Sustaining Valves

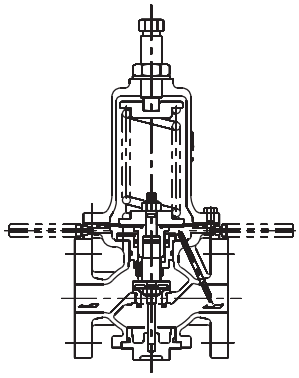
Sustaining valve, Differential pressure sustaining valve

SUSTAINING VALVES prevent water falling when the pump is stopped.
Hence, when the pump is restarted, damage from water hammer can be avoided, and smooth operation is ensured.

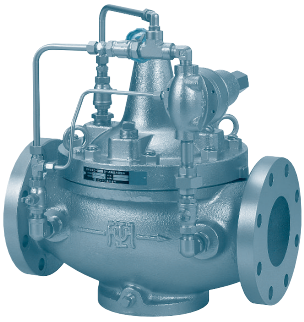
1. Type of Valves

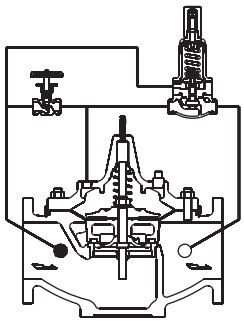
1.1 Sustaining valves

RMD31

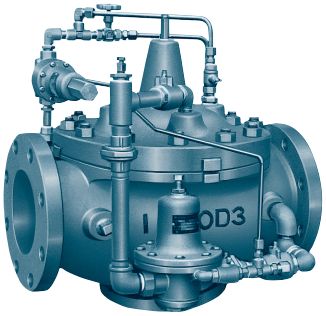


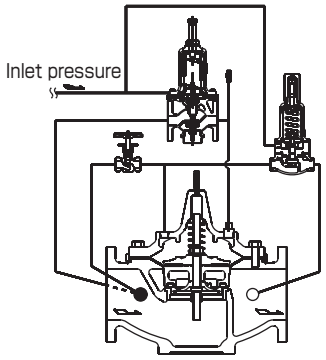
RFD42





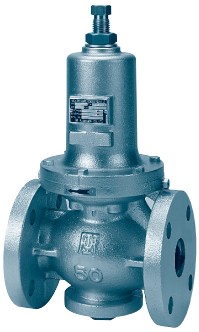
SFD42

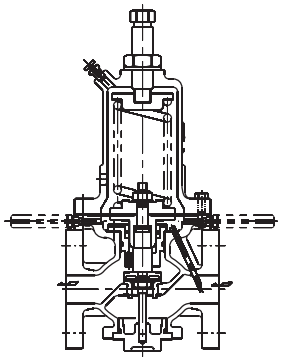




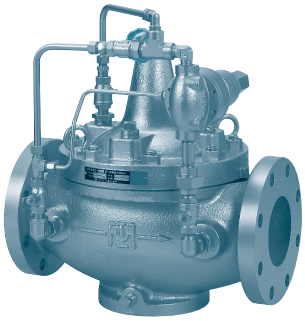
1.2 Differential pressure sustaining valve

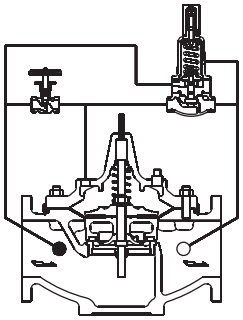
RMD31D





RFD42D





Sustaining valve, Differential pressure sustaining valve

2. Description

Sustaining valve : Sustaining valve maintains inlet pressure at a constant rate. Sustaining valve is used to prevent water falling of returning piping or to keep pump discharge pressure constant at open cycle, that is to say back pressure regulating valve.

Differential pressure sustaining valve : Differential pressure sustaining valve maintains a difference in pressure between headers or between the inlet and the outlet of the pump constant, that is to say differential pressure regulating valve.

2.1 Sustaining valve at open cycle — Refer to Fig. 1

Sustaining valve is used for open cycle air conditioning system. Sustaining valve will close at stoppage of pump operation to prevent water falling of returning piping and in addition this valve maintains adequate pressure during operation. Pump bypass systems may reguire use of sustaining valves at this cycle.

2.2 Differential pressure sustaining valve at closed cycle — Refer to Fig. 2

Differential pressure sustaining valves are used for closed cycle air conditioning systems. Differential pressure sustaining valves maintain a necessary difference in pressure between the pump inlet and the outlet. Heat exchangers like refrigerators and boilers thus maintain constant circulation flow regardless of load fluctuation.

2.3 Sustaining valve at closed cycle using with open tank — Refer to Fig. 3

Sustaining valves can be used because the valve outlet is exposed to atmosphere.

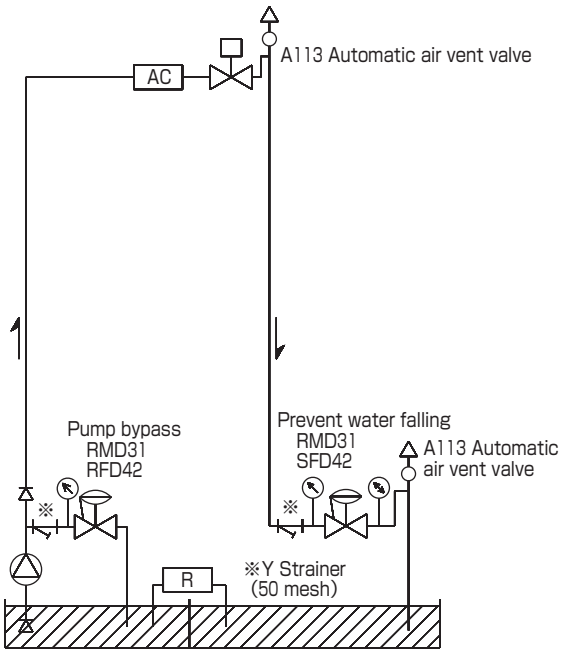


Fig.1

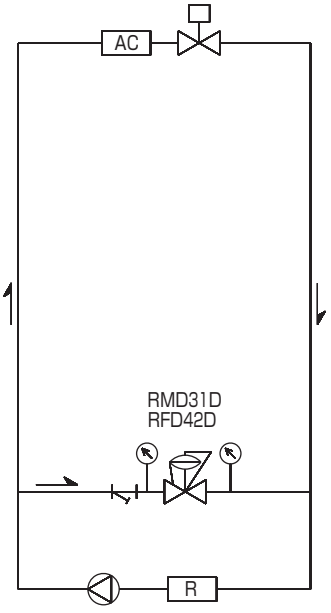


Fig. 2

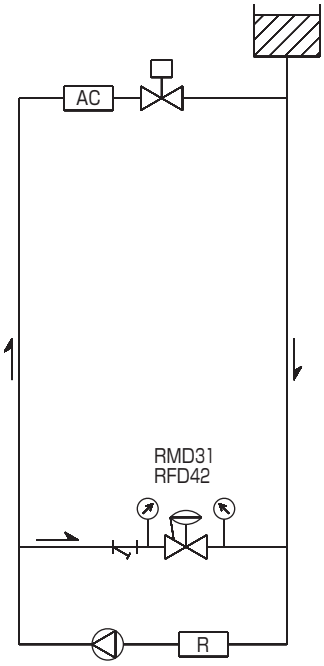


Fig. 3

Symbol

	Sustaining valve		Check valve	AC	Air conditioner		Open tank
	Differential pressure sustaining valve		Strainer	R	Heat exchanger		Pressure gauge
	Automatic air vent valve		Pump		Two-way valve		Compound pressure gauge

3. Specification

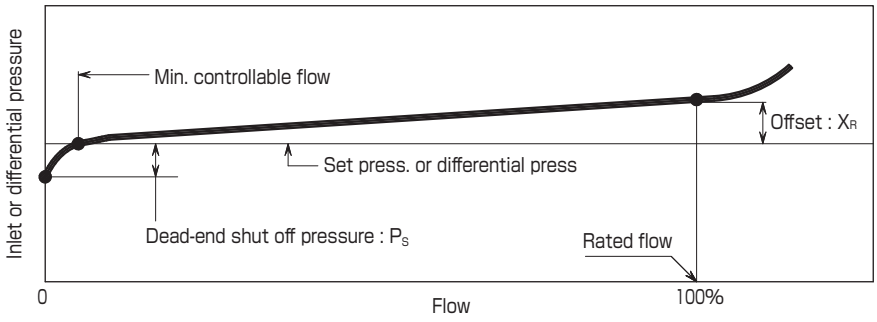


Fig. 4 Flow characteristic curve

Cv calculation (specific gravity : 1 (water))

$$Cv=\frac{0.696Q}{\sqrt{\triangle P}}$$

Q : Flow ℓ/min
△P : Differential pressure kPa

3.1 RMD31 Sustaining valve, RMD31D Differential pressure sustaining valve

	Liquid	Size	RMD31		RMD31D		Dead-end shut off pressure P_S (kPa)	Minimum controllable flow (ℓ/min)	Maximum temperature (℃)
			Set pressure range (kPa)	Offset press. at rated flow X_R (kPa)	Set pressure range (kPa)	Offset press. at rated flow X_R (kPa)			
Specification and performance	Water	15−40	35−300	60	35−250	50	約20	3−5	80 (60℃ in case of nylon coating)
			200−700		200−400	60			
		50	35−300	80	35−250	60			
			200−700		200−400	80			
		65	35−300	60	35−250	50			
			200−700		200−400	60			
		80	35−300	80	35−250	80			
			200−700		200−400				
		100	35−300		35−220				
			200−550		200−300				
		125・150	35−400	60	35−100	60			

	Size			15	20	25	32	40	50	65	80	100	125	150
Capacity, dimensions and weight	Capacity	Cv value		3.9	3.9	3.9	6.3	8.3	13	21	29	50	76	109
		Max. capacity ℓ/min		90	90	90	150	204	330	543	767	1323	2016	2892
	Body : Cast iron	Face to face (JIS10KFF)	mm	196	200	200	175	190	195	230	250	290	365	415
		From center to top	mm	317	317	317	317	325	325	425	425	460	607	787
		From center to bottom	mm	70	70	70	70	80	80	104	104	127	174	207
		Weight	kg	12	12	13	14	16	17	34	35	58	98	159
	Body : Cast steel, Stainless cast steel	Face to face (JIS10KFF)	mm	206	210	210	220	220	225	280	280	330	380	470
		From center to top	mm	317	317	317	317	325	325	425	425	465	607	787
		From center to bottom	mm	70	70	70	70	80	80	109	109	121	174	207
		Weight	kg	16	17	17	18	21	22	38	39	65	114	170

Sustaining valve, Differential pressure sustaining valve

	Maximum temperature	Body	Disc Diaphragm	Seat	Liner	Shaft	Bonnet	Connection
Main parts material	80℃	Cast iron	Synthetic rubber	Bronze	Bronze	Stainless steel	Cast iron	Flanged JIS10KFF
	60℃	Cast iron / Nylon coating						
	80℃	Cast steel		Stainless steel				
		Stainless cast steel			Stainless steel			

3.2 RFD42 Sustaining valve, RFD42D Differential pressure sustaining valve

	Liquid	Size	RFD42		RFD42D		Offset press. at rated flow X_R (kPa)	Minimum controllable flow (ℓ/min)
			Set pressure range (kPa)	Dead-end shu off pressure P_S (kPa)	Set pressure range (kPa)	Dead-end shut off diff. pressure P_S (kPa)		
Specification and performance	Water	40—300	50— 250	10— 30	50—250	10—30	Below 10% of set pressure, but min. 40	5—15
			200— 650	20— 50	150—350	15—35		
			600—1200	60— 90	200—650	20—40		
			1000—2000	80—120				

	Size			40	50	65	80	100	125	150	200	250	300
Capacity, dimensions and weight	Capacity		Cv value	22.5	40	62.5	90	160	250	360	640	1000	1440
			Max. capacity ℓ/min	533	800	1300	2000	3000	5000	7700	12000	17000	24000
	Face to face mm	Body : Cast iron	JIS10KFF	220	260	290	330	390	470	530	670	800	900
			JIS16KFF	220	260	290	334	394	474	534	678	808	908
		Body : Cast steel, Stainless cast steel	JIS10KFF	212	256	282	322	378	468	524	668	796	892
			JIS16KFF	212	256	282	326	386	472	528	676	804	904
			JIS20KRF	216	260	286	330	390	480	536	684	816	916
	From center to top mm			260	280	300	300	320	320	355	447	561	663
	From center to bottom mm			75	90	97	110	125	155	175	220	275	333
	Weight kg		Body : Cast iron	16	20	32	39	62	94	138	240	420	695
			Body : Cast steel, Stainless cast steel	18	25	43	53	70	108	150	280	530	790

Remark : Capacity is the smaller value either the Cv value calculation or limited flow. This is called rated flow.

	Maximum temperature	Type OD3 Valve				Type RPD52-2, RPD52D-2 Pilot valve			
		Body Cover	Disc Diaphragm	Seat	Seat	Body Cover	Disc Diaphragm	Seat	Shaft,
Main parts material	80℃	Cast iron	Synthetic rubber	Bronze	Stainless steel	Bronze	Synthetic rubber	Stainless steel	Cast iron for RPD52-2 Stainless steel for RPD52D-2
	80℃	Cast steel							
	80℃	Cast iron, Cast steel / Epoxy coating							
	60℃	Cast iron / Nylon coating							
	80℃	Stainless cast steel		Stainless cast steel		Stainless cast steel			Stainless steel

Sustaining valve, Differential pressure sustaining valve

3.3 SFD42 Sustaining valve

Specification and performance	Liquid	Size	Set pressure range (RPD52-2) (kPa)	Dead-end shut off pressure P_S (kPa)	Offset press. at rated flow X_R (kPa)	Minimum controllable flow (ℓ/min)	Bypass valve (B. V)	Opening press. range of B. V (kPa)	Differential pressure(1) (kPa)
	Water	65—150	50— 250	20	40	5—15	VPD41B-3	30— 150	Minimum 40
			200— 550		60			100— 700	
			500—1000	20—30				600—1000	
		200—300	50— 250	20	40	15	VMD31	30— 90	
			200— 550		60			80— 200	
								170— 400	
			500—1000	20—30				300— 700	

Note (1) : Differential pressure between set pressure of RPD52-2 and bypass valve opening pressure.

Capacity, dimensions and weight	Size		65	80	100	125	150	200	250	300
	Capacity	Cv value	62.5	90	160	250	360	640	1000	1440
		Maximum capacity ℓ/min	1300	2000	3000	5000	7700	12000	17000	24000
	Face to face (JIS10KFF) mm	Body : Cast iron	290	330	390	470	530	670	800	900
		Body : Cast steel, Stainless cast steel	282	322	378	468	524	668	796	892
	From center to top mm		300	300	320	320	355	447	561	663
	From center to bottom mm		97	110	125	155	175	220	275	333
	Weight kg	Body : Cast iron	39	46	70	102	146	270	480	790
		Body : Cast steel, Stainless cast steel	50	60	80	120	160	310	590	890

Remark : Capacity is the smaller value either the Cv value calculation or limited flow. This is called rated flow.

Main parts material	Maximum temperature	OD3 diaphragm main valve Body, cover	Others parts of OD3 RPD52-2	Bypass valve Body	Cover	Disc	Seat	Diaphragm	Shaft
	80℃	Cast iron	Same as RFD42	Bronze	Cast iron	Synthetic rubber	Bronze	Synthetic rubber	Stainless steel
		Cast steel							
	80℃	Cast iron, Cast steel / Epoxy coating							
	60℃	Cast iron / Nylon coating							
	80℃	Stainless cast steel		Stainless cast steel			Stainless steel		

4. Sizing

4.1 For pump bypass (RMD31, RFD42)

Obtain water flow from pump characteristic curve corresponding to set pressure, which is the required Max. flow for sustaining valve to be used.
Valve model and size can be selected from Fig.6 or 7.
In case that the constant flow into other line is ensured without shut-off, the required Max. flow can be reduced by the constant flow.
Example
Assuming from pump characteristic curve
Set pressure : 30m (head) =300kPa
Required Max. flow : 400 ℓ/min
From inter connection of 400 ℓ/min line and differential pressure 300— O =300kPa line at Fig. 6, the valve size selected is between 50 and 65.
The required valve size is therefore 65.

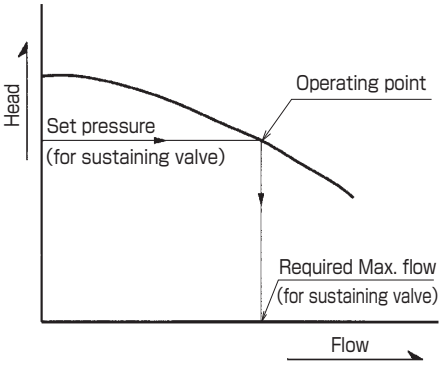


Fig. 5 Pump characteristic curve

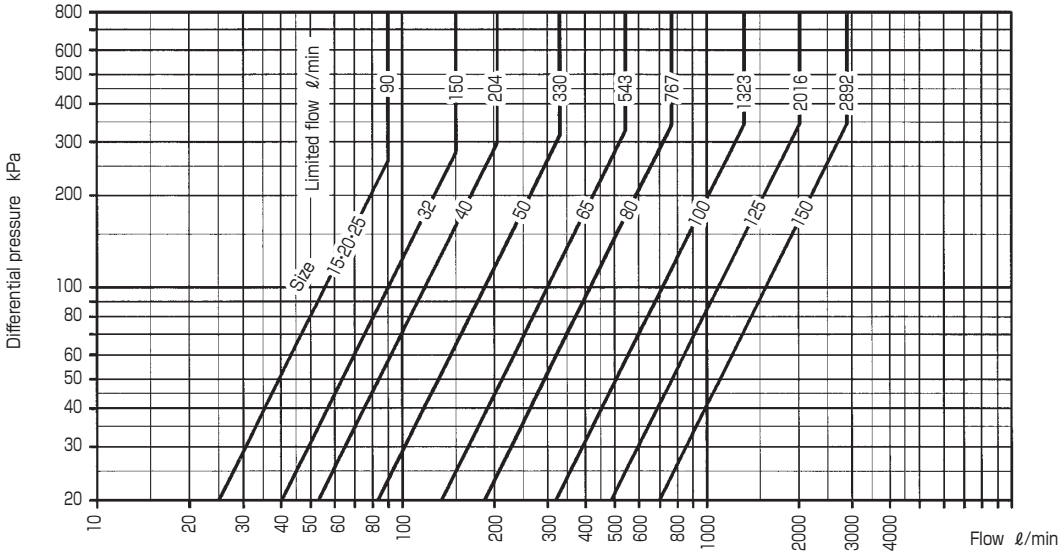


Fig. 6 RMD31 sustaining valve, RMD31D differential pressure sustaining valve

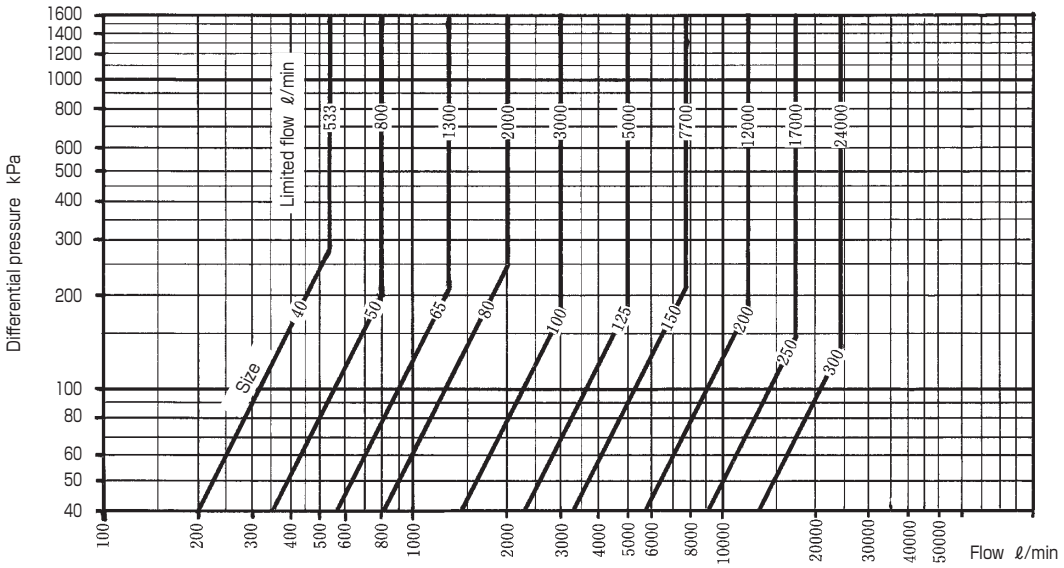
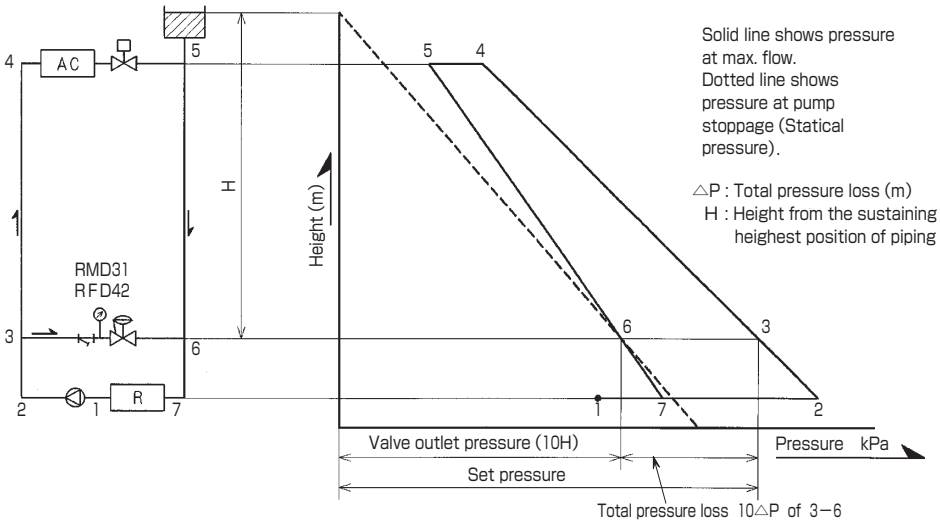


Fig. 7 RFD42·SFD42 sustaining valve, RFD42D differential pressure sustaining valve

4.2 For closed cycle

4.2.1 In case open tank provided (RMD31, RFD42)



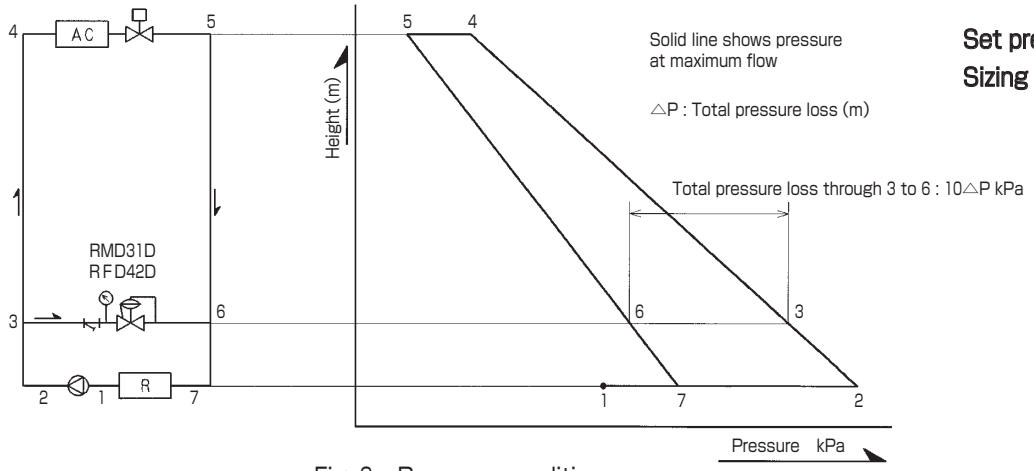
Set pressure :

10(H+△P)kPa

Sizing is same as 4.1

Fig. 8 Pressure condition

4.2.2 In case without open tank (RMD31D, RFD42D)



Set pressure : 10△P kPa
Sizing is same as 4.1

Fig. 9 Pressure condition

4.3 For the prevention of water falling at open cycle (RMD31, SFD42)

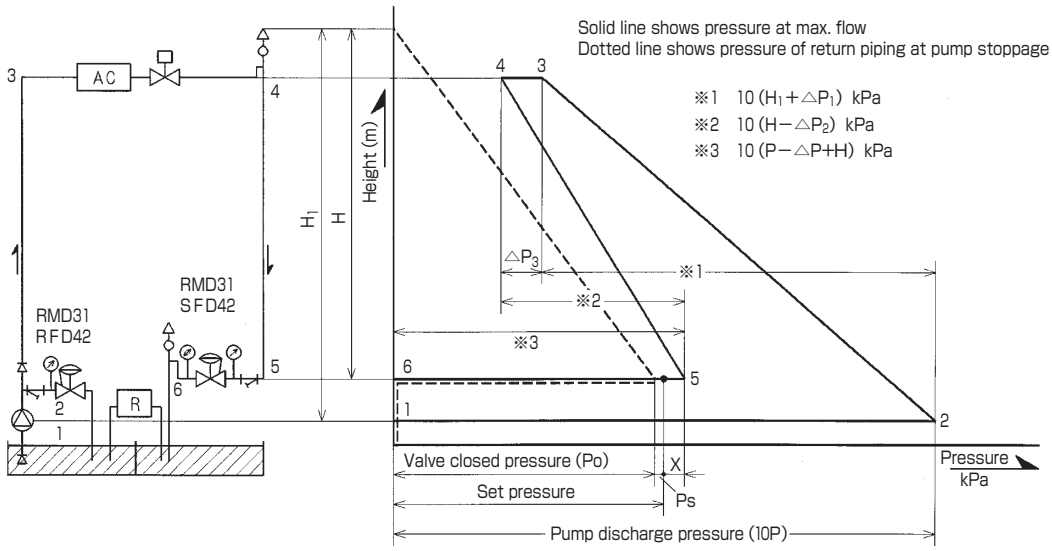


Fig. 10 Pressure condition

Q : Required max. flow for air conditioner (ℓ /min)
Q_R : Rated flow of sustaining valve (ℓ /min)
P : Pump discharge pressure at max. flow Q (m)
H_1 : Height from pump to top (m)
H : Height from sustaining valve to top (m)
P_S : Dead-end shut off pressure of sustaining valve (kPa)
X : Offset at max. flow Q of sustaining valve (kPa)
X_R : Offset at rated flow Q_R of sustaining valve (kPa)
$\triangle P_1$: Pressure loss of the fore piping (m)
$\triangle P_2$: Pressure loss of the return piping (m)
$\triangle P_3$: Pressure loss of equipments (m)
△P : Total pressure drop ($\triangle P_1+\triangle P_2+\triangle P_3+H_1$) (m)

Refer to Fig.10
To fill the return piping with water, with the sustaining valve closed, ie. to prevent water falling, the valve inlet pressure (head) $P-\triangle P+H-(P_S+X)\div 10$ (m) should be larger than the statical head H (m) from the sustaining valve to the top.
This is to satisfy following formula.

$10P \geqq (10\triangle P+X+P_S)$ kPa

Following procedure is required to confirm the above condition.
(1) Select Type RMD31 according to the size of pipe line.
Refer to Fig. 6.

Sustaining valve, Differential pressure sustaining valve

Obtain flow by drawing a line downward vertically from intersecting point of valve differential pressure $10\times(P-\triangle P+H)-O=10(P-\triangle P+H)$ kPa line and valve size line on condition that the back pressure is atmospheric (O) (in the case of the back pressure available, subtract back pressure).

This is rated flow O_R of RMD31. (If O_R is smaller than Q, SFD42 should be selected.)

Offset at maximum flow of sustaining valve is obtained from the following formula.

$$X = X_R \frac{Q}{Q_R}$$

Obtain set pressure by subtracting off set X from inlet pressure $10(P-\triangle P+H)$ kPa.

Dead-end shut off pressure Ps of valve is obtained from aforementioned list.

Finally, the following condition should be confirmed.

$10P \geqq (10\triangle P+X+P_S)$ kPa

(2) If RMD31 is unsuitable, SFD42 should be selected for suitability using Fig. 7 by the same method as RMD31.

Obtain the valve size, the rated flow Q_R, offset X and dead-end shut off pressure Ps by the same method as RMD31.

The following condition can be confirmed by the same method as RMD31.

$10P \geqq (10\triangle P+X+P_S)$ kPa

If it is not satisfied, re-calculate with a larger valve size.

Calculation sheet for sustaining valve to prevent water falling

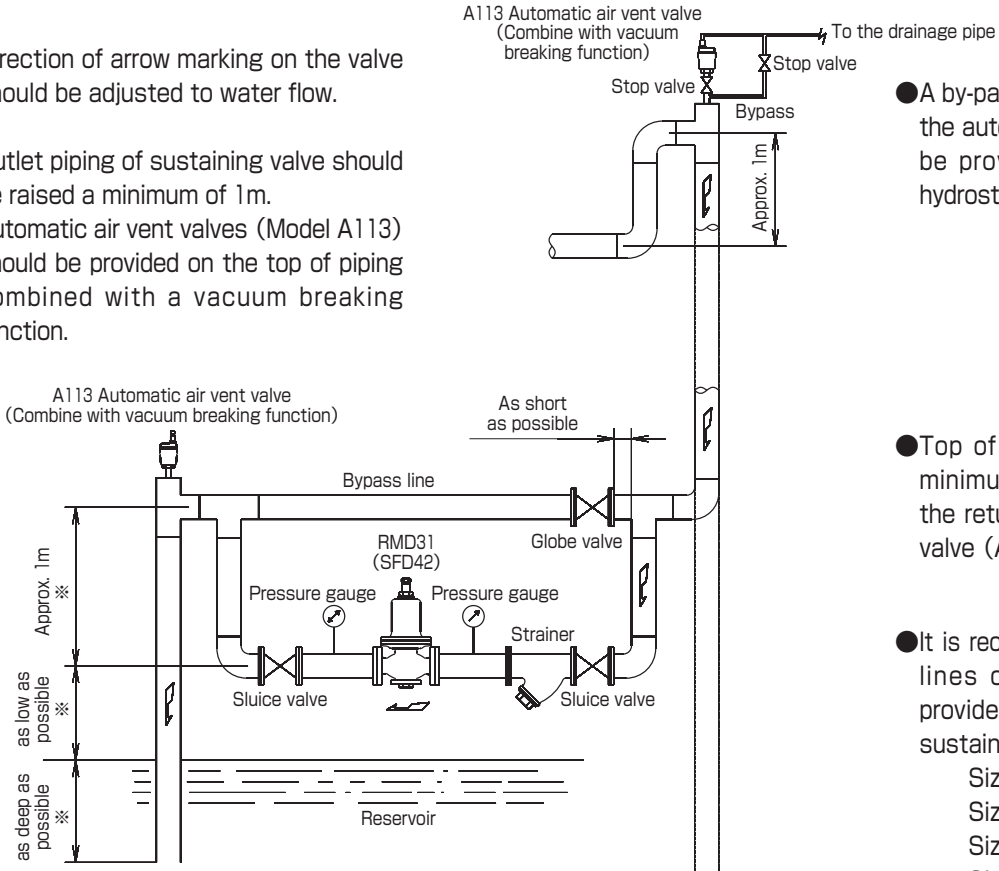
	Item \ Pipe Line					
Design condition	①Piping size					
	②Pump discharge pressure	m·····P				
	③Required maximum flow	ℓ/min·····Q				
	④Height of return piping	m·····H				
	⑤Total loss from pump to top of return piping	m·····$H_1+\triangle P_1+\triangle P_3$				
	⑥Pressure loss of return piping	m·····$\triangle P_2$				
	⑦Residual pressure at the top of return piping	m (②−⑤)				
	⑧Sustaining valve inlet pressure	kPa $10\times$(⑦+④−⑥)				
	⑨Sustaining valve outlet pressure	kPa				
	⑩Differential pressure for sizing	kPa (⑧−⑨)				
Selection of valve	⑪Valve model					
	⑫Valve size					
	⑬Valve rated flow	ℓ/min ·····Q_R				
	⑭Offset at rated flow	kPa·····X_R				
	⑮Offset at maximum flow	kPa (⑭×③÷⑬)···X				
	⑯Set pressure	kPa (⑧−⑮)				
	⑰Dead-end shut off pressure	kPa·····Ps				
	⑱Inlet pressure at valve shut off	kPa (⑯−⑰)···Po				
	⑲Check of the condition, $10P \geqq (10\triangle P+X+Ps)$	kPa ⑱$\geqq 10\times$④				
Remarks	⑤include statical head loss H_1, pipe friction loss $\triangle P_1$ and equipment loss $\triangle P_3$.					

1. If the required conditions can not be satisfied, even with the use of the SFD42, the following factors may be the cause :
   (1) Excess friction loss
   (2) Lack of pump capacity (pump discharge pressure). Pump head should be larger than "height of return piping+10m" as a guide.
2. It is important to specify accurate pump capacity. Higher set pressure in the sustaining valve will cause insufficient water flow due to reduction of pump discharge flow.

5. Installation example

●Direction of arrow marking on the valve should be adjusted to water flow.

●Outlet piping of sustaining valve should be raised a minimum of 1m.
Automatic air vent valves (Model A113) should be provided on the top of piping combined with a vacuum breaking function.



Example of horizontal piping

Example of vertical piping

※Disassembling space should be considered

●A by-pass line with a stop valve for the automatic air vent valves should be provided to confirm accurate hydrostatic head.

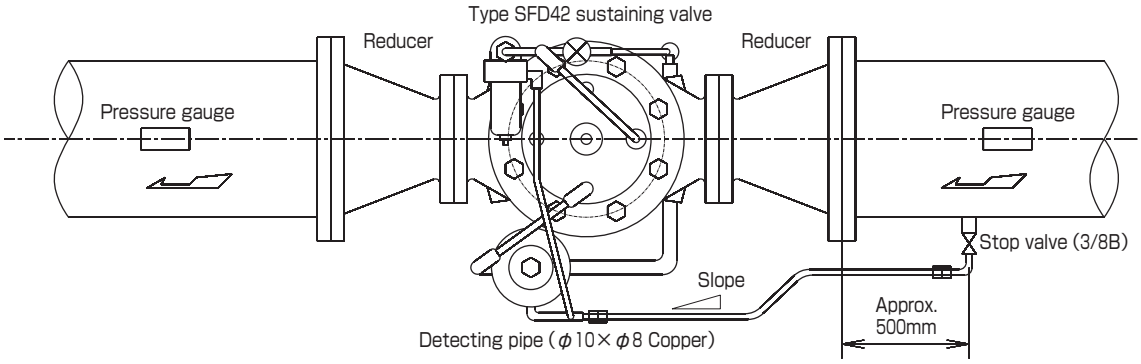
●Top of piping should be raised a minimum of 1m and connected to the return piping, where an air vent valve (A113) should be provided.

●It is recommended that straight pipe lines of following in length are provided in front of and behind the sustaining valve.

Size 15— 25…… 400mm
Size 35— 40…… 600mm
Size 50—100…… 900mm
Size 125, 150……1200mm
Size 200, 250……1600mm
Size 300 ……2000mm

●RMD31 can be installed in both horizontal and vertical piping.
SFD42 should be installed upright in horizontal piping.

Fig. 11 Example of piping



Note : Detecting pipe 2.5m will be supplied by FUSHIMAN.
Stop valve shall be supplied by customer

Fig. 12 Pressure detecting piping for SFD42 sustaining valve

An inlet pressure detecting point should be installed on the side of piping where the inlet side pressure gauge is located. Detecting piping should be inclined to prevent air accumulation. The detecting point (sustaining valve side) should be higher than other end.
Stop valve 3/8B should be provided at the detecting point.

6. Space required for disassembling and maintenance, insulation

Space required for disassembling and maintenance at horizontal piping (mm)

Size		15	20	25	32	40	50	65	80	100	125	150	200	250	300
Above the center of pipe line	RMD31(1)	470				480		520		570	930	1220	———		
	SFD42	—						490	500	520	550	590	690	890	1060
Beneath the center of pipe line		100	140	170	190	220	250	290	310	480	560	670	810	980	1110

Note(1) In the case of vertical piping, space is reguired on the spring case side.

Insulation

(1) For RMD31, the vent valve should be replaced by a long type. The top of the air vent valve and the adjusting screw should not be insulated.

(2) For SFD42, insulate OD3 valve only. Vent valve and accessories should not be insulated.

7. Prevention of water-hammering and noise

(1) Pressure should be raised slowly over 4 or 5 seconds or more at pump, starting with Y-Δ connection, etc.

(2) The non-return valve should not be a swing type which opens and closes too quickly. It should be a spring return type and soft seat discs should be used.

Inquiry

Please specify the following at inquiries for sustaining valves and differential sustaining valve.

1. Valve type or use
2. Valve size or piping size
3. Fluid (water) temperature
4. Set pressure or differential pressure and required set range
5. Outlet pressure
6. Required flow (Max. Nor. Min.)
7. Code of flange connection
8. Additional details

For the prevention of water falling , please specify the following in addition.

9. Pump discharge pressure at max. flow
10. Height from pump to the top of piping
11. Height from sustaining valve to the top of piping
12. Pressure loss in fore piping
13. Pressure loss in return piping
14. Pressure loss in equipments