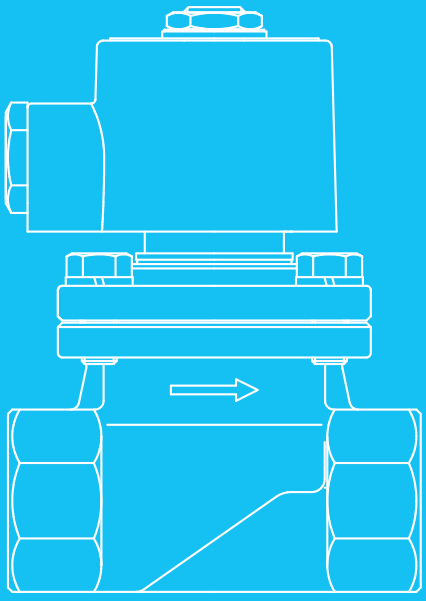
Solenoid Valve
Motor Valve

11



Step 0 Type/Structure/Features

Please refer to this for structure and feature of Solenoid Valve and Motor Valve.

Step 1 Selection

Please look at the ID chart to select the right products depending on the intended of uses. Confirm the additional details on the product page.

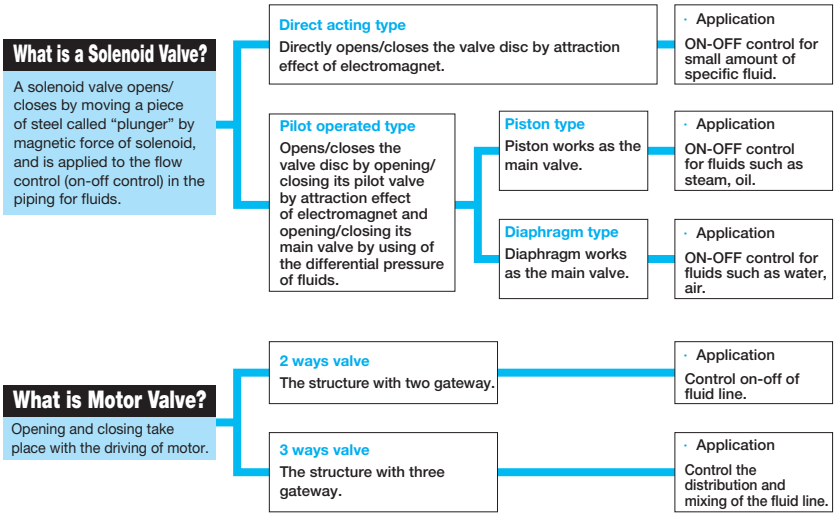
Step 2 Sizing

Please confirm the essential Cv value on the sizing data P.11-9. or Please confirm the essential sizes on the nominal diameter selection chart of the product page.

Step 3 Attentions for usage

Please check some guidelines for optimal usage of the products such as installation.

Selection of Solenoid Valve



11

Solenoid Valve/Motor Valve

■What is RED MAN series?

It is the general term of YOSHITAKE ON-OFF valve.
There are 3 kinds of valve-solenoid valve (DD series, DP series, and MD series).

■Best Selection Chart

* This chart include PD series other than solenoid valve and motor valve.

Requirement		1st recommendation	2nd recommendation
High-speed response	Steam	DP-100•100F	DP-10
	Cold and hot water	DP-200 Series	PD Series
Water hammer prevention	Steam	MD-54	
	Cold and hot water	DP-200 Series	PD Series + Speed controller
No rubber material (Request stainless steel, PTFE)		DP-100•100F	MD Series
Easy maintenance		DP•DD Series	
Manual operation		MD Series	
On/Off switch		MD Series	
Usable in explosion-proof area		DP-34N	PD Series
Less scale problems		PD Series	MD Series
Lightweight, compact and space-saving		DD Series	DP Series

Features of Pilot Operated Piston Type <DP-100 Series>

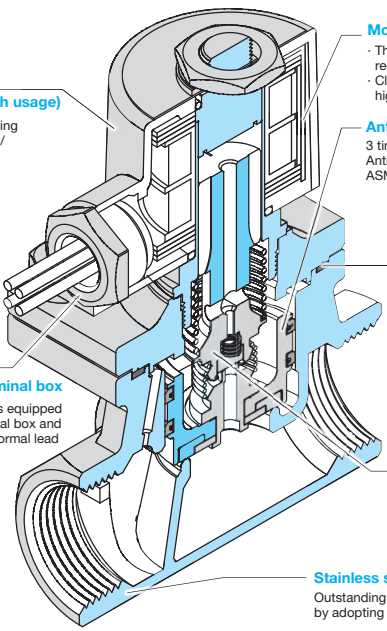
Step 0

Please use in such application.

The DP-100 series, solenoid valves of pilot-operated type, are used for automatic on-off control of a fluid flow in combination with remote operated equipments or various control switches.

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

High performance and high quality solenoid valve.



AC 110 V 220 V (Available for both usage)
AC 110 V / 220 V wiring selective type 50 Hz / 60 Hz common

Molded coil
· The coil protective structure complies with splash-proof requirement.
· Class H molded coil provides excellent insulation from high temperature.

Anti-scale resistance
3 times more durability than our conventional model. Anti-scale resistance has improved by ASM adoption. ASM: Anti Sticking Mechanism

PTFE (Teflon) Gasket
Airtightness has improved.

Available for the attached terminal box
Available for the coils equipped with the other terminal box and electrical piping of normal lead wiring.

Maintenance improvement
A combined internal component enables easy cartridge replacement with this product installed.

Stainless steel body (SCS14A)
Outstanding corrosion resistance achieved by adopting stainless steel for major parts and body.


DP-100


DP-100F


DP-100-C

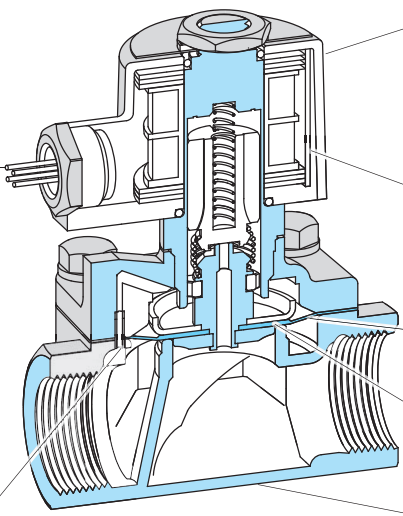

DP-100F-C

Features of Pilot Operated Piston Type <DP-200 series>

Step 0

Please use in such application.

Enable used for gas and fluid of 60˚C or less due to synthetic rubber valve.



AC 110 V 220 V (available for both usage)

AC 110 V / 220 V wiring selection type.
50 / 60 Hz common use are enable for many applications.
* AC 100V/200V is also available.

Available for the attached terminal box

Available for the coils equipped with the other terminal box and electrical piping of normal lead wiring.

Molded coil

- The coil protective structure complies with splash-proof requirement.
- Class H molded coil provides excellent insulation from high temperature.

Resistance to scale

Less scale problems occurs because the valve opens/closes by diaphragm and has no sliding parts.

Leak 0

No Leakage occurs because synthetic rubber valve is used.

Water hammer relief structure

DP-200-N, DP-200F-N is JWWA approval product as standard.

Horizontal and Vertical installation is available

DP-200

DP-12C
Normally open

DP-200F
Flanged type

DP-16
Stainless steel

Solenoid Valve ID-Charts

Step 1

	Model	Type	Operation: Normally closed	Operation: Normally opened	Coil	Fluid	Material	Working Press. (MPa)	Max. Temp. (°C)	Connection	Size	Feature	Page
	DP-100	Piston type	○		AC	Steam, Air, Cold and hot water, N_2 gas, CO_2 gas (dry), Ar gas, Oil	SCS14A	0-1.0	180°C	JIS Rc	10-50A	· High-performance high-quality · Alternating current usage	11-13
	DP-100F									JIS 10KFF	15-65A		11-13
	DP-100-C	Piston type		○	AC	Steam, Air, Cold and hot water, N_2 gas, CO_2 gas (dry), Ar gas, Oil	SCS14A	0-1.0	180°C	JIS Rc	10-50A		11-13
	DP-100F-C									JIS 10KFF	15-65A		11-13
	DP-100-D	Piston type	○		DC	Steam, Air, Cold and hot water, N_2 gas, CO_2 gas (dry), Ar gas, Oil	SCS14A	0-1.0	180°C	JIS Rc	10-50A	· Direct current usage	11-18
	DP-100F-D									JIS 10KFF	10-65A	· Direct current usage	11-18
	DP-200	Diaphragm type	○		AC	Steam, Air, Cold and hot water, N_2 gas, CO_2 gas (dry), Ar gas, Oil	SCS406	0-1.0	60°C	JIS Rc	10-50A	· Water hammer relief	11-23
	DP-200-N												11-23
	DP-200F									JIS 10KFF	15-50A	· Water hammer relief	11-23
	DP-200F-N											· Water hammer relief JWWA	11-23
	DP-10	Piston type	○		AC	Steam, Air, Cold and hot water, Oil	CAC406	0.05-1.0	180°C	JIS Rc	10-50A		11-27
	DP-16	Diaphragm type	○		AC	Air, Cold and hot water, Oil	SCS14A or SCS13	0-1.0	60°C	JIS Rc	10-50A	· Normally opened · Available for DC coil · Allowed for 90°C specification	11-28
	DP-18	Diaphragm type	○		AC	Air, Cold and hot water, Oil	SCS14A or SCS13	0-1.0	60°C	JIS 10KFF	15-50A	· Normally opened · Available for DC coil · Allowed for 90°C specification	11-28
	DP-12D	Diaphragm type	○		DC	Air, Cold and hot water, Oil	CAC406	0-1.0	60°C	JIS Rc	10-50A	· Direct current usage	11-28
	DP-16D						SCS14A or SCS13				15-50A		
	DP-14D	Diaphragm type	○		DC	Air, Cold and hot water, Oil	CAC406	0-1.0	60°C	JIS 10KFF	15-50A	· Direct current usage	11-28
	DP-18D						SCS14A or SCS13						

* Please contact us for fluid and connections except those mentioned above.

Solenoid Valve ID-Charts

	Model	Type	Operation: Normally closed	Operation: Normally opened	Coil	Fluid	Material	Working Press. (MPa)	Max. Temp. (°C)	Connection	Size	Feature	Page
	DD-2	Direct acting type	○		AC	Steam, Air, Cold and hot water, N_2 gas, CO_2 gas (dry), Ar gas, Oil	SCS14A	0-0.15	175°C	JIS Rc	10-20A	· Made of stainless steel · Altermating current usage	11-36
	DD-2-8							0-0.8					
	DD-3					Steam, Air, Cold and hot water, N_2 gas, CO_2 gas (dry), Ar gas, Oil		0-0.15	100°C				
	DD-3-8							0-0.8					
	DP-34-N	Piston type	○		AC	Air, N_2 gas	C3771	0.05-0.9	60°C	JIS Rc	15-25A	· Explosion-proof	11-33
						Cold and hot water, Oil		0.05-1.6					

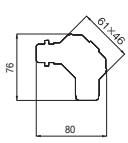
* Please contact us for fluid and connections except those mentioned above.

■Teminal box (made of resin)

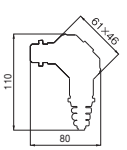
· The terminal box is both for indoor and outdoor, and can be attached to DP-100 series and DP-10.


TN-1

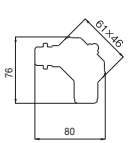

TN-1C



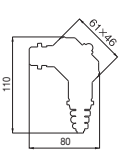
TN-1



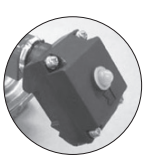
TN-1C

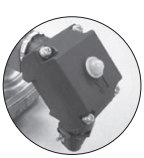


TN-2



TN-2C

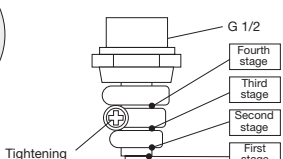

TN-2


TN-2C

* The TN-2, 2C cannot be used for DC voltage.

■Cap cone fitting method

· Applicable electric wiring and protection grade



Applicable wire outer diameter (mm)	Protection grade
ϕ4 - 5.5	First stage
ϕ5.5 - 8	Second stage
ϕ8 - 10	Third stage
ϕ10 - 12	Fourth stage

Motor Valve ID-Charts

Step 1

	Model	Type	Fluid	Material	Working Press. (MPa)	Max. Temp. (°C)	Connection	Size	Feature	Page
	MD-35R	3 ways valve	Cold and hot water, Air	C3771	0-1.0	80°C	JIS Rc JIS R	15-25A	· Ball type 3 way valve	11-38
	MD-36R	2 ways valve	Cold and hot water, Air	C3771	0-1.0	80°C	JIS Rc	15-25A	· Ball type 2 way valve	11-39
	MD-53	2 ways valve	Cold and hot water, Air	SCS14A	0-1.0	80°C	JIS Rc	15-50A	· Stainless steel ball type	11-40
	MD-54	2 ways valve	Steam	SCS14A	0-0.6	160°C	JIS Rc	15-50A	· Stainless steel ball type	11-42
			Air		0-1.0	120°C				
			Cold and hot water		0-1.0	100°C				
	MD-55	2 ways valve	Cold and hot water, Air	FCD400	0-1.0	80°C	JIS 10KRF	65-150A	· Large diameter	11-44
	MD-61	2 ways valve	Cold and hot water, Air	SCS13A	0-1.0	80°C	JIS 10KRF	65-150A	· Large diameter stainless steel	11-44

Nominal Size Selection for Solenoid Valve

Step 2

■Calculation formula for Cv value

(1) For steam

When $P_2 > \frac{P_1}{2}$ $Cv = \frac{Wk}{138\sqrt{\Delta P(P_1 + P_2)}}$

When $P_2 \leqq \frac{P_1}{2}$ $Cv = \frac{Wk}{120P_1}$

(2) For gas

When $P_2 > \frac{P_1}{2}$ $Cv = \frac{Q}{2940}\sqrt{\frac{(273 + t)\,G}{\Delta P(P_1 + P_2)}}$

When $P_2 \leqq \frac{P_1}{2}$ $Cv = \frac{Q\sqrt{(273 + t)G}}{2560P_1}$

(3) For liquid

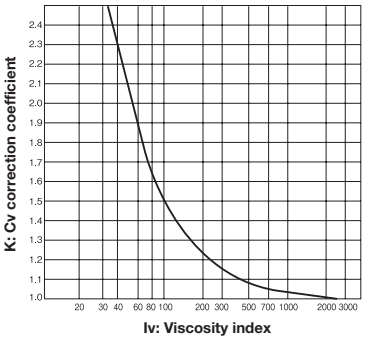
$Cv = \frac{0.365V\sqrt{G}}{\sqrt{\Delta P}}$

W : Max. steam flow rate [kg/h]
P_1 : Inlet pressure [MPa · A]
P_2 : Outlet pressure [MPa · A]
ΔP : P_1 - P_2 [MPa]
k : 1 + 0.0013 x {superheated steam temp. [°C] – saturated steam temp. [°C] }
Q : Max. gas flow rate [m³/h (standard condition)]
G : Specific gravity (relative to air for gas, or relative to water for liquid)
t : Fluid temperature [°C]
V : Max. liquid flow rate [m³/h]
Cv : Cv value of each nominal size
Iv : Viscosity index
Mcst: Viscosity [cSt]

■Formula for correction of viscosity

$Iv = \frac{72780}{Mcst}\left(\frac{\Delta P}{G}\right)^{\frac{1}{4}}V^{\frac{1}{2}}$

Viscosity correction curve



■Cv value table

Model \ Nominal size	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A
DP-100·100-C	3	4.5	7.5	12	17.7	25	33.6			
DP-100F·100F-C		4.5	7.5	12	17.7	25	33.6	33.6		
DP-200, 200-N·200F, 200F-N	3(1.2)	4 (1.7)	7.5(3.2)	10 (4.6)	14(5.5)	17 (6.5)	24 (9.5)			
DP-10	3.1	4.9	8.2	12.4	17.7	25.0	33.6	33.6		
DP-16, 18		4.4(1.7)	8.1(3.2)	11.5(4.6)	17(6.8)	23.3(9.3)	30.5(12.2)			
DP-34N		4.5	8.6	12.6						
DD-2, DD-3	1.7	1.7	1.7							
DD-2-8, DD-3-8	0.55	0.55	0.55							
MD-35R		3	6	8						
MD-36R		6	11	15						
MD-53		12	16	28	47	83	123			
MD-54		9	13	24	44	80	120			

* ( ) common number mentioned when the differential pressure is below 0.01 MPa.

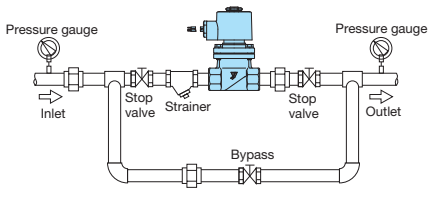
Guidelines for Installing Solenoid Valve

Step 3

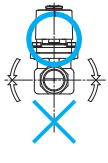
⚠Warning and caution for installation

1. Before connecting the product to piping, remove foreign substances and scales inside the piping. Note that the seal material must not flow into the inside of the product.
   * Contamination of foreign substances can cause valve seat leakage and malfunction.
2. When installation, check the direction of the product so that the fluid flowing and the arrow marked on the product are in the same direction.
3. As shown in the above figure, it is recommended that stop valves, strainers, pressure gauges and bypass line be installed to the piping. For screwed valve, a union joint is recommended to install for easy maintenance and inspection.
4. Make sure to install a strainer with the mesh size 80-100 at the inlet side of the product.
5. Avoid over-tightening of screw and excessive stress imposed from the piping in order to prevent malfunction due to the distortion of the body.
6. Vertical or horizontal installation is possible, however, the coil must be installed above the horizontal level.
7. Secure a space required for disassembly or removal of the product at the time of maintenance and inspection.
8. Solenoid valve and motor valve are not explosion-proof. Do not use them in the area or ambience where explosive gasses accumulate.
9. When using at the outdoor, set eaves to avoid direct rain.
10. “When using the product under the conditions where the outlet pressure can accidentally become higher than the inlet pressure, install a check valve at the outlet side to prevent backflow.”
11. Do not install the solenoid valve at the intake part of pump. * Failure to follow this notice may result in an abnormal operation.
12. “When the product is used with AC voltage, it may produce a buzzing sound depending on the conditions of use. Please use with DC voltage on the condition that will not allow for outdoor electrical noises.”
13. “Do not apply excessive load, torque or vibration to the product. *Failure to follow this notice may result in drastically shortened service life.”

■Piping example



<Installation posture>

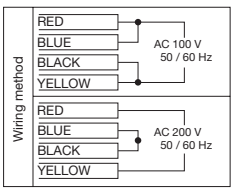


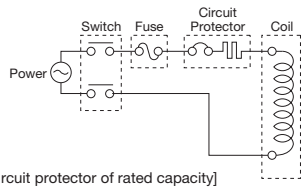
· Horizontal or vertical installation is possible. Please avoid upside-down installation.
* In the horizontal installation of the differential pressure for DP-100 series is 0.3 MPa or more and for DP-10 series is 0.1 MPa or more.

Guidelines for Installing Solenoid Valve

■Wiring method

AC coil





[Circuit protector of rated capacity]

Model·Size	DP-100·100F		DP-200·200F
	10-25A	32-65A	10-50A
AC100/110V	0.5A	0.7-1A	0.5A
AC200/220V	0.3A	0.5A	0.3A

DC coil

· DC coil has two lead wires (red and black). Connect each of them to + and – (the correspondence relation is undecided).

[Circuit protector of rated capacity]

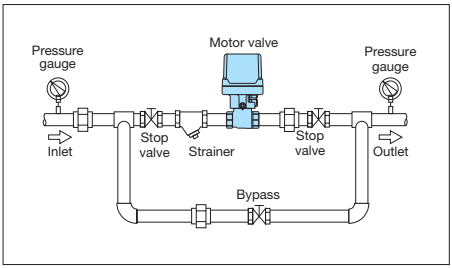
Model·Size	DP-100-D·100F-D	
	10-25A	32-65A
DC24V	2A	2A

1. Method of wire binding differs between the voltages AC 100 V and AC 200 V. Bind the lead wires of the coil according to the instruction label attached on the side of the coil. In order to prevent faulty or erroneous wiring when in a dark or narrow space, it is recommended that each of the lead wires be clearly identified with different colors that can be easily recognized.
2. In order to prevent disconnection or insulation failure, do not pull the lead wires or subject them to an excessive load while binding or using them.
3. Use an electric wire with wire core of 0.75 mm^2 or more.
4. Install a fuse (2-10A) to protect the electric circuit. Additionally, if the product is used in a fuel supply system, install a circuit protector of a rated ampere shown above.

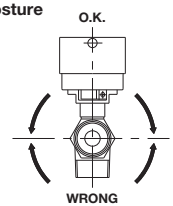
Guidelines for Installing Motor Valve

Step 3

■Piping example



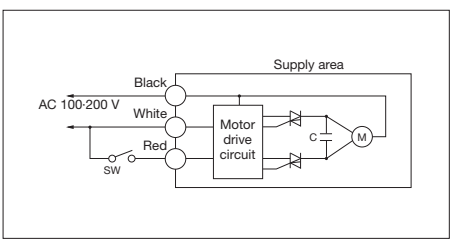
· **Installation posture**



⚠Warning and caution for installation

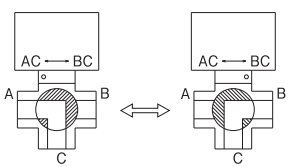
1. Before connecting the product to piping, remove foreign substances and scales inside the piping.
   Note that the seal material must not flow into the inside of the product.
   * Contamination of foreign substances can cause valve seat leakage and malfunction.
2. When installation, check the direction of the product so that the fluid flowing and the arrow marked on the product are in the same direction.
3. As shown in the above figure, it is recommended that stop valves, strainers, pressure gauges and bypass line be installed to the piping. For screwed valve, a union joint is recommended to install for easy maintenance and inspection.
4. Make sure to install a strainer with the mesh size 80-100 at the inlet side of the product.
5. Avoid over-tightening of screw and excessive stress imposed from the piping in order to prevent malfunction due to the distortion of the body.
6. Vertical or horizontal installation is possible, however, the coil must be installed above the horizontal level.
7. Secure a space required for disassembly or removal of the product at the time of maintenance and inspection.
8. Solenoid valve and motor valve are not explosion-proof. Do not use them in the area or ambience where explosive gasses accumulate.
9. When using at the outdoor, set eaves to avoid direct rain.

■Wiring method (MD-35R·36R)



· MD-36R: Valve closes when SW is OFF.
Valve opens when SW is ON.
· MD-35R: Passage is from A to C when SW is OFF.
Passage is from B to C when SW is On.

[Switch direction (MD-35R)]



DP-100,100F
DP-100-C,100F-C

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

Pilot type | Direct type | Piston | Diaphragm
Normally closed | Normally opened | AC coil | DC coil
Stainless steel | 110 V / 220 V | Explosion-proof | JWWA
Leak 0


DP-100


DP-100-C


DP-100F


DP-100F-C

■Features

1. Ultra-high performance technology gives high precision in performance.
2. Three-times more durability than our conventional models.
3. ASM (Anti-Sticking Mechanism) for three-times more scale resistance.
4. Body and main parts made of stainless steel give higher corrosion resistance, making usable for clean fluid.
5. A combined internal component enables easy cartridge replacement with this product installed.
6. Improve air tightness by adopting PTFE gasket.
7. Usable for wide pressure range of 0-1.0 MPa (0.03-1.0 MPa if the coil is sideways).
8. Horizontal and vertical installation (within 90 degrees from upward position of the coil).

■Specifications

Model	Normally closed	DP-100*	DP-100F*
	Normally opened	DP-100-C	DP-100F-C
Nominal size		10A-50A	15A-65A
Structure		Pilot-operated piston type	
Application		Steam, Air, Cold and hot water, N_2 gas, CO_2 gas (dry), Ar gas, Oil (20 cSt or less)	
Working pressure		0-1.0 MPa (unusable under vacuum)	
Min. differential pressure		0 MPa (0.03 MPa or more is required for vertical installation)	
Allowable valve seat leakage		50 mL/min under standard conditions (at air pressure of 0.6 MPa)	
Temperature range		5-180°C (no freeze condition)	
Ambient temperature		5-60°C (no freeze condition)	
Installation posture		Vertical or horizontal installation (within 90 degrees from upward position of the coil)	
Material	Body	Stainless steel (SCS14A)	
	Piston	Stainless steel (SCS14A)	
	Valve disc	PTFE	
Connection		JIS Rc screwed	JIS 10K FF flanged

* Recommended to use DP-200, DP-200F when using cold and hot water application.

■Specifications of Coil

Rated voltage	AC 100 / 200 V selective type		AC 110 / 220 V selective type	
	50 / 60 Hz common			
Nominal size	10-25A	32-65A	10-25A	32-65A
Allowable fluctuation	Rated voltage –5% to +10%			
Rated current	0.34 / 0.17 A	0.46 / 0.23 A	0.32 / 0.16 A	0.42 / 0.21 A
Starting current	1.64 / 0.82 A	1.90 / 0.95 A	1.48 / 0.74 A	1.80 / 0.90 A
Insulation class	Insulation class H			
Protective structure	Dust tight, Splash proof			
Ingress protection code	IP64 (JIS C0920)			
Insulation resistance	50 MΩ and more / 500 V megger			
Withstand voltage test	1500 V/min			
Removing lead wire	Conduit G 1/2 (CTG 16)			

* Available with a terminal box.

■Dimensions (mm) and Weights (kg)

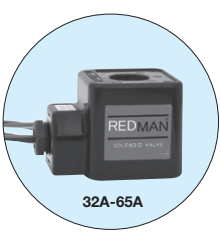
· DP-100, DP-100-C

Nominal size	d	L	H_1	DP-100		DP-100-C	
				H	Weight	H	Weight
10A	Rc 3/8	70	14.5	127	1.4	174	1.7
15A	Rc 1/2	70	14.5	127	1.4	174	1.7
20A	Rc 3/4	80	17.5	131	1.5	177	1.8
25A	Rc 1	95	21.0	135	1.9	181	2.2
32A	Rc 1-1/4	110	26.0	172	3.1	218	3.4
40A	Rc 1-1/2	120	29.5	178	4.0	225	4.3
50A	Rc 2	140	36.5	187	5.6	233	5.9

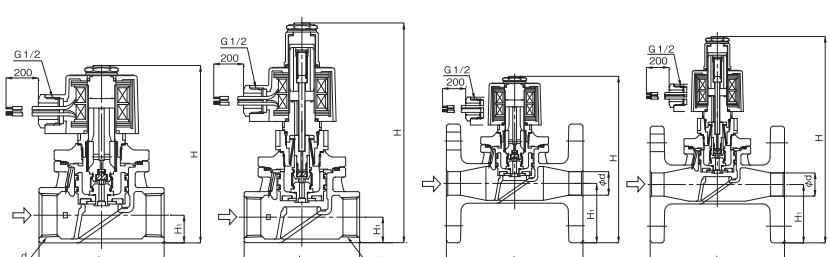
10A-25A

· DP-100F, DP-100F-C

Nominal size	d	L	H_1	DP-100F		DP-100F-C	
				H	Weight	H	Weight
15A	15	120	47.5	161	2.7	207	3.0
20A	20	130	50.0	164	3.2	210	3.5
25A	25	145	62.5	177	4.5	223	4.8
32A	32	160	67.5	213	6.9	260	7.2
40A	40	170	70.0	219	8.0	265	8.3
50A	50	195	77.5	228	10.5	274	10.8
65A	65	198	87.5	238	12.3	284	12.6

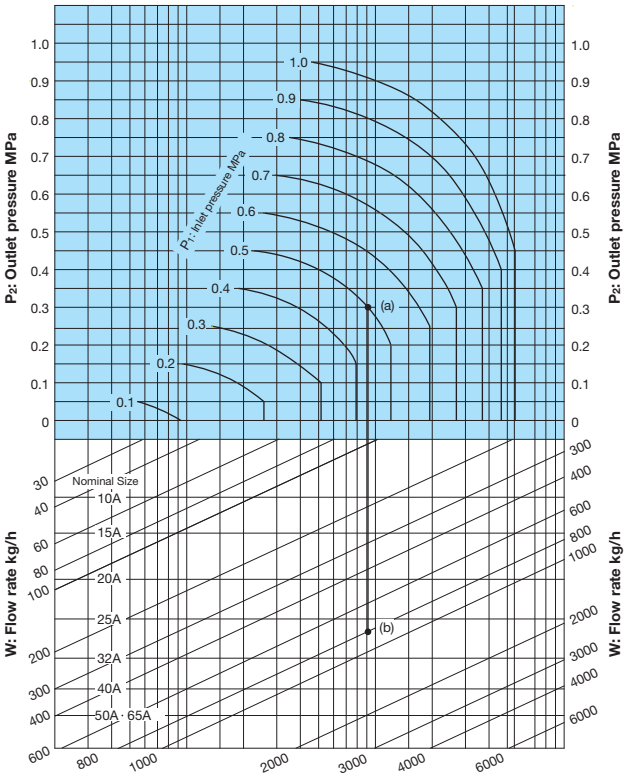


32A-65A



DP-100 DP-100-C DP-100F DP-100F-C

■Nominal Size Selection Chart (For Steam)

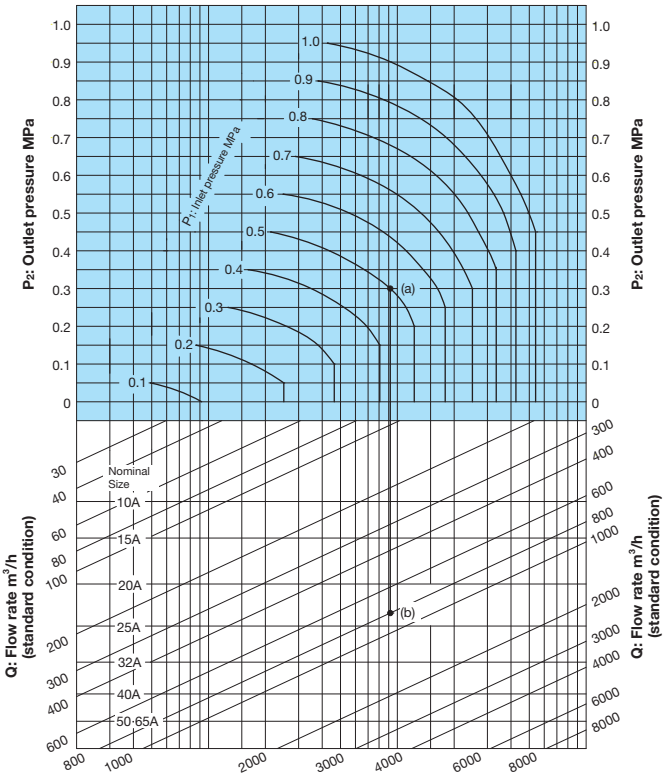


How to use the chart

When selecting the nominal size of a solenoid valve whose inlet pressure (P_1), outlet pressure (P_2), and steam (saturated steam) flow rate (W) are 0.5 MPa, 0.3 MPa, and 800 kg/h, respectively, first find intersection point (a) of P_1 = 0.5 MPa and P_2 = 0.3 MPa.
Trace down vertically from this intersection point (a) to find intersection point (b) with W = 800 kg/h.
Since this intersection point (b) lies between nominal sizes 25A and 32A, select the larger one, 32A.

* Please refer to P.11-9 for Cv value and calculation formula.

■Nominal Size Selection Chart (For Air)

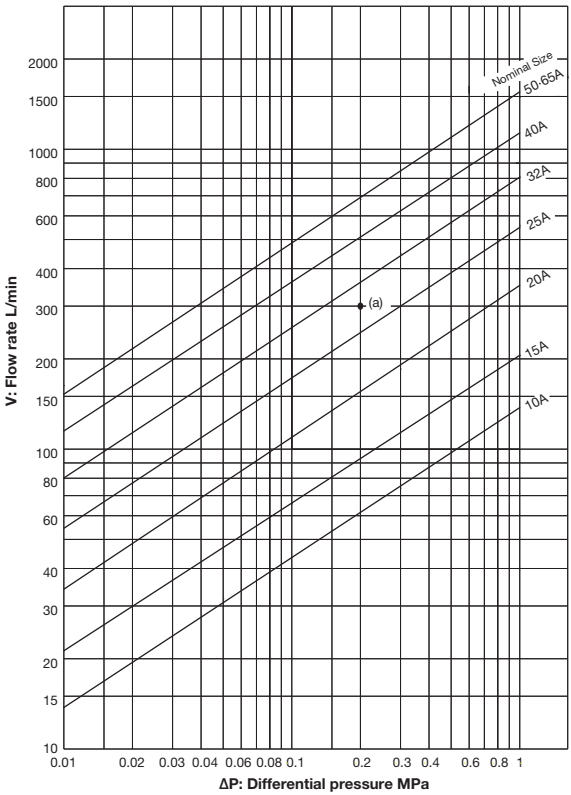


How to use the chart

When selecting the nominal size of a solenoid valve whose inlet pressure (P_1), outlet pressure (P_2), and air (20℃) flow rate (Q) are 0.5 MPa, 0.3 MPa, and 800 m^3/h (standard condition), respectively, first find intersection point (a) of P_1 = 0.5 MPa and P_2 = 0.3 MPa. Trace down vertically from this intersection point (a) to find intersection point (b) with Q = 800 m^3/h (standard condition). Since this intersection point (b) lies between nominal sizes 20A and 25A, select the larger one, 25A.

* Please refer to P.11-9 for Cv value and calculation formula.

■Nominal Size Selection Chart (For Water)



How to use the chart

When selecting the nominal size of a solenoid valve whose inlet pressure (P_1), outlet pressure (P_2), and flow rate (V) are 0.5 MPa, 0.3 MPa, and 300 L/min, respectively, first find intersection point (a) of the differential pressure before and after the valve [ΔP = 0.5 – 0.3 = 0.2 MPa] and V = 300 L/min. Since this intersection point (a) lies between nominal sizes 25A and 32A, select the larger one, 32A.

* Please refer to P.11-9 for Cv value and calculation formula.

DP-100-D,100F-D

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

Pilot type	Direct type	Piston	Diaphragm
Normally closed	Normally opened	AC coil	DC coil
Stainless steel	110 V / 220 V	Explosion-proof	JWWA
Leak 0			

■Features

1. DC voltage piston type solenoid valve.
2. Horizontal and vertical installation is available.

DP-100-D

DP-100F-D

Stainless steel	DC coil
	Normally closed
Screwed type	DP-100-D
Flanged type	DP-100F-D

■Specifications

Model	DC coil	DP-100-D	DP-100F-D
Nominal size		10A-50A	15A-65A
Structure		Pilot-operated piston type	
Application		Steam, Air, Cold and hot water, N_2 gas, CO_2 gas (dry), Ar gas, Oil (20 cSt or less)	
Working pressure		0-1.0 MPa (unusable under vacuum)	
Min. differential pressure		0 MPa (0.03 MPa or more is required for vertical installation)	
Allowable valve seat leakage		50 mL/min under standard conditions (at air pressure of 0.6 MPa)	
Temperature range		5-180°C (no freeze condition)	
Ambient temperature		5-60°C (no freeze condition)	
Installation posture		Vertical or horizontal installation (within 90 degrees from upward position of the coil)	
Material	Body	Stainless steel (SCS14A)	
	Piston	Stainless steel (SCS14A)	
	Valve disc	PTFE	
Connection		JIS Rc screwed	JIS 10K FF flanged

■Specifications of Coil

Rated voltage	DC 24 V	
Nominal size	10-25A	32-65A
Rated current	1.34 A	1.14 A
Allowable fluctuation	Rated voltage –5% to +10%	
Insulation class	Insulation class H	
Protective structure	Dust tight, Splash proof	
Ingress protection code	IP64 (JIS C0920)	
Insulation resistance	50 MΩ and more / 500 V megger	
Withstand voltage test	1500 V/min	

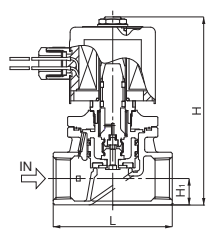
* Available with a terminal box.

■Dimensions (mm) and Weights (kg)

· DP-100-D

Nominal size	d	L	H_1	H	Weight
10A	Rc 3/8	70	14.5	143	2.2
15A	Rc 1/2	70	14.5	143	2.2
20A	Rc 3/4	80	17.5	147	2.3
25A	Rc 1	95	21.0	151	2.7
32A	Rc 1-1/4	110	26.0	194	4.3
40A	Rc 1-1/2	120	29.5	200	5.2
50A	Rc 2	140	36.5	209	6.8

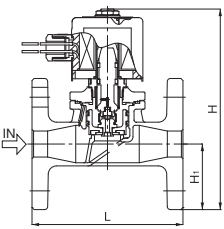
DP-100-D



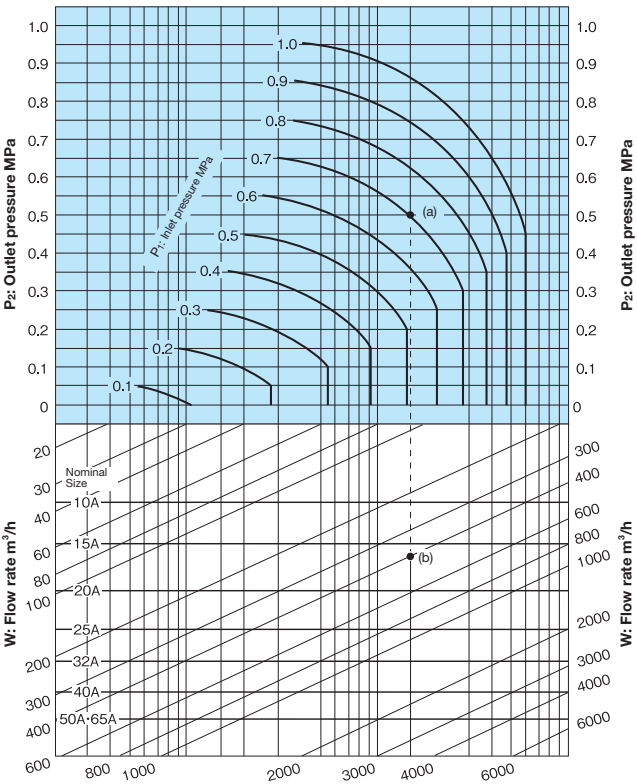
· DP-100F-D

Nominal size	d	L	H_1	H	Weight
15A	15	120	47.5	177	3.5
20A	20	130	50.0	180	4.0
25A	25	145	62.5	193	5.3
32A	32	160	67.5	235	8.1
40A	40	170	70.0	241	9.2
50A	50	195	77.5	250	11.7
65A	50	198	87.5	260	13.5

DP-100F-D



■Nominal Size Selection Chart (For Steam)

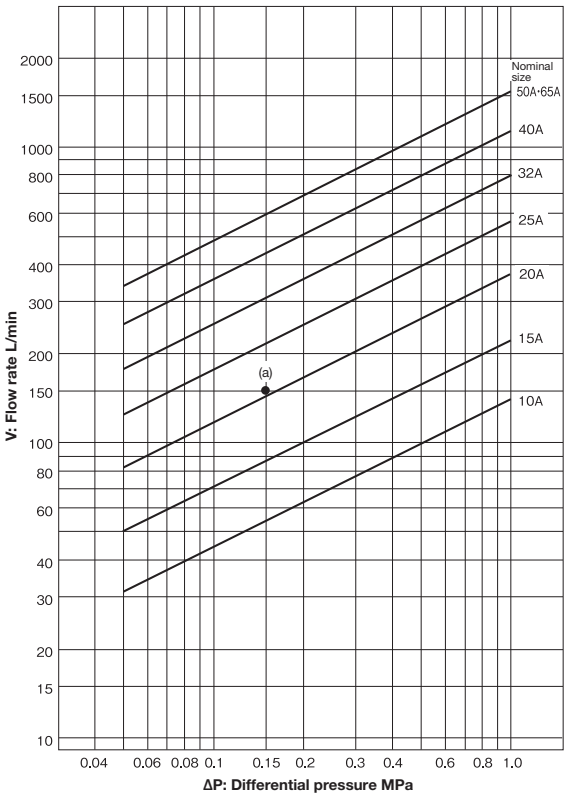


How to use the chart

When selecting the nominal size of a solenoid valve whose inlet pressure (P_1), outlet pressure (P_2), and steam (saturated steam) flow rate (W) are 0.7 MPa, 0.5 MPa, and 400 kg/h, respectively, first find intersection point (a) of P_1 = 0.7 MPa and P_2 = 0.5 MPa.
Trace down vertically from this intersection point (a) to find intersection point (b) with W = 400 kg/h.
Since this intersection point (b) lies between nominal sizes 15A and 20A, select the larger one, 20A.

* Please refer to P.11-9 for Cv value and calculation formula.

■Nominal Size Selection Chart (For Water)

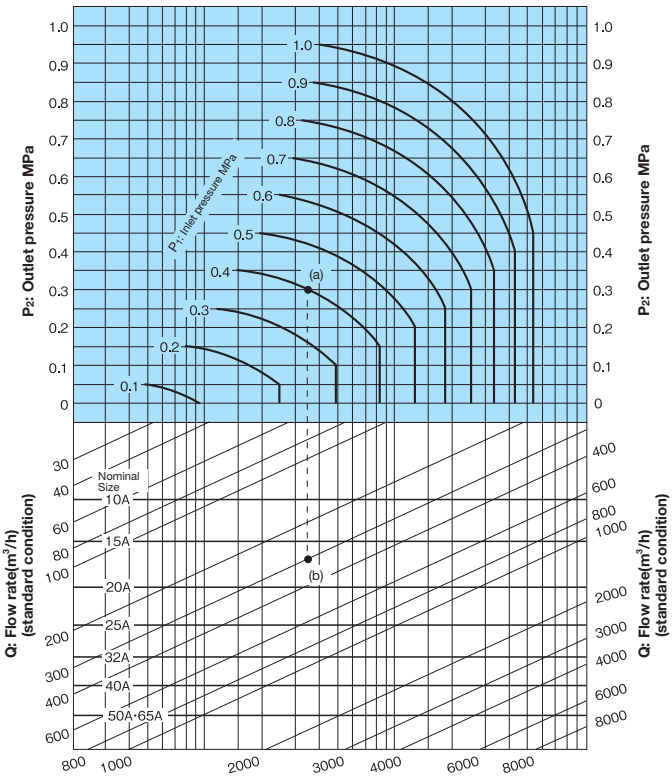


How to use the chart

When selecting the nominal size of a solenoid valve whose inlet pressure (P_1), outlet pressure (P_2), and flow rate (V) are 0.5 MPa, 0.35 MPa, and 150 L/min, respectively, first find intersection point (a) of the differential pressure before and after the valve [ΔP = 0.5 – 0.35 = 0.15 MPa] and V = 150 L/min. Since this intersection point (a) lies between nominal sizes 20A and 25A, select the larger one, 25A.

* Please refer to P.11-9 for Cv value and calculation formula.

■Nominal Size Selection Chart (For Air)



How to use the chart

When selecting the nominal size of a solenoid valve whose inlet pressure (P_1), outlet pressure (P_2), and air (20°C) flow rate (Q) are 0.4 MPa, 0.3 MPa, and 300 m^3/h (standard condition), respectively, first find intersection point (a) of P_1 = 0.4 MPa and P_2 = 0.3 MPa. Trace down vertically from this intersection point (a) to find intersection point (b) with Q = 300 m^3/h (standard condition). Since this intersection point (b) lies between nominal sizes 15A and 20A, select the larger one, 20A.

* Please refer to P.11-9 for Cv value and calculation formula.

DP-200,200-N
DP-200F,200F-N

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

JWWA approval
[DP-200-N, DP-200F-N]

Pilot type	Direct type	Piston	Diaphragm
Normally closed	Normally opened	AC coil	DC coil
Stainless steel	110 V / 220 V	Explosion-proof	JWWA
Leak 0			

DP-200

DP-200F

■Features

1. The shock of water hammer is reduced, and the closing time of valve is shortened.
2. Zero leakage due to synthetic rubber used for valve part.
3. Usable for wide pressure range of 0-1.0 MPa (0.1-1.0 MPa if the coil set sideways).
4. Horizontal and vertical installation. (Within 90 degrees from upward position of the coil)

■Specifications

Model	Normally closed	DP-200	DP-200-N	DP-200F	DP-200F-N
Nominal size		10A-50A		15A-50A	
Structure		Pilot-operated diaphragm type			
Application		Cold and Hot water, Air, N_2 gas, Co_2 gas (dry), Ar gas, Oil (20 cSt or less: equivalent to kerosene and light oil)			
Working pressure		0-1.0 MPa (Unusable under vacuum)			
Min. differential pressure		0 MPa (0.1 MPa or more is required if the coil set sideways)			
Allowable valve seat leakage		No (by confirming pressure gauge visually)			
Temperature range		5-60°C (no freeze condition)			
Ambient temperature		50°C or less (no freeze condition)			
Installation posture		Vertical or horizontal installation (within 90 degrees from upward position of the coil)			
Material	Body	Bronze	Bronze (NPb-treated)	Bronze	Bronze (NPb-treated)
	Valve				
	Diaphragm	NBR			
Connection		JIS Rc screwed		JIS 10K FF flanged	

· Available with rubber material FKM for the diaphragm. Max. temperature: 90C° (It can provide only for DP-200, DP-200F)

■Specifications of Coil

Rated voltage	AC 100 / 200 V selective type	AC 110 / 220 V selective type
	50 / 60 Hz common	
Nominal size	10-50A	
Allowable fluctuation	Rated voltage –5% to +10%	
Rated current	0.42 / 0.21 A	0.38 / 0.19 A
Starting current	1.64 / 0.82 A	1.48 / 0.74 A
Insulation class	Insulation class H	
Protective structure	Dust tight, Splash proof	
Ingress protection code	IP64 (JIS C0920)	
Insulation resistance	50 MΩ and more / 500 V megger	
Withstand voltage test	1500 V/min	
Removing lead wire	Conduit G 1/2 (CTG 16)	

* Available with a terminal box.

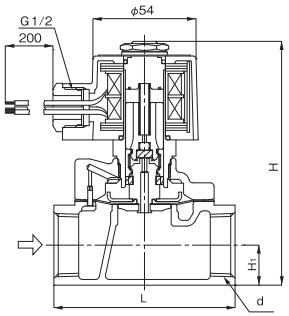
■Dimensions (mm) and Weights (kg)

· DP-200, DP-200-N

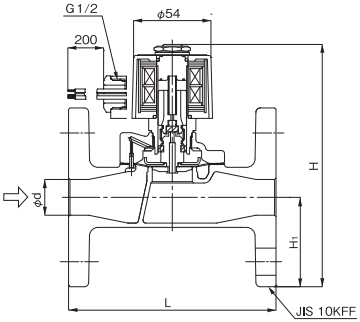
Nominal size	d	L	H	H_1	Weight
10A	Rc 3/8	70	114	14.5	1.1
15A	Rc 1/2				1.1
20A	Rc 3/4	80	121	17.5	1.3
25A	Rc 1	95	128	21.0	1.7
32A	Rc 1-1/4	110	150	26.0	2.5
40A	Rc 1-1/2	120	157	29.5	3.1
50A	Rc 2	140	172	36.5	5.0

· DP-200F, DP-200F-N

Nominal size	d	L	H	H_1	Weight
15A	15	120	147	47.5	2.7
20A	20	130	153	50.0	3.3
25A	25	145	169	62.5	4.8
32A	32	160	192	67.5	6.6
40A	40	170	198	70.0	7.3
50A	50	195	213	77.5	10.0

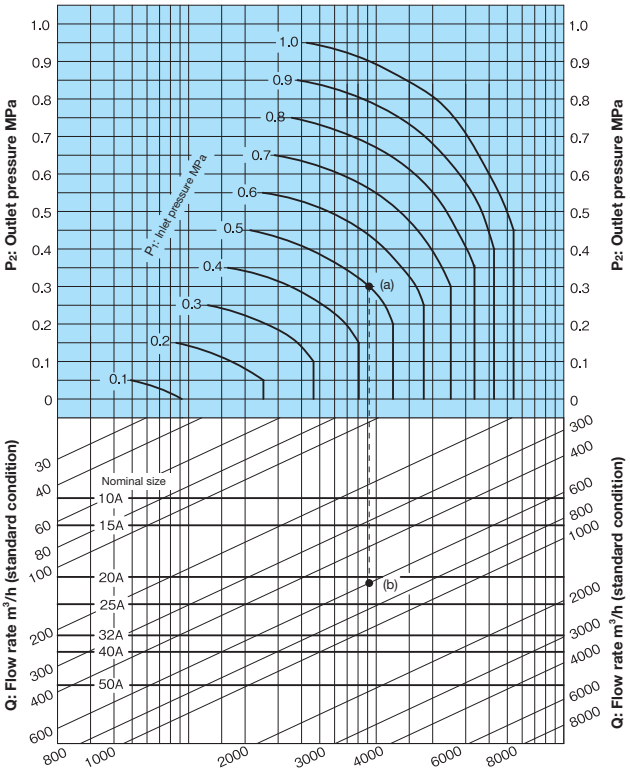


DP-200



DP-200F

■Nominal Size Selection Chart (For Air)

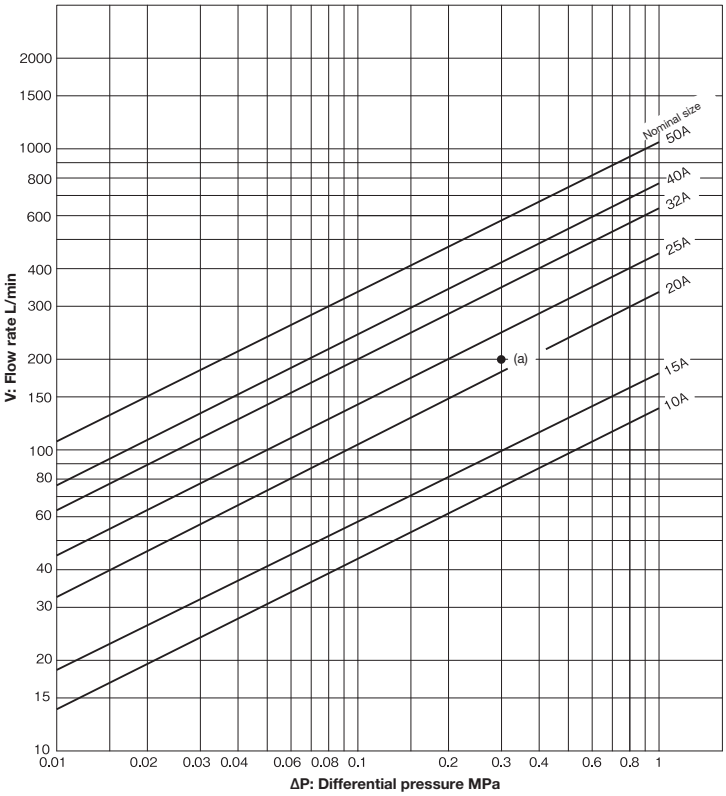


How to use the chart

When selecting the nominal size of a solenoid valve whose inlet pressure (P_1), outlet pressure (P_2), and air (20°C) flow rate (Q) are 0.5 MPa, 0.3 MPa, and 600 m^3/h (standard condition), respectively, first find intersection point (a) of P_1 = 0.5 MPa and P_2 = 0.3 MPa. Trace down vertically from this intersection point (a) to find intersection point (b) with Q = 600 m^3/h (standard condition). Since this intersection point (b) lies between nominal sizes 20A and 25A, select the larger one, 25A.

* Please refer to P.11-9 for Cv value and calculation formula.

■Nominal Size Selection Chart (For Water)



How to use the chart

When selecting the nominal size of a solenoid valve whose inlet pressure (P_1), outlet pressure (P_2), and flow rate (V) are 0.6 MPa, 0.3 MPa, and 200 L/min, respectively, first find intersection point (a) of the differential pressure before and after the valve [ΔP = 0.6 – 0.3 = 0.3 MPa] and V = 200 L/min. Since this intersection point (a) lies between nominal sizes 20A and 25A, select the larger one, 25A.

* Please refer to P.11-9 for Cv value and calculation formula.

DP-10

Pilot type	Direct type	Piston	Diaphragm
Normally closed	Normally opened	AC coil	DC coil
Stainless steel	110 V / 220 V	Explosion-proof	Leak 0

■Features

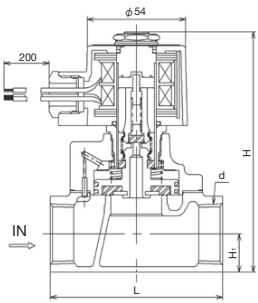
1. Excellent performance on fluid control, mainly used for steam.
2. Compact, lightweight and large capacity.
3. Horizontal and vertical installation is available.

■Specifications

Model	AC coil	DP-10
Application		Steam, Air, Cold and hot water, Oil (20 cSt or less)
Working pressure		0.05-1.0 MPa (unusable under vacuum)
Min. differential pressure		0.05 MPa (0.1 MPa or more is required for vertical installation)
Valve seat leakage		50 mL/min (at the time of air pressure 0.6 MPa)
Max. temperature		180°C
Operation		Normally closed
Material	Body	Cast bronze
	Piston	Stainless steel
	Valve disc	PTFE
Connection		JIS Rc screwed

■Dimensions (mm) and Weights (kg)

Nominal size	d	L	H	H_1	Weight
10A	Rc 3/8	70	119	14.5	1.2
15A	Rc 1/2	70	119	14.5	1.2
20A	Rc 3/4	80	126	17.5	1.4
25A	Rc 1	95	133	21.0	1.8
32A	Rc 1-1/4	110	155	26.0	2.6
40A	Rc 1-1/2	120	162	29.5	3.2
50A	Rc 2	140	177	36.5	5.1



DP-12,14,16,18

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

Pilot type | Direct type | Piston | Diaphragm
Normally closed | Normally opened | AC coil | DC coil
Stainless steel | 110 V / 220 V | Explosion-proof | JWWA
Leak 0

■Features

1. Outstanding corrosion resistance ensured by stainless steel wetted parts.
2. Horizontal and vertical installation.


DP-16


DP-18


Normaly opened coil type


DC coil type

■Diaphragm Type Solenoid Valve

Voltage and operation	AC voltage		DC voltage	
	Normally closed	Normally opened	Normally closed	Normally opened
Screwed type	DP-16	DP-12C·DP-16C	DP-12D·DP-16D	DP-12CD·DP-16CD
Flanged type	DP-18	DP-14C·DP-18C	DP-14D·DP-18D	DP-14CD·DP-18CD

■Specifications

Model	AC coil	–	–	DP-12C	DP-14C
	DC coil	DP-12D	DP-14D	DP-12CD	DP-14CD
Application		Air, Cold and hot water, Oil (20 cSt or less)			
Working pressure		0-1.0 MPa (unusable under vacuum)			
Min. differential pressure		0 MPa (0.1 MPa or more is required for vertical installation)			
Valve seat leakage		No (by confirming pressure gauge visually)			
Max. temperature		60°C			
Operation		Normally closed		Normally opened	
Material	Body	Bronze			
	Valve	NBR (diaphragm)			
Connection		JIS Rc screwed	JIS 10K FF flanged	JIS Rc screwed	JIS 10K FF flanged

Model	AC coil	DP-16	DP-18	DP-16C	DP-18C
	DC coil	DP-16D	DP-18D	DP-16CD	DP-18CD
Application		Air, Cold and hot water, Oil (20 cSt or less)			
Working pressure		0-1.0 MPa (unusable under vacuum)			
Min. differential pressure		0 MPa (0.1 MPa or more is required for vertical installation)			
Valve seat leakage		No (by confirming pressure gauge visually)			
Max. temperature		60°C			
Operation		Normally closed		Normally opened	
Material	Body	Stainless steel			
	Valve	NBR (diaphragm)			
Connection		JIS Rc screwed	JIS 10K FF flanged	JIS Rc screwed	JIS 10K FF flanged

· Available with FKM.

· Available with a terminal box (made of resin).

■Specifications of coil

Rated voltage	AC100/200V / AC110/220V Connection method selection type 50/60 Hz common		DC24V
Voltage fluctuation tolerance	Rated voltage ±10%		
Rated current	0.42/0.21A	0.38/0.19A	1.13A
Starting current	1.64/0.82A	1.48/0.74A	-
Insulation type	Class H		
Protection structure	Dust-proof · Splash-proof		
Degree of protection	IP64		
Insulation resistance	More than 50MΩ/500V megger		
Anti-voltage test	1500V/min		

■Dimensions (mm) and Weights (kg)

· DP-16

Nominal size	d	L	H	H_1	Weight
15A	Rc 1/2	70	109.5	14.5	1.1
20A	Rc 3/4	80	116.5	17.5	1.3
25A	Rc 1	95	123.5	21.0	1.7
32A	Rc 1-1/4	110	150.5	26.0	2.5
40A	Rc 1-1/2	120	157.5	29.5	3.1
50A	Rc 2	140	172.5	36.5	5.0

· DP-12C, 16C (DP-16C: 15A-50A)

Nominal size	d	L	H	H_1	Weight
10A	Rc 3/8	70	172	14.5	1.4
15A	Rc 1/2	70	172	14.5	1.4
20A	Rc 3/4	80	179	17.5	1.6
25A	Rc 1	95	186	21.0	2.0
32A	Rc 1-1/4	110	213	26.0	2.8
40A	Rc 1-1/2	120	220	29.5	3.4
50A	Rc 2	140	235	36.5	5.3

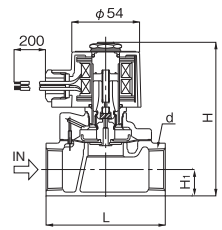
· DP-12D, 16D (DP-16D: 15A-50A)

Nominal size	d	L	H	H_1	Weight
10A	Rc 3/8	70	124	14.5	1.9
15A	Rc 1/2	70	124	14.5	1.9
20A	Rc 3/4	80	131	17.5	2.1
25A	Rc 1	95	138	21.0	2.5
32A	Rc 1-1/4	110	166	26.0	3.3
40A	Rc 1-1/2	120	173	29.5	3.9
50A	Rc 2	140	187	36.5	5.8

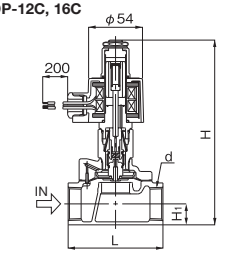
· DP-12CD, 16CD (DP-16CD: 15A-50A)

Nominal size	d	L	H	H_1	Weight
10A	Rc 3/8	70	172	14.5	2.1
15A	Rc 1/2	70	172	14.5	2.1
20A	Rc 3/4	80	179	17.5	2.3
25A	Rc 1	95	186	21.0	2.7
32A	Rc 1-1/4	110	213	26.0	3.5
40A	Rc 1-1/2	120	220	29.5	4.1
50A	Rc 2	140	235	36.5	6.0

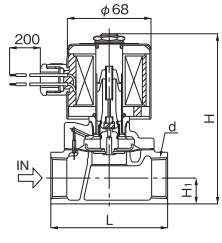
DP-16



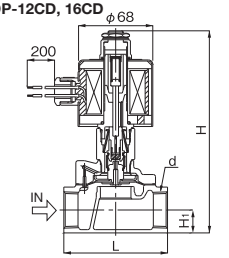
DP-12C, 16C



DP-12D, 16D



DP-12CD, 16CD



· **DP-18**

Nominal size	d	L	H	H_1	Weight
15A	15	120	142.5	47.5	2.6
20A	20	130	149.0	50.0	3.2
25A	25	145	165.0	62.5	4.7
32A	32	160	192.0	67.5	6.5
40A	40	170	198.0	70.0	7.2
50A	50	195	213.0	77.5	9.9

· **DP-14C, 18C**

Nominal size	d	L	H	H_1	Weight
15A	15	120	205	47.5	2.9
20A	20	130	212	50.0	3.5
25A	25	145	228	62.5	5.0
32A	32	160	255	67.5	6.8
40A	40	170	261	70.0	7.5
50A	50	195	276	77.5	10.2

· **DP-14D, 18D**

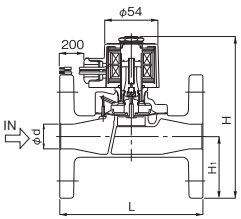
Nominal size	d	L	H	H_1	Weight
15A	15	120	157	47.5	3.4
20A	20	130	164	50.0	4.0
25A	25	145	180	62.5	5.5
32A	32	160	207	67.5	7.3
40A	40	170	213	70.0	8.0
50A	50	195	228	77.5	10.7

· **DP-14CD, 18CD**

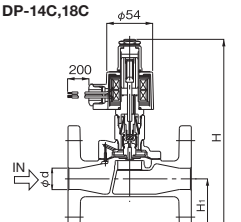
Nominal size	d	L	H	H_1	Weight
15A	15	120	205	47.5	3.6
20A	20	130	212	50.0	4.2
25A	25	145	228	62.5	5.7
32A	32	160	255	67.5	7.5
40A	40	170	261	70.0	8.2
50A	50	195	276	77.5	10.9

· The DP-18 Series is slightly heavier.

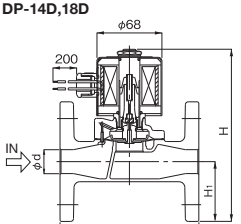
DP-18



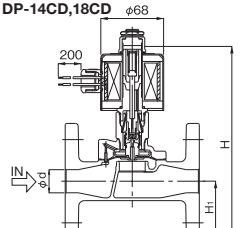
DP-14C,18C



DP-14D,18D

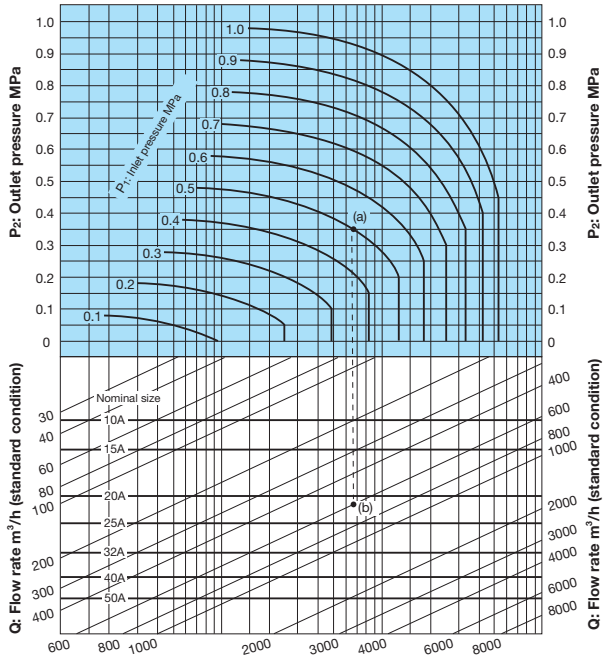


DP-14CD,18CD



* DP-18 series is welding flanged structure.

■Nominal Size Selection Chart (For Air)

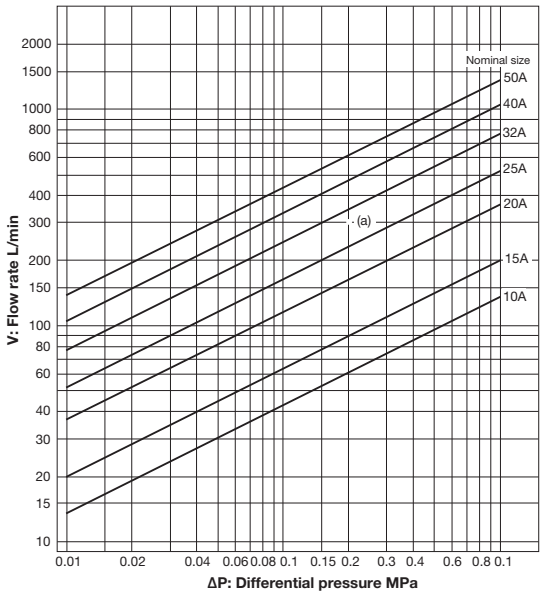


How to use the chart

When selecting the nominal size of a solenoid valve whose inlet pressure (P_1), outlet pressure (P_2), and air (20°C) flow rate (Q) are 0.5 MPa, 0.35 MPa, and 600 m^3/h (standard condition), respectively, first find intersection point (a) of P_1 = 0.5 MPa and P_2 = 0.35 MPa. Trace down vertically from this intersection point (a) to find intersection point (b) with Q = 600 m^3/h (standard condition). Since this intersection point (b) lies between nominal sizes 20A and 25A, select the larger one, 25A.

* Please refer to P.11-9 for Cv value and calculation formula.

■Nominal Size Selection Chart (For Water)



How to use the chart

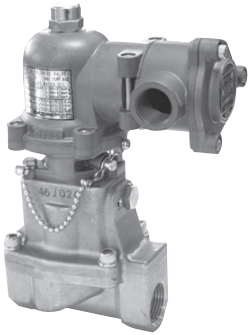
When selecting the nominal size of a solenoid valve whose inlet pressure (P_1), outlet pressure (P_2), and flow rate (V) are 0.7 MPa, 0.5 MPa, and 300 L/min, respectively, first find intersection point (a) of the differential pressure before and after the valve [ΔP = 0.7 – 0.5 = 0.2 MPa] and V = 300 L/min. Since this intersection point (a) lies between nominal sizes 25A and 32A, select the larger one, 32A.

* Please refer to P.11-9 for Cv value and calculation formula.

DP-34N

Pressure- and Explosion-proof structure d2G4
Approval number T21092

Pilot type | Direct type | Piston | Diaphragm
Normally closed | Normally opened | AC coil | DC coil
Stainless steel | 110 V / 220 V | Explosion-proof | JWWA
Leak 0



■Features

1. Able to use in explosive place (Can be used at zone 1 and 2).
2. Vertical and horizontal installation is available.

■Specifications of Coil

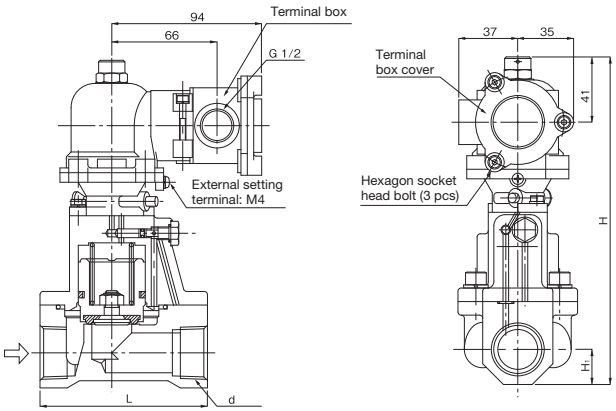
Rated voltage	AC 100 V [50 / 60 Hz selective]		* The coil of AC 100 V and AC 200 V are different.
	AC 200 V [50 / 60 Hz selective]		
Allowable fluctuation	Rated voltage -15% to +10%		
Ingress protection code	IP67		
Cable wiring method	Conduit tube connection G 1/2		
Electric cable size	When connecting conduit tube 3.5 mm^2		
Ambient temperature	5-60°C		
Voltage & Current	Voltage [V] / Frequency [Hz]	Starting current [A]	Exciting current [A]
	100 / 50	0.27	0.16
	100 / 60	0.25	0.13
	200 / 50	0.14	0.08
	200 / 60	0.13	0.07
Insulation class	Class H		
Protective structure	Pressure-and Explosion-proof [Explosion-proof code d2G4]		Approval number: T21092
Insulation resistance	100 MΩ or more (when cold)		
Withstand voltage test	AC 100 V: AC 2000 V/min AC 200 V: AC 2400 V/min		

■Specifications

Application	Air, Nitrogen	Cold and hot water, Heavy oil A, Light oil	
Fluid viscosity	50 cSt or less		
Working pressure	0.05-0.9 MPa	0.05-1.6 MPa	
	No vacuum condition		
Min. differential pressure	0.05 MPa		
Applicable fluid temperature	5-60°C		
Operation	Normally closed		
Material Body	Brass (C3771)		
Material Main valve	Brass (C3604)		
Material Disc	Fluoro rubber (FKM)		
Connection	JIS Rc screwed		

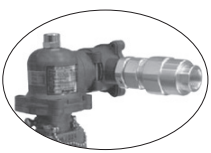
■Dimensions (mm) and Weights (kg)

Nominal size	d	L	H1	H	Weight
15A	Rc 1/2	85	14.5	173	2.2
20A	Rc 3/4	95	17	190	2.7
25A	Rc 1	105	22	210	3.5



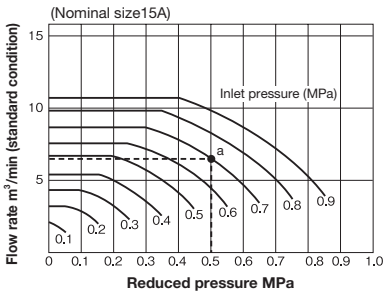
DP-34N option

· Pressure-proof packing gland

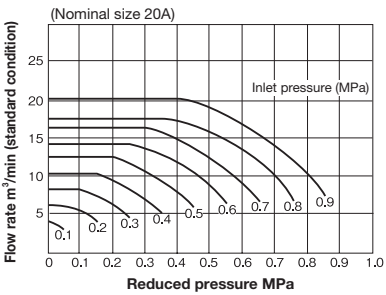


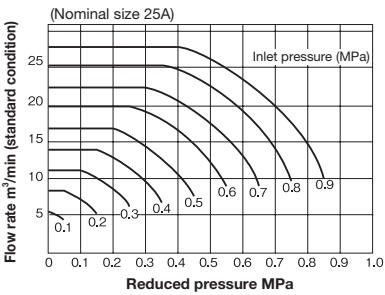
Use packing at the through portion of outside conductor, and cable is used as outside conductor. Connect pressure-proof packing gland to the through portion for significant part 5 screw thread and more. First tighten the gland as strong as possible by locknut, next tighten the pressure-proof packing part and lock the cable.

■Nominal Size Selection Chart (For Air)

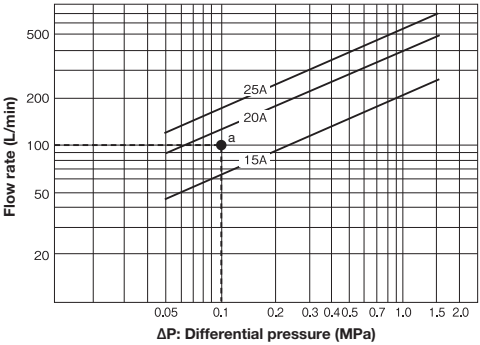


How to use the chart
When flow rate is 5 m^3/min (standard condition), inlet pressure (P_1) is 0.7 MPa, outlet pressure (P_2) is 0.5 MPa, first find intersection point (a) of P_1 = 0.7 MPa and P_2 = 0.5 MPa from the left chart.
Point (a) shows about 6 m^3/min flow rate which is larger than operation flow rate 5 m^3/min, so the suitable size will be 15A. If flow rate in the chart is smaller, review the larger size 20A or 25A.





■Nominal Size Selection Chart (For Water)



How to use the chart
When inlet pressure is 0.4 MPa, outlet pressure is 0.3 MPa, and flow rate is 100 L/min, first find the intersection point (a) of the differential pressure (Δ P) before and after the valve 0.1 MPa and flow rate 100 L/min. Since this intersection point (a) locates between nominal sizes 15A and 20A, select the larger one, 20A.

* Please refer to P.11-9 for Cv value and calculation formula.

DD-2,3

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

Pilot type	Direct type	Piston	Diaphragm
Normally closed	Normally opened	AC coil	DC coil
Stainless steel	110 V / 220 V	Explosion-proof	JWWA
Leak 0			

■Features

1. Outstanding corrosion resistance achieved by adopting stainless steel for major parts and body.
2. Significantly improved corrosion resistance with stainless steel made body and trim parts.
3. Various installation postures: Vertical or horizontal including intermediates.
4. Equipped with coil of AC 110/220V selective and common for 50 Hz/60 Hz.

■Specifications

Model		DD-2	DD-2-8	DD-3	DD-3-8
Application		Steam, Air, Cold and hot water, N_2 gas, CO_2 gas (dry), Ar gas, Oil		Air, Cold and hot water, N_2 gas, CO_2 gas (dry), Ar gas, Oil	
Fluid viscosity		20 cSt or less			
Working pressure		0-0.15 MPa	0-0.8 MPa	0-0.15 MPa	0-0.8 MPa
Orifice (mm)		ϕ9.5	ϕ4.0	ϕ9.5	ϕ4.0
Cv value		1.7	0.55	1.7	0.55
Allowable valve seat leakage		50 mL/min under standard conditions		No (by confirming pressure gauge visually)	
MAX temperature		175°C		100°C	
Operation		Normally closed			
Material	Body	Stainless steel (SCS14A)			
	Plunger	Stainless steel			
	Valve disc	PTFE		FKM	
Connection		JIS Rc screwed			

■Specification of Coil

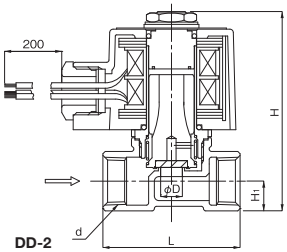
Rated voltage	AC 100 / 200 V selective type	AC 110 / 220 V selective type
	50 / 60 Hz common	
Allowable fluctuation	Rated voltage ±10%	
Rated current	0.42 / 0.21 A	0.38 / 0.19 A
Starting current	1.10 / 0.55 A	1.00 / 0.50 A
Insulation class	Insulation class H	
Protective structure	Dust proof, Splash proof	
Ingress protection code	IP64 (JIS C0920)	
Insulation resistance	50 MΩ and more/500V megger	
Withstand voltage test	1500 V/min	

· Available with the terminal box.

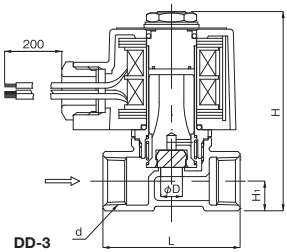
■Dimensions (mm) and Weights (kg)

Nominal size	d	L	H	H_1	Weight
10A	Rc 3/8	50	85.5	12	0.66
15A	Rc 1/2	60	87.5	13	0.69
20A	Rc 3/4	65	91	16.5	0.74

Model	ϕD(mm)
DD-2	9.5
DD-3	
DD-2-8	4.0
DD-3-8	



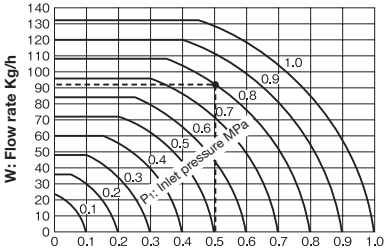
DD-2



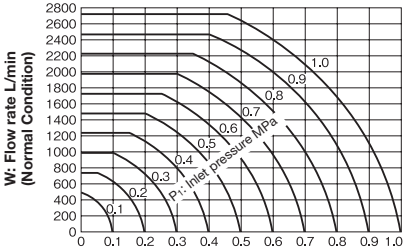
DD-3

■Nominal Size Selection Chart

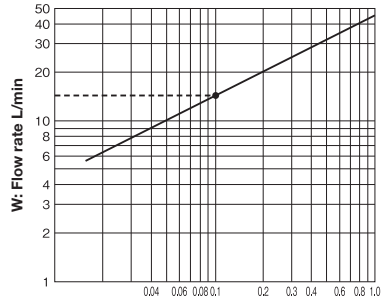
· For steam (Cv = 1)



· For air (Cv = 1)



· For water (Cv = 1)



* Please refer to P.11-9 for Cv value and calculation formula.

· How to determine the flow rate (Steam, Air)

First find the flow rate (W for steam, Q for air), the intersection of inlet pressure P_1 and outlet pressure P_2. Secondly, multiply the flow rate Q or W by Cv value for each model.
[Example] · Model: DD-2-8 (Cv value: 0.55)
· Fluid: Steam
· Inlet Pressure (P_1): 0.8 MPa
· Outlet Pressure (P_2): 0.5 MPa
Flow rate W is 92 kg/h, which is the intersection of P_1 = 0.8 MPa and P_2 = 0.5 MPa, as shown by the dashed line. Next, multiply W = 92 kg/h by the Cv value of 0.55.
Therefore: 92 kg/h x 0.55 = 50.6 kg/h

· How to determine the flow rate (Water)

First calculate pressure loss ΔP and then find the flow rate V in the above chart. Secondly, multiply the flow rate V by Cv value for each model.
[Example] · Model: DD-3 (Cv value: 1.7)
· Inlet Pressure (P_1): 0.15 MPa
· Outlet Pressure (P_2): 0.05 MPa
Pressure loss is calculated as $\Delta P = P_1 - P_2$ = 0.1 MPa. Then, find the flow rate V = 14 L/min as shown by the dashed lines in the above chart. Next, multiply V = 14 L/min by the Cv value of 1.7.
Therefore: 14 L/min x 1.7 = 23.8 L/min

MD-35R

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

Two way | Three way | Full bore | Reduced bore
Stainless steel

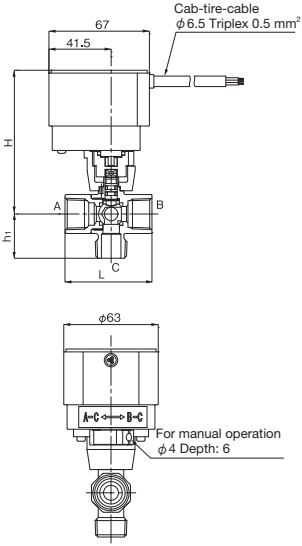
■Features

1. Outdoor, rainproof structure (IP65 specified in JIS C 0920).
2. Starts and stops are quick and accurate, and the indication of the working position can be checked.
3. Smoothly opens and closes, preventing water hammer by the fluid and ensuring complete sealing.
4. Manually operable.
5. A space heater is incorporated to prevent dew condensation (0.5 W).

■Specifications

Application		Cold and hot water, Air
Working pressure		0-1.0 MPa
Application temperature		-10-80˚C (no freeze condition)
Ambient temperature		-20-50 (60)°C *
Rated voltage		AC 100 / 110 V (50 / 60 Hz common)
		AC 200 / 220 V (50 / 60 Hz common)
Power consumption		8 VA
Operation		Diverting
Operation angle		90˚ Positive & Negative rotation
Opening and closing time		7.5 / 6.3 sec. (50 / 60 Hz)
Percentage duty cycle		20% 15 min
Manual operation		Possible
Protective structure		Dust and water proof structure
Valve shape		Reduced bore
Material	Body	Brass
	Ball	Brass (Hcr-plated)
	Seat	Fluorine resin
Connection		A · B: JIS Rc screwed C: JIS R screwed

* The ambient temperature of 60˚C depends on the frequency of operation and the temperature of the fluid. Please contact us.
· Valve (ball) is opened between B to C upon shipment from the factory.
· Any flow directions are available.



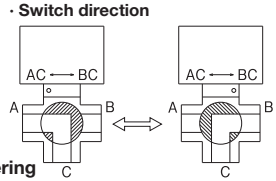
■Dimensions (mm) and Weights (kg)

Nominal size	L	H	h1	Port size	Weight
15A	58	96	29.5	9	0.6
20A	63	98	32	12	0.7
25A	71	102	38	15	0.9

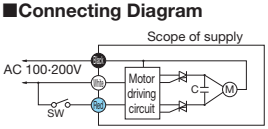
· Cv value

Nominal size	Cv value
15A	3
20A	6
25A	8

· Switch direction



■Connecting Diagram



When SW is OFF, the valve closes. (A-C)
When SW is ON, the valve opens. (B-C)
Note) This valve may not be available if the switch is semiconductor such as triac.

■At the Time of Ordering

Please specify model, size, and also rated voltage.

MD-36R

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

Two way | Three way | Full bore | Reduced bore
Stainless steel

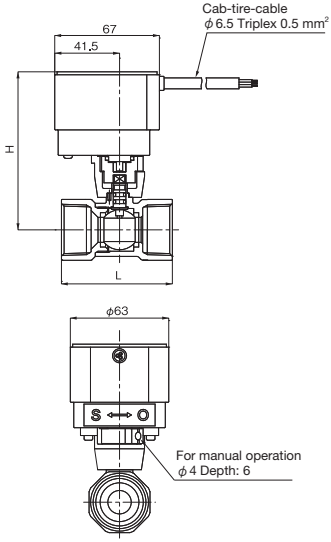
■Features

1. Outdoor, rainproof structure (IP65 specified in JIS C 0920).
2. Starts and stops are quick and accurate, and the indication of the working position can be checked.
3. Smoothly opens and closes, preventing water hammer by the fluid and ensuring complete sealing.
4. Manually operable.
5. A space heater is incorporated to prevent dew condensation (0.5 W).
6. Superior in durability: no motor burnout by function of the timer for motor protection.

■Specifications

Application		Air, Cold and hot water
Working pressure		0-1.0 MPa
Application temperature		-10-80°C (no freeze condition)
Ambient temperature		-20-50 (60)°C *
Rated voltage		AC 100 / 110 V 50 / 60 Hz common AC 200 / 220 V 50 / 60 Hz common
Power consumption		8 VA
Operation		ON-OFF
Operation angle		90° Positive & Negative rotation
Opening and closing time		7.5/6.3 seconds (50/60Hz)
Percentage duty cycle		20% 15 min.
Manual operation		Possible
Protective structure		Rainproof structure at the outdoor
Valve shape		Reduced bore
Material	Body	Brass
	Ball	Brass (Hcr plated)
	Seat	PTFE
Connection		JIS Rc screwed

* The ambient temperature of 60°C depends on the frequency of operation and the temperature of the fluid. Please contact us.
· Valve (ball) is opened upon shipment from the factory.
· Any flow directions are available.



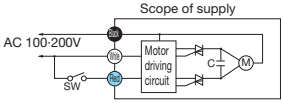
■Dimensions (mm) and Weights (kg)

Nominal size	L	H	Bore	Weight
15A	58	96	10	0.6
20A	63	98	12.5	0.7
25A	71	102	15	0.8

· Cv value

Nominal size	Cv value
15A	6
20A	11
25A	15

■Connecting Diagram



When SW is OFF, the valve closes.
When SW is ON, the valve opens.
Note) This valve may not be available if the switch is semiconductor such as triac.

■At the Time of Ordering

Please specify model, size, and also rated voltage.

MD-53

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

Two way | Three way | Full bore | Reduced bore
Stainless steel

■Features

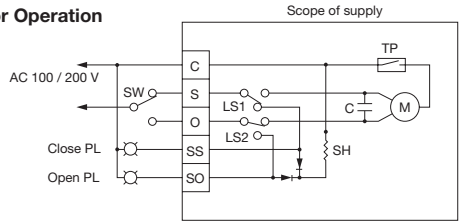
1. IP 65 dust and water proof structure (JIS C 0920).
2. Excellent durability by built-in thermal protector (no motor burnout).
3. Quickly accurate starting/stopping operation. The indication of the working position can be checked.
4. Valve disc smoothly opens and closes, preventing water hammer and ensuring complete sealing.
5. Manually operable.
6. Equipped with opening-closing indicator lamp circuit.
7. Incorporated space heater for dew condensation prevention (1 W).

■Specifications

Application		Cold and hot water, Air		
Working pressure		0-1.0 MPa		
Application temperature		-15-80℃ (no freeze condition)		
Ambient temperature		-15-55℃		
Rated voltage		AC 100 / 110 V (50 / 60 Hz common)	AC 200 / 220 V (50 / 60 Hz common)	
Power consumption		Nominal size 15A-40A	Nominal size 50A	
		16 VA	19 VA	
Operation		ON-OFF		
Operation angle		90°		
Opening and closing time		Nominal size 15A-25A	Nominal size 32A·40A	Nominal size 50A
		5.4 sec. (50 Hz) 4.5 sec. (60 Hz)	15.5 sec. (50 Hz) 13 sec. (60 Hz)	16 sec. (50 Hz) 13.5 sec. (60 Hz)
Percentage duty cycle		20% 15 min		
Manual operation		Possible		
Over current protection		Built-in thermal protector		
Indicator lamp circuit		Built-in		
Protective structure		IP65 dust and water proof structure (JIS C 0920)		
Valve shape		Reduced bore		
Material	Body	Cast stainless steel		
	Ball	Stainless steel		
	Seat	Fluorine resin		
Connection		JIS Rc screwed		

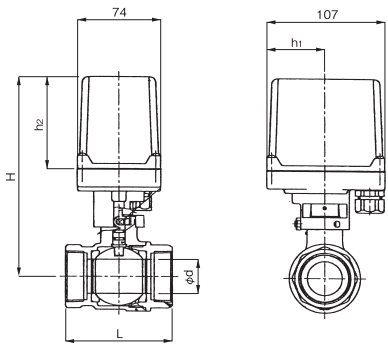
· Valve (ball) is opened upon shipment from the factory.
· Any flow directions are available.

■Circuit of Motor Operation



LS1: Close-limit SW LS2: Open-limit SW SH: Space heater
TP: Thermal protector C: Condenser M: Motor

■Dimensions (mm) and Weights (kg)



Nominal size	L	H	h1	h2	d	Weight
15A	59	121	36	58	13	1.4
20A	66	123	36	58	15	1.5
25A	78	129	36	58	20	1.7
32A	87	140	36	58	25	2.0
40A	95	146	36	58	32	2.3
50A	109	194	53	85	40	3.3

· Cv value

Nominal size	Cv value
15A	12
20A	16
25A	28
32A	47
40A	83
50A	123

■At the Time of Ordering

Please specify model, size and also rated voltage.

MD-54

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

Two way | Three way | Full bore | Reduced bore
Stainless steel

■Features

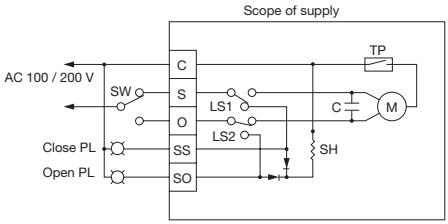
1. IP65 dust and water proof structure (JIS C 0920).
2. Excellent durability by built-in thermal protector (no motor burnout).
3. Quickly accurate starting/stopping operation. The indication of the working position can be checked.
4. Valve disc smoothly opens and closes, preventing water hammer and ensuring complete sealing.
5. Manually operable.
6. Equipped with opening-closing indicator lamp circuit.
7. Incorporated space heater for dew condensation prevention (1W).

■Specifications

Application		Steam, Air, Cold and hot water		
Working pressure		Steam: 0-0.6 MPa Air, Cold and hot water: 0-1.0 MPa		
Application temperature		Steam: Max. 160°C Air: Max. 120°C Cold and hot water: Max. 100°C		
Ambient temperature		-15-55°C		
Rated voltage		AC 100 / 110 V 50 / 60 Hz common AC 200 / 220 V 50 / 60 Hz common		
Power consumption		Nominal size 15A-32A	Nominal size 40A50A	
		16 VA	19 VA	
Operation		ON-OFF		
Operation angle		90°		
Opening and closing time		Nominal size 15A·20A	Nominal size 25A·32A	Nominal size 40A·50A
		5.4 sec. (50 Hz) 4.5 sec (60 Hz)	15.5 sec. (50 Hz) 13 sec. (60 Hz)	16 sec. (50 Hz) 13.5 sec. (60 Hz)
Percentage duty cycle		20% 15 min.		
Manual operation		Possible		
Over current protection		Built-in thermal protector		
Indicator lamp circuit		Built-in		
Protective structure		IP65 dust and water proof structure (JIS C 0920)		
Valve shape		Reduced bore		
Material	Body	Cast stainless steel		
	Ball	Stainless steel		
	Seat	Reinforced fluorine resin for high temperature		
Connection		JIS Rc screwed		

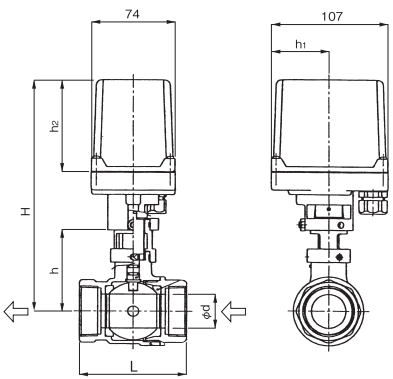
· Valve (ball) is opened upon shipment from the factory.
· Require to adjust the flow direction and arrow mark.

■Circuit of Motor Operation



LS1: Close-limit SW LS2: Open-limit SW SH: Space heater
TP: Thermal protector C: Condenser M: Motor

■Dimensions (mm) and Weights (kg)



Nominal size	L	H	h	h_1	h_2	d	Weight
15A	59	178	52	36	85	13	1.4
20A	66	180	54	36	85	15	1.5
25A	78	187	61	36	85	20	1.7
32A	87	197	71	36	85	25	2.0
40A	95	218	77	53	85	32	2.8
50A	109	224	83	53	85	40	3.3

· Cv value

Nominal size	Cv value
15A	9
20A	13
25A	24
32A	44
40A	80
50A	120

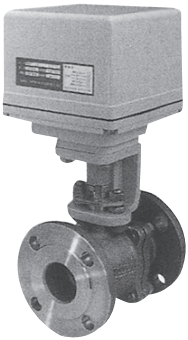
■At the Time of Ordering

Please specify model, size and also rated voltage.

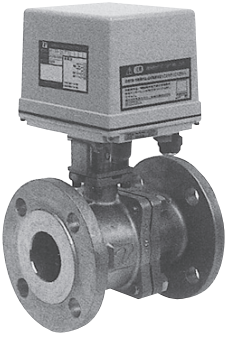
MD-55,61

RED MAN™
ULTRA-HIGH PERFORMANCE SOLENOID

Two way | Three way | Full bore | Reduced bore
Stainless steel



MD-55



MD-61

■Features

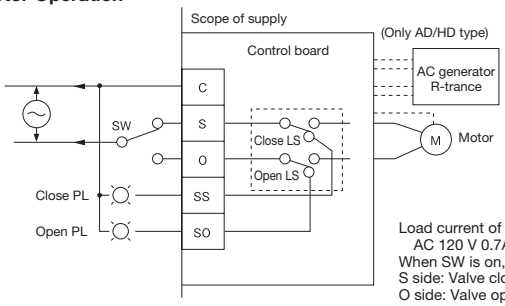
1. IP 65 dust and water proof structure (JIS C 0920).
2. Built-in thermal protector (partly thermistor type) makes no motor burnout at abnormal situation.
3. Quickly accurate starting/stopping operation. The indication of the working position can be checked.
4. Valve disc smoothly opens and closes, preventing water hammer and ensuring complete sealing.
5. Manually operable.
6. Incorporated space heater for dew condensation prevention (0.8 W).

■Specifications

Model		MD-55	MD-61
Application		Cold and hot water, Air	
Working pressure		0-1.0 MPa	
Application temperature		0-80°C	
Ambient temperature		-20-50°C	
Rated voltage		AC 100 / 110 V (50 / 60 Hz common)	
		AC 200 / 220 V (50 / 60 Hz common)	
Power consumption		100 VA (150 VA for size 125A · 150A) MAX	
Operation		ON-OFF	
Operation angle		90˚ Positive & Negative rotation	
Opening and closing time		65A: 6-10 sec. 80A · 100A: 8-15 sec. 125A · 150A: 24-45 sec.	65A: 12-15 sec. 80A · 100A: 25-30 sec. 125A: 24-45 sec.
Percentage duty cycle		20% 15 min.	
Manual operation		Possible	
Protective structure		IP65 dust and water proof structure (JIS C 0920)	
Valve shape		Full bore	
Material	Body	Ductile cast iron (FCD400)	Stainless steel
	Ball	Stainless steel	
	Seat	Fluorine resin	
Connection		JIS 10K RF flanged	JIS 10K RF flanged

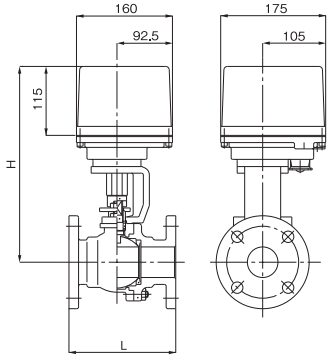
· Valve (ball) is opened upon shipment from the factory.
· Any flow directions are available.

■Circuit of Motor Operation

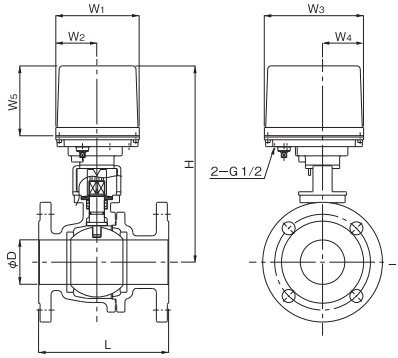


Load current of output signal:
AC 120 V 0.7A/AC 250 V 0.5A MAX.
When SW is on,
S side: Valve close, Close PL lights up
O side: Valve open, Open PL lights up

■Dimensions (mm) and Weights (kg)



MD-55



MD-61

· MD-55

Nominal size	L	H	Port size	Weight
65A	190	368	64	21.4
80A	203	400	76	26.8
100A	229	436	102	38.3
125A	356	473	127	73.0
150A	394	493	152	92.0

· MD-61

Nominal size	L	H	W1	W2	W3	W4	W5	Port size	Weight
65A	190	287	122	60	145	60	102	65	17.5
80A	203	357	160	97	175	63	115	80	26.5
100A	229	383	160	97	175	63	115	100	37.0
125A	356	449	217.5	156	175	87.5	115	125	56.0

* Please contact us for 150A.

■At the Time of Ordering

Please specify model, size and also rated voltage.

Solenoid Valve – Annex

⚠ Warning	Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.
⚠ CAUTION	Please refer to the manual attached to the product for procedures for installation and operation.

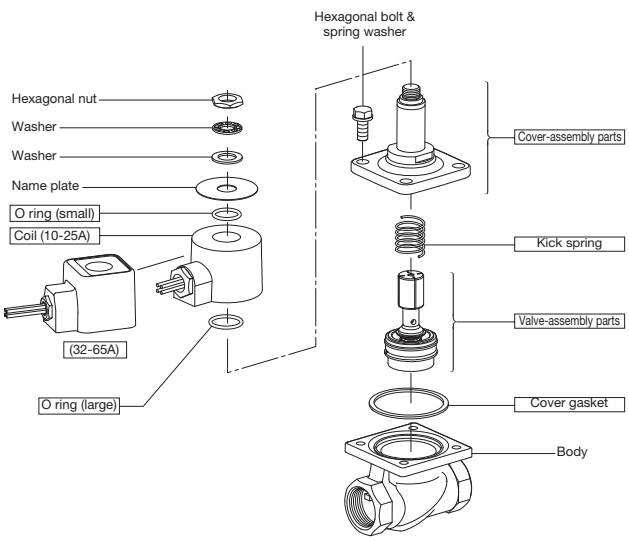
Disassembly and troubleshooting — Solenoid valve

DP-100, DP-100-C (DP-100F and DP-100F-C are different in body flanged structure only.)

· Disassembly and assembly (see exploded view.)

1. Loosen hexagonal nut (width across flat: 19 mm) and remove coil part.
   Be careful not to loose small parts such as washers and O-ring.
2. Loosen the hexagon bolts by 2 to 3 mm and check that no residual pressure is detected.
   Width across flats of hexagonal bolt: 10 to 20A (10 mm), 25 to 32A (13 mm), 40 to 65A (17 mm)
3. Remove the hexagon bolts and the cover assembly and then take off the valve assembly and the kick spring.
4. Be careful not to have the disassembled parts damaged, deformed or lost.
5. Reassemble the parts in the reverse order of disassembly. Replace new gasket at the time of reassembly.

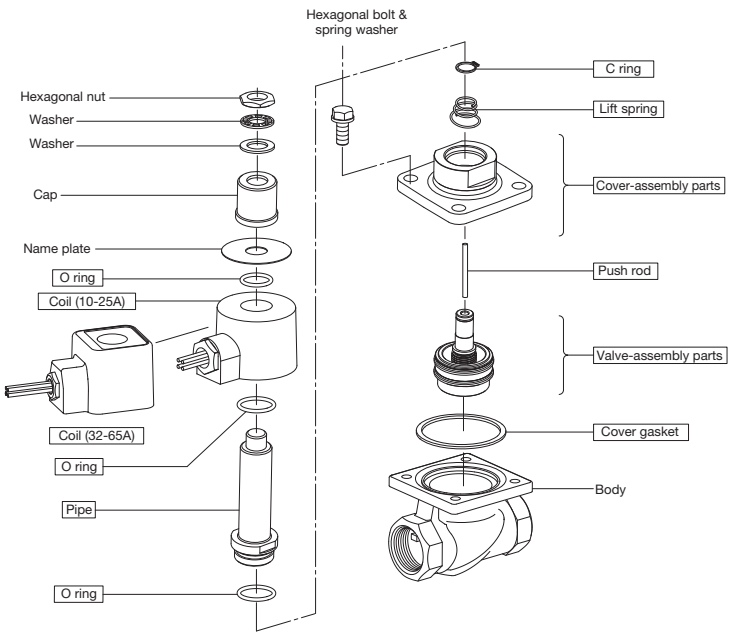
· DP-100 (For DP-100F, body is flanged structure.)



The parts shown in the rectangle boxes ▭ are available as consumable parts.

*** For screw part, apply lubricant agent for burning proof (recommendation: SOLVEST 110 by STT INC.)**

· DP-100-C (for DP-100F-C, body is flanged structure.)



The parts shown in the rectangle boxes ▭ are available as consumable parts.

* For screw part, apply lubricant agent for burning proof (recom mendation: SOLVEST 110 by STT INC.)

⚠ Warning	**Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.**
⚠ CAUTION	**Please refer to the manual attached to the product for procedures for installation and operation.**

Trouble	Cause	Remedy
Valve does not open. (Fluid does not flow.)	● Strainer at the inlet side of the product is clogged.	Clean the strainer.
	● Plunger is stuck by foreign substances in the piping.	Remove foreign substances and check that sliding parts moves smoothly.
	● Port at the center of valve is stuck foreign substances in the piping.	Replace valve assembly.
	● Fluid pressure exceeds appropriate pressure.	Adjust the fluid pressure to appropriate pressure.
	● Fluid viscosity exceeds 20 cSt.	Adjust the fluid viscosity to appropriate viscosity.
	● No electric conduction (trouble with electric circuit).	Check power supply and voltage.
	● Wires of coil not bound properly for the applied voltage.	Wire the coil properly for the applied voltage. If the trouble still exists, replace the coil with new one.
	● Voltage fluctuates widely.	Adjust electric circuit to regulate voltage within allowable fluctuation.
	● Coil specifications do not match with applied voltage.	Check applied voltage and replace the coil with new one.
	● Coil burns out by over current.	Replace the coil.
Valve does not close. (Fluid flow does not stop.)	● There is electric conduction.	Check power supply.
	● Plunger or valve is stuck with foreign substances or get damaged.	Remove foreign substances. Replace the valve assembly with new one if damage is observed.
	● Plunger is stuck by foreign substances in the piping.	Remove foreign substances and check that sliding parts moves smoothly.
	● Inlet/outlet of the product is installed in the opposite direction of the fluid flow.	Make fluid direction consistent with arrow direction.
	● Bypass stop valve is kept open.	Close the bypass stop valve.
	● The differential pressure is less than 0.03 MPa when the coil is set sideways.	Adjust the differential pressure to be 0.03 MPa or more. If differential pressure is not obtained, install the product to a horizontal piping with the coil faced upward.
The product vibrates.	● There is a constricted part of piping just in front of the inlet of the product.	Change installation place or constricted part.
	● Gas is commingled in the liquid when applied fluid is liquid.	Change facility or installation place.
Abnormal sound.	● Hexagonal nut on the coil is loosened.	Retighten the nut with specified torque.
	● Foreign substances exist on internal surface of the pipe or at absorption face of plunger.	Remove foreign substances. If foreign substances cannot be removed, replace cover assembly and valve assembly.
	● Fluid pressure exceeds appropriate pressure.	Adjust fluid pressure to appropriate pressure.
	● Voltage applied to the coil is not proper.	Check voltage.
Outside leakage.	● Pipe is loosened.	Replace cover assembly.
	● Hexagonal bolt is loosened.	Retighten hexagonal bolt with specified torque.
	● Cover gasket is damaged.	Replace cover gasket.

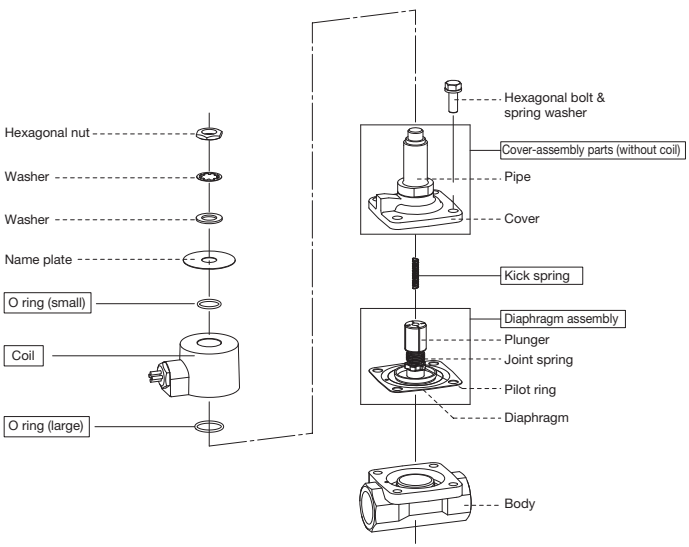
⚠ Warning	**Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.**
⚠ CAUTION	**Please refer to the manual attached to the product for procedures for installation and operation.**

Disassembly and troubleshooting — Solenoid valve

DP-200 (DP-200F is different in body flanged structure only.)

· Disassembly and assembly (see exploded view.)

1. Loosen hexagonal nut (width across flat: 19 mm) and remove coil part.
   Be careful not to lose small parts such as washers and O-ring.
2. Loosen the hexagon bolts by 2 to 3 mm and check that no residual pressure is detected.
   Width across flats of hexagonal bolt: 10 to 20A (10 mm), 25 to 32A (13 mm), 40 to 50A (17 mm)
3. Remove hexagon bolts and cover assembly and then take off the valve assembly. Be careful not to lose kick spring.
4. Be careful not to have the disassembled parts damaged, deformed or lost.
5. Reassemble the parts in the reverse order of disassembly. For the details, see instruction manual.



The parts shown in the rectangle boxes ▭ are available as consumable parts.

⚠ Warning	**Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.**
⚠ CAUTION	**Please refer to the manual attached to the product for procedures for installation and operation.**

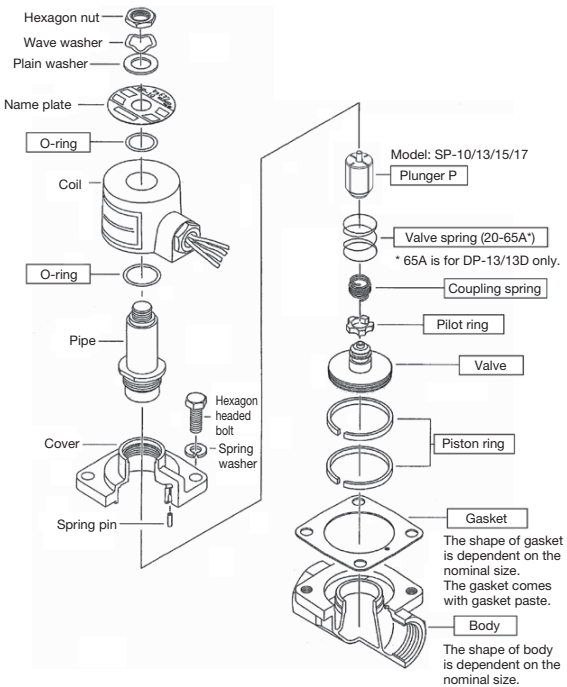
Trouble	Cause	Remedy
Valve does not open. (Fluid does not flow.)	● Strainer at the inlet side of the product is clogged.	Clean the strainer.
	● Plunger is stuck by foreign substances in the piping.	Remove foreign substances and check that sliding parts moves smoothly.
	● Port at the center of valve is stuck foreign substances in the piping.	Replace diaphragm assembly.
	● Fluid pressure exceeds appropriate pressure.	Adjust the fluid pressure to appropriate pressure.
	● Fluid viscosity exceeds 20 cSt.	Adjust the fluid viscosity to appropriate viscosity.
	● No electric conduction (trouble with electric circuit).	Check power supply and voltage.
	● Wires of coil not bound properly for the applied voltage.	Wire the coil properly for the applied voltage. If the trouble still exists, replace the coil with new one.
	● Voltage fluctuates widely.	Adjust electric circuit to regulate voltage within allowable fluctuation.
	● Coil specifications do not match with applied voltage.	Check applied voltage and replace the coil with new one.
	● Coil burned out with abnormal temperature rise caused by use in high ambient temperature condition or in insulated condition, etc.	Make ambient temperature lower than 50 degree C, and do not insulate the coil. Under such condition, replace the coil with a new one.
Valve does not close. (Fluid flow does not stop.)	● Plunger or diaphragm is stuck with foreign substances or get damaged.	Disassemble the product and remove foreign substances. Replace diaphragm complete set with new one if damage is observed.
	● Plunger is stuck by foreign substances in the piping.	Remove foreign substances and check that sliding parts moves smoothly.
	● Inlet/outlet of the product is installed in the opposite direction of the fluid flow.	Make fluid direction consistent with arrow direction.
	● Bypass stop valve is kept open.	Close the bypass stop valve.
	● Differential pressure is less than 0.1 MPa when the coil is set sideways.	Adjust the differential pressure to be 0.1 MPa or more.
	● Bleed port (on the body) is obstructed.	If differential pressure is not obtained, install the product to a horizontal piping with the coil faced upward. Replace cover set. If seal agent for piping is protruded, remove it.
	● There is electric conduction.	Check power supply.
The product vibrates.	● There is a constricted part of piping just in front of the inlet of the product.	Do not make nominal size of piping at inlet side of the product smaller than nominal size of the product.
	● Gas is commingled in the liquid when applied fluid is liquid.	Avoid commingling of air.
Abnormal sound.	● Hexagonal nut on the coil is loosened.	Retighten the nut with specified torque.
	● Foreign substances exist on internal surface of the pipe or at absorption face of plunger.	Remove foreign substances. If foreign substances cannot be removed, replace cover complete set and diaphragm complete set.
	● Fluid pressure exceeds appropriate pressure.	Adjust fluid pressure to appropriate pressure.
	● Voltage applied to the coil is not proper.	Check voltage.
Outside leakage.	● Pipe is loosened.	Replace cover complete set.
	● Hexagonal bolt is loosened.	Retighten hexagonal bolt with specified torque.
	● Cover gasket is damaged.	Replace cover gasket.

⚠ Warning	**Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.**
⚠ CAUTION	**Please refer to the manual attached to the product for procedures for installation and operation.**

DP-10 Series

1. Remove hexagonal nut and remove coil part.
   Be careful not to lose small parts such as washers and O-ring.
2. Loosen the hexagon bolts by 2 to 3 mm and check that no residual pressure is detected.
3. Remove hexagon bolts and remove cover carefully and then take off valve part.
4. Be careful not to have the disassembled parts damaged, deformed or lost.
5. Reassemble the parts in the reverse order of disassembly.

DP-10 type



- For DP-18, body is flanged type, and other parts are same as those of DP-16.
- DC coil type differs a little in shape.
- Normal open type differs a little in structure.

The parts shown in the rectangle boxes ☐ are available as consumable parts.

⚠ Warning	**Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.**
⚠ CAUTION	**Please refer to the manual attached to the product for procedures for installation and operation.**

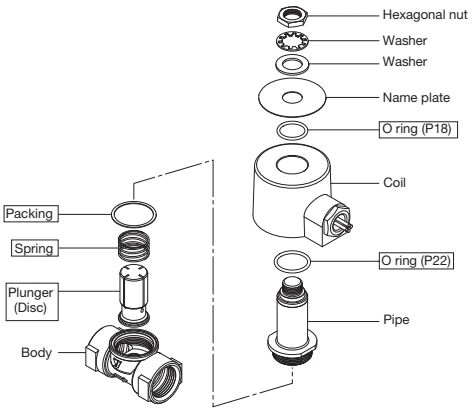
Trouble	Cause	Remedy
Valve does not open.	● No electric conduction (trouble with electric circuit).	Check power supply and voltage.
	● Plunger is stuck by foreign substances in the piping.	Remove foreign substances and check that sliding parts moves smoothly.
	● There is a dent on pipe and plunger does not move smoothly.	Replace the pipe.
	● Fluid pressure exceeds appropriate pressure.	Adjust the fluid pressure to appropriate pressure, or replace the product with appropriate model.
	● Fluid viscosity exceeds 20 cSt.	Adjust the fluid pressure to appropriate pressure, or replace the product with appropriate model.
	● Voltage fluctuates widely.	Adjust electric circuit to regulate voltage within 10 %.
	● Coil specifications do not match with applied voltage.	Check applied voltage and replace the coil with new one.
Valve does not close.	● Plunger or diaphragm is stuck with foreign substances or get damaged.	Disassemble the product and remove foreign substances. Replace diaphragm assembly with new one if damage is observed.
	● Plunger is stuck by foreign substances in the piping.	Remove foreign substances and check that sliding parts moves smoothly.
	● There is a dent on pipe and plunger does not move smoothly.	Replace the pipe.
	● Inlet/outlet of the product is installed in the opposite direction of the fluid flow.	Change the present piping into appropriate piping.
Abnormal sound is heard.	● Hexagonal nut on the coil is loosened.	Retighten the hexagonal nut.
	● Foreign substances exist at absorption face of plunger.	Remove foreign substances. If foreign substances can not be removed, replace cover assembly and diaphragm assembly.
	● Fluid pressure exceeds appropriate pressure.	Adjust fluid pressure to appropriate pressure.
	● Voltage applied to the coil is not proper.	Check voltage.

* Contact us for normally open type.

⚠ Warning	Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.
⚠ CAUTION	Please refer to the manual attached to the product for procedures for installation and operation.

DD-2, DD-3

1. Loosen hexagonal nut (M14) and remove washer, plain washer, name plate and O-ring (P18), and then remove coil.
2. Remove pipe with a spanner (32 mm width across flat).
3. Remove plunger.
4. Reassemble the product in the reverse order of disassembly.
5. Tighten pipe with the torque of 30 N m, and hexagonal nut with the torque of 15 N m.



The parts shown in the rectangle boxes ▭ are available as consumable parts.

Trouble	Cause	Remedy
Valve does not open. (Fluid does not flow.)	• Strainer at the inlet side of the product is clogged.	Clean the strainer.
	• Plunger is stuck by foreign substances in the piping.	Remove foreign substances and check that sliding parts moves smoothly.
	• Fluid pressure exceeds appropriate pressure.	Adjust the fluid pressure to appropriate pressure, or replace the product with appropriate model.
	• Fluid viscosity exceeds 20 cSt.	Adjust the fluid viscosity to appropriate viscosity.
	• No electric conduction (trouble with electric circuit).	Check power supply and voltage.
	• Wires of coil not bound properly for the applied voltage.	Wire the coil properly for the applied voltage. If the trouble still exists, replace the coil with new one.
	• Voltage fluctuates widely.	Adjust electric circuit to regulate voltage within 10 %.
	• Coil specifications do not match with applied voltage.	Check applied voltage and replace the coil with new one.
	• Coil burns out by over current.	Replace the coil.
Valve does not close. (Fluid flow does not stop.)	• There is electric conduction.	Check power supply.
	• Plunger or diaphragm is stuck with foreign substances or get damaged.	Disassemble the product and remove foreign substances. Replace parts with new one if damage is observed.
	• Plunger is stuck by foreign substances in the piping.	Remove foreign substances and check that sliding parts moves smoothly.
	• Inlet/outlet of the product is installed in the opposite direction of the fluid flow.	Make fluid direction consistent with arrow direction.
	• Bypass stop valve is open.	Close bypass stop valve.
Abnormal sound.	• Hexagonal nut on the coil is loosened.	Retighten the hexagonal nut with specified torque.
	• Foreign substances exist on pipe or at absorption face of plunger.	Disassemble the product and remove foreign substances.
	• Fluid pressure exceeds appropriate pressure.	Adjust fluid pressure to appropriate pressure or replace the product with appropriate model.
	• Voltage applied to the coil is not proper.	Check voltage.

⚠ Caution **Completely discharge the internal pressure from the valves before disassembly. Check whether power supply is off.**

⚠ Warning	Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.
⚠ CAUTION	Please refer to the manual attached to the product for procedures for installation and operation.

Points to be checked for wiring — Motor valve

1. Turn off the power.
   For motor valve, even when not in operation, there is electric voltage to limit switch inside motor valve.
2. Check what is connected to three wires from motor valve.
   1) Whether white wire of C (common) is connected to the side of power.
   2) Whether red wire or S wire and black wire or O wire is connected to device which has switch function (relay, etc.).
3. · Wired correctly: Make electric conduction and do a trial operation.
   · Not wired correctly: Confer with construction worker or person in charge, and show wiring drawing (instruction manual, etc) of motor valve, and instruct regular wiring method.

Troubleshooting — Motor valve

Trouble	Cause	Check	Remedy
Valve (motor) does not rotate.	• Fluid pressure exceeds appropriate pressure.	Check pressure by pressure gauge.	▶ Adjust fluid pressure to appropriate pressure or replace the product with appropriate model.
	• Valve is stuck by foreign substances.	Rotate valve manually and check rotation condition.	▶ Factory repair.
	• Malfunction of limit switch.	Rotate valve manually and check conduction between lead wires at opening and closing by resistance gauge.	▶ Replace actuator.
	• Power and voltage is not appropriate.	Measure power and voltage by voltage gauge.	▶ Adjust power and voltage or replace the product with appropriate model.
	• Wiring method is not appropriate.	See points to be checked for wiring method.	▶ Amend wiring.
	• Breaking of wire in actuator.	Rotate valve manually and check conduction between lead wires at opening and closing by resistance gauge.	▶ Replace actuator.
	• Contact failure of wiring.	Check loosening of screw at connection part of terminal.	▶ Tighten screw securely.
	• Crack of thermal protector.	It can be checked by removing motor case.	▶ Replace actuator.
	• Motion of thermal protector.	When ambient temperature exceeds 50 degree C or motor has overload and produces heat more than rating, motor moves.	▶ By cooling the motor and eliminating overload reason, motor recovers automatically and become controllable.
Valve (motor) keeps to rotate.	• Malfunction of limit switch.	Rotate valve manually and check conduction between lead wires at opening and closing by resistance gauge.	▶ Replace actuator.
	• Tightening part of cam is loosened, and cam does not rotate.	Disassemble and inspect cam part.	▶ Tighten the cam (pay attention to position of cam and direction of valve). Or, replace actuator.
	• Wiring method is not appropriate.	See points to be checked for wiring method.	▶ Amend wiring.
Others	• False operation by parallel operation for more than two products.	Check parallel operation for more than two products is conducted.	▶ Change wiring according to wiring method for parallel operation.
	• False operation by difference of cam position.	Valve does not stop at position of complete closing or complete opening but stop position is constant.	▶ Replace actuator.
	• Output axis and connector slip and then motor rotates but valve does not move.	Rotate motor and check motion of connector part.	▶ Replace actuator.

⚠ Warning	**Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.**
⚠ CAUTION	**Please refer to the manual attached to the product for procedures for installation and operation.**

Troubleshooting — Explosion-proof solenoid valve

DP-34

Trouble	Cause	Remedy
Fluid does not flow.	• No electric conduction (trouble with electric circuit).	Check power supply and voltage.
	• Power supply and voltage are not consistent with plate indication.	Select solenoid (coil) according with power supply and voltage. This product has different solenoid (coil) for AC 100V and AC 200V.
	• Voltage drop by distance of electric wire.	Replace with electrical wire with thick core, or re-examine the distance.
	• Differential pressure of inlet side and outlet side is small.	Make differential pressure more than 0.05 MPa.
	• Fluid viscosity (more than 50 cSt) is high.	Change fluid viscosity less than 50 cSt.
	• Strainer installed before solenoid valve is clogged.	Clean the strainer.
	• Main valve, piston ring, disc etc is stuck by foreign substance inside piping.	Contact us or professionals. Also, conduct parts inspection according to "8.2. Warning and caution for maintenance and inspection".
	• Since abnormal load is applied to piping of solenoid valve, valve does not work normally.	Change the piping.
	• Piston ring is jammed by foreign substance.	Contact us or professionals. Also, conduct parts inspection according to "8.2. Warning and caution for maintenance and inspection".
Fluid does not stop.	• Power is not OFF.	Inspect electric circuit.
	• Installation direction of solenoid valve (fluid flow direction is different from direction of solenoid valve).	Make fluid flow direction accord with direction of solenoid valve.
	• Since fluid viscosity is high (more than 50 cSt), valve cannot close.	Make fluid viscosity less than 50 cSt.
	• Main valve inside solenoid valve is damaged.	Contact us or professionals. Also, conduct parts inspection according to "8.2. Warning and caution for maintenance and inspection".
	• Disc of solenoid valve is damaged.	Contact us or professionals. Also, conduct parts inspection according to "8.2. Warning and caution for maintenance and inspection".
	• Piston ring is jammed by foreign substance.	Contact us or professionals. Also, conduct parts inspection according to "8.2. Warning and caution for maintenance and inspection".
Abnormal sound.	• Fluid pressure exceeds appropriate pressure.	Adjust to appropriate pressure, or change to appropriate model.
	• Voltage is not appropriate.	Check the voltage.

⚠ Caution **The above failure reason, remedy, treatment are explained according to instruction manual included. When instruction manual is not founded at the time of purchasing the product, or when losing instruction manual, be sure to contact us and obtain instruction manual. When conducting inspection not according to instruction manual, it may lead to accident or injury.**

⚠ Warning	Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.
⚠ CAUTION	Please refer to the manual attached to the product for procedures for installation and operation.

Classification of degree of protection for coil

IP indication is indication way of classification of degree of protection for container objecting all electrical equipment specified by IEC529. The degree of protection for electrical equipment is classified by showing degrees of protection against solid foreign objects entering the enclosure (1st character: 0-6) and degrees of protection against water (2nd character: 0-8) following the characteristic letter (IP).

IP-6 4

- 4 — Degrees of protection against water (2nd character: 0-8)
- 6 — Degrees of protection against solid foreign objects entering the enclosure (1st character: 0-6)
- IP — Characteristic letter

■Overview and Feature

Classification of degree of protection for coil (2) (For IP indication)

· **1st characteristic figure (IEC529)**

(Degree of protection against the ingress of solid foreign objects and contact of human body)

1st characteristic figure	Degree of protection Meaning (example)	IEC 598-1
0	Not protected	–
1	Protected against solid foreign objects larger than 50 mm in diameter	–
2	Protected against solid foreign objects larger than 12.5 mm in diameter	–
3	Protected against solid foreign objects larger than 2.5 mm in diameter	–
4	Protected against solid foreign objects larger than 1 mm in diameter	–
5	Protected against such dust passing a 75 µm screen as damages the equipment operation.	
6	Protected against dust passing through a 75 µm screen.	

· **2nd characteristic figure (IEC529)**

(Degree of protection against the ingress of water)

2nd characteristic figure	Degree of protection Meaning (example)	JIS C0920	IEC 598-1
0	Not protected	–	–
1	Protected against vertically falling water drops	Drip-proof I	
2	Protected against vertically falling water drops when enclosure is tilted us at a 15 degree angle	Drip-proof II	–
3	Protected against water sprayed at up to a 60 degree angle	Rain-proof	
4	Protected against splashing water from any directions	Splash-proof	
5	Protected against water jets from any directions	Water jets-proof	
6	Protected against powerful water jets from any directions	Heavy water jets-proof	–
7	Protected against temporary immersion in 1m depth water in 30 minutes	Emersion-proof	
8	Protected against submersion of specified pressure	Submersible type	m
	Protected against humidity at more than 90% relative humidity	Humidity-proof	–

Coil	Model of solenoid valve	Degree of protection
AC coil	DP-100, 100F, DP-200, DP-200F, DP-10, DP-16, 18 DP-12C, 14C, 16C, 18C, DD-2, 3 DP-100-C, 100F-C	IP64 Dust-proof, Splash-proof type (JIS C 0920)
DC coil	DP-100-D, 100F-D, DP-12D, 14D, 16D, 18D DP-12CD, 14CD, 16CD, 18CD	

Terminal box	Model of terminal box	Degree of protection
–	TN-1	IP03 (*1) Rain-proof type (JIS C 0920)
With indication light	TN-2	
With cab tire cable	TN-1C	IP54 Dust-proof, Splash-proof type (JIS C 0920)
With indication light and cab tire cable	TN-2C	

*1 For no cab tire cable type (TN-1 and 2), since solid substance enter through opening part (electrical wire insert part) of gland nut into ternimal box, it is no protection (0).

⚠ Warning	**Be sure to install safety device for such as blocking or opening when failure or malfunction of solenoid valve may violate human life, body, or property.**
⚠ CAUTION	**Please refer to the manual attached to the product for procedures for installation and operation.**

Description of pressure-and explosion-proof code

d 2 G4

- **G4** — Degree of ignition
  - G1: Ignition temperature of more than 450°C
  - G2: Ignition temperature of more than 300°C up to 450°C
  - G3: Ignition temperature of more than 200°C up to 300°C
  - G4: Ignition temperature of more than 135°C up to 200°C
  - G5: Ignition temperature of more than 100°C up to 135°C
  - G6: Ignition temperature of more than 85°C up to 100°C
- **2** — Explosion class
  - Minimum value of clearance with the depth of 25 mm, which causes the transmission of flame
  - 1: More than 0.6 mm (Ex. Propane gas)
  - 2: More than 0.4 mm up to 0.6mm (Ex. Ethylene)
  - 3: 0.4 mm or less (Ex. Hydrogen (3a))
- **d** — Type of explosion-proof structure
  - d: Pressure-and explosion-proof structure (Zone 1, 2)
  - e: Explosion-proof structure for increased safety structure (Zone 2)
  - i : Explosion-proof structure for intrinsic safety (Zone 0)

Type of zone where explosion-proof solenoid valve is used

Zone 0
Ignitable concentrations present continuously or for long periods of time.
Ex.) Vicinity of the surface of combustible liquid.
Zone 1
Ignitable concentrations likely to exist under normal operations.
Ex.) Vicinity of the opening which often emits combustible gas while inspection or repair work of products.
Zone 2
Ignitable concentrations likely to exist under normal operations, or may exist for a short time only (twice or three times per year).
Ex.) A place where combustible gas may ingress due to corrosion or deterioration of a vessel, or vicinity of rupture disk.