

Composition(%)	C ≤ 0.08	Mn ≤ 1.50	Si ≤ 2	S ≤ 0.04
	P ≤ 0.04	Cr:18~21	Ni:8~11	

CF8 Stainless steel material is a common material for corrosive or ultra low or high temperature non corrosive applications.

℃ ANSI	150	300	600	900
-29 to 38	19	49.6	99.3	148.9
50	18.3	47.8	95.6	143.5
100	15.7	40.9	81.7	122.6
150	14.2	37	74	111
200	13.2	34.5	69	103.4
250	12.1	32.5	65	97.5
300	10.2	30.9	61.8	92.7
325	9.3	30.2	60.4	90.7
350	8.4	29.6	59.3	88.9
375	7.4	29	58.1	87.1
400	6.5	28.4	56.9	85.3
425	5.5	28	56	84
450	4.6	27.4	54.8	82.2
475	3.7	26.9	53.9	80.8
500	2.8	26.5	53	79.5
538	1.4	24.4	48.9	73.3
550	1.4*	23.6	47.1	70.7
575	1.4*	20.8	41.7	62.5
600	1.4*	16.9	33.8	50.6
625	1.4*	13.8	27.6	41.4
650	1.4*	11.3	22.5	33.8

STAINLESS STEEL CF8M

UNIT: Bar

Cast 316 stainless steel ASTM A351 Grade CF8M
Operating temperature: -268 ≤ t ≤ 649℃
(As per ASME B16.34-1996)

Composition(%)	C ≤ 0.08	Mn ≤ 1.50	Si ≤ 1.5	S ≤ 0.04
	P ≤ 0.04	Cr:17~21	Ni:9~13	Mo:2~3

CF8M Stainless steel material is a common material for corrosive or ultra low or high temperature non corrosive applications.

℃ ANSI	150	300	600	900
-29 to 38	19	49.6	99.3	148.9
50	18.4	48.1	96.2	144.3
100	16.2	42.2	84.4	126.6
150	14.8	38.5	77	115.5
200	13.7	35.7	71.3	107
250	12.1	33.4	66.8	100.1
300	10.2	31.6	63.2	94.9
325	9.3	30.9	61.8	92.7
350	8.4	30.3	60.7	91
375	7.4	29.9	59.8	89.6
400	6.5	29.4	58.9	88.3
425	5.5	29.1	58.3	87.4
450	4.6	28.8	57.7	86.5
475	3.7	28.7	57.3	86
500	2.8	28.2	56.5	84.7
538	1.4	25.2	50	75.2
550	1.4*	25	49.8	74.8
575	1.5*	24	47.9	71.8
600	1.6*	19.9	39.8	59.7
625	1.7*	15.8	31.6	47.4
650	1.8*	12.7	25.3	38

Note * Only for valves with butt welded ends. The flange connection end grade terminates at 538 ℃ .

STAINLESS STEEL CF3M

UNIT: Bar

Cast 316L stainless steel ASTM A351 Grade CF3M
Operating temperature: t ≤ 454℃
(As per ASME B16.34-1996)

Composition(%)	C ≤ 0.03	Mn ≤ 1.50	Si ≤ 1.5	S ≤ 0.04
	P ≤ 0.04	Cr:17~21	Ni:9~13	Mo:2~3

CF3M Stainless steel material is a common material for orrosive or non corrosive applications.

℃ ANSI	150	300	600	900
-29 to 38	15.9	41.4	82.7	124.1
50	15.3	40	80	120.1
100	13.3	34.8	69.6	104.4
150	12	31.4	62.8	94.2
200	11.2	29.2	58.3	87.5
250	10.5	27.5	54.9	82.4
300	10	26.1	52.1	78.2
325	9.3	25.5	51	76.4
350	8.4	25.1	50.1	75.2
375	7.4	24.8	49.5	74.3
400	6.5	24.3	48.6	72.9
425	5.5	23.9	47.7	71.6
450	4.6	23.4	46.8	70.2

Note * Only for valves with butt welded ends. The flange connection end grade terminates at 538 ℃ .

STAINLESS STEEL 321

UNIT: Bar

Cast 321 stainless steel AISI 321, ZG1Cr18Ni9Ti
Operating temperature: -268 ≤ t ≤ 649℃
(As per ASME B16.34-1996)

Composition(%)	C ≤ 0.12	Mn ≤ 2.00	Si ≤ 1.00	S ≤ 0.03
P ≤ 0.035	Cr:17~19	Ni:8~11	Ti: 5*(C%-0.02)-0.8%	

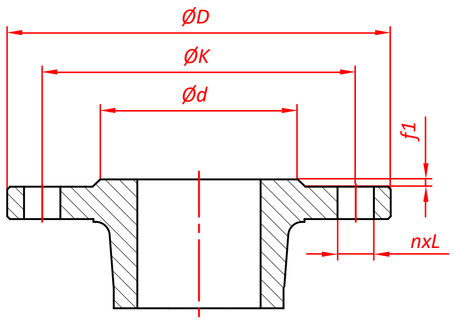
CF8M Stainless steel material is a common material for corrosive or ultra low or high temperature non corrosive applications.

℃ ANSI	150	300	600	900
-29 to 38	19	49.6	99.3	148.9
50	18.6	48.6	97.1	145.7
100	17	44.2	88.5	132.7
150	15.7	41	82	122.9
200	13.8	38.3	76.6	114.9
250	12.1	36	72	108.1
300	10.2	34.1	68.3	102.4
325	9.3	33.3	66.6	99.9
350	8.4	32.6	65.2	97.8
375	7.4	32	64.1	96.1
400	6.5	31.6	63.2	94.8
425	5.5	31.1	623	93.4
450	4.6	30.8	61.7	92.5
475	3.7	30.5	61.1	91.6
500	2.8	28.2	56.5	84.7
538	1.4	25.2	50	75.2
550	1.4*	25	49.8	74.8
575	1.5*	24	47.9	71.8
600	1.6*	20.3	40.5	60.8
625	1.7*	15.8	31.6	47.4
650	1.8*	12.6	25.3	37.9
675	1.9*	9.9	19.8	29.6
700	1.10*	7.9	15.8	23.7

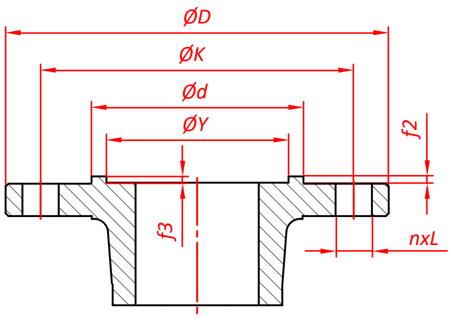
Note * Only for valves with butt welded ends. The flange connection end grade terminates at 538 ℃ .

APPENDIX II
END CONNECTION DIMENSIONS

GB/JB/HG FLANGE - GB9113.1~4



RF FLANGE



MF FLANGE

PN1.6Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	105	75	14	4	M12	56	51	2	3	4
25	1"	115	85	14	4	M12	65	58	2	3	4
32	1-1/4"	140	100	18	4	M16	76	66	2	3	4
40	1-1/2"	150	110	18	4	M16	84	76	2	3	4
50	2"	165	125	18	4	M16	99	88	2	3	4
65	2-1/2"	185	145	18	4/8	M16	118	110	2	3	4
80	3"	200	160	18	8	M16	132	121	2	3	4
100	4"	220	180	18	8	M16	156	150	2	3.5	4.5
125	5"	250	210	18	8	M16	184	176	2	3.5	4.5
150	6"	285	240	22	8	M20	211	204	2	3.5	4.5
200	8"	340	295	22	12	M20	266	260	2	3.5	4.5
250	10"	405	355	26	12	M24	319	313	2	3.5	4.5
300	12"	460	410	26	12	M24	370	364	2	3.5	4.5

PN2.5Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	105	75	14	4	M12	56	51	2	3	4
25	1"	115	85	14	4	M12	65	58	2	3	4
32	1-1/4"	140	100	18	4	M16	76	66	2	3	4
40	1-1/2"	150	110	18	4	M16	84	76	2	3	4
50	2"	165	125	18	4	M16	99	88	2	3	4
65	2-1/2"	185	145	18	8	M16	118	110	2	3	4
80	3"	200	160	18	8	M16	132	121	2	3	4
100	4"	235	190	22	8	M20	156	150	2	3.5	4.5
125	5"	270	220	26	8	M24	184	176	2	3.5	4.5
150	6"	300	250	26	8	M24	211	204	2	3.5	4.5
200	8"	360	310	26	12	M24	274	260	2	3.5	4.5
250	10"	425	370	30	12	M27	330	313	2	3.5	4.5
300	12"	485	430	30	16	M27	389	364	2	3.5	4.5

PN4.0Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	105	75	14	4	M12	56	51	2	3	4
25	1"	115	85	14	4	M12	65	58	2	3	4
32	1-1/4"	140	100	18	4	M16	76	66	2	3	4
40	1-1/2"	150	110	18	4	M16	84	76	2	3	4
50	2"	165	125	18	4	M16	99	88	2	3	4
65	2-1/2"	185	145	18	8	M16	118	110	2	3	4
80	3"	200	160	18	8	M16	132	121	2	3	4
100	4"	235	190	22	8	M20	156	150	2	3.5	4.5
125	5"	270	220	26	8	M24	184	176	2	3.5	4.5
150	6"	300	250	26	8	M24	211	204	2	3.5	4.5
200	8"	375	320	30	12	M27	284	260	2	3.5	4.5
250	10"	450	385	33	12	M30	345	313	2	3.5	4.5
300	12"	515	450	33	16	M30	409	364	2	3.5	4.5

PN6.3Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	130	90	18	4	M16	56	51	2	3	4
25	1"	140	100	18	4	M16	65	58	2	3	4
32	1-1/4"	155	110	22	4	M20	76	66	2	3	4
40	1-1/2"	170	125	22	4	M20	84	76	2	3	4
50	2"	180	135	22	4	M20	99	88	2	3	4
65	2-1/2"	205	160	22	8	M20	118	110	2	3	4
80	3"	215	170	22	8	M20	132	121	2	3	4
100	4"	250	200	26	8	M24	156	150	2	3.5	4.5
125	5"	295	240	30	8	M27	184	176	2	3.5	4.5
150	6"	345	280	33	8	M30	211	204	2	3.5	4.5
200	8"	415	345	36	12	M33	284	260	2	3.5	4.5
250	10"	470	400	36	12	M33	345	313	2	3.5	4.5
300	12"	530	460	36	16	M33	409	364	2	3.5	4.5

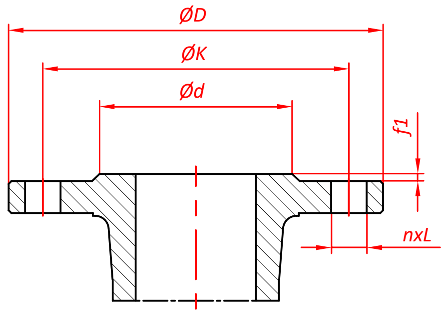
PN10Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	130	90	18	4	M16	56	51	2	3	4
25	1"	140	100	18	4	M16	65	58	2	3	4
32	1-1/4"	155	110	22	4	M20	76	66	2	3	4
40	1-1/2"	170	125	22	4	M20	84	76	2	3	4
50	2"	195	145	26	4	M24	99	88	2	3	4
65	2-1/2"	220	170	26	8	M24	118	110	2	3	4
80	3"	230	180	26	8	M24	132	121	2	3	4
100	4"	265	210	30	8	M27	156	150	2	3.5	4.5
125	5"	315	250	33	8	M30	184	176	2	3.5	4.5
150	6"	355	290	33	12	M30	211	204	2	3.5	4.5
200	8"	430	360	36	12	M33	284	260	2	3.5	4.5
250	10"	505	430	39	12	M36	345	313	2	3.5	4.5
300	12"	585	500	42	16	M39	409	364	2	3.5	4.5

GB/JB/HG FLANGE - JB79.1~4

PN1.6Mpa - RF FLANGE

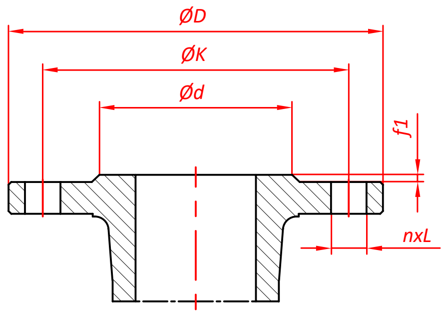
Norminal Diameter		Connection Dimension					Flange Surface	
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	f1
		D	K	L	n	Th.		
20	3/4"	105	75	14	4	M12	55	2
25	1"	115	85	14	4	M12	65	2
32	1-1/4"	140/135	100	18	4	M16	78	2
40	1-1/2"	150/145	110	18	4	M16	85	3
50	2"	165/160	125	18	4	M16	100	3
65	2-1/2"	185/180	145	18	4	M16	120	3
80	3"	200/195	160	18	8	M16	135	3
100	4"	220/215	180	18	8	M16	155	3
125	5"	250/245	210	18	8	M16	185	3
150	6"	285/280	240	23	8	M20	210	3
200	8"	340/335	295	23	12	M20	265	3
250	10"	405	355	26/25	12	M24/M22	320	3
300	12"	460	410	26/25	12	M24/M22	375	4



RF FLANGE

PN2.5Mpa - RF FLANGE

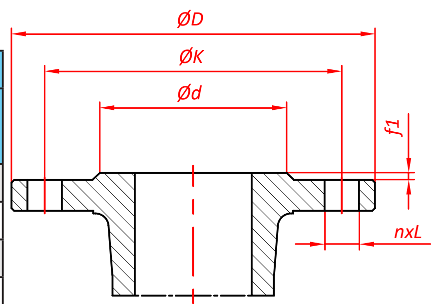
Norminal Diameter		Connection Dimension					Flange Surface	
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	f1
		D	K	L	n	Th.		
20	3/4"	105	75	14	4	M12	55	2
25	1"	115	85	14	4	M12	65	2
32	1-1/4"	140/135	100	18	4	M16	78	2
40	1-1/2"	150/145	110	18	4	M16	85	3
50	2"	165/160	125	18	4	M16	100	3
65	2-1/2"	185/180	145	18	8	M16	120	3
80	3"	200/195	160	18	8	M16	135	3
100	4"	230	190	23	8	M20	160	3
125	5"	270	220	26/25	8	M24/M22	188	3
150	6"	300	250	26/25	8	M24/M22	218	3
200	8"	360	310	26/25	12	M24/M22	278	3
250	10"	425	370	30	12	M27	332	3
300	12"	485	430	30	16	M27	390	4



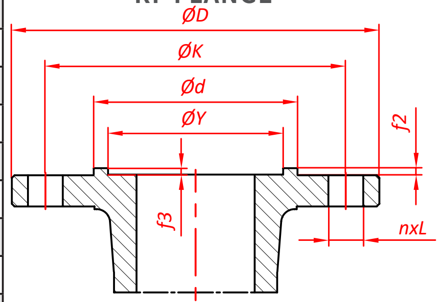
RF FLANGE

PN4.0Mpa - RF FLANGE/MF FLANGE

Norminal Diameter		Connection Dimension					Flange Surface			
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1/f2	f3
		D	K	L	n	Th.				
20	3/4"	105	75	14	4	M12	55	51	2	4
25	1"	115	85	14	4	M12	65	58	2	4
32	1-1/4"	140/135	100	18	4	M16	78	66	2	4
40	1-1/2"	150/145	110	18	4	M16	85	76	3	4
50	2"	165/160	125	18	4	M16	100	88	3	4
65	2-1/2"	185/180	145	18	8	M16	120	110	3	4
80	3"	200/195	160	18	8	M16	135	121	3	4
100	4"	235/230	190	23	8	M20	160	150	3	4.5
125	5"	270	220	26/25	8	M24/M22	188	176	3	4.5
150	6"	300	250	26/25	8	M24/M22	218	204	3	4.5
200	8"	375	320	30	12	M27	282	260	3	4.5
250	10"	450/445	385	34	12	M30	345	313	3	4.5
300	12"	515/510	450	34	16	M30	408	364	4	4.5

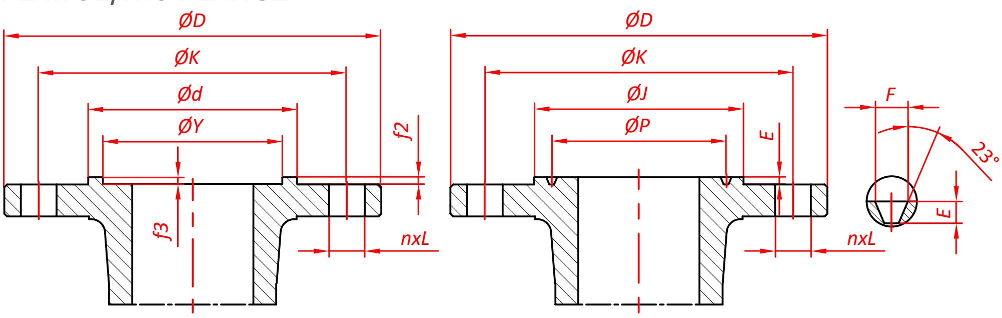


RF FLANGE



MF FLANGE

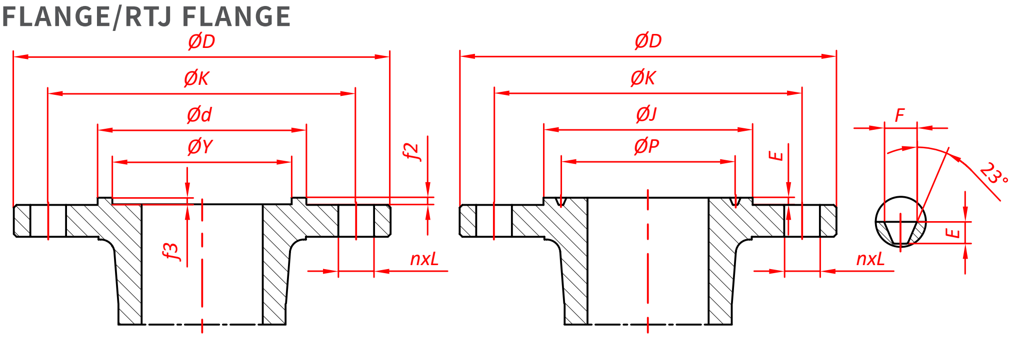
PN6.3Mpa - MF FLANGE/RTJ FLANGE



MF FLANGE RTJ FLANGE

Norminal Diameter		Connection Dimension					Flange Surface						
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	P	E	F	f2	f3
		D	K	L	n	Th.							
20	3/4"	130/125	90	18	4	M16	68	51	45	6.5	9	2	4
25	1"	140/135	100	18	4	M16	78	58	50	6.5	9	2	4
32	1-1/4"	155/150	110	23	4	M20	82	66	65	6.5	9	2	4
40	1-1/2"	170/165	125	23	4	M20	95	76	75	6.5	9	3	4
50	2"	180/175	135	23	4	M20	105	88	85	8	12	3	4
65	2-1/2"	205/200	160	23	8	M20	130	110	110	8	12	3	4
80	3"	215/210	170	23	8	M20	140	121	115	8	12	3	4
100	4"	250	200	26/25	8	M24/M22	168	150	145	8	12	3	4.5
125	5"	295	240	30	8	M27	202	176	175	8	12	3	4.5
150	6"	345/340	280	34	8	M30	240	204	205	8	12	3	4.5
200	8"	415/405	345	36/34	12	M33/M30	300	260	265	8	12	3	4.5
250	10"	470	400	36/41	12	M33/M36	352	313	320	8	12	3	4.5
300	12"	530	460	36/41	16	M33/M36	412	364	375	8	12	4	4.5

PN10Mpa - MF FLANGE/RTJ FLANGE

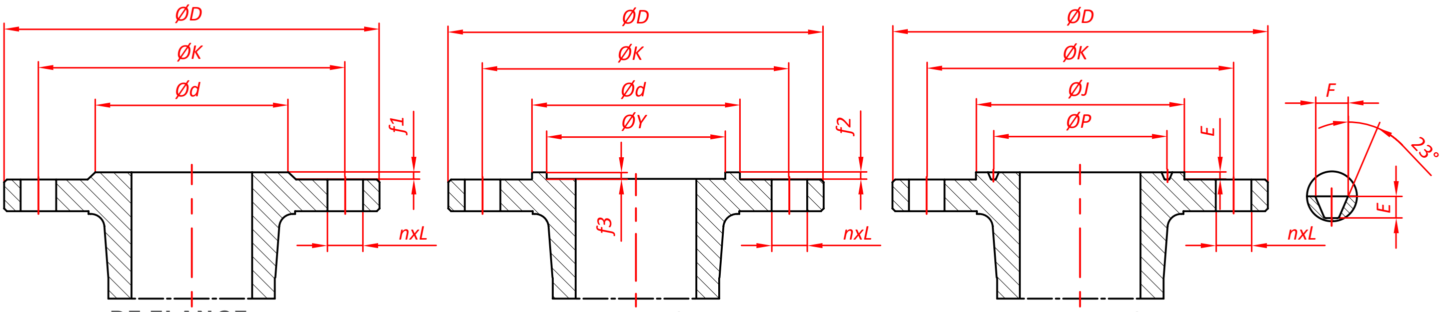


MF FLANGE RTJ FLANGE

Norminal Diameter		Connection Dimension					Flange Surface						
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	P	E	F	f2	f3
		D	K	L	n	Th.							
20	3/4"	130/125	90	18	4	M16	68	51	45	6.5	9	2	4
25	1"	140/135	100	18	4	M16	78	58	50	6.5	9	2	4
32	1-1/4"	155/150	110	23	4	M20	82	66	65	6.5	9	2	4
40	1-1/2"	170/165	125	23	4	M20	95	76	75	6.5	9	3	4
50	2"	195	145	26/25	4	M24/M22	112	88	85	8	12	3	4
65	2-1/2"	220	170	26/25	8	M24/M22	138	110	110	8	12	3	4
80	3"	230	180	26/25	8	M24/M22	148	121	115	8	12	3	4
100	4"	265	210	30	8	M27	172	150	145	8	12	3	4.5
125	5"	315/310	250	34	8	M30	210	176	175	8	12	3	4.5
150	6"	355/350	290	34	12	M30	250	204	205	8	12	3	4.5
200	8"	430	360	36/41	12	M33/M36	312	260	265	8	12	3	4.5
250	10"	505/500	430	41	12	M36	382	313	320	8	12	3	4.5
300	12"	585	500	42/48	16	M39/M42	442	364	375	8	12	4	4.5

GB/JB/HG FLANGE - HG20592

PN1.6Mpa



RF FLANGE MF FLANGE RTJ FLANGE

PN1.6Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	105	75	14	4	M12	56	51	2	4	3
25	1"	115	85	14	4	M12	65	58	2	4	3
32	1-1/4"	140	100	18	4	M16	76	66	2	4	3
40	1-1/2"	150	110	18	4	M16	84	76	2	4	3
50	2"	165	125	18	4	M16	99	88	2	4	3
65	2-1/2"	185	145	18	4	M16	118	110	2	4	3
80	3"	200	160	18	8	M16	132	121	2	4	3
100	4"	220	180	18	8	M16	156	150	2	4.5	3.5
125	5"	250	210	18	8	M16	184	176	2	4.5	3.5
150	6"	285	240	22	8	M20	211	204	2	4.5	3.5
200	8"	340	295	22	12	M20	266	260	2	4.5	3.5
250	10"	405	355	26	12	M24	319	313	2	4.5	3.5
300	12"	460	410	26	12	M24	370	364	2	4.5	3.5

PN2.5Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	105	75	14	4	M12	56	51	2	4	3
25	1"	115	85	14	4	M12	65	58	2	4	3
32	1-1/4"	140	100	18	4	M16	76	66	2	4	3
40	1-1/2"	150	110	18	4	M16	84	76	2	4	3
50	2"	165	125	18	4	M16	99	88	2	4	3
65	2-1/2"	185	145	18	8	M16	118	110	2	4	3
80	3"	200	160	18	8	M16	132	121	2	4	3
100	4"	235	190	22	8	M20	156	150	2	4.5	3.5
125	5"	270	220	26	8	M24	184	176	2	4.5	3.5
150	6"	300	250	26	8	M24	211	204	2	4.5	3.5
200	8"	360	310	26	12	M24	274	260	2	4.5	3.5
250	10"	425	370	30	12	M27	330	313	2	4.5	3.5
300	12"	485	430	30	16	M27	389	364	2	4.5	3.5

PN4.0Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD D	PCD K	Hole Diam. L	Bolts No. n	Bolt Diam. Th.	d	Y	f1	f2	f3
20	3/4"	105	75	14	4	M12	56	51	2	4	3
25	1"	115	85	14	4	M12	65	58	2	4	3
32	1-1/4"	140	100	18	4	M16	76	66	2	4	3
40	1-1/2"	150	110	18	4	M16	84	76	2	4	3
50	2"	165	125	18	4	M16	99	88	2	4	3
65	2-1/2"	185	145	18	8	M16	118	110	2	4	3
80	3"	200	160	18	8	M16	132	121	2	4	3
100	4"	235	190	22	8	M20	156	150	2	4.5	3.5
125	5"	270	220	26	8	M24	184	176	2	4.5	3.5
150	6"	300	250	26	8	M24	211	204	2	4.5	3.5
200	8"	375	320	30	12	M27	284	260	2	4.5	3.5
250	10"	450	385	33	12	M30×2	345	313	2	4.5	3.5
300	12"	515	450	33	16	M30×2	409	364	2	4.5	3.5

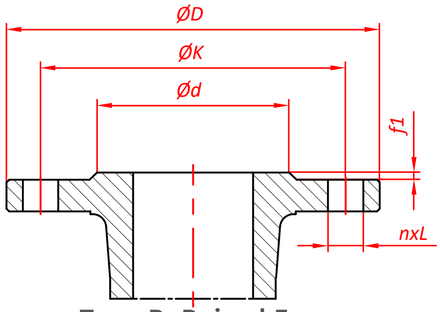
PN6.3Mpa

Norminal Diameter		Connection Dimension					Flange Surface					RTJ Face			
DN	NPS	Flange OD D	PCD K	Hole Diam. L	Bolts No. n	Bolt Diam. Th.	d	Y	f1	f2	f3	J	P	E	F
20	3/4"	130	90	18	4	M16	56	51	2	4	3	68	45	6.5	9
25	1"	140	100	18	4	M16	65	58	2	4	3	78	50	6.5	9
32	1-1/4"	155	110	22	4	M20	76	66	2	4	3	86	65	6.5	9
40	1-1/2"	170	125	22	4	M20	84	76	2	4	3	102	75	6.5	9
50	2"	180	135	22	4	M20	99	88	2	4	3	112	85	8	12
65	2-1/2"	205	160	22	8	M20	118	110	2	4	3	136	110	8	12
80	3"	215	170	22	8	M20	132	121	2	4	3	146	115	8	12
100	4"	250	200	26	8	M24	156	150	2	4.5	3.5	172	145	8	12
125	5"	295	240	30	8	M27	184	176	2	4.5	3.5	208	175	8	12
150	6"	345	280	33	8	M30×2	211	204	2	4.5	3.5	245	205	8	12
200	8"	415	345	36	12	M33×2	284	260	2	4.5	3.5	306	265	8	12
250	10"	470	400	36	12	M33×2	345	313	2	4.5	3.5	362	320	8	12
300	12"	530	460	36	16	M33×3	409	364	2	4.5	3.5	422	375	8	12

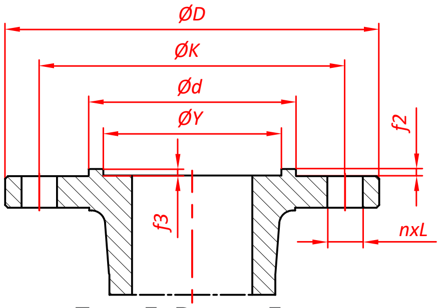
PN10Mpa

Norminal Diameter		Connection Dimension					Flange Surface					RTJ Face			
DN	NPS	Flange OD D	PCD K	Hole Diam. L	Bolts No. n	Bolt Diam. Th.	d	Y	f1	f2	f3	J	P	E	F
20	3/4"	130	90	18	4	M16	56	51	2	4	3	68	45	6.5	9
25	1"	140	100	18	4	M16	65	58	2	4	3	78	50	6.5	9
32	1-1/4"	155	110	22	4	M20	76	66	2	4	3	86	65	6.5	9
40	1-1/2"	170	125	22	4	M20	84	76	2	4	3	102	75	6.5	9
50	2"	195	145	26	4	M24	99	88	2	4	3	116	85	8	12
65	2-1/2"	220	170	26	8	M24	118	110	2	4	3	140	110	8	12
80	3"	230	180	26	8	M24	132	121	2	4	3	150	115	8	12
100	4"	265	210	30	8	M27	156	150	2	4.5	3.5	176	145	8	12
125	5"	315	250	33	8	M30×2	184	176	2	4.5	3.5	212	175	8	12
150	6"	355	290	33	12	M30×2	211	204	2	4.5	3.5	250	205	8	12
200	8"	430	360	36	12	M33×2	284	260	2	4.5	3.5	312	265	8	12
250	10"	505	430	39	12	M36×3	345	313	2	4.5	3.5	376	320	8	12
300	12"	585	500	42	16	M39×3	409	364	2	4.5	3.5	448	375	8	12

DIN FLANGE - EN1092-1



Type B: Raised Face



Type F: Recess Face

PN1.6Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	105	75	14	4	M12	58	51	2	2	4
25	1"	115	85	14	4	M12	68	58	2	2	4
32	1-1/4"	140	100	18	4	M16	78	66	2	2	4
40	1-1/2"	150	110	18	4	M16	88	76	2	2	4
50	2"	165	125	18	4	M16	102	88	2	2	4
65	2-1/2"	185	145	18	4/8	M16	122	110	2	2	4
80	3"	200	160	18	8	M16	138	121	2	2	4
100	4"	220	180	18	8	M16	158	150	2	2	4.5
125	5"	250	210	18	8	M16	188	176	2	2	4.5
150	6"	285	240	22	8	M20	212	204	2	2	4.5
200	8"	340	295	22	12	M20	268	260	2	2	4.5
250	10"	405	355	26	12	M24	320	313	2	2	4.5
300	12"	460	410	26	12	M24	378	364	2	2	4.5

PN2.5Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	105	75	14	4	M12	58	51	2	2	4
25	1"	115	85	14	4	M12	68	58	2	2	4
32	1-1/4"	140	100	18	4	M16	78	66	2	2	4
40	1-1/2"	150	110	18	4	M16	88	76	2	2	4
50	2"	165	125	18	4	M16	102	88	2	2	4
65	2-1/2"	185	145	18	8	M16	122	110	2	2	4
80	3"	200	160	18	8	M16	138	121	2	2	4
100	4"	235	190	22	8	M20	162	150	2	2	4.5
125	5"	270	220	26	8	M24	188	176	2	2	4.5
150	6"	300	250	26	8	M24	218	204	2	2	4.5
200	8"	360	310	26	12	M24	278	260	2	2	4.5
250	10"	425	370	30	12	M27	335	313	2	2	4.5
300	12"	485	430	30	16	M27	395	364	2	2	4.5

PN4.0Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	105	75	14	4	M12	58	51	2	2	4
25	1"	115	85	14	4	M12	68	58	2	2	4
32	1-1/4"	140	100	18	4	M16	78	66	2	2	4
40	1-1/2"	150	110	18	4	M16	88	76	2	2	4
50	2"	165	125	18	4	M16	102	88	2	2	4
65	2-1/2"	185	145	18	8	M16	122	110	2	2	4
80	3"	200	160	18	8	M16	138	121	2	2	4
100	4"	235	190	22	8	M20	162	150	2	2	4.5
125	5"	270	220	26	8	M24	188	176	2	2	4.5
150	6"	300	250	26	8	M24	218	204	2	2	4.5
200	8"	375	320	30	12	M27	285	260	2	2	4.5
250	10"	450	385	33	12	M30	345	313	2	2	4.5
300	12"	515	450	33	16	M30	410	364	2	2	4.5

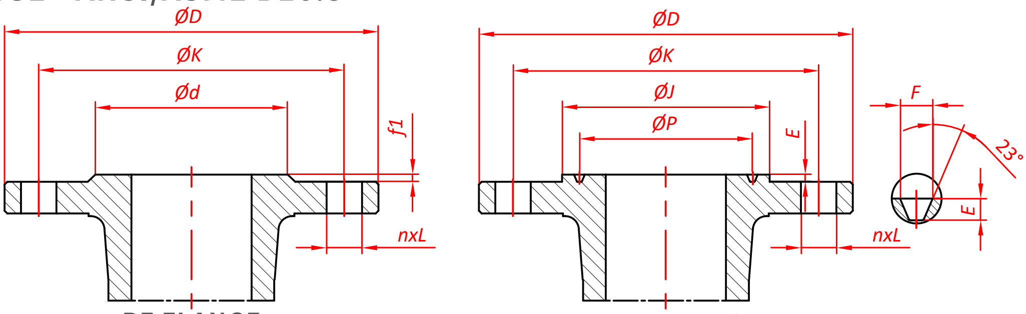
PN6.3Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	130	90	18	4	M16	58	51	2	2	4
25	1"	140	100	18	4	M16	68	58	2	2	4
32	1-1/4"	155	110	22	4	M20	78	66	2	2	4
40	1-1/2"	170	125	22	4	M20	88	76	2	2	4
50	2"	180	135	22	4	M20	102	88	2	2	4
65	2-1/2"	205	160	22	8	M20	122	110	2	2	4
80	3"	215	170	22	8	M20	138	121	2	2	4
100	4"	250	200	26	8	M24	162	150	2	2	4.5
125	5"	295	240	30	8	M27	188	176	2	2	4.5
150	6"	345	280	33	8	M30	218	204	2	2	4.5
200	8"	415	345	36	12	M33	285	260	2	2	4.5
250	10"	470	400	36	12	M33	345	313	2	2	4.5
300	12"	530	460	36	16	M33	410	364	2	2	4.5

PN10Mpa

Norminal Diameter		Connection Dimension					Flange Surface				
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	Y	f1	f2	f3
		D	K	L	n	Th.					
20	3/4"	130	90	18	4	M16	58	51	2	2	4
25	1"	140	100	18	4	M16	68	58	2	2	4
32	1-1/4"	155	110	22	4	M20	78	66	2	2	4
40	1-1/2"	170	125	22	4	M20	88	76	2	2	4
50	2"	195	145	26	4	M24	102	88	2	2	4
65	2-1/2"	220	170	26	8	M24	122	110	2	2	4
80	3"	230	180	26	8	M24	138	121	2	2	4
100	4"	265	210	30	8	M27	162	150	2	2	4.5
125	5"	315	250	33	8	M30	188	176	2	2	4.5
150	6"	355	290	33	12	M30	218	204	2	2	4.5
200	8"	430	360	36	12	M33	285	260	2	2	4.5
250	10"	505	430	39	12	M36	345	313	2	2	4.5
300	12"	585	500	42	16	M39	410	364	2	2	4.5

ANSI/ASME FLANGE - ANSI/ASME B16.5



RF FLANGE RTJ FLANGE

CLASS150LBS

Norminal Diameter		Connection Dimension					RF Flange Surface		RTJ Flange Surface			
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	f1	J	P	E	F
		D	K	L	n	Th.						
20	3/4"	100	69.9	16	4	M1/2"	42.9	2	–	–	–	–
25	1"	110	79.4	16	4	M1/2"	50.8	2	63.5	47.63	6.35	8.74
32	1-1/4"	115	88.9	16	4	M1/2"	63.5	2	73.0	57.15	6.35	8.74
40	1-1/2"	125	98.4	16	4	M1/2"	73	2	82.5	65.07	6.35	8.74
50	2"	150	120.7	19	4	M5/8"	92.1	2	102.0	82.55	6.35	8.74
65	2-1/2"	180	139.7	19	4	M5/8"	104.8	2	121.0	101.60	6.35	8.74
80	3"	190	152.4	19	4	M5/8"	127	2	133.0	114.30	6.35	8.74
100	4"	230	190.5	19	8	M5/8"	157.2	2	171.0	149.23	6.35	8.74
125	5"	255	215.9	22	8	M3/4"	185.7	2	194.0	171.45	6.35	8.74
150	6"	280	241.3	22	8	M3/4"	215.9	2	219.0	193.68	6.35	8.74
200	8"	345	298.5	22	8	M3/4"	269.9	2	273.0	247.65	6.35	8.74
250	10"	405	362	26	12	M7/8"	323.8	2	330.0	304.80	6.35	8.74
300	12"	485	431.8	26	12	M7/8"	381	2	406.0	381.00	6.35	8.74

CLASS300LBS

Norminal Diameter		Connection Dimension					RF Flange Surface		RTJ Flange Surface			
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	f1	J	P	E	F
		D	K	L	n	Th.						
20	3/4"	115	82.6	19	4	M5/8"	42.9	2	63.5	42.88	6.35	8.74
25	1"	125	88.9	19	4	M5/8"	50.8	2	70	50.8	6.35	8.74
32	1-1/4"	135	98.4	19	4	M5/8"	63.5	2	79.5	60.33	6.35	8.74
40	1-1/2"	155	114.3	22	4	M3/4"	73	2	90.5	68.27	6.35	8.74
50	2"	165	127	19	8	M5/8"	92.1	2	108	82.55	7.92	11.91
65	2-1/2"	190	149.2	22	8	M3/4"	104.8	2	127	101.6	7.92	11.91
80	3"	210	168.3	22	8	M3/4"	127	2	146	123.83	7.92	11.91
100	4"	255	200	22	8	M3/4"	157.2	2	175	149.23	7.92	11.91
125	5"	280	235	22	8	M3/4"	185.7	2	210	180.98	7.92	11.91
150	6"	320	269.9	22	12	M3/4"	215.9	2	241	211.12	7.92	11.91
200	8"	380	330.2	26	12	M7/8"	269.9	2	302	269.88	7.92	11.91
250	10"	445	387.4	29	16	M1"	323.8	2	356	323.85	7.92	11.91
300	12"	520	450.8	32	16	M1-1/8"	381	2	413	381	7.92	11.91

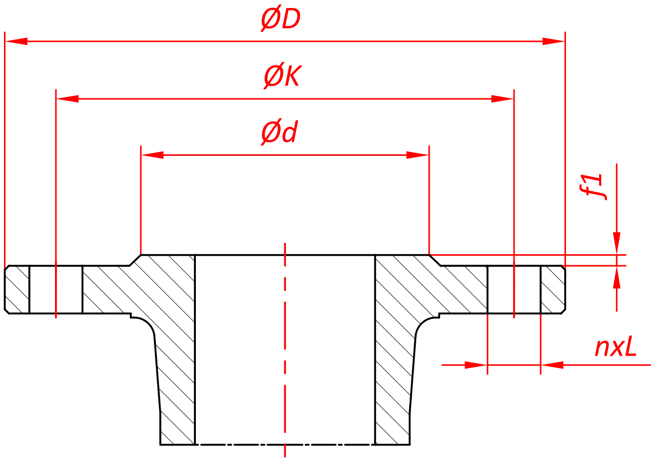
CLASS600LBS

Norminal Diameter		Connection Dimension					RF Flange Surface		RTJ Flange Surface			
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	f1	J	P	E	F
		D	K	L	n	Th.						
20	3/4"	115	82.6	19	4	M5/8"	42.9	7	63.5	42.88	6.35	8.74
25	1"	125	88.9	19	4	M5/8"	50.8	7	70	50.8	6.35	8.74
32	1-1/4"	135	98.4	19	4	M5/8"	63.5	7	79.5	60.33	6.35	8.74
40	1-1/2"	155	114.3	22	4	M3/4"	73	7	90.5	68.27	6.35	8.74
50	2"	165	127	19	8	M5/8"	92.1	7	108	82.55	7.92	11.91
65	2-1/2"	190	149.2	22	8	M3/4"	104.8	7	127	101.6	7.92	11.91
80	3"	210	168.3	22	8	M3/4"	127	7	146	123.83	7.92	11.91
100	4"	275	215.9	26	8	M7/8"	157.2	7	175	149.23	7.92	11.91
125	5"	330	266.7	29	8	M1"	185.7	7	210	180.98	7.92	11.91
150	6"	355	292.1	29	12	M1"	215.9	7	241	211.12	7.92	11.91
200	8"	420	349.2	32	12	M1-1/8"	269.9	7	302	269.88	7.92	11.91
250	10"	510	431.8	35	16	M1-1/4"	323.8	7	356	323.85	7.92	11.91
300	12"	560	489	35	20	M1-1/4"	381	7	413	381	7.92	11.91

CLASS900LBS

Norminal Diameter		Connection Dimension					RF Flange Surface		RTJ Flange Surface			
DN	NPS	Flange OD	PCD	Hole Diam.	Bolts No.	Bolt Diam.	d	f1	J	P	E	F
		D	K	L	n	Th.						
20	3/4"	130	88.9	22	4	M3/4"	42.9	7	-	-	-	-
25	1"	150	101.6	26	4	M7/8"	50.8	7	-	-	-	-
32	1-1/4"	160	111.1	26	4	M7/8"	63.5	7	-	-	-	-
40	1-1/2"	180	123.8	29	4	M1"	73	7	-	-	-	-
50	2"	215	165.1	26	8	M7/8"	92.1	7	-	-	-	-
65	2-1/2"	245	190.5	29	8	M1"	104.8	7	-	-	-	-
80	3"	240	190.5	26	8	M7/8"	127	7	156.0	123.83	7.92	11.91
100	4"	290	235.0	32	8	M1-1/8"	157.2	7	181.0	149.23	7.92	11.91
125	5"	350	279.4	35	8	M1-1/4"	185.7	7	216.0	180.98	7.92	11.91
150	6"	380	317.5	32	12	M1-1/8"	215.9	7	241.0	211.12	7.92	11.91
200	8"	470	393.7	39	12	M1-3/8"	269.9	7	308.0	269.88	7.92	11.91
250	10"	545	469.9	39	16	M1-3/8"	323.8	7	362.0	323.85	7.92	11.91
300	12"	610	533.4	39	20	M1-3/8"	381	7	419.0	381	7.92	11.91

JIS FLANGE - JIS B2220



JIS10K

Norminal Diameter		Connection Dimension					Flange Surface	
DN	NPS	Flange OD D	PCD K	Hole Diam. L	Bolts No. n	Bolt Diam. Th.	d	f1
20	3/4"	100	75	15	4	M12	56	1
25	1"	125	90	19	4	M16	67	1
32	1-1/4"	135	100	19	4	M16	76	2
40	1-1/2"	140	105	19	4	M16	81	2
50	2"	155	120	19	4	M16	96	2
65	2-1/2"	175	140	19	4	M16	116	2
80	3"	185	150	19	8	M16	126	2
100	4"	210	175	19	8	M16	151	2
125	5"	250	210	23	8	M20	182	2
150	6"	280	240	23	8	M20	212	2
200	8"	330	290	23	12	M20	262	2
250	10"	400	355	25	12	M22	324	2
300	12"	445	400	25	16	M22	368	3

JIS20K

Norminal Diameter		Connection Dimension					Flange Surface	
DN	NPS	Flange OD D	PCD K	Hole Diam. L	Bolts No. n	Bolt Diam. Th.	d	f1
20	3/4"	100	75	15	4	M12	56	1
25	1"	125	90	19	4	M16	67	1
32	1-1/4"	135	100	19	4	M16	76	2
40	1-1/2"	140	105	19	4	M16	81	2
50	2"	155	120	19	8	M16	96	2
65	2-1/2"	175	140	19	8	M16	116	2
80	3"	200	160	23	8	M20	132	2
100	4"	225	185	23	8	M20	160	2
125	5"	270	225	25	8	M22	195	2
150	6"	305	260	25	12	M22	230	2
200	8"	350	305	25	12	M22	275	2
250	10"	430	380	27	12	M24	345	2
300	12"	480	430	27	16	M24	395	3

APPENDIX III
MATERIAL CORROSION RESISTANCE TABLE

STEEL MATERIAL CORROSION RESISTANCE TABLE

Note I:

A: Applicable

B: Should pay attention to and careful

C: Not applicable

I and L: Insufficient reference

Note II:

The above table is taken from ISA Control Valve Manual, the second edition, 1976. This table is only a general reference for material selection and cannot be regarded as absolutely correct. Because the corrosivity of materials is related to the temperature, concentration, pressure, flow rate and other factors of the medium.

	Carbon Steel	Cast Iron	S.S. 302 or 304	S.S. 316	Bronze	Monel	Hast-ettoy B	Hast-ettoy C	Duri-ment 20#	Titan-lum Alloy	Alloy (Co-Cr) 6#/STL	S.S. 416	S.S. 440C	S.S. 17-4PH
ACETALDEHYDE	A	A	A	A	A	A	I、L	A	A	I、L	I、L	A	A	A
AIRLESS ACETIC ACID	C	C	B	B	B	A	A	A	A	A	A	C	C	B
AERATED ACETIC ACID	C	C	A	A	A	A	A	A	A	A	A	C	C	B
ACETIC ACID STEAM	C	C	A	A	B	B	I、L	A	B	A	A	C	C	B
ACETONE	A	A	A	A	A	A	A	A	A	A	A	A	A	A
ACETYLENE GAS	A	A	A	A	I、L	A	A	A	A	I、L	A	A	A	A
ETHANOL	A	A	A	A	A	A	A	A	A	A	A	A	A	A
ALUMINUM SULFATE	C	C	B	B	B	B	A	A	A	A	B	C	C	I、L
AMMONIA	A	A	A	A	C	A	A	A	A	A	A	A	A	I、L
AMMONIUM CHLORIDE	C	C	B	B	B	B	A	A	A	A	B	C	C	I、L
AMMONIUM NITRATE	A	C	A	A	B	B	A	A	B	A	A	B	B	I、L
AMMONIUM DIHYDROGEN PHOSPHATE	C	C	A	A	B	B	A	A	B	A	A	B	B	I、L
AMMONIUM SULPHATE	C	C	B	A	B	A	A	A	A	A	A	C	C	I、L
AMMONIUM SULFITE	C	C	A	A	C	C	I、L	A	A	A	A	B	B	I、L
ANILINE	C	C	A	A	C	B	A	A	A	A	A	C	C	I、L
ASPHALT	A	A	A	A	A	A	A	A	A	I、L	A	A	A	A
BEER	B	B	A	A	B	A	A	A	A	A	A	B	B	A
BENZENE	A	A	A	A	A	A	A	A	A	A	A	A	A	A
BENZOIC ACID	C	C	A	A	A	A	I、L	A	A	A	I、L	A	A	A
BORIC ACID	C	C	A	A	A	A	A	A	A	AA	A	B	B	I、L
BUTANE	A	A	A	A	A	A	A	A	A	I、L	A	A	A	A
CALCIUM CHLORIDE (BASIC)	B	B	C	B	C	A	A	A	A	A	I、L	C	C	I、L
CALCIUM HYPOCHLORITE	C	C	B	B	B	B	C	A	A	A	I、L	C	C	I、L
CARBONIC ACID	B	B	A	A	A	A	A	A	A	A	A	I、L	I、L	I、L
CARBON DIOXIDE (DRY)	A	A	A	A	A	A	A	A	A	A	A	A	A	A
CARBON DIOXIDE (WET)	C	C	A	A	B	A	A	A	A	A	A	A	A	A
CARBON DISULFIDE	A	A	A	A	C	B	A	A	A	A	A	B	B	I、L
CARBON TETRACHLORIDE	B	B	B	B	A	A	B	A	A	A	I、L	C	A	I、L
CHLORINE (DRY)	A	A	B	B	B	A	A	A	A	C	B	C	C	C
CHLORINE (WET)	C	C	C	C	C	C	C	B	C	A	B	C	C	C
LIQUID CHLORINE	C	C	C	C	B	C	C	A	B	C	B	C	C	C
CHROMIC ACID	C	C	C	B	C	A	C	A	C	A	B	C	C	C
CITRIC ACID	I、L	C	B	A	A	B	A	A	A	A	I、L	B	B	B
COKING GAS	A	A	A	A	B	B	A	A	A	A	A	A	A	A
COPPER SULPHATE	C	C	B	B	B	C	I、L	A	A	A	I、L	A	A	A
COTTONSEED OIL	A	A	A	A	A	A	A	A	A	A	A	A	A	A

STEEL MATERIAL CORROSION RESISTANCE TABLE

	Carbon Steel	Cast Iron	S.S. 302 or 304	S.S. 316	Bronze	Monel	Hast-ettoy B	Hast-ettoy C	Duri-ment 20#	Titan-lum Alloy	Alloy (Co-Cr) 6#/STL	S.S. 416	S.S. 440C	S.S. 17-4PH
CREOSOTE	A	A	A	A	C	A	A	A	A	I、L	A	A	A	A
ETHANE	A	A	A	A	A	A	A	A	A	A	A	A	A	A
ETHER	B	B	A	A	A	A	A	A	A	A	A	A	A	A
CHLOROETHANE	C	C	A	A	A	A	A	A	A	A	A	B	B	I、L
ETHYLENE	A	A	A	A	A	A	A	A	A	A	A	A	A	A
NATURAL GAS	A	A	A	A	A	A	A	A	A	A	A	A	A	A
NITRIC ACID	C	C	A	B	C	C	C	B	A	A	C	C	C	B
OLEIC ACID	C	C	A	A	B	A	A	A	A	A	A	A	A	I、L
OXALATE	C	C	B	B	B	B	A	A	A	B	B	B	B	I、L
HYDROGEN	A	A	A	A	A	A	A	A	A	A	A	A	A	A
REFINED PETROLEUM	A	A	A	A	A	A	A	A	A	A	A	A	A	A
AERATED PHOSPHORIC ACID	C	C	A	A	C	C	A	A	A	B	A	C	C	I、L
AIRLESS PHOSPHORIC ACID	C	C	A	A	C	B	A	A	A	B	A	C	C	I、L
PHOSPHORIC ACID STEAM	C	C	B	B	C	C	A	I、L	A	B	C	C	C	I、L
POTASSIUM CHLORIDE	B	B	A	A	B	B	A	A	A	A	I、L	C	C	I、L
POTASSIUM HYDROXIDE	B	B	A	A	B	A	A	A	A	A	I、L	B	B	I、L
PROPANE	A	A	A	A	A	A	A	A	A	A	A	A	A	A
SILVER NITRATE	C	C	A	A	C	C	A	A	A	A	B	B	B	I、L
SODIUM ACETATE	A	A	B	A	A	A	A	A	A	A	A	A	A	A
SODIUM CARBONATE	A	A	A	A	A	A	A	A	A	A	A	B	B	A
SODIUM CHLORIDE	C	C	B	B	A	A	A	A	A	A	A	B	B	B
SODIUM CHROMATE	A	A	A	A	A	A	A	A	A	A	A	A	A	A
SODIUM HYDROXIDE	A	A	A	A	C	A	A	A	A	A	A	B	B	A
SODIUM HYPOCHROMATE	C	C	C	C	B	B	C	A	B	A	I、L	C	C	I、L
SODIUM THIOSULFATE	C	C	A	A	C	C	A	A	A	A	I、L	B	B	I、L
STANNIC CHLORIDE	B	B	C	A	C	B	A	A	A	A	I、L	C	C	I、L
GLYCOL	A	A	A	A	A	A	I、L	I、L	A	I、L	A	A	A	A
FORMALDEHYDE	B	B	A	A	A	A	A	A	A	A	A	A	A	A
FORMIC ACID	I、L	C	B	B	A	A	A	A	A	C	B	C	C	B
FREON (WET)	B	B	B	A	A	A	A	A	A	A	A	I、L	I、L	I、L
FREON (DRY)	B	B	A	A	A	A	A	A	A	A	A	I、L	I、L	I、L
GASOLINE	A	A	A	A	A	A	A	A	A	A	A	A	A	A
GLUCOSE	A	A	A	A	A	A	A	A	A	A	A	A	A	A
AERATED HYDROCHLORIC ACID	C	C	C	C	C	C	A	B	C	C	B	C	C	C
AIRLESS HYDROCHLORIC ACID	C	C	C	C	C	C	A	B	C	C	B	C	C	C
AERATED HYDROFLUORIC ACID	B	C	C	B	C	C	A	A	B	C	B	C	C	C
AIR FREE HYDROFLUORIC ACID	A	C	C	B	C	A	A	A	B	C	I、L	C	C	I、L
HYDROGEN PEROXIDE	I、L	A	A	A	C	A	B	B	A	A	I、L	B	B	I、L
MERCURY	A	A	A	A	C	B	A	A	A	A	A	A	A	B
METHANOL	A	A	A	A	A	A	A	A	A	A	A	A	B	A
MILK	C	C	A	A	A	A	A	A	A	A	A	C	C	C
STEARIC ACID	A	C	A	A	B	B	A	A	A	A	B	B	B	I、L
SULFITE SOLUTION	A	A	A	A	C	A	A	A	A	A	A	I、L	I、L	I、L
SULFUR	A	A	A	A	C	A	A	A	A	A	A	A	A	A
SULFUR DIOXIDE (DRY)	A	A	A	A	A	A	B	A	A	A	A	B	B	I、L

STEEL MATERIAL CORROSION RESISTANCE TABLE

	Carbon Steel	Cast Iron	S.S. 302 or 304	S.S. 316	Bronze	Monel	Hast-ettoy B	Hast-ettoy C	Duri-ment 20#	Titan-lum Alloy	Alloy (Co-Cr) 6#/STL	S.S. 416	S.S. 440C	S.S. 17-4PH
SULFUR TRIOXIDE (DRY)	A	A	A	A	A	A	B	A	A	A	A	B	B	I、L
AERATED SULFURIC ACID	C	C	C	C	C	C	A	A	A	B	B	C	C	C
AIRLESS SULFURIC ACID	C	C	C	C	B	B	A	A	A	B	B	C	C	C
TRICHLOROETHYLENE	B	B	B	A	A	A	A	A	A	A	A	B	B	I、L
VINEGAR	C	C	A	A	B	A	A	A	A	I、L	A	C	C	A
MAGNESIUM HYDROXIDE	A	A	A	B	A	A	A	A	A	A	A	A	A	I、L
DISTILLED WATER	A	A	A	A	A	A	A	A	A	A	A	B	B	I、L
SEAWATER	B	B	B	B	A	A	A	A	A	A	A	C	C	A
ZINC CHLORIDE	C	C	C	C	C	C	A	A	A	A	B	C	C	I、L
ZINC SULFATE	C	C	A	A	B	A	A	A	A	A	A	B	B	I、L

APPENDIX IV
CALCULATION OF CV VALUE

CALCULATION PROCESS OF CV VALUE FOR CONTROL VALVE

When determining the diameter of the control valve, the required Cv value or Kv value shall be calculated according to the known fluid conditions, and then the appropriate diameter of the control valve shall be selected from the rated Cv/Kv value table in the Model Selection Table of the Control Valve. As the most commonly used formula for calculating Cv value, it is stipulated by Standard IEC 60534-2-1-2011. The specific contents are as follows:

1. DEFINITION OF CV VALUE

Under the condition that the valve is fully open, the pressure difference between two ends of valve is 1 lb/in2 (0.07 kgf/cm2), the U.S. gallons per minute of clean water (at 60 °F (15.6℃)) passing through the valve. (Cv=1.17Kv)

2. CALCULATION PROCESS OF Cv/Kv VALUE FOR INCOMPRESSIBLE FLUID (LIQUID)

A. Datas Need For Calculation

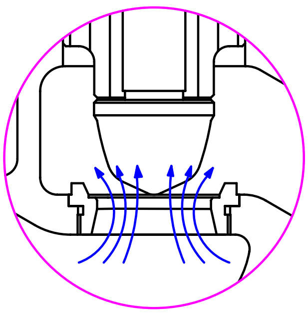
Before calculating the Cv/Kv value, it is necessary to clarify the fluid data used by the valve as shown in below table to accurately calculate the valve Cv/Kv value.

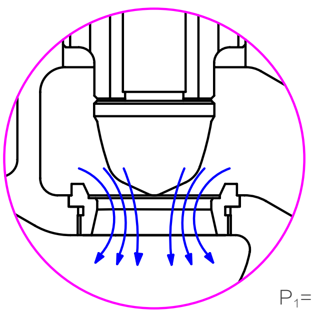
No.	Symbol	Description	Unit	
a	–	Valve Type and Flow– to– Open/Flow– to– Close	–	–
b	–	Flow Name and State	–	–
c	P_1	Upstream Pressure	kPa(A)	Bar(A)
d	P_2	Downstream Pressure	kPa(A)	Bar(A)
e	Q	Actual volumetric flow rate	m^3/hr	–
f	ρ_1	Standard Density of fliud at P_1 and T_1	kg/m^3	–
g	P_V	Absolute vapour pressure of the liquid at inlet temperature	kPa(A)	Bar(A)
h	ν	Dynamic Viscosity	mm^2/s	m^2/s
i	T_1	Inlet Port Temperature	℃	–

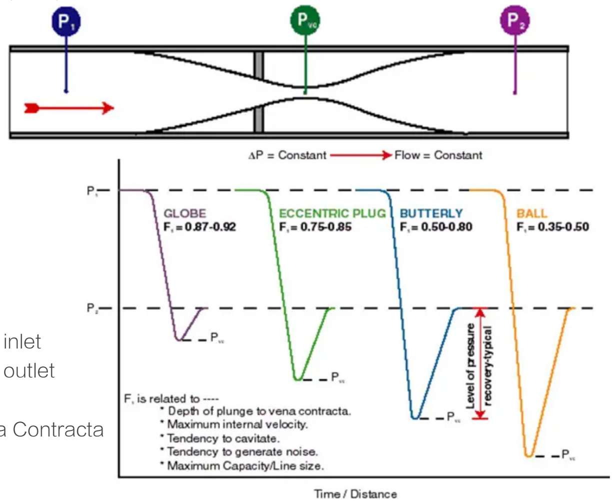
B. Confirm of F_L: Liquid pressure recovery factor of control valve

At the valve trim and valve seat, a contraction flow is generated at the downstream of the valve due to the throttling effect, and the flow rate of the fluid is the largest, but the static pressure is the smallest. The pressure of the fluid at the throttling point drops sharply, and gradually recovers in the subsequent throttling channel, but it can no longer recover to the original P_1 value. This is the phenomenon of pressure recovery. Therefore, a ratio F_L representing the degree of pressure recovery of the control valve is introduced to correct the Cv/Kv calculation formula.

According to the valve type and flow direction, choose the correct Liquid pressure recovery factor F_L according to TABLE A in APPENDIX V.


FLOW TO OPEN


FLOW TO CLOSE



P_1= Pressure at valve inlet
P_2= Pressure at valve outlet
$\Delta P=P_1-P_2$
P_{VC}= Pressure at Vena Contracta

C. Calculation of F_F: Liquid critical pressure ration factor

The F_F is the ratio of the apparent "contraction section" pressure under the condition of choked flow to the vapor pressure of the liquid at the inlet temperature. The calculation formula is as follows:

$$F_F = 0.96 - 0.28\sqrt{\frac{P_V}{P_C}} \quad \text{......................} (1)$$

No.	Symbol	Description	Unit	
a	F_F	Liquid critical pressure ration factor	–	–
b	P_V	Absolute vapour pressure of the liquid at inlet temperature	kPa(A)	Bar(A)
c	P_C	Absolute thermodynamic critical pressure, Check TABLE B in APPENDIX V.	kPa(A)	Bar(A)

D. Confirm of Non-choked flow and Choked flow

In the process of testing the flow coefficient of most valves, the test medium is in a non-choked turbulent flow, which is an ideal flow state. However, when the differential pressure is further increased to the max differential pressure, a choked flow will occur. Under the choked flow state, there is a deviation between the pressure difference between the upstream and downstream of the tested valve measured by the sensor and the pressure difference that actually affects the flow of the valve. If the flow coefficient is also calculated according to the former tested data, the result will be inaccurate. Therefore, after the choked flow occurs, the max differential pressure will be used to replace the measured differential pressure to calculate the flow coefficient.

By comparing ΔP (Pressure difference between the upstream pressure and downstream pressure) and ΔP_{cr} (Max allowable pressure) , we can determine whether there will be the choked flow in the control valve.

$$\Delta P = P_1 - P_2 \qquad \text{..................... (2)}$$

$$\Delta P_{cr} = F_L^2 (P_1 - F_F \cdot P_V) \qquad \text{..................... (3)}$$

No.	Symbol	Description	Unit	
a	ΔP	Pressure difference between the upstream pressure and downstream pressure	kPa(A)	Bar(A)
b	ΔP_{cr}	Max allowable pressure	kPa(A)	Bar(A)
c	P_1	Upstream Pressure	kPa(A)	Bar(A)
d	P_2	Downstream Pressure	kPa(A)	Bar(A)
e	F_L	Liquid pressure recovery factor of control valve	–	–
f	F_F	Liquid critical pressure ration factor	–	–
g	P_V	Liquid Vapour Pressure	kPa(A)	Bar(A)

If $\Delta P \leqslant \Delta P_{cr}$, it is a Non-choked flow, and use equation (4)~(8) to calculate the Cv/Kv value.

If $\Delta P > \Delta P_{cr}$, it is a choked flow, and use equation (9)~(13) to calculate the Cv/Kv value.

E. Calculation of Cv/Kv value for Non-choked flow

If $\Delta P \leqslant \Delta P_{cr}$, use the following equations to calculate the Cv/Kv value.

The equations (4) is the general equation for the Non-choked flow calculation.

The equations (5) is for Cv value with pressure units under kPa.

The equations (6) is for Cv value with pressure units under bar.

The equations (7) is for Kv value with pressure units under kPa.

The equations (8) is for Kv value with pressure units under bar.

General Equation of Calculation for Non-choked flow

$$C = \frac{Q}{N_1}\sqrt{\frac{\rho_1/\rho_0}{\Delta P}} \qquad \text{..................... (4)}$$

No.	Symbol	Description	Unit	
a	C	Cv value or Kv value	–	–
b	Q	Actual volumetric flow rate	m^3/h	–
c	N_1	Numerical constants	–	–
d	ρ_1	Standard Density of fliud at P_1 and T_1	kg/m3	–
e	ρ_0	Water density=1000kg/m^3 at 15℃	–	–
f	ΔP	Pressure difference between the upstream pressure and downstream pressure	kPa(A)	Bar(A)

A	Cv Value	ΔP : Unit – kPa

$$C_V = \frac{Q}{0.0865}\sqrt{\frac{\rho_1/\rho_0}{\Delta P}} \qquad \text{..................... (5)}$$

B	Cv Value	ΔP : Unit – Bar

$$C_V = \frac{Q}{0.865}\sqrt{\frac{\rho_1/\rho_0}{\Delta P}} \qquad \text{..................... (6)}$$

C	Kv Value	ΔP : Unit – kPa

$$K_V = \frac{Q}{0.1}\sqrt{\frac{\rho_1/\rho_0}{\Delta P}} \qquad \text{..................... (7)}$$

D	Kv Value	ΔP : Unit – Bar

$$K_V = Q\sqrt{\frac{\rho_1/\rho_0}{\Delta P}} \qquad \text{..................... (8)}$$

F. Calculation of Cv/Kv value for choked flow

If $\Delta P > \Delta P_{cr}$, use the following equations to calculate the Cv/Kv value.
The equations (9) is the general equation for the choked flow calculation.
The equations (10) is for Cv value with pressure units under kPa.
The equations (11) is for Cv value with pressure units under bar.
The equations (12) is for Kv value with pressure units under kPa.
The equations (13) is for Kv value with pressure units under bar.

General Equation of Calculation for Choked flow

$$C = \frac{Q}{N_1 F_L}\sqrt{\frac{\rho_1/\rho_0}{P_1 - F_F P_V}} \quad \text{.....................} (9)$$

No.	Symbol	Description	Unit	
a	C	Cv value or Kv value	–	–
b	Q	Actual volumetric flow rate	m^3/h	–
c	N_1	Numerical constants	–	–
d	F_L	Liquid pressure recovery factor of control valve	–	–
e	ρ_1	Standard Density of fliud at P_1 and T_1	kg/m3	–
f	ρ_0	Water density=1000kg/m^3 at 15℃	–	–
g	P_1	Upstream Pressure	kPa(A)	Bar(A)
h	F_F	Liquid critical pressure ration factor	–	–
i	P_V	Absolute vapour pressure of the liquid at inlet temperature	kPa(A)	Bar(A)

A	Cv Value	ΔP : Unit – kPa

$$C_V = \frac{Q}{0.0865 F_L}\sqrt{\frac{\rho_1/\rho_0}{P_1 - F_F P_V}} \quad \text{.....................} (10)$$

B	Cv Value	ΔP : Unit – Bar

$$C_V = \frac{Q}{0.865 F_L}\sqrt{\frac{\rho_1/\rho_0}{P_1 - F_F P_V}} \quad \text{.....................} (11)$$

C	Kv Value	ΔP : Unit – kPa

$$K_V = \frac{Q}{0.1 F_L}\sqrt{\frac{\rho_1/\rho_0}{P_1 - F_F P_V}} \quad \text{.....................} (12)$$

D	Kv Value	ΔP : Unit – Bar

$$K_V = \frac{Q}{F_L}\sqrt{\frac{\rho_1/\rho_0}{P_1 - F_F P_V}} \quad \text{.....................} (13)$$

G. Correction of Viscosity

The flow phase in the above Cv/Kv calculation equation (4)~(13) is for turbulent flow, which is vaild when the Reynolds number is larger than 4000. However, when the Reynolds number is very small, the medium flow phase is close to laminar flow and needs to be corrected. For liquids with viscosity above 20mm^2/s, viscosity correction shall be carried out in the following steps (14)~(17). (1mm^2/s=1cst)

Calculation for Ratio R :

$$R = \frac{44000Q}{\sqrt{C_{V1} \bullet \nu}} \quad \text{.....................} \ (14)$$

If $R \le 70$, the Viscosity Correction Ratio F_R is calculated as equation (15):

$$F_R = \frac{15.5}{\sqrt{R}} \quad \text{.....................} \ (15)$$

If $R > 70$, the Viscosity Correction Ratio F_R is calculated as equation (16):

$$F_R = 0.95 + \frac{63.14}{R} \quad \text{.....................} \ (16)$$

Calculation of corrected Cv value based on uncorrected Cv_1 value :

$$C_V = C_{V1} \cdot F_R \quad \text{.....................} \ (17)$$

No.	Symbol	Description	Unit	
a	R	Calculation Ratio	–	–
b	Cv_1	Uncorrected Cv value calcualted in steps E or F	–	–
c	ν	Dynamic Viscosity	mm^2/s	m^2/s
d	F_R	Viscosity Correction Ratio	–	–
e	Cv	Viscosity corrected Cv value	gas/min	–

F. Other Corrections

There is other correction ratio like Piping geometry factor F_P. Please contact POV engineer for more details.

3. CALCULATION PROCESS OF Cv/Kv VALUE FOR COMPRESSIBLE FLUID (GAS)

A. Datas Need For Calculation

Before calculating the Cv/Kv value, it is necessary to clarify the fluid data used by the valve as shown in below table to accurately calculate the valve Cv/Kv value.

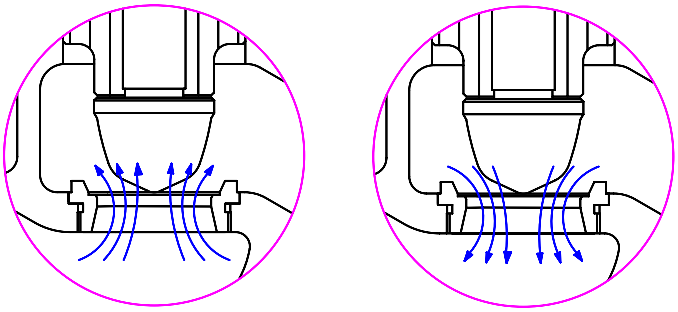
No.	Symbol	Description	Unit	
a	–	Valve Type and Flow– to– Open/Flow– to– Close	–	–
b	–	Flow Name and State	–	–
c	P_1	Upstream Pressure	kPa(A)	Bar(A)
d	P_2	Downstream Pressure	kPa(A)	Bar(A)
e	Q	Actual volumetric flow rate	m^3/hr	–
f	W	Mass flow rate	kg/h	–
g	γ	Specific heat ratio, checked by Table B	–	–
h	F_γ	Specific heat factor, checked by Table B	–	–
i	M	Molecular mass of flow	kg/kmol	
j	ρ_1	Standard Density of fliud at P_1 and T_1	kg/m^3	–
k	T_1	Inlet Port Temperature	K	–

B. Confirm of X_T: Pressure differential ratio factor of control valve

The ratio of differential pressure to inlet pressure is called differential pressure ratio X.

If the inlet pressure P_1 remains constant and the outlet pressure P_2 gradually decreases, the mass flowrate of the control valve will increase to the maximum limit value, and the flow will not increase if the P_2 flow is further reduced. At this time, choked flow will occur. The ratio X at this time is called the critical differential pressure ratio, which is symbolized by X_T, also named as Pressure differential ratio factor of control valve.

According to the valve type and flow direction, choose the correct Pressure differential ratio factor X_T according to TABLE A in APPENDIX V.



FLOW TO OPEN　　FLOW TO CLOSE

C. Calculation of X: Ratio of actual pressure differential to inlet absolute pressure ($\Delta P/P$)

$$X = \frac{P_1 - P_2}{P_2} \quad \text{.....................} (18)$$

No.	Symbol	Description	Unit	
a	X	Ratio of actual pressure differential to inlet absolute pressure (ΔP/P)	–	–
b	P_1	Upstream Pressure	kPa(A)	Bar(A)
c	P_2	Downstream Pressure	kPa(A)	Bar(A)

D. Calculation of F_γ: Specific heat factor

Specific heat ratio is an important parameter to describe the thermodynamic properties of gases. It is defined as the ratio of the Specific heat C_P at constant pressure to the Specific heat C_V at constant volume, usually using the symbol γ, and $\gamma = C_P/C_V$.

Specific heat factor F_γ: The Pressure differential ratio factor X_T is based on an air fluid with a specific heat ratio of 1.40, which is close to atmospheric pressure. If the specific heat ratio of the fluid is not 1.40, the factor F_γ can be used to adjust X_T. The Specific heat factor is calculated by the following equation (19), or checked by TABLE B in APPENDIX V:

$$F_\gamma = \frac{\gamma}{1.40} \quad \text{.....................} (19)$$

No.	Symbol	Description	Unit	
a	γ	Specific heat ratio, checked by Table 3	–	–
b	F_γ	Specific heat factor, checked by Table 3	–	–

E. Confirm of Non-choked flow and Choked flow

In the process of testing the flow coefficient of most valves, the test medium is in a non-choked turbulent flow, which is an ideal flow state. However, when the differential pressure is further increased to the max differential pressure, a choked flow will occur. Under the choked flow state, there is a deviation between the pressure difference between the upstream and downstream of the tested valve measured by the sensor and the pressure difference that actually affects the flow of the valve. If the flow coefficient is also calculated according to the former tested data, the result will be inaccurate. Therefore, after the choked flow occurs, the max differential pressure will be used to replace the measured differential pressure to calculate the flow coefficient.

By comparing X (Ratio of actual pressure differential to inlet absolute pressure (ΔP/P)) and $F_\gamma \cdot X_T$, we can determine whether there will be the choked flow in the control valve.

If $X < F_\gamma \cdot X_T$, it is a Non-choked flow, and use equation (20)~(35) to calculate the Cv/Kv value.

If $X \geq F_\gamma \cdot X_T$, it is a choked flow, and use equation (36)~(50) to calculate the Cv/Kv value.

F. Confirm of *Z* : Compressibility factor at inlet conditions

Under some conditions, the density property of real gas deviates greatly from that of ideal gas. In these cases, the compression factor *Z* should be introduced to compensate for this deviation. *Z* is a function of the contrast pressure and the contrast temperature (refer to Figue 1 to determine *Z*). The Reduced pressure P_R is defined as the ratio of the actual inlet absolute pressure to the absolute thermal critical pressure of the fluid. The Reduced temperature T_R is defined as the ratio of the actual inlet absolute temperature to the absolute thermal critical temperature of the fluid. As below:

$$P_r = \frac{P_1}{P_c} \quad \text{..................... (20)}$$

$$T_r = \frac{T_1}{T_c} \quad \text{..................... (21)}$$

No.	Symbol	Description	Unit	
a	P_r	Reduced pressure	–	–
b	T_r	Reduced temperature	–	–
c	P_1	Absolute Upstream Pressure	kPa(A)	Bar(A)
d	T_1	Absolute Upstream Temperature	K	–
e	P_C	Absolute thermodynamic critical pressure, Check TABLE B in APPENDIX V.	kPa(A)	Bar(A)
f	T_C	Absolute thermodynamic critical temperature, Check TABLE B in APPENDIX V.	K	–

Confirm the compressibility factor *Z* according to Figue 1.

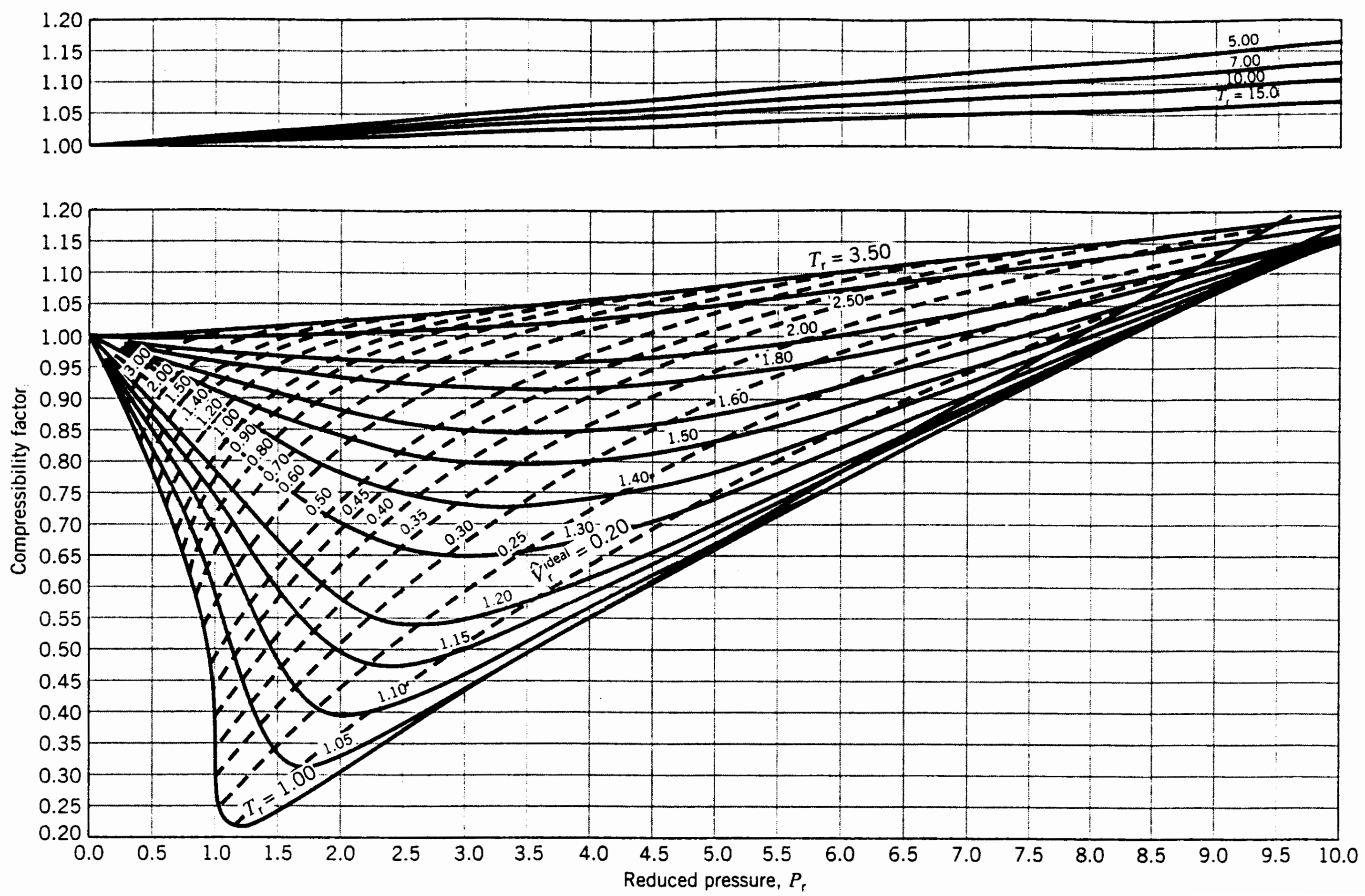


FIGURE 1

G. Calculation of Cv/Kv value for Non-choked flow

If $X < F_\gamma \cdot X_T$, calculate the Expansion factor Y by equation (22).

Expansion factor Y: used to correct the change of gas density from the inlet of the valve to the contraction flow behind the valve.

Theoretically, the value of Y is related to the ratio of orifice area to inlet area, flow path shape, pressure difference ratio X, Reynolds number, Specific heat ratio F_γ and other factors.

Due to the high flow rate of the gas medium, in the case of compressible flow, the influence of Reynolds number is small and can be ignored because turbulence almost always exists. The relationship between other factors and Expansion factor Y can be expressed by the following equation:

$$Y = 1 - \frac{X}{3F_\gamma X_T} \quad \text{.....................} \ (22)$$

No.	Symbol	Description	Unit	
a	Y	Expansion factor	–	–
b	X	Ratio of actual pressure differential to inlet absolute pressure (⊿P/P)	–	–
c	F_γ	Specific heat factor, checked by Table B	–	–
d	X_T	Pressure differential ratio factor of control valve	–	–

The equations (23) ~(25) is the general equation for the Non-choked flow calculation.
The equations (26) ~(28) is for Cv value with pressure units under kPa.
The equations (29) ~(31) is for Cv value with pressure units under bar.
The equations (32) ~(34) is for Kv value with pressure units under kPa.
The equations (35) ~(37) is for Kv value with pressure units under bar.

General Equation of Calculation for Non-choked flow

$$C = \frac{W}{N_6 Y \sqrt{X P_1 \rho_1}} \quad \text{.....................} \ (23)$$

$$C = \frac{W}{N_8 P_1 Y} \sqrt{\frac{T_1 Z}{XM}} \quad \text{.....................} \ (24)$$

$$C = \frac{Q}{N_9 P_1 Y} \sqrt{\frac{M T_1 Z}{X}} \quad \text{.....................} \ (25)$$

No.	Symbol	Description	Unit	
a	C	Cv value or Kv value	–	–
b	Q	Actual volumetric flow rate	m^3/h	–
c	W	Mass flow rate	kg/h	–
d	$N_6/N_8/N_9$	Numerical constants	–	–
e	Y	Expansion factor	–	–
f	X	Ratio of actual pressure differential to inlet absolute pressure (⊿P/P)	–	–
g	P_1	Absolute Upstream Pressure	kPa(A)	Bar(A)
h	ρ_1	Standard Density of fliud at P_1 and T_1	kg/m3	–
i	Z	Compressibility factor at inlet conditions	–	–
j	M	Water density=1000kg/m^3 at 15℃	–	–
k	T_1	Absolute Upstream Temperature	K	–
A	Cv Value	P_1 : Unit – kPa, W : Unit – kg/h, Q : Unit – m^3/h		

$$C_{V1} = \frac{W}{2.73 Y \sqrt{X P_1 \rho_1}} \quad \text{.....................} \ (26)$$

$$C_{V2} = \frac{W}{0.948 P_1 Y} \sqrt{\frac{T_1 Z}{XM}} \quad \text{.....................} \ (27)$$

$$C_{V3} = \frac{Q}{22.5 P_1 Y} \sqrt{\frac{M T_1 Z}{X}} \quad \text{.....................} \ (28)$$

B	Cv Value	P_1 : Unit – Bar, W : Unit – kg/h, Q : Unit – m³/h
		$$C_{V4}=\frac{W}{27.3Y\sqrt{XP_1\rho_1}}$$ .... (29)
		$$C_{V5}=\frac{W}{94.8P_1Y}\sqrt{\frac{T_1Z}{XM}}$$ .... (30)
		$$C_{V6}=\frac{Q}{2250P_1Y}\sqrt{\frac{MT_1Z}{X}}$$ .... (31)
C	Kv Value	P_1 : Unit – kPa, W : Unit – kg/h, Q : Unit – m³/h
		$$K_{V1}=\frac{W}{3.16Y\sqrt{XP_1\rho_1}}$$ .... (32)
		$$K_{V2}=\frac{W}{1.1P_1Y}\sqrt{\frac{T_1Z}{XM}}$$ .... (33)
		$$K_{V3}=\frac{Q}{26P_1Y}\sqrt{\frac{MT_1Z}{X}}$$ .... (34)
D	Kv Value	P_1 : Unit – Bar, W : Unit – kg/h, Q : Unit – m³/h
		$$K_{V4}=\frac{W}{31.6Y\sqrt{XP_1\rho_1}}$$ .... (35)
		$$K_{V5}=\frac{W}{110P_1Y}\sqrt{\frac{T_1Z}{XM}}$$ .... (36)
		$$K_{V6}=\frac{Q}{2600P_1Y}\sqrt{\frac{MT_1Z}{X}}$$ .... (37)

H. Calculation of Cv/Kv value for Choked flow

If $X \geqslant F_\gamma \cdot X_T$, the Expansion factor $Y = 0.667$.

The equations (38) ~(40) is the general equation for the Choked flow calculation.

The equations (41) ~(43) is for Cv value with pressure units under kPa.

The equations (44) ~(46) is for Cv value with pressure units under bar.

The equations (47) ~(49) is for Kv value with pressure units under kPa.

The equations (50) ~(52) is for Kv value with pressure units under bar.

General Equation of Calculation for Choked flow

$$C=\frac{W}{0.667N_6\sqrt{F_\gamma X_T P_1\rho_1}}$$ .... (38)

$$C=\frac{W}{0.667N_8P_1}\sqrt{\frac{T_1Z}{F_\gamma X_T M}}$$ .... (39)

$$C=\frac{Q}{0.667N_9P_1}\sqrt{\frac{MT_1Z}{F_\gamma X_T}}$$ .... (40)

No.	Symbol	Description	Unit	
a	C	Cv value or Kv value	–	–
b	Q	Actual volumetric flow rate	m³/h	–
c	W	Mass flow rate	kg/h	–
d	$N_6/N_8/N_9$	Numerical constants	–	–
e	F_γ	Specific heat factor, checked by Table B	–	–
f	X_T	Pressure differential ratio factor of control valve	–	–

g	P_1	Absolute Upstream Pressure	kPa(A)	Bar(A)
h	ρ_1	Standard Density of fliud at P_1 and T_1	kg/m3	–
i	Z	Compressibility factor at inlet conditions	–	–
j	M	Water density=1000kg/m^3 at 15℃	–	–
k	T_1	Absolute Upstream Temperature	K	–

A	Cv Value	P_1 : Unit – kPa, W : Unit – kg/h, Q : Unit – m^3/h

$$C_{V1}=\frac{W}{1.82091\sqrt{F_\gamma X_T P_1 \rho_1}} \quad \text{.................... (41)}$$

$$C_{V2}=\frac{W}{0.632316P_1}\sqrt{\frac{T_1 Z}{F_\gamma X_T M}} \quad \text{.................... (42)}$$

$$C_{V3}=\frac{Q}{15.0075P_1}\sqrt{\frac{MT_1 Z}{F_\gamma X_T}} \quad \text{.................... (43)}$$

B	Cv Value	P_1 : Unit – Bar, W : Unit – kg/h, Q : Unit – m^3/h

$$C_{V4}=\frac{W}{18.2091\sqrt{F_\gamma X_T P_1 \rho_1}} \quad \text{.................... (44)}$$

$$C_{V5}=\frac{W}{63.2316P_1}\sqrt{\frac{T_1 Z}{F_\gamma X_T M}} \quad \text{.................... (45)}$$

$$C_{V6}=\frac{Q}{1500.75P_1}\sqrt{\frac{MT_1 Z}{F_\gamma X_T}} \quad \text{.................... (46)}$$

C	Kv Value	P_1 : Unit – kPa, W : Unit – kg/h, Q : Unit – m^3/h

$$K_{V1}=\frac{W}{2.10772\sqrt{F_\gamma X_T P_1 \rho_1}} \quad \text{.................... (47)}$$

$$K_{V2}=\frac{W}{0.7337P_1}\sqrt{\frac{T_1 Z}{F_\gamma X_T M}} \quad \text{.................... (48)}$$

$$K_{V3}=\frac{Q}{17.342P_1}\sqrt{\frac{MT_1 Z}{F_\gamma X_T}} \quad \text{.................... (49)}$$

D	Kv Value	P_1 : Unit – Bar, W : Unit – kg/h, Q : Unit – m^3/h

$$K_{V4}=\frac{W}{21.0772\sqrt{F_\gamma X_T P_1 \rho_1}} \quad \text{.................... (50)}$$

$$K_{V5}=\frac{W}{73.37P_1}\sqrt{\frac{T_1 Z}{F_\gamma X_T M}} \quad \text{.................... (51)}$$

$$K_{V6}=\frac{Q}{1734.2P_1}\sqrt{\frac{MT_1 Z}{F_\gamma X_T}} \quad \text{.................... (52)}$$

4. CALCULATION PROCESS OF Cv/Kv VALUE FOR STEAM

A. Datas Need For Calculation

Before calculating the Cv value, it is necessary to clarify the fluid data used by the valve as shown in below to accurately calculate the valve Cv value.

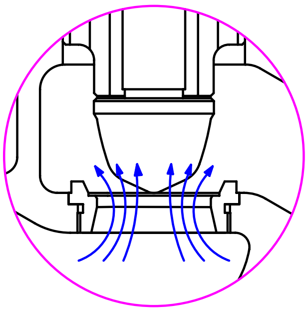
No.	Symbol	Description	Unit	
a	–	Valve Type and Flow– to– Open/Flow– to– Close	–	–
b	X_T	Pressure differential ratio factor of control valve	–	–
c	P_1	Upstream Pressure	kPa(A)	Bar(A)
d	P_2	Downstream Pressure	kPa(A)	Bar(A)
e	W	Mass flow rate	kg/h	–
f	T_1	Inlet Port Temperature	K	–

B. Confirm of X_T: Pressure differential ratio factor of control valve

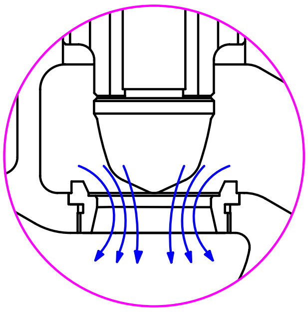
The ratio of differential pressure to inlet pressure is called differential pressure ratio X.

If the inlet pressure P_1 remains constant and the outlet pressure P_2 gradually decreases, the mass flowrate of the control valve will increase to the maximum limit value, and the flow will not increase if the P_2 flow is further reduced. At this time, choked flow will occur. The ratio X at this time is called the critical differential pressure ratio, which is symbolized by X_T, also named as Pressure differential ratio factor of control valve.

According to the valve type and flow direction, choose the correct Pressure differential ratio factor X_T according to TABLE A in APPENDIX V.



FLOW TO OPEN



FLOW TO CLOSE

C. Calculation of X: Ratio of actual pressure differential to inlet absolute pressure ($\Delta P/P$)

$$X = \frac{P_1 - P_2}{P_2} \quad \text{.....................} \ (50)$$

No.	Symbol	Description	Unit	
a	X	Ratio of actual pressure differential to inlet absolute pressure (ΔP/P)	–	–
b	P_1	Upstream Pressure	kPa(A)	Bar(A)
c	P_2	Downstream Pressure	kPa(A)	Bar(A)

D. Calculation of T_{sh}: Ratio of steam superheat

$$T_{sh} = T_1 - T_c \quad \text{.....................} \ (51)$$

No.	Symbol	Description	Unit	
a	T_{sh}	Ratio of steam superheat	K	–
b	T_1	Inlet Port Temperature	K	–
c	T_C	Absolute thermodynamic critical temperature, Check TABLE B in APPENDIX V.	K	–

E. Calculation of Cv value for Steam

$$C_V = \frac{W(1+0.00126Tsh)}{6.6P_1(3-X/X_T)\sqrt{X}} \quad \text{......................} \ (52)$$

No.	Symbol	Description	Unit	
a	Cv	Cv value	–	–
b	W	Mass flow rate	kg/h	–
c	T_{sh}	Ratio of steam superheat	K	–
d	P_1	Absolute Upstream Pressure	Bar(A)	–
e	X	Ratio of actual pressure differential to inlet absolute pressure (⊿P/P)	–	–
f	X_T	Pressure differential ratio factor of control valve	–	–

APPENDIX V
REFERENCE DATA FOR CALCULATION OF CV VALUE

Table A. TYPICAL VAUES OF DIFFERENT CONTROL VALVES

No.	Symbol	Description	Unit
a	F_L	Liquid pressure recovery factor of control valve	–
b	X_T	Pressure differential ratio factor of control valve	–

Valve type	Valve type	Flow Direction	F_L	X_T
Single Seat Globe Control Valve	V-Port Cage type	Flow-to-Open/Flow-to-Close	0.9	0.7
	Parabolic plug (linear and equal percentage)	Flow-to-Open	0.9	0.72
		Flow-to-Close	0.8	0.55
	cage type with 60/120 equal diameter hole drill	Outward/Inward	0.9	0.68
	Cage type with 4 ports	Outward	0.9	0.75
		Inward	0.85	0.7
Double Seat Globe Control Valve	Ported Plug	Inlet between seats	0.9	0.75
	Parabolic plug	Either direction	0.85	0.7
Angle type Globe Control Valve	Parabolic plug (linear and equal percentage)	Flow-to-Open	0.9	0.72
		Flow-to-Close	0.8	0.65
	Cage type with 4 ports	Outward	0.9	0.65
		Inward	0.85	0.6
Ball Valve	Full Bored	Either direction	0.74	0.42
	V-Port Bored	Either direction	0.6	0.3
Eccentric type Rotary Valve	Eccentric Spherical Plug	Flow-to-Open	0.85	0.6
		Flow-to-Close	0.68	0.4
	Eccentric Conical Plug	Flow-to-Open	0.77	0.54
		Flow-to-Close	0.79	0.55
Concentric type Butterfly Valve	Swing-through (70°)	Either direction	0.62	0.35
	Swing-through (60°)	Either direction	0.7	0.42
	Fluted vane (70°)	Either direction	0.67	0.38
Eccentric type Butterfly Valve	Offset Seat (70°)	Either direction	0.67	0.35

Table B. PHYSICAL CONSTANTS OF GASES AND VAPOUR

No.	Symbol	Description	Unit
a	M	Molecular mass of flow	kg/kmol
b	γ	Specific heat ratio	–
c	F_γ	Specific heat factor	–
d	P_C	Absolute thermodynamic critical pressure	kPa(A)
e	T_C	Absolute thermodynamic critical temperature	K

GAS OR VAPOUR	SYMBOL	M	γ	F_γ	P_C	T_C
Acetylene	C2H2	26.04	1.3	0.929	6 140	309
Air	—	28.97	1.4	1	3 771	133
Ammonia	NH3	17.03	1.32	0.943	11 400	406
Argon	A	39.948	1.67	1.191	4 870	151
Benzene	C6H6	78.11	1.12	0.8	4 924	562
Isobutane	C4H9	58.12	1.1	0.784	3 638	408
n-Butane	C4H10	58.12	1.11	0.793	3 800	425
Isobutylene	C4H8	56.11	1.11	0.79	4 000	418

GAS OR VAPOUR	SYMBOL	M	γ	F_γ	P_c	T_c
Carbon dioxide	CO2	44.01	1.3	0.929	7 387	304
Carbon monoxide	CO	28.01	1.4	1	3 496	133
Chlorine	CI2	70.906	1.31	0.934	7 980	417
Ethane	C2H6	30.07	1.22	0.871	4 884	305
Ethylene	C2H4	28.05	1.22	0.871	5 040	283
Fluorine	F2	18.998	1.36	0.97	5 215	144
Freon 11 (trichloromonofluoromethane)	CCI3F	137.37	1.14	0.811	4 409	471
Freon 12 (dichlorodifluoromethane)	CCI2F2	120.91	1.13	0.807	4 114	385
Freon 13 (chlorotrifluoromethane)	CCIF	104.46	1.14	0.814	3 869	302
Freon 22 (chlorodifluoromethane)	CHCIF2	80.47	1.18	0.846	4 977	369
Helium	He	4.003	1.66	1.186	229	5.25
n-Heptane	C7H16	100.2	1.05	0.75	2 736	540
Hydrogen	H2	2.016	1.41	1.007	1 297	33.25
Hydrogen chloride	HCI	36.46	1.41	1.007	8 319	325
Hydrogen fluoride	HF	20.01	0.97	0.691	6 485	461
Methane	Ch4	16.04	1.32	0.943	4 600	191
Methyl chloride	CH3CI	50.49	1.24	0.889	6 677	417
Natural gas	—	17.74	1.27	0.907	4 634	203
Neon	Ne	20.179	1.64	1.171	2 726	44.45
Nitric oxide	NO	63.01	1.4	1	6 485	180
Nitrogen	N2	28.013	1.4	1	3 394	126
Octane	C8H18	114.23	1.66	1.186	2 513	569
Oxygen	O2	32	1.4	1	5 040	155
Pentane	C5H12	72.15	1.06	0.757	3 374	470
Propane	C3H8	44.1	1.15	0.821	4 256	370
Propylene	C3H6	42.08	1.14	0.814	4 600	365
Saturated steam	—	18.016	1.25-1.32	0.893-0.943	22 119	647
Sulphur dioxide	SO2	64.06	1.26	0.9	7 822	430
Superheated steam	—	18.016	1.315	0.939	22 119	647

Table C. CHARACTERISTIC OF WATER

No.	Temperature ℉	Temperature ℃	Saturated Pressure bf/in2(PSI.A)	Saturated Pressure MPa.A	Specific Gravity 60/60 ℉
1	32	0	0.0885	0.0006	1.0013
2	40	4.44	0.1217	0.0008	1.0013
3	50	10	0.1781	0.0012	1.0007
4	60	15.56	0.2653	0.0018	1
5	70	21.11	0.3631	0.0025	0.9989
6	80	26.67	0.5069	0.0035	0.9976
7	86	30	0.7397	0.0051	
8	90	32.22	0.6982	0.0048	0.9963
9	100	37.78	0.9492	0.0065	0.9946
10	104	40	1.2328	0.0085	
11	110	43.33	1.2748	0.0088	0.9919
12	120	48.89	1.6924	0.0117	0.9901

No.	Temperature °F	Temperature °C	Saturated Pressure bf/in2(PSI.A)	Saturated Pressure MPa.A	Specific Gravity 60/60 °F
12	120	48.89	1.6924	0.0117	0.9901
13	122	50	2.0015	0.0138	
14	130	54.44	2.2225	0.0153	0.9872
15	140	60	2.8886	0.0199	0.9848
16	150	65.56	3.718	0.0256	0.9818
17	158	70	4.7571	0.0328	
18	160	71.11	4.741	0.0327	0.9786
19	170	76.67	5.992	0.0413	0.9752
20	176	80	7.0776	0.0488	
21	180	82.22	7.51	0.0518	0.9717
22	185	85	8.5569	0.0590	
23	190	87.78	9.339	0.0644	0.9681
24	194	90	10.2973	0.0710	
25	200	93.33	11.526	0.0795	0.9646
26	203	95	12.7774	0.0881	
27	210	98.89	14.123	0.0974	0.9605
28	212	100	14.696	0.1013	0.9594
29	220	104.44	17.186	0.1185	0.9566
30	230	110	20.5801	0.1419	
31	240	115.56	24.946	0.1720	0.948
32	248	120	28.3249	0.1953	
33	260	126.67	35.429	0.2443	0.9386
34	266	130	38.3756	0.2646	
35	280	137.78	49.203	0.3393	0.9294
36	284	140	51.2400	0.3533	
37	293	145	58.8978	0.4061	
38	300	148.89	67.013	0.4621	0.9194
39	302	150	67.4837	0.4653	
40	311	155	77.0848	0.5315	
41	316.4	158	83.3503	0.5747	
42	320	160	87.7592	0.6051	
43	325.4	163	94.7353	0.6532	
44	329	165	99.6374	0.6870	
45	334.4	168	107.3677	0.7403	
46	338	170	112.7919	0.7777	
47	343.4	173	121.3343	0.8366	
48	350	176.67	134.63	0.9283	0.8918
49	356	180	143.3503	0.9884	
50	365	185	160.9717	1.1099	
51	374	190	180.3046	1.2432	
52	383	195	201.4793	1.3892	
53	392	200	224.6120	1.5487	
54	400	204.44	247.31	1.7052	0.8606
55	410	210	277.2734	1.9118	
56	419	215	307.0631	2.1172	
57	428	220	339.3619	2.3399	
58	437	225	374.3002	2.5808	
59	446	230	412.0377	2.8410	
60	450	232.22	422.6	2.9138	0.827
61	456.8	236	461.2328	3.1802	

No.	Temperature ℉	Temperature ℃	Saturated Pressure bf/in2(PSI.A)	Saturated Pressure MPa.A	Specific Gravity 60/60 ℉
62	464	240	496.5047	3.4234	
63	473	245	543.5678	3.7479	
64	482	250	594.0537	4.0960	
65	491	255	648.1218	4.4688	
66	500	260	680.8	4.6941	0.7863
67	509	265	767.7737	5.2938	
68	518	270	833.6766	5.7482	
69	536	280	978.5932	6.7474	
70	550	287.78	1045.2	7.2067	0.7358
71	554	290	1142.1610	7.8752	
72	572	300	1325.9028	9.1421	
73	590	310	1531.3561	10.5587	
74	600	315.56	1542.9	10.6383	0.6796
75	608	320	1760.0580	12.1356	
76	626	330	2013.6186	13.8839	
77	644	340	2293.6041	15.8144	
78	662	350	2601.6389	17.9383	
79	680	360	2939.3183	20.2666	
80	700	371.11	3097.7	21.3586	0.4347
81	706	374.44	3208	22.1192	

Molecular Formula: H_2O
Boiling point: 212 ℉ (100 ℃) at 14.696 (0.1013MPa)
Critical pressure: 3208PSIA (22.1192MPaA)
Critical temperature: 706 ℉ (374.44 ℃)
℃ =(℉ -32)*5/9
MPa=PSI*0.006895

Table D. CHARACTERISTIC OF SATURATED STEAM

No.	Absolute pressure PSI.A	Absolute pressure MPa.A	Temperature ℉	Temperature ℃	Specific Volume ft3/lb	Specific Volume l/kg	Density kg/m^3
1	0.2	0.0014	53.14	11.74	1526	95263.9815	0.0105
2	0.45	0.0031	76.38	24.66	708.5	44229.7057	0.0226
3	0.5	0.0034	79.58	26.43	641.4	40040.8373	0.0250
4	0.9	0.0062	98.24	36.8	368.4	22998.1984	0.0435
5	1	0.0069	101.74	38.74	333.6	20825.7302	0.0480
6	1.8	0.0124	122.23	50.13	191.8	11973.5463	0.0835
7	2	0.0138	126.08	52.27	173.73	10845.4859	0.0922
8	2.8	0.0193	138.79	59.33	126.65	7906.4110	0.1265
9	3	0.0207	141.48	60.82	118.71	7410.7387	0.1349
10	4	0.0276	152.97	67.21	90.63	5657.7815	0.1767
11	5	0.0345	162.24	72.36	73.52	4589.6513	0.2179
12	10	0.0690	193.21	89.56	38.62	2410.9403	0.4148
13	14.696	0.1013	212	100	26.8	1673.0503	0.5977
14	20	0.1379	227.96	108.87	20.089	1254.1010	0.7974
15	22	0.1517	233.07	111.71	18.375	1147.1007	0.8718
16	24	0.1655	237.82	114.34	16.938	1057.3927	0.9457
17	26	0.1793	242.25	116.81	15.715	981.0442	1.0193
18	28	0.1931	246.41	119.12	14.663	915.3707	1.0925
19	30	0.2069	250.33	121.29	13.746	858.1250	1.1653
20	34	0.2344	257.58	125.32	12.226	763.2355	1.3102
21	38	0.2620	264.16	128.98	11.015	687.6361	1.4543

No.	Absolute pressure PSI.A	Absolute pressure MPa.A	Temperature °F	Temperature ℃	Specific Volume ft3/lb	Specific Volume l/kg	Density kg/m^3
22	42	0.2896	270.21	132.34	10.029	626.0829	1.5972
23	46	0.3172	275.8	135.44	9.209	574.8925	1.7395
24	50	0.3448	281.01	138.34	8.515	531.5680	1.8812
25	55	0.3792	287.07	141.71	7.787	486.1210	2.0571
26	60	0.4137	292.71	144.84	7.175	447.9155	2.2326
27	65	0.4482	297.97	147.76	6.655	415.4533	2.4070
28	70	0.4827	302.92	150.51	6.206	387.4235	2.5812
29	75	0.5171	307.6	153.11	5.816	363.0769	2.7542
30	80	0.5516	312.03	155.57	5.472	341.6019	2.9274
31	90	0.6206	320.27	160.15	4.896	305.6438	3.2718
32	100	0.6895	327.81	164.34	4.432	276.6776	3.6143
33	110	0.7585	334.77	168.21	4.049	252.7679	3.9562
34	120	0.8274	341.25	171.81	3.728	232.7288	4.2968
35	130	0.8964	347.32	175.18	3.455	215.6861	4.6364
36	140	0.9653	353.02	178.34	3.220	201.0157	4.9747
37	150	1.0343	358.42	181.34	3.015	188.2182	5.3130
38	160	1.1032	363.53	184.18	2.834	176.9188	5.6523
39	170	1.1722	368.41	186.89	2.675	166.9929	5.9883
40	180	1.2411	373.06	189.48	2.532	158.0658	6.3265
41	190	1.3101	377.51	191.95	2.404	150.0751	6.6633
42	200	1.3790	381.79	194.33	2.288	142.8335	7.0012
43	220	1.5169	389.86	198.81	2.087	130.2857	7.6754
44	240	1.6548	397.37	202.98	1.9183	119.7542	8.3504
45	260	1.7927	404.42	206.9	1.7748	110.7959	9.0256
46	280	1.9306	411.05	210.58	1.6511	103.0736	9.7018
47	300	2.0685	417.33	214.07	1.5433	96.3440	10.3795
48	340	2.3443	428.97	220.54	1.3655	85.2444	11.7310
49	380	2.6201	439.6	226.44	1.2222	76.2986	13.1064
50	420	2.8959	449.39	231.88	1.1061	69.0508	14.4821
51	460	3.1717	458.5	236.94	1.0094	63.0141	15.8695
52	500	3.4475	467.01	241.67	0.9278	57.9200	17.2652
53	540	3.7233	475.01	246.12	0.8578	53.5501	18.6741
54	560	3.8612	478.85	248.25	0.8256	51.5399	19.4024
55	580	3.9991	482.58	250.32	0.7973	49.7732	20.0911
56	600	4.1370	486.21	252.34	0.7698	48.0565	20.8088
57	620	4.2749	489.75	254.31	0.744	46.4459	21.5304
58	660	4.5507	496.58	258.1	0.6971	43.5180	22.9790
59	700	4.8265	503.1	261.72	0.6554	40.9148	24.4410
60	740	5.1023	509.34	265.19	0.618	38.5800	25.9202
61	780	5.3781	515.33	268.52	0.5843	36.4762	27.4151
62	820	5.6539	521.08	271.71	0.5538	34.5722	28.9250
63	860	5.9297	526.63	274.79	0.526	32.8367	30.4537
64	900	6.2055	531.98	277.77	0.5006	31.2511	31.9989
65	940	6.4813	537.16	280.64	0.4772	29.7903	33.5680
66	980	6.7571	542.17	283.43	0.4557	28.4481	35.1517
67	1000	6.8950	544.61	284.78	0.4456	27.8176	35.9485
68	1050	7.2398	550.57	288.09	0.4218	26.3318	37.9769
69	1100	7.5845	556.31	291.28	0.4001	24.9771	40.0367
70	1150	7.9293	561.86	294.37	0.3802	23.7348	42.1322
71	1200	8.2740	567.22	297.34	0.3619	22.5924	44.2627

No.	Absolute pressure PSI.A	Absolute pressure MPa.A	Temperature °F	Temperature ℃	Specific Volume ft3/lb	Specific Volume l/kg	Density kg/m^3
72	1250	8.6188	572.42	300.23	0.345	21.5374	46.4309
73	1300	8.9635	577.46	303.03	0.3293	20.5573	48.6445
74	1350	9.3083	582.35	305.75	0.3148	19.6521	50.8851
75	1400	9.6530	587.1	308.39	0.3012	18.8031	53.1827
76	1450	9.9978	591.73	310.96	0.2884	18.0040	55.5432
77	1500	10.3425	596.23	313.46	0.2765	17.2611	57.9337
78	1600	11.0320	604.9	318.28	0.2548	15.9065	62.8674
79	1700	11.7215	613.15	322.86	0.2354	14.6954	68.0485
80	1800	12.4110	621.03	327.24	0.2197	13.7153	72.9113
81	1900	13.1005	628.58	331.43	0.2021	12.6165	79.2613
82	2000	13.7900	635.82	335.46	0.1878	11.7238	85.2966
83	2100	14.4795	642.77	339.32	0.1746	10.8998	91.7448
84	2200	15.1690	649.46	343.03	0.1625	10.1444	98.5766
85	2300	15.8585	655.91	346.62	0.1513	9.4452	105.8739
86	2400	16.5480	662.12	350.07	0.141	8.7835	113.8498
87	2500	17.2375	668.13	353.41	0.1307	8.1592	122.5610
88	2600	17.9270	673.94	356.63	0.1213	7.5724	132.0585
89	2700	18.6165	679.55	359.75	0.1035	6.4612	154.7700
90	2800	19.3060	684.99	362.77	0.1035	6.4612	154.7700
91	2900	19.9955	690.26	365.7	0.0947	5.9119	169.1504
92	3000	20.6850	695.36	368.53	0.0858	5.3563	186.6960
93	3100	21.3745	700.31	371.28	0.0753	4.7008	212.7297
94	3200	22.0640	705.11	373.95	0.058	3.6208	276.1821
95	3206.2	22.1067	705.4	374.11	0.0503	3.1401	318.4612