

MODEL DD-2 · DD-3 series

REDMANTM DIRECT ACTING SOLENOID VALVE

PRODUCT MANUAL

Thank you very much for purchasing our solenoid valve. Please read this instruction manual thoroughly before using the product, so that you may do so correctly and safely. Please carefully store this manual in a handy place. The following safety symbols are used in this manual.

| | | |
|---|----------------|---|
|  | Warning | This symbol indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury. |
|  | Caution | This symbol indicates a hazardous situation that, if not avoided, may result in minor or moderate injury or may result in only property damage. |

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1. Usage of the Product

The DD-2 and DD-3 series compact designed direct-acting solenoid valve has stainless steel body and offers superior corrosion resistance. Because it can be applied to various fluids, it is widely used for water supply/drainage systems in a house, plant facilities and automatic controllers for industrial use, etc.

2. Features

1. Superior corrosion resistance with stainless-steel-made trim parts.
2. Vertical or horizontal installation is possible.

3. Specifications



Caution

Please confirm that the indications on the product name plate coincide with the specifications of the ordered product model before usage.

* In case they do not coincide, do not use the product and contact us.

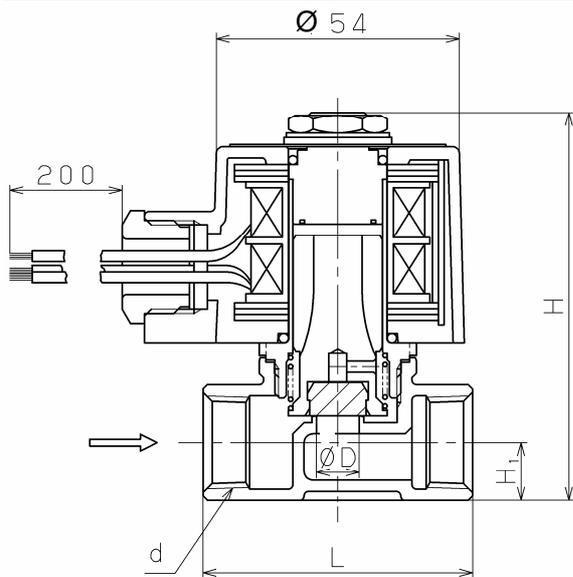
| Model | DD-2 | DD-2-8 | DD-3 | DD-3-8 |
|------------------------------|--|-----------------|---|-----------|
| Application | Steam, Cold and hot water, Air, N ₂ gas, CO ₂ gas (dry), Ar gas, Oil | | Cold and hot water, Air, N ₂ gas, CO ₂ gas (dry), Ar gas, Oil | |
| Fluid viscosity | 20 cSt or below | | | |
| Working pressure | 0-0.15 MPa | 0-0.8 MPa | 0-0.15 MPa | 0-0.8 MPa |
| Orifice (mm) | 9.5 | 4.0 | 9.5 | 4.0 |
| Cv value | 1.7 | 0.55 | 1.7 | 0.55 |
| Allowable valve seat leakage | 50 mL/min under standard conditions | | No leakage at the pressure gauge | |
| Max. temperature | 175°C | | 100°C | |
| Operation | Normally closed | | | |
| Material | Body | Stainless steel | | |
| | Plunger | Stainless steel | | |
| | Valve disc | PTFE | | FKM |
| Connection | JIS Rc screwed | | | |

Performance and specifications 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 tight, Splash proof | |
| Ingress protection code | IP64 (JIS C0920) | |
| Insulation resistance | 50 MΩ and more / 500 V megger | |
| Withstand voltage test | 1500 V / min | |

- Coil equipped with a terminal box (made of plastic) is also available.

4. Dimensions and Weight



| Model | ØD (mm) |
|--------|---------|
| DD-2 | 9.5 |
| DD-3 | |
| DD-2-8 | 4.0 |
| DD-3-8 | |

(Example structural drawing: DD-3)

| Nominal size | d | L | H | (mm) | |
|--------------|--------|----|------|----------------|-------------|
| | | | | H ₁ | Weight (kg) |
| 10A | Rc 3/8 | 55 | 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 |

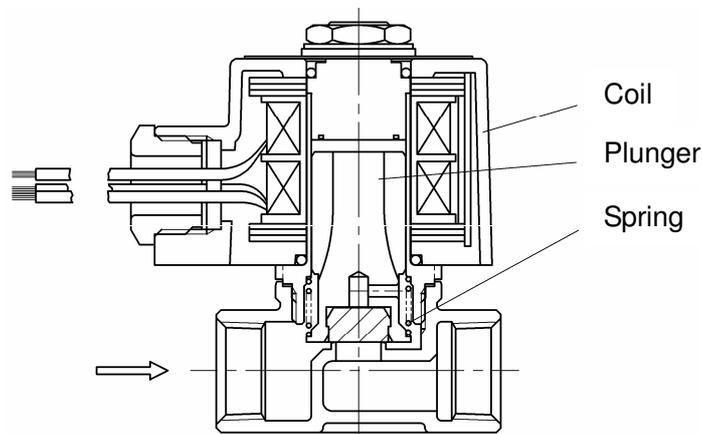
5. Operation

(1) Opening operation

When the coil is supplied with power, the plunger is pulled up and extends the spring upwardly, opening the valve.

(2) Closing operation

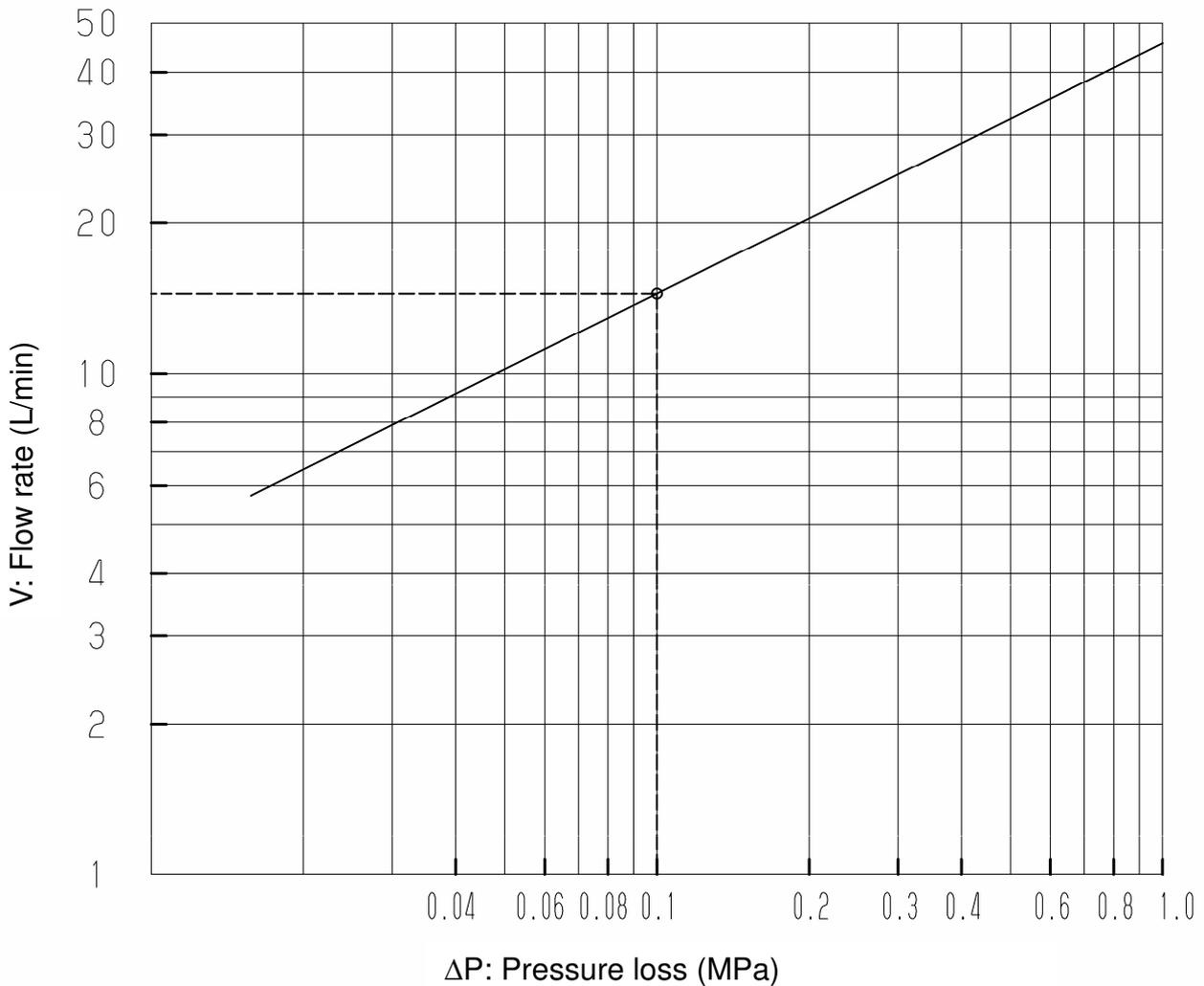
When the coil is not supplied with power, the plunger drops down by its own empty weight and the spring load, closing the valve.



6. Nominal Size Selection

6.1 Nominal size selection chart

■ For water ($C_v = 1$)



First calculate pressure loss ΔP and then find flow rate V in the above chart. Secondly, multiply the flow rate V by C_v value for each model.

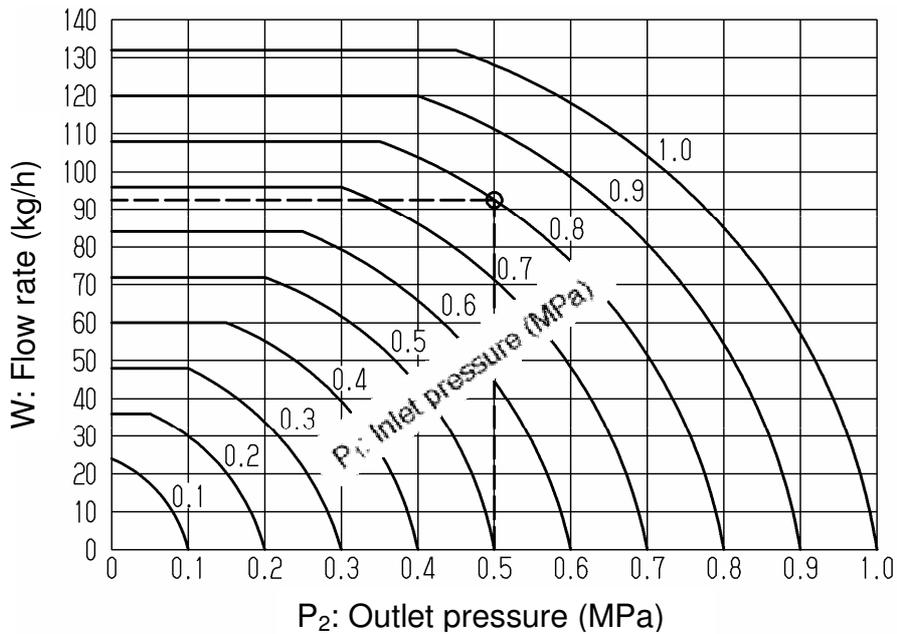
[Example]

- Model: DD-3 (C_v value: 1.7)
- Inlet pressure (P_1): 0.15 MPa
- Outlet pressure (P_2): 0.05 MPa

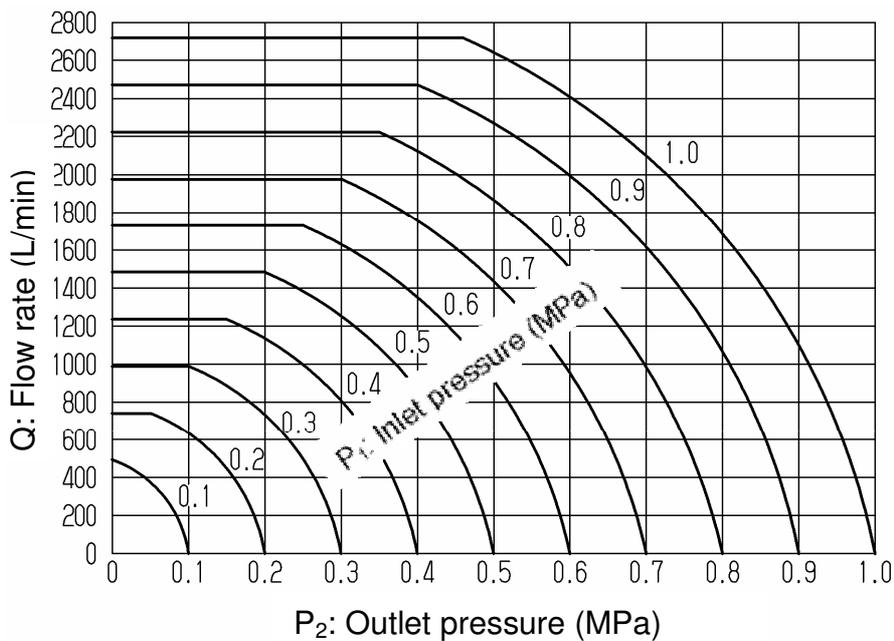
Pressure loss is calculated as $\Delta P = P_1 - P_2 = 0.1$ MPa. Then, find the flow rate $V = 14$ L/min as shown by the dashed lines in the above chart. Next, multiply $V = 14$ L/min by the C_v value of 1.7.

Therefore: $14 \text{ L/min} \times 1.7 = 23.8 \text{ L/min}$

■ For steam (Cv = 1)



■ For air (Cv = 1)



First find the flow rate (W for steam, Q for air), the intersection of inlet pressure P₁ and outlet pressure P₂. 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 (P₁): 0.8 MPa
- Outlet pressure (P₂): 0.5 MPa

Flow rate W is 92 kg/h, which is the intersection of P₁ = 0.8 MPa and P₂ = 0.5 MPa, as shown by the dashed line. Next, multiply W = 92 kg/h by the Cv value of 0.55.

Therefore: $92 \text{ kg/h} \times 0.55 = 50.6 \text{ kg/h}$

6.2 Calculation formula for Cv value

<For liquid>

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

<For steam>

When $P_2 > \frac{P_1}{2}$

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

When $P_2 \leq \frac{P_1}{2}$

$$Cv = \frac{Wk}{120P_1}$$

<For air>

When $P_2 > \frac{P_1}{2}$

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

When $P_2 \leq \frac{P_1}{2}$

$$Cv = \frac{Q\sqrt{(273 + t)G}}{2550P_1}$$

Cv: Cv value of each nominal size

W: Max. steam flow rate [kg/h]

Q: Max. gas flow rate [m³/h (standard condition)]

V: Max. liquid flow rate [m³/h]

P₁: Inlet pressure [MPa·A]

P₂: Outlet pressure [MPa·A]

ΔP: P₁ – P₂ [MPa]

K: 1 + 0.0013 × {superheated steam temp.[°C]
– saturated steam temp. [°C]}

G: Specific gravity (for gas, relative to air
/for liquid, relative to water)

■ Cv value

| Model | Cv value |
|--------|----------|
| DD-2 | 1.7 |
| DD-3 | |
| DD-2-8 | 0.55 |
| DD-3-8 | |

7. Installation

7.1 Precaution for installation



Warning

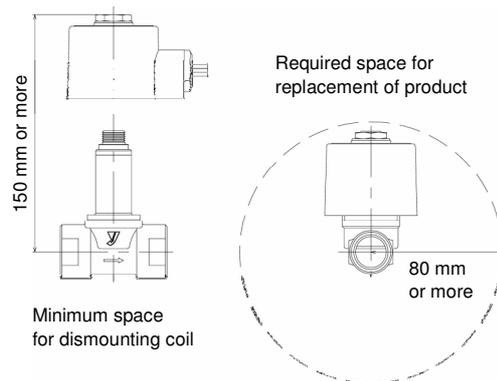
Electric wiring work must be performed by a professional.

1. When there is a risk of having life hazard, harming a body or property by the malfunction of the product, please install the safety device which operates interception, opening, warnings according to each facility.
2. The product cannot be used as an emergency shutoff valve.
 - * The product is not designed as a safety valve such as an emergency shutoff valve. If the product is applied to a system that needs safety measures, install other equipment besides the product to ensure the safety.
3. The product is not explosion-proof. Do not use it in the area or ambience where explosive gases accumulate.
 - * Doing so may cause fire.
4. Connect the cables only after confirming that no power is supplied.
 - * Failure to do so may cause an electric shock.
5. Connect the cables according to the instruction after confirming the rated voltage.
 - * Erroneous cable connection may cause an electric shock or fire.
6. Do not supply electric power to the coil while it is detached from the valve.
 - * Doing so may result in coil burnout or fire due to an overcurrent.

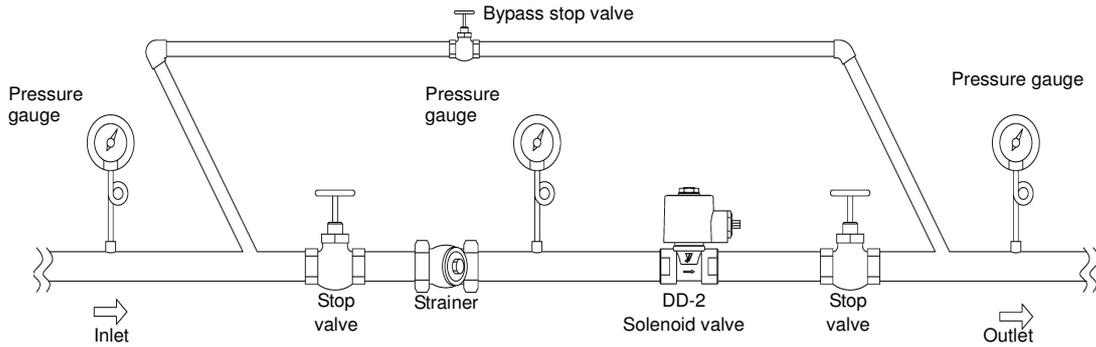


Caution

1. Vertical or horizontal installation is possible including the intermediates between vertical and horizontal positions, however, do not install it upside-down.
 - * Failure to do so may result in an abnormal operation.
2. Before connecting piping to the product, remove foreign substances, dirt, etc. inside of the piping by flushing.
 - * Failure to do so may prevent the product from functioning correctly.
3. Match the fluid flow direction with the inlet and outlet of the product to ensure proper installation.
 - * Failure to do so may prevent the product from functioning correctly. (The valve will not close.)
4. Make sure to connect a strainer (80-100 mesh) to the inlet of the product.
 - * Failure to do so may prevent the product from functioning correctly.
5. Do not apply excessive load, torque or vibration to the product.
 - * Doing so may result in drastically shortened service life.
6. Secure the space required for disassembly or removal at maintenance or inspections.
 - * Failure to do so prevents maintenance or inspections being implemented.
7. Do not get the product wet.
 - * Failure to do so may result in an electric leakage.
8. Do not apply insulation to the solenoid coil.
 - * Doing so may cause an abnormal operation.
9. When the product is used in a facility which cannot stop operating, install a bypass line with a bypass stop valve.
 - * Use the bypass line while troubleshooting or disassembling the product so that the facility can keep operating.
10. Before piping, remove foreign substances and note that seal materials must not flow into the inside of the product and piping.
 - * Foreign substances may cause valve seat leakage and malfunction.
11. 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.
 - * Failure to do so may cause the backflow even during the solenoid valve is closed.
12. If the product is used in a steam line and negative pressure generates at its outlet side when it is closed, install a vacuum breaker at the outlet side.
13. When using the product in a steam line, install a steam trap in the line.
 - * Failure to do so may cause condensate-induced problems.
14. When the product is used in a steam line, install it in such a way that avoids condensate accumulation at the inlet side.
 - * Failure to do so may result in malfunction.
15. In case of a possible frozen line, take proper measures to remove water inside the piping or equip the product with insulating materials.
 - * Freezing may damage the product. Do not insulate the coil.
16. When installing the product in the piping, do not grip and turn the coil or turn it with a tool.
 - * Doing so may damage the coil.
17. Do not pull the lead wires or hold the wire to lift and carry the product.
 - * Doing so may damage the coil.
18. Make the lead wires connected to the coil long enough so that the coil is easily dismantled or replaced when required.
19. Band and support the lead wires connected to the coil to avoid their contact with workers or other equipment and to avoid subjecting the wires to its own weight and tension.

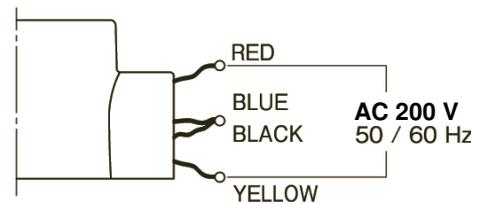
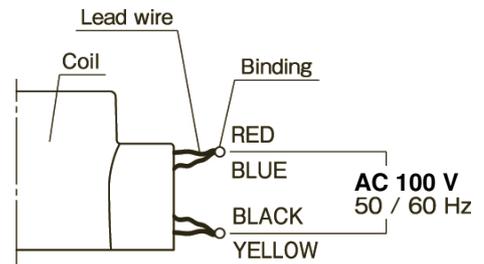
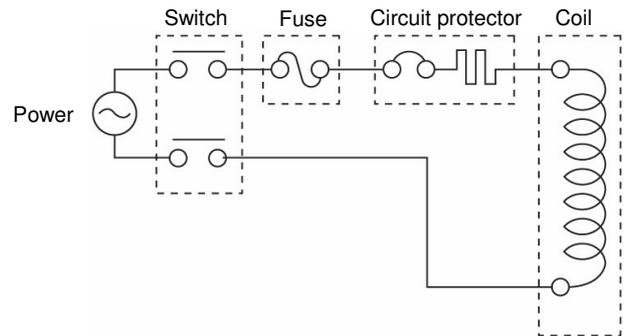


7.2 Piping example



7.3 Wiring method

1. Wiring differs according to voltage, AC 100 V or 200 V. Wire the coil according to the instruction on the label attached to the coil.
2. In order to prevent disconnection or insulation failure, avoid unnecessarily pulling the lead wires or subjecting them to excessive load while wiring or use.
3. Use electric wires which have a core of 0.75 mm² or more.
4. Use a fuse (3A) to protect the electric circuit.
Use a circuit protector as follows if the product is used in a fuel supply system.
 - Rated voltage 100 V: 0.5 A circuit protector
 - Rated voltage 200 V: 0.3 A circuit protector
5. When using a terminal box, do not turn it to change its posture.
* Doing so may cause disconnection or insulation failure.



8. Operating Procedure

8.1 Precaution for operating procedure



Warning

1. Do not touch the product with bare hands in case of high-temperature fluid.
 - * Doing so may result in burns.
 - * The coil becomes hot while it is continuously energized even in normal operation.
2. Before leading fluid, make sure that there is no danger when the fluid flows to the end of piping.
 - * The fluid outflow may cause physical damage.
 - * The hot fluid, if spouted out, may scald your skin.



Caution

1. When the product is newly installed or after the product is not used for a long time, perform test working before starting operation.
 2. Completely discharge the fluid inside of the product and line before leaving the product not operated for a long time.
 - * Failure to do so may cause malfunction due to rust inside of the product and line, or result in damaged due to freezing.
 3. Sudden application of pressure to the product may open the valve instantly and cause leakage.
1. When the product is used with AC voltage, it may produce a buzzing sound depending on the conditions of use.

8.2 Test working

Before performing test working, be sure to close the stop valves installed at both the inlet and outlet sides of the product and remove foreign substances and scale completely by flushing the bypass line.

1. Before leading fluid into the product, switch it on and off a few times and confirm the sound caused by the plunger when the coil turns on.
2. Fully open the stop valve at the outlet side.
3. With the product at open condition, open the stop valve at the inlet side gradually and confirm the fluid flows to the end of piping.
4. Gradually close the stop valve at the outlet side, and confirm the fluid does not leak from connection parts of the product or piping.
5. With the product at closed condition, fully open the stop valves at both the inlet and outlet side.
6. Switch on and off the product a few times to confirm it operates correctly.
7. With the product at closed condition, confirm there is no leakage at the end of the piping.

In case of any abnormal condition observed during test working, refer to “9.3 Troubleshooting” to take proper measures and treatment.

9. Maintenance

Since most of the troubles with the product are caused by foreign substances inside of the piping, care should be taken. Note that any repairs caused by foreign substances or scales are subject to a charge even during the warranty period.

9.1 Precaution for maintenance

Warning

Disassembling and inspections must be performed by a professional or a valve manufacturer.

1. Confirm that no power is supplied before disassembling or maintenance.
 - * Failure to do so may cause an electric shock.
2. Completely discharge the pressure inside of the product, line and equipment before disassembling or maintenance and cool down the product till it can be touched with bare hands in the case of high-temperature fluid.
 - * Failure to do so may result in injury or burns due to residual pressure.
3. Do not supply electric power to the coil while it is detached from the valve.
 - * Doing so may result in coil burnout or fire due to an overcurrent.

Caution

1. Conduct daily/periodic inspections in order to maintain the optimal performance of the product.
2. Be careful not to drop the product at the time of disassembling, and put the disassembled parts on soft cloth to avoid scratch and damage.
 - * Damage on the product or parts may cause malfunction and affect the optimal performance.
3. When replacing parts, make sure the replacement parts are supplied by Yoshitake. And do not make any alteration to the product.
 - * Using any part supplied by other than Yoshitake or making any alteration may cause damage to the product or may result in injury or scalds due to blow-off or malfunction.
4. In the event of failure, close the stop valves and turn off the power before inspection.
5. When any defect is found on the product during the daily/periodic inspections, be sure to contact a professional and follow its instructions.
6. Be sure to replace the gasket with new one at the time of re-assembling.
 - * Failure to do so may result in external leakage.
7. After disassembling and re-assembling, perform test working before starting operation again.
8. While disassembling, the fluid leaks from inside of the product. Set a container to collect the fluid. Completely discharge the fluid inside of the product prior to disassembly.

9.2 Daily and periodic inspections

Conduct daily and periodic inspection/replacement in order to maintain the optimal performance of the product.

- Daily inspection (to be conducted once every operational day.)

| Item | How to inspect | Trouble and remedy | |
|--------------------|--|--|----------------------------|
| Working conditions | Check that the valve opens when switched on, and closes when switched off, using a pressure gauge. | The valve does not open. (Fluid does not flow.) | See "9.3 Troubleshooting." |
| | | The valve does not close. (Fluid flow does not stop.) | |
| External leakage | Inspect the product visually. | See "9.3 Troubleshooting." | |

- Periodic inspection (to be conducted once every year.)

| Item | How to inspect | Trouble and remedy |
|--|---|---|
| Seal seat surfaces of the body | Disassemble the product and visually inspect these parts. | If seal seat surface of the body is damaged, replace the product. |
| Seal seat surface and sliding surface of the plunger | Disassemble the product and visually inspect these parts. | If seal seat surface or sliding surface is damaged, replace the plunger assembly. |

9.3 Troubleshooting

| Trouble | Cause | Remedy |
|---|---|--|
| Valve does not open. (Fluid does not flow.) | 1. Strainer installed at the inlet side of the product is clogged. | 1. Clean the strainer. |
| | 2. Plunger a'ssy is stuck with foreign substances in the piping. | 2. Disassemble the product and remove foreign substances. Make sure that the sliding action is smooth. |
| | 3. Fluid pressure exceeds the specified working pressure. | 3. Adjust the fluid pressure to the specified range or replace the product with a proper model. |
| | 4. Fluid viscosity exceeds 20 cSt. | 4. Adjust the fluid viscosity to the specified range. |
| | 5. No electric conduction. (Trouble with electric circuit) | 5. Check the power supply and voltage. |
| | 6. Coil is not wired properly for the applied voltage. | 6. Wire the coil properly for the applied voltage. If the trouble still exists, replace the coil with new one. |
| | 7. Voltage is fluctuating widely. | 7. Adjust the electric circuit to regulate the voltage within the allowable fluctuation. |
| | 8. Coil specifications do not match with the applied voltage. | 8. Replace the coil with new one proper for the applied voltage. |
| | 9. Coil is burnt out because of overcurrent. | 9. Replace the coil with new one. |
| Valve does not close. (Fluid does not stop flowing.) | 1. Electricity is kept conducted. | 1. Check the power supply. |
| | 2. Plunger a'ssy is stuck with foreign substances or get damaged. | 2. Disassemble the product and remove foreign substances. Replace the parts with new ones if any damage is observed. |
| | 3. Plunger a'ssy is stuck with foreign substances in the piping. | 3. Disassemble the product and remove foreign substances. Make sure that the sliding action is smooth. |
| | 4. Inlet/outlet of the product is installed oppositely to the fluid flow. | 4. Reinstall the product correctly. |
| | 5. Bypass stop valve is kept open. | 5. Close the bypass stop valve. |
| The product vibrates. | 1. There is a constricted part of piping just in front of the inlet of the product. | 1. Install the product in another configuration or change the position of the constricted part. |
| | 2. Gas is mixed in the liquid. (If the applied fluid is liquid.) | 2. Change the piping including equipment, or install the product in another position. |
| Abnormal sound is detected. | 1. Hexagon nut clamping the coil is loosened. | 1. Retighten the nut with the specified torque. |
| | 2. Foreign substances exist on the internal surface of the pipe or at the top surface of plunger a'ssy. | 2. Disassemble the product and remove the foreign substances. |
| | 3. Fluid pressure exceeds the specified working pressure. | 3. Adjust the fluid pressure to the specified range or replace the product with a proper model. |
| | 4. Voltage applied to the coil is not proper. | 4. Check the voltage. |
| External leakage is observed. | 1. Cover gasket is damaged. | 1. Replace it with a new one. |
| | 2. Pipe is loosened. | 2. Retighten it with the specified torque. |

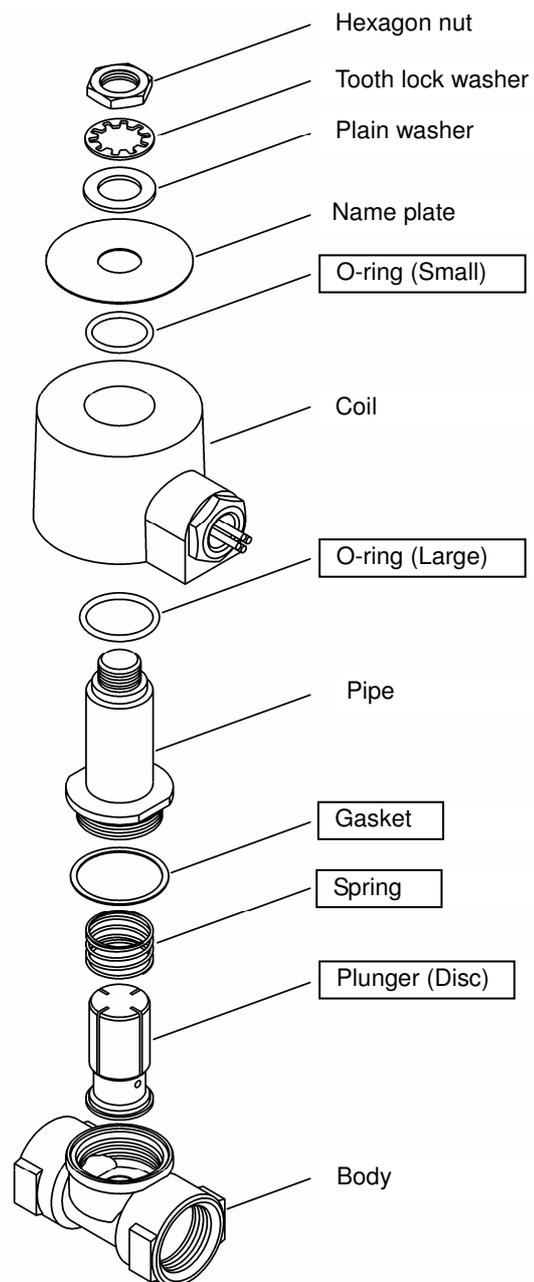
9.4 Disassembly and reassembly (See “Exploded drawing” below.)

Warning

1. Confirm that no power is supplied before disassembling.
* Failure to do so may cause an electric shock.
2. Completely discharge the pressure inside of the product, line and equipment before disassembling or maintenance, and cool down the product till it can be touched with bare hands in the case of high-temperature fluid.
* Failure to do so may result in injury or burns due to residual pressure.

■ Exploded drawing

- (1) Loosen Hexagon nut (M14) and remove Tooth lock washer, Plain washer, Name plate and O-ring (Small), and then dismount Coil.
- (2) Remove Pipe with a spanner (32 mm width across flat).
- (3) Remove Plunger.
- (4) Reassemble the product in the reverse order of disassembling.
- (5) Tighten Pipe with the torque of 50 N•m, and Hexagon nut with that of 15 N•m.



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