Selection of Pressure Reducing Valve and Back Pressure Regulating Valve

1. Selection for fluid

The model of valve shall be selected appropriately for each fluid (steam, gas and liquid).
Note : AW pressure reducing valve and AWR back pressure regulating valve are available for any fluid.

2. Selection of size

Select the size by the sizing chart.
If there is no sizing chart, Cv calculation should be done acording to specifications.
Flow conditions, such as pressure, flow rate, temperature, should be at the worst levels when selecting an appropriate valve.
If the valve is too big, however, this will cause problem such as unstable pressure and could result in short lifetime.
Ensure verification of pressure range ability, min. differential pressure, min. controllable flow and max. flow rate (limited flow).

3. Material selection

Metal
Standard materials have anti-corrosive characteristics for fluids.
Other materials are available on request.

Synthetic rubber and gasket
Synthetic rubber is used where there is contact with fluid.
PTFE sheeting laid on synthetic rubber is available on request.

Acting aid
Acting aid is coated on thread and sliding parts to prevent sticking to metal.

For medicine and semiconductor production
Strict quality control and cleaning are required.
Rusty material and rubber are not used where there is contact with fluid.
Care is taken in the selection of an appropriate acting aid.
Please contact FUSHIMAN, to request such valves because of their special requirements.

For oxygen
Made with stainless steel, bronze and PTFE.
Oil is washed off completely.

4. Connections

Standard connections comply with JIS B2220, JIS B2239 (Flanged) and JIS B0203 (Screwed).
Other standards like ANSI/ASME, API, GB, DIN, GOST and NPT are applicable, although delivery times and prices are differ from the standard ones.

5. Anti-corrosive

Where long term preservation is necessary, or for exportation, or where rusting is liable, a special anti-corrosive can be applied before assembling.
Please specify special conditions when ordering.

6. Painting

FUSHIMAN standard painting is applied.
Please specify special painting requirements or site conditions.

Cv value, Maximum flow rate

Cv values

Type	Fluid	Model \ Size	8・10	15	20	25	32	40	50	65	80	100	125	150	200	250	300	Page
Pressure reducing valve	Steam	P260		$Cv = Ad^2$ d : Nominal size (in) A : Refer to calculation below														6
		P260-DHC		Same as above														10
		P260-1LFA		Same as above														12
		PHP30				5		12	19	28	44	76						14
		PPD41-3		0.4	1	1												16
	Gas	PMD31		1.8	2.6	3.9	6.3	8.3	13	21	29	50	76	109				18
		PPD41B		1.8	2.6	3.9												21
		PPD41B-3		1.8	2.6	3.9												22
		PPD41L-3		1.8	1.8	1.8												25
		P260		$Cv = Ad^2$ d : Nominal size (in) A : Refer to calculation formula below														26
		PMD31L		1.8	2.6	3.9	6.3	8.3	13	21	29	50	76	109				28
		PLG41			1 (# 1, 2) 1. 3 (# 3, 4, 5)													30
		PLG61-2		1.8	2.6	3.9	6.3	8.3	13									31
		PRL								35	46	72	123	178				35
		67R		0.04														37
		PPD25		0.07														37
	Liquid	PMD31		1.8	2.6	3.9	6.3	8.3	13	21	29	50	76	109				39
		P100-2Y		1.8	2.6	3.9	6.3	8.3	13	21	26	40	70	109				42
		P110-2S			2.6	3.9	6.3	8.3	13									44
		PPD41B-3		1.8	2.6	3.9												48
		PPD48・48F		(3/8) Refer to"Sizing"														50
		PFD42						22.5	40	62.5	90	160	250	360	640	1000	1440	52
	All Fluid	AW		Refer to "Cv values"														56
Back pressure regulating valve	Steam	B260		1.1	2.5	4.5	7	10.1	18	28.1	40.5							64
	Gas	RMD31		3.9	3.9	3.9	6.3	8.3	13	21	29	50	76	109				66
		RMD31L		3.9	3.9	3.9	6.3	8.3	13	21	29	50	76	109				68
		RLG61-2		1.8	2.6	3.9	6.3	8.3	13									70
		BRL								35	46	72	123	178				74
	Liquid	RMD31		3.9	3.9	3.9	6.3	8.3	13	21	29	50	76	109				76
		RPD52-2		(3/8) 0.7														78
		RFD42						22.5	40	62.5	90	160	250	360	640	1000	1440	80
	All Fluid	AWR		Refer to "Cv values"														83
Type	Fluid	Model \ Size	8・10	15	20	25	32	40	50	65	80	100	125	150	200	250	300	Page

Remark : The valve models in ■ have limited maximum flow rate. Limited maximum flow rate shall be following calculation formula or data.

Maximum flow rate

Type	Fluid	Model	Calculation formula
Pressure reducing valve	Steam, Gas	P260 P260-DHC P260-1LFA	$Cv=Ad^2$ A is inverse relation to pressure reducing ratio $\left(\frac{P_1}{P_2}\right)$ $A=\frac{16.2\times P_2^{0.52}}{P_1+0.101}$ P_1 : Inlet pressure MPa P_2 : Outlet pressure MPa d : Nominal size (in)

Cv values at A=4.5

Size	15	20	25	32	40	50	65	80	100	125	150	200	250
Cv	1.1	2.5	4.5	7.0	10.1	18	28.1	40.5	72	112.5	162	288	450

Cv value, Maximum flow rate

Maximum flow rate

<table>
<tr><th>Type</th><th>Fluid</th><th>Model</th><th>Calculation formula</th></tr>
<tr><td rowspan="8">Pressure reducing valve</td><td rowspan="4">Gas</td><td colspan="2">Use as the flow rate either the Cv value calculation or the maximum flow rate, depending on which is the smaller rate. Use the smaller value as the rated flow.</td></tr>
<tr><td>PPD41B-3
PPD41B</td><td>Max. flow $V_{LM}=K\times P_2\times\frac{273}{G\ (273+t)}$ m³/h (Normal)
K : Constant
218 for 15A
392 for 20A
641 for 25A
P_2 : Set pressure MPa abs
G : Specific gravity air : 1
t : Temperature ℃</td></tr>
<tr><td>PPD41L-3</td><td>Max. flow
20m³/h (normal) for 15A, 350m³/h (normal) for 20A, 25A</td></tr>
<tr><td>PLG61-2</td><td>Max. flow at P1 : 0.2—0.4MPa and P2 : 0.5—3kPa
Size 15 20 25 32 40 50
Max. flow 60 90 120 200 260 370 m³/h (normal)
Under the condition where the inlet pressure is beyond 0.4MPa, the flow is at the maximum when it is 0.4MPa.</td></tr>
<tr><td rowspan="4">Liquid</td><td>PLG41</td><td>20m³/h (normal) for set pressure lower than 5kPa
30m³/h (normal) for set pressure 5kPa and above</td></tr>
<tr><td colspan="2">Use as the flow rate either the Cv value calculation or the maximum flow rate, depending on which is the smaller rate. Use the smaller value as the rated flow.</td></tr>
<tr><td>P100-2Y</td><td>Size 15 20 25 32 40 50 65 80 100 125 150
Max. flow $30/\sqrt{\gamma}$ $55/\sqrt{\gamma}$ $85/\sqrt{\gamma}$ $120/\sqrt{\gamma}$ $150/\sqrt{\gamma}$ $250/\sqrt{\gamma}$ $350/\sqrt{\gamma}$ $450/\sqrt{\gamma}$ $700/\sqrt{\gamma}$ $1200/\sqrt{\gamma}$ $1800/\sqrt{\gamma}$
γ : sp.gr. (water 4℃ : 1) unit : ℓ/min</td></tr>
<tr><td>P110-2S</td><td>Size 20 25 32 40 50
Max. flow $55/\sqrt{\gamma}$ $85/\sqrt{\gamma}$ $120/\sqrt{\gamma}$ $150/\sqrt{\gamma}$ $250/\sqrt{\gamma}$
γ : sp.gr. (water 4℃ : 1) unit : ℓ/min</td></tr>
<tr><td>PPD41B-3</td><td>$30/\sqrt{\gamma}$ ℓ/min for 15A
$55/\sqrt{\gamma}$ ℓ/min for 20A
$90/\sqrt{\gamma}$ ℓ/min for 25A
γ: sp.gr. (water 4℃ : 1)</td></tr>
<tr><td>PFD42</td><td>Size 40 50 65 80 100 125
Max. flow $533/\sqrt{\gamma}$ $800/\sqrt{\gamma}$ $1300/\sqrt{\gamma}$ $2000/\sqrt{\gamma}$ $3000/\sqrt{\gamma}$ $5000/\sqrt{\gamma}$
Size 150 200 250 300
Max. flow $7700/\sqrt{\gamma}$ $12000/\sqrt{\gamma}$ $17000/\sqrt{\gamma}$ $24000/\sqrt{\gamma}$
γ : sp.gr. (water 4℃ : 1) unit : ℓ/min</td></tr>
<tr><td rowspan="3">Back pressure regulating valve</td><td rowspan="3">Liquid</td><td colspan="2">Use as the flow rate either the Cv value calculation or the maximum flow rate, depending on which is the smaller rate. Use the smaller value as the rated flow.</td></tr>
<tr><td>RMD31</td><td>Size 15~25 32 40 50 65 80 100 125 150
Max. flow $90/\sqrt{\gamma}$ $150/\sqrt{\gamma}$ $204/\sqrt{\gamma}$ $330/\sqrt{\gamma}$ $543/\sqrt{\gamma}$ $767/\sqrt{\gamma}$ $1323/\sqrt{\gamma}$ $2016/\sqrt{\gamma}$ $2892/\sqrt{\gamma}$
γ : sp.gr. (water 4℃ : 1) unit : ℓ/min</td></tr>
<tr><td>RFD42</td><td>Size 40 50 65 80 100 125
Max. flow $533/\sqrt{\gamma}$ $800/\sqrt{\gamma}$ $1300/\sqrt{\gamma}$ $2000/\sqrt{\gamma}$ $3000/\sqrt{\gamma}$ $5000/\sqrt{\gamma}$
Size 150 200 250 300
Max. flow $7700/\sqrt{\gamma}$ $12000/\sqrt{\gamma}$ $17000/\sqrt{\gamma}$ $24000/\sqrt{\gamma}$
γ : sp.gr. (water 4℃ : 1) unit : ℓ/min</td></tr>
</table>

Troubleshooting

The interior of the piping should be thoroughly cleaned before valve installation.
Defective operation is mostly caused by grit, scale and other foreign matter in the pipe, so ensure thorough removal of foreign matter.
Use of a strainer with 50mesh or finer at the inlet of the valve is recommended.
Provision of a bypass line, stop valve and pressure gauge at the inlet and outlet are recommended for maintenace during operation.

⚠ Caution

Piping shall be atmospheric pressure and ambient temperature at disassembling of valve, which should be safety condition even if fluid escape from line.

Pressure Reducing Valve

Trouble	Cause	Measures
Outlet pressure is not raised to the required pressure.	1. Clogging of strainer or piping,	Clean up strainer and piping. Built-in strainer shall be cleaned up also.
	2. Stick sliding portion of valve disc and seat.	Remove the foreign matters after disassembling. Please note that the pilot valve apt to stick.
	3. Not enough size for specified flow.	Re-check specification, sizing and replace to proper size.
Outlet pressure raises excessively. Safety relief valve blows off fluid.	4. Stick sliding portion of valve disc and seat.	Remove the foreign matters after disassembling. Same as condition of 2. Pressure will rise due to valve sticking in spite of low load.
	5. Outflow is clogged, e. g. ON-OFF valve is closed which is located at valve outlet.	It is recommended to install ON-OFF valve at valve inlet. If above is impractical, in case of steam or gas, it is recommended to provide trap between valve and ON-OFF valve.
	6. Leakage of bypass valve.	Repair or replace the bypass valve.
Outlet pressure is instability.	7. Large friction because of sliding parts wear.	Repair or replace the sliding parts.
	8. Distortion of diaphragm. (In case of metal diaphragm)	Replace diaphragm.
	9. In adequate opening of throttle valve. (In case of P260, SCPH, 30K)	Open throttle valve slowly until stable pressure.

Back Pressure Regulating Valve

Trouble	Cause	Measures
Inlet pressure rises excessively.	10. Clogging of strainer or piping.	Same as 1. of Pressure Reducing Valve.
	11. Stick sliding portion of valve disc and seat.	Same as 2. of Pressure Reducing Valve.
	12. Not enough size for specified flow.	Same as 3. of Pressure Reducing Valve.
Inlet pressure falls excessively.	13. Stick sliding portion of valve disc and seat.	Remove the foreign matters after disassembling.
	14. Leakage of bypass valve.	Repair or replace the bypass valve.

- Please examine the pressure gauge and piping as well as the valve in order to test for abnormal pressure.
- Vibration and valve noise may occur at excess velocity. Please check the line velocity.
- Parts of the pressure reducing valve for liquid may be damaged by water hammer due to sudden closure of the ON-OFF valve.

Important notes regarding piping arrangement

There are many problems caused by piping arrangement.
Problems with vibration and noise can also be due to piping arrangement.
Piping arrangement must be taken into consideration during maintenance and periodical inspection of valves.
The following are minimum requirements to take into consideration regarding piping arrangement.

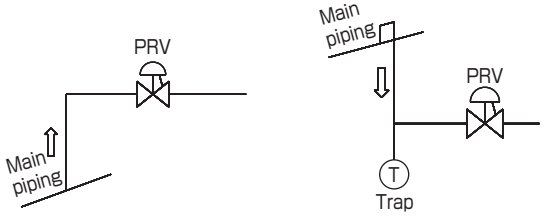
1. A bypass line and bypass valve are necessary for piping.
   Valve maintenance is done by bypassing the fluid.
   A pressure gauge at each inlet and outlet of the valve (inlet of upstream stop valve and outlet of downstream stop valve) must be provided.
   Globe valve is suitable for use as a stop valve because of its shut off ability.
   Sluice valve is suitable for large capacity flow.

2. Maintenance and disassembling space is required beneath and/or above the valve.
   Work space is also required.

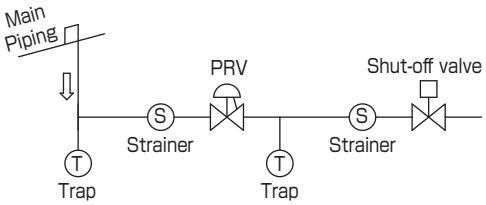
3. Piping should be fixed properly to avoid unexpected force to the valve.
   Force on the valve in particular from thermal expansion should be avoided.
   Excess force will distort the valve body and cause trouble and damage.

4. Regarding steam or gases, if condensate/drain flows into the PRV, unstable operation such as vibration may occur.
   When installing the PRV, ensure that the inlet piping is higher than the main piping to avoid condensate/drain flowing into the valve as shown in the left figure below.
   Similarly, the outlet piping is recommended to be installed lower than PRV.
   In addition, it is recommended to install the traps where condensate/drain accumulates.

   Proper example

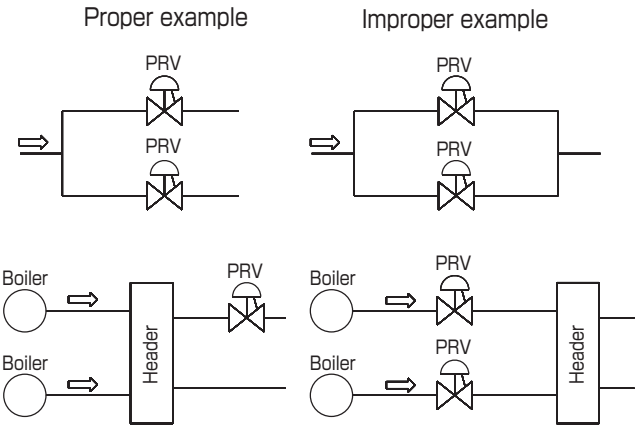


5. ⚠ Warning In the case of steam, if a shut-off valve is installed at the outlet of the PRV as shown in the sketch below and the PRV or strainer is made of grey cast iron (FC), a steam trap should be installed at both sides of PRV in order to prevent storage of condensate in the piping and should be checked periodically.
   If the shut-off valve opens with condensate remaining, steam hammer may occur. As a result, the valve body could break due to it being made of cast iron (FC), which may cause a grave accident resulting in personal injury or death or suspended operation.



6. In the case of liquids, an air vent shall be suitably provided on piping.
   Stagnant air can be the cause of vibration.

7. Pressure reducing valves installed in a parallel position, with joined outlet, should not be operated together.
   These pressure reducing valves must not be adjusted to same set pressure.
   The pressure reducing valves should be operated separately.



8. However, when such a pressure reducing valve installation is unavoidable, in order to allow for a large flow range, the difference in set pressure between the pressure reducing valves should be at least 0.03MPa.

9. The distance between the pressure reducing valve and the ON-OFF valve should be a minimum of 3m.
   When installing a control valve, a distance of 1m is required as a minimum.
   When installing two stage reducing valves, a distance of 3m is required between the valves for the pirot operated type and a distance of 1.5m for the direct acting type.
   In the case of steam and gas, a trap should be provided between the pressure reducing valve and the ON-OFF valve.

10. In the case of steam and gas, the outlet piping should be larger than the inlet piping.

11. If a quick ON-OFF valve is installed at the outlet of the PRV, water hammer may occur, which may cause lockup pressure and offset pressure to go far beyond set capacity prescribed performances. Install an ON-OFF valve which operates gradually or a water hammer arrestor.

12. Adjusting screw and name plate should be recognizable even when insulated.