SM－50639－A

CKD

Technical Manual

2 PORT MOTOR VALVE
Non-Oil Type

MXB1-10～50－N

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

Introduction

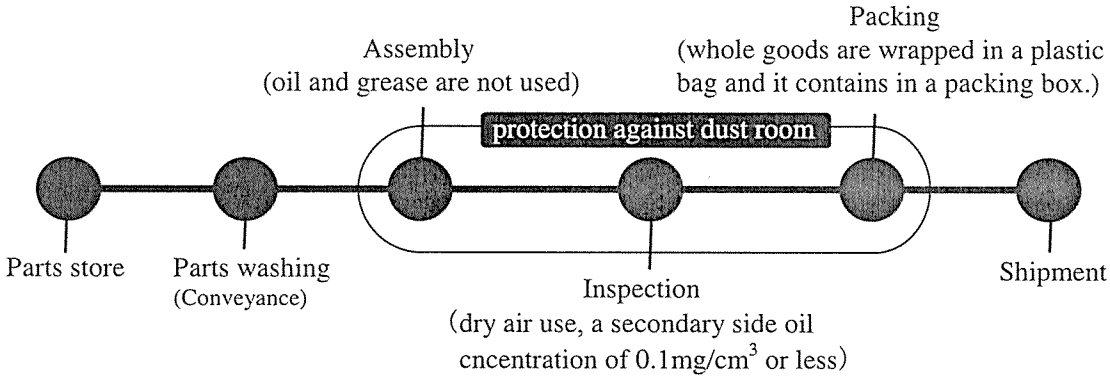
Thank you for choosing CKD's type MXB1-N (non-oil type) motor valve.

1. Description

A motor-driven non-oil ball valve used for general industrial machines and equipments.

2. Intended use

- This valve is suitably used for an automatic or central control system for pipelines conveying service pure water or N_2 gas etc.
- However, when you wear internal parts out at the time of a valve operation, keep in mind that wear power may be generated and it may flow into a secondary side.
- In CKD, in order to realize a high oil-less level, the following assembly organization is prepared.
- Be carefull of the handling of a product enough.



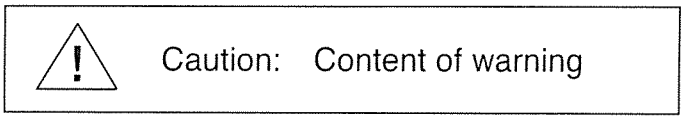
3. General precautions

- This operation manual describes the basic matters concerning the handling of the product, including unpackaging, installation, use, and maintenance.
- The description about the installation in this manual is intended for qualified mechanicians and electricians. This should be thoroughly read before designing and installation to ensure the safety of the machine or tool and the proper handling of this product.

4. Safety precautions

- Warnings are shown in this manual as required to avoid injury, fire, and damage to your properties. They must be strictly observed.
- Warnings should be shown under different headings, i.e. Danger, Warning, and Caution, according to the degree of risk. However, they are all shown under the heading of Caution in this manual because this product is used as a component of a machine or tool.

Example of warning



【 Contents 】

1. Unpackaging

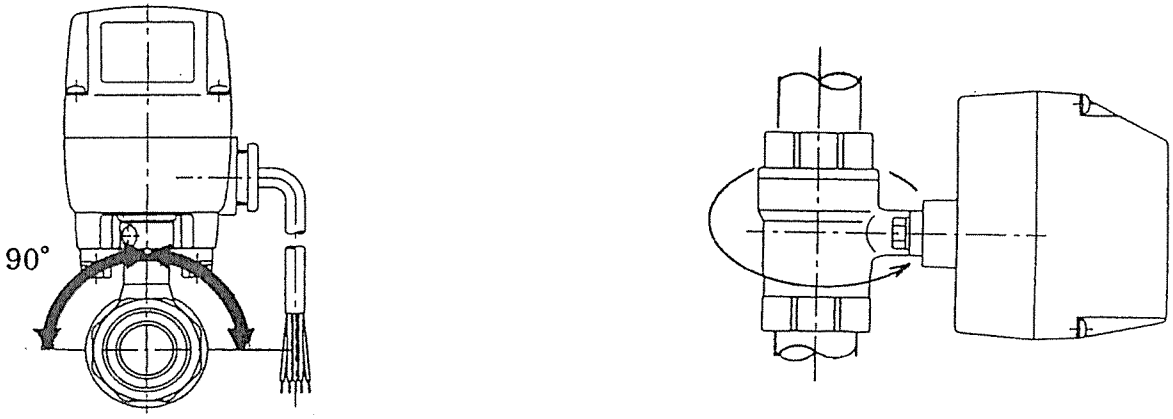
- Check that the model No. indicated on the nameplate of the product is the same with that you ordered.
- Check that the rated voltage and frequency are satisfied.
- Check that the product is free of external damage.
- When the product is not used, put a seal plug in place to prevent foreign matter from entering the valve. Remove the seal plug before piping the valve.

2. Installation

2.1 Conditions for installation

2.1.1 Attitude of the valve

- The valve shall be installed at an angle within +/-90 degrees with the actuator facing upward (see Figure 1).

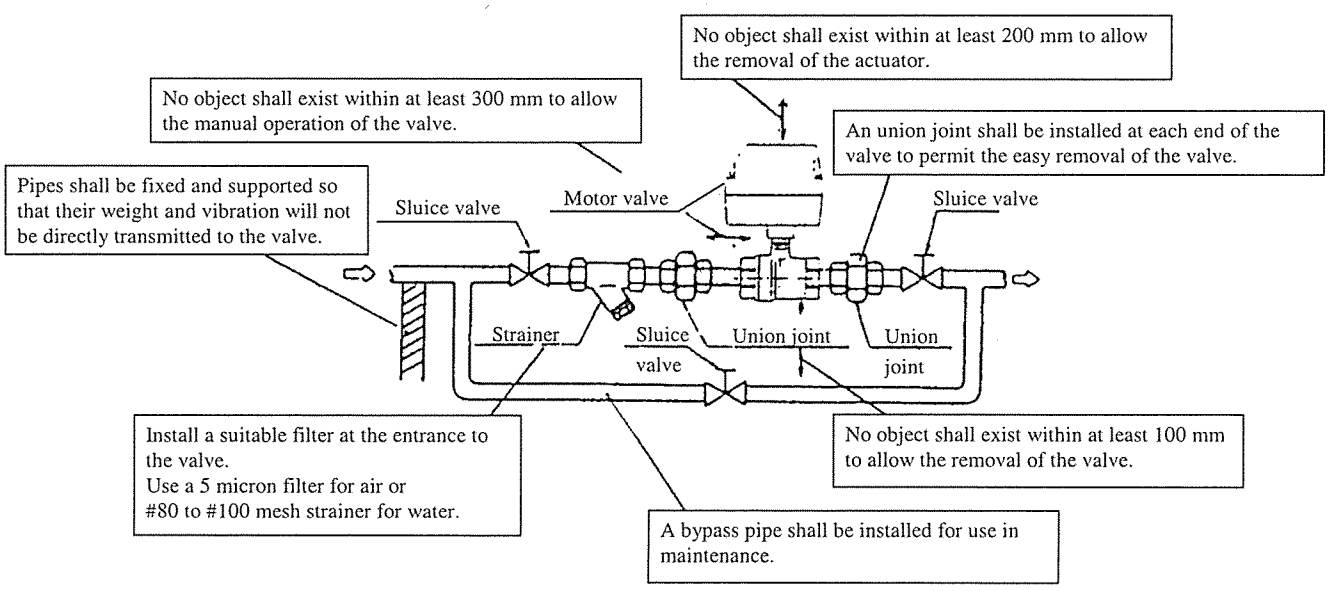


<For horizontal piping> <For vertical piping>

(Figure 1 Attitude of the valve)

2.1.2 Space for maintenance

- An adequate space shall be provided to ensure the operator's safety in maintenance and troubleshooting work (see Figure 2).



(Figure 2 Piping model)

2.1.3 Protection of the product

- When the product is used outdoor or in a cold district, it shall be properly protected against freezing temperatures.
- When it is used for a machine or tool to be cleaned with a water jet (hose), it shall be covered or housed so that no water will enter it.

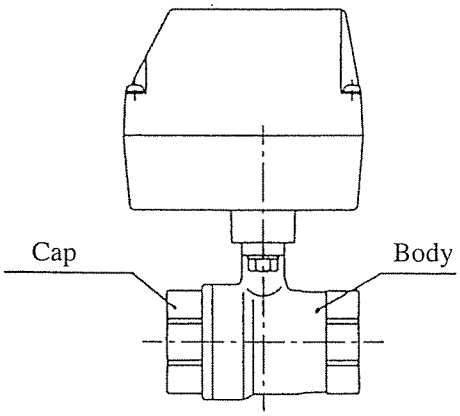
  This product is dust- and water-proof as specified by IPX3, IEC-529 standard.

2.2 Piping work

- There is no specification concerning the fluid flowing direction to be considered in piping this product.
- When piping to the cap side, screw in a pipe with the cap held with a wrench or another tool.
- When piping to the body side, screw in a pipe with the body held with a wrench or another tool.
- For the torque used for tightening pipes, see Table 1.

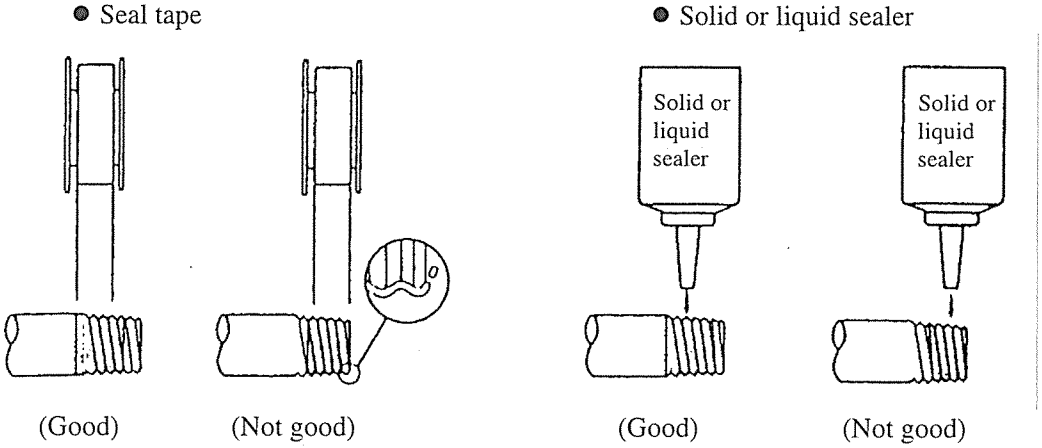
Table 1 Recommended pipe tightening torque

Nominal pipe diameter	Recommended pipe tightening torque
Rc3/8	31 to 33 [N·m] ±10%
Rc1/2	41 to 43 [N·m] ±10%
Rc3/4	62 to 65 [N·m] ±10%
Rc1	83 to 86 [N·m] ±10%
Rc1 1/4	97 to 100 [N·m] ±10%
Rc1 1/2	104 to 108 [N·m] ±10%
Rc2	132 to 136 [N·m] ±10%



(Figure 3 Outside view)

- Before piping, check that pipes are free of sticking foreign matter, swarf, and burrs.
  If necessary, deburr or clean the inside of each pipe using compressed air at 0.3 MPa or higher.
- When using sealer, special care is required to prevent it from entering the pipe or leaking outside.
  When seal-taping the threaded portion, two or three threads from the end of the threaded portion shall remain exposed (see Figure 4).
  When using liquid sealer, do not apply it excessively. Two or three thread from the end of the threaded portion shall remain exposed.
  Do not apply liquid sealer to internal threads on the machine.



(Figure 4)

2.3 Piping work

> **Caution:** The valve shall be correctly connected with a power supply according to the motor valve wiring diagram (shown on the product).
> A wrong connection may short the circuit.

- When connecting two or more motor valves, separate contacts shall be used for each of them (see Figure 5).

(Good) (Not good)

(Figure 5 Connecting two or more motor valves)

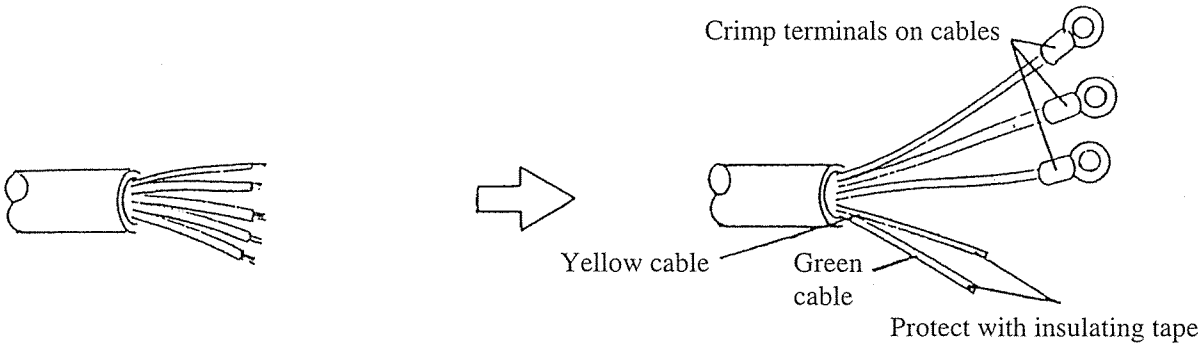
- When connecting the motor valve with another device, separate contacts shall be used for each of them (see Figure 6).

(Good) (Not good)

(Figure 6 Connecting motor valve with another device)

- Leads shall be fixed with wire bands or such so that no tensile force will be applied to them. Where wires may be damaged, they should be passed through conduits or otherwise protected for safety.

- When the yellow and green cables are not used for checking signals, cut away exposed wires and adequately protect the cables using insulating tape (see Figure 7).



(Figure 7 Terminating cables)

- Also see the circuit diagram and the description of operating mechanism in page 13.
- The operation time required for opening and closing the valve is shown in Table 2-1.
  When the valve is withdrawn from service for a day or longer, the initial operation time may be one to five seconds longer.

Table 2-1 Operation time

Nominal pipe diameter	AC models (50 Hz/60 Hz)	DC models
10 - 25 A	5/6 seconds	8 seconds
32 - 50 A	11/10 seconds	10.5 seconds

- The valve opening/closing signals shall be turned on/off after the valve completes a movement.

3. Checking before use (after installation)

3.1 Appearance check

> **Caution:** Stop the fluid supply (close the supply valve) and power off the system.

- Check by pushing with hand that the ball valve body is firmly fixed to each pipe.
- Check that the hexagonal bolt and other fittings are not loose.

3.2 Electrical check

> **Caution:** Power off the system.

- Check that the valve is correctly wired as indicated by the motor valve wiring diagram shown on the product.
- Check the dielectric resistance.
  Check the dielectric resistance between the ball valve body and the charger (see Table 3-1).

Table 3-1 Dielectric resistance

Voltage used	Measuring instrument	Dielectric resistance
AC voltage	1000 VDC Megger	100 Mohms or higher
DC voltage	500 VDC Megger	100 Mohms or higher

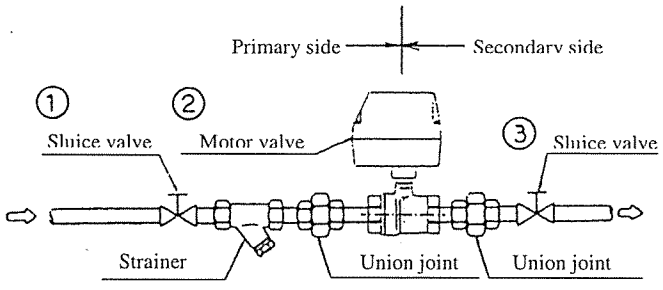
3.3 Leak check

- Power on the system.
- Compress the fluid and check the connections for leak.
  For leak check, it is recommended to apply soapy water to the connections and check for air bubbles while supplying compressed air at 0.3 to 0.5 MPa.

<Procedure:>

a) Close motor valve ② and open sluice valves ① and ③ in this order.
   No fluid shall leak outside or into the secondary side.

b) Close sluice valve ③ with sluice valve ① left open.
   Open motor valve ②.
   No fluid shall leak outside.



(Figure 8 Piping diagram)

4. For correct use

> ⚠ Caution: Never remove the bonnet.
> If you touch an internal electric part, you may have an electric shock.

- For the operation time required for opening/closing the valve, see Table 2-1 in page 6.
  When the valve is withdrawn from service for a day or longer, the initial operation time may be one to five seconds longer.
- If the valve does not complete a movement when the operation time shown in Table 2-1 is elapsed, the following failures are suspected.
  ① Valve being locked due to entangled foreign matter
  ② Disorder of an electric part
  See section 7 'Troubleshooting.'
- Do not apply an external force exceeding 0.5 N-m to the actuator.
- If any unusual condition is found, see section 7 'Troubleshooting.'
- The voltage variation shall not exceed ±10% of the rated voltage.
- Observe the operating frequency (see Table 4-1).

Table 4-1 Operating frequency

Nominal pipe diameter	AC models	DC models
10A - 25 A	2 cycles/minute or less	1 cycle/minute or less
32A - 50 A	1 cycle/minute or less	0.5 cycle/minute or less

- The valve shall be operated through the entire stroke from the fully closed position to the fully open position or vice versa.
  If the valve is used at an intermediate position, it may cause a malfunction and/or internal leak.
- In case of power failure, the valve is kept as it was before the power failure.
  Operate the sluice valves shown in the piping model in page 3 (Figure 2) or manually operate the valve as described in page 10.

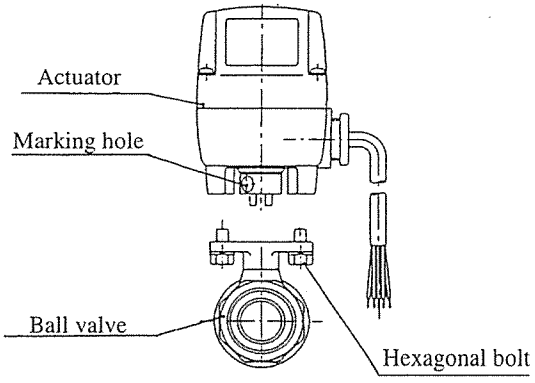
5. Overhaul and assembly

5.1 Replacement of the actuator

5.1.1 Overhaul procedure

> ⚠ Caution: Power off the system and stop the fluid supply before overhauling.

- Disconnect cables.
- Loosen the hexagonal bolt using a wrench.
- Raise the actuator to separate it from the ball valve body.



(Figure 9)

5.1.2 Assembly procedure

- Align the fully open and closed positions of the ball valve body with the marking hole on a new actuator.
- Tighten the hexagonal bolt to a torque between 5 and 7.5 N-m.
- Crimp terminals on leads.
- Wire the valve according to the wiring diagram.
- Check the dielectric resistance between the ball valve body and charger.
  For AC models, 100 Mohms or higher as measured with a 1000 VDC Megger.
  For DC models, 100 Mohms or higher as measures with a 500 VDC Megger.
- Power on the system to make the fluid circuit ready for use.

5.2 Replacement of the ball valve

5.2.1 Overhaul procedure

⚠ Caution:	Power off the system and stop the fluid supply before overhauling.

- Loosen the hexagonal bolt and separate the actuator. At this time, no tensile force shall be applied to any lead.
- Loosen the pipes to the ball valve.

5.2.2 Assembly procedure

- Pipe a new ball valve.
  Pipe the cap side with the cap held with a wrench and pipe the body side with the body held with a wrench.
- Assemble the actuator to the ball valve.
  Tighten the hexagonal bolt to a torque between 5 and 7.5 N-m.
- Apply a fluid pressure to check that the fluid is not leaking outside.
- Power on the system to make the fluid circuit ready for use.

6. Maintenance

6.1 Maintenance and inspection

- To maintain an efficient operation of this product, it should be checked on a regular basis (usually every six months).
- For the inspection items, see section 3 'Checking before use.'

6.2 Service parts

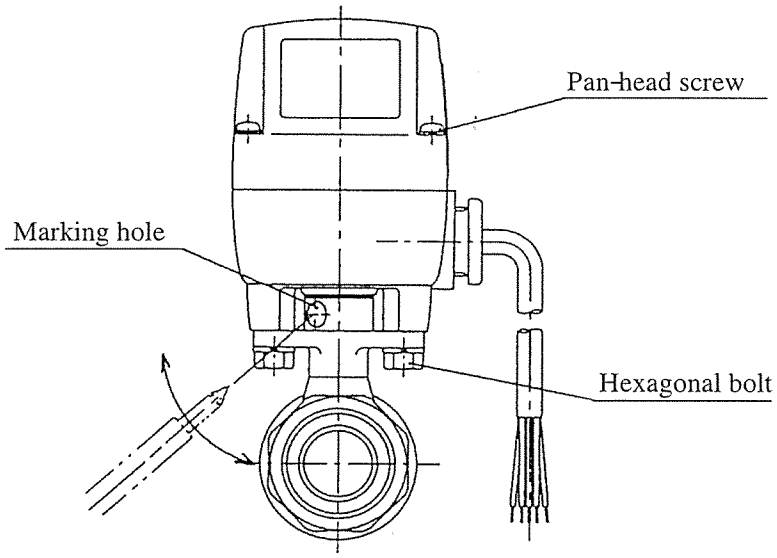
- Actuator
  It shall be replaced if it is found to have an electrical failure or unusual condition. As a guideline, it needs replacement every 100 thousand cycles.
- Ball valve body
  It shall be replaced if it is found to leak or stick during the use. As a guideline, it needs replacement every 50 thousand cycles.

7. Troubleshooting

- Manually operate the valve in case of power failure or malfunction.
- Manual operation procedure

⚠ Caution:	The valve for pipes with nominal diameters of Rc1 1/4 or larger cannot be manually operated except when optionally equipped for manual operation. If it is manually operated, the motor gear inside the actuator may be damaged. This procedure applies to the models that are optionally equipped for manual operation.

- Power off the system.
- Insert the edge of a cross-ended screw driver (type H2, No. 2) to the marking hole. Apply a gradually increasing force and slowly turn.
  Rotate from S to O or vice versa within about 20 seconds.



(Figure 10 Outside view)

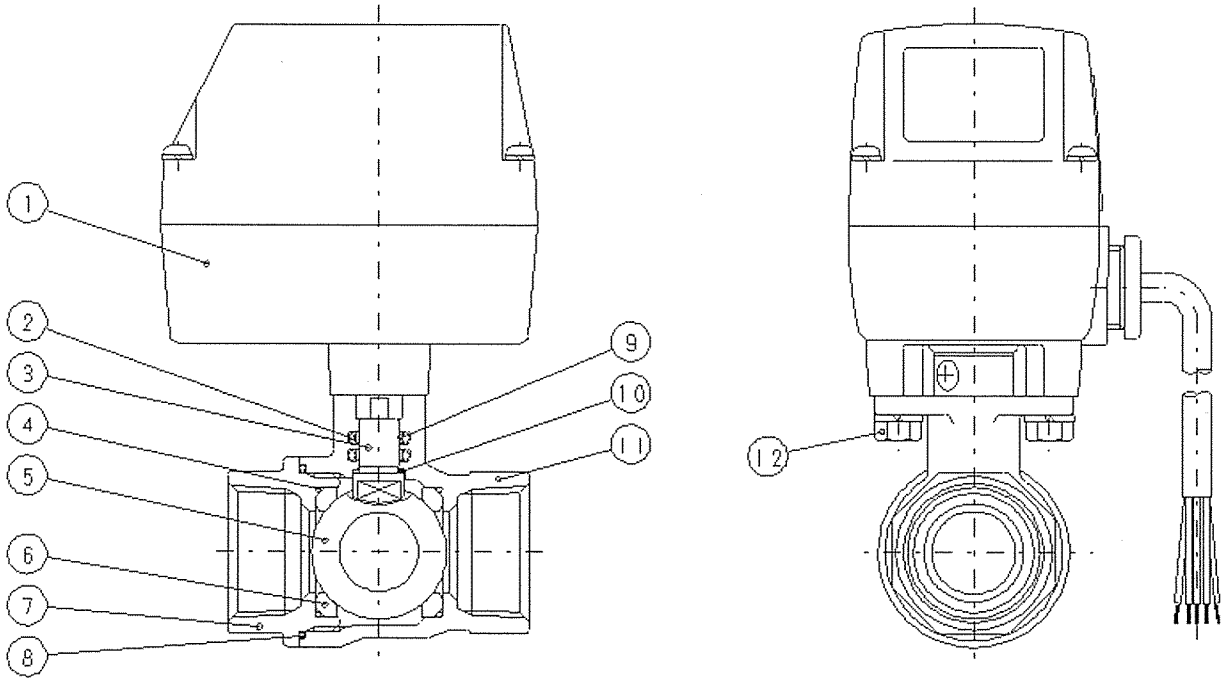
- When the motor valve does not operate as intended, check it according to the following table.

Table 7-1 Troubleshooting

Symptom	Cause	Action
Valve does not operate.	Valve is not energized.	Check wiring and fuses and turn on power again.
	Rated voltage is not reached.	Check power supply and apply rated voltage.
	Foreign matter is entangled within ball valve.	Overhaul and clean valve or replace ball valve.
	Valve seat sticks.	
	Both opening and closing signals have turned on.	Check switch and relays.
	Actuator is faulty.	Replace actuator.
Valve operates but not properly. (Actuator vibrates or stops halfway.)	Two or more valves are operated in parallel.	Use separate relays and contacts for each signal circuit.
	Valve operates in a reverse way.	Opening and closing wires are reversely connected. Correct wiring.
	Foreign matter is entangled within ball valve.	Overhaul and clean valve or replace ball valve.
	Valve seat sticks.	
Motor operates but valve does not.	Gear head is damaged or has reached the end of its life.	Overhaul and clean valve. Replace actuator if no unusual condition is observed within valve. If both are faulty, replace the whole product with a new one.
Valve leaks.	Foreign matter is entangled within ball valve.	Replace ball valve.
	Valve seat is worn.	
	Valve is energized too shortly to be fully closed.	Extend operation time over the level shown in Table 2-1.

- If you have any questions, contact us or one of our agents.

8. Internal construction



(Figure 11)

Table 8-1 Part list

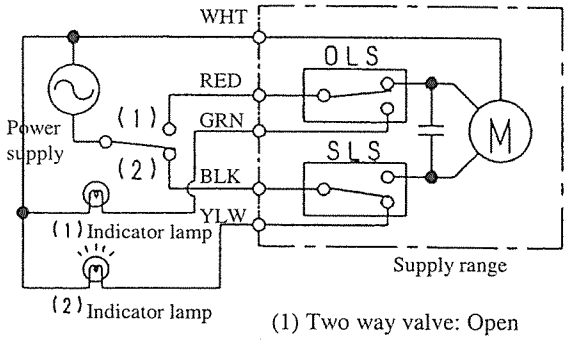
Part No.	Part name	Quantity	Note
1	Actuator	1	
2	O ring	2	FKM
3	Shaft	1	SUS
4	O ring	2	FKM
5	Valve ball	1	SUS
6	Valve seat	2	PTFE
7	Cap	1	SUS
8	O ring	1	FKM
9	Seal ring	2	PE
10	Spacer	1	PTFE
11	Body	1	SUS
12	Hexagonal bolt	2	

9. Circuit diagrams and description of operational mechanism

9.1 Circuit diagrams

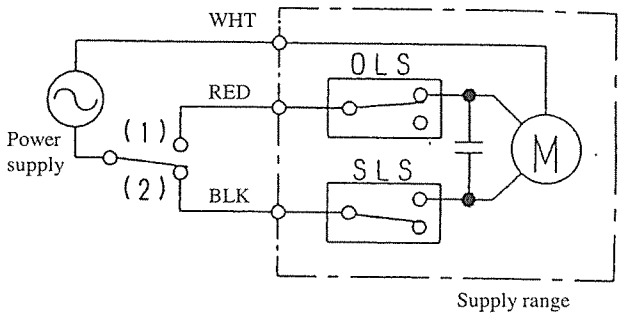
9.1.1 AC models

● Standard type



(1) Two way valve: Open
(2) Two way valve: Closed

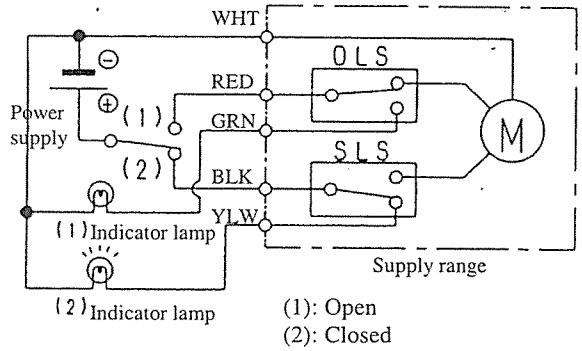
● Optional (3-wire cable)



(1) Two way valve: Open
(2) Two way valve: Closed

(Figure 12)

9.1.2 DC models



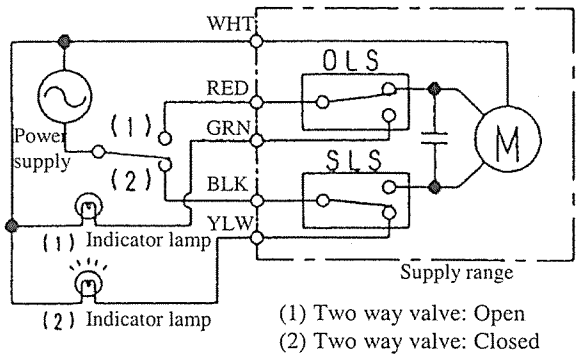
(1): Open
(2): Closed

(Figure 13)

9.2 Description of operational mechanism

9.2.1 Standard type (including option B)

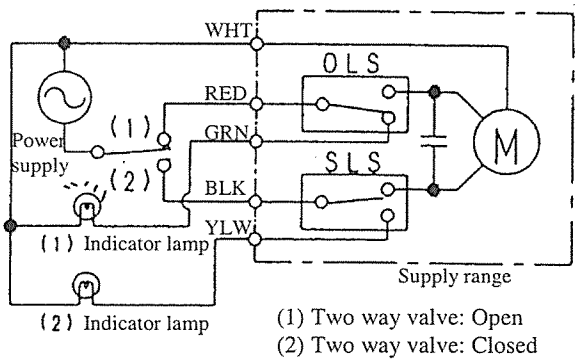
(1) Opening movement
(fully closed to fully open position)



(Figure 14 When valve completes closing movement)

If the operating switch is set to position (1) when the circuit is as shown in Figure 15, a current is applied between white and red leads.
Then, the motor starts revolving and the output shaft rotates counterclockwise as viewed from the top face of the actuator toward the valve.
As the valve is fully opened, the OLS contacts open to stop the motor and light the OPEN lamp.
Connecting a relay or equivalent instead of the OPEN lamp will move another device.
(see Figure 15.)

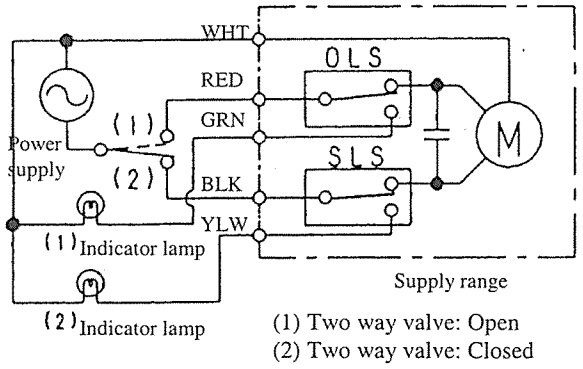
(2) Closing movement
(from fully open to fully closed position)



(Figure 15 When valve completes opening movement)

If the operating switch is set to position (2) when the circuit is as shown in Figure 16, a current is applied between white and black leads.
Then, the motor starts revolving and the output shaft rotates clockwise as viewed from the top face of the actuator toward the valve.
As the valve is fully closed, the SLS contacts open to stop the motor and light the CLOSED lamp.
Connecting a relay or equivalent instead of the CLOSED lamp will move another device.
(See Figure 14.)

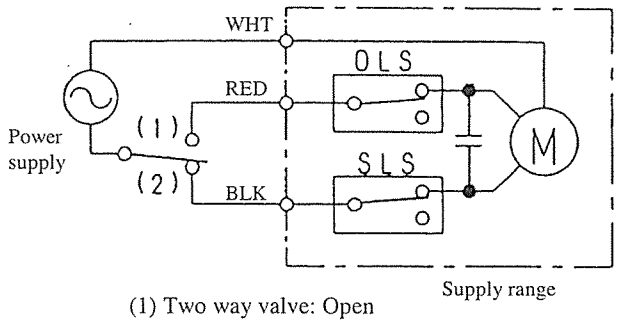
(3) During opening/closing movement



(Figure 16 During opening/closing movement)

During the movement described in (1) or (2), the circuit is as shown to the left and the output shaft rotates in either direction according to the position of the operating switch.
It should be noted, however, that operating the valve in a reverse way before it completes another movement may damage the valve and should be avoided.
(See Figure 16.)

9.2.2 Option T (3-wire cable)



(1) Two way valve: Open
(2) Two way valve: Closed

(Figure 17)

(1) Opening movement
(fully closed to fully open position)
If the operating switch is set to position (1) to apply a current between white and read leads, the motor starts revolving. As the valve is fully opened, the cam opens the OLS contacts to stop the motor.

(2) Closing movement
(from fully open to fully closed position)
If the operating switch is set to position (2) to apply a current between white and black leads, the motor starts revolving. As the valve is fully closed, the cam opens the SLS contacts to stop the motor.

9.2.3 Option L (w/OPEN lamp)

The OPEN lamp shown in Figure 14 is contained in the terminal box to light when the opening movement (from fully closed to fully open position) of (1) is completed. This lamp does not light during the movement. (The wiring circuit for this lamp is the same as for option T.)

9.2.4 Option R (w/CLOSED lamp)

The CLOSED lamp shown in Figure 15 is contained in the terminal box to light when the closing movement (from fully open to fully closed position) of (2) is completed. This lamp does not light during the movement. (The wiring circuit for this lamp is the same as for option T.)

10. Specifications for the product

10.1 Model numbering system

MXB1 - 32 - N B M - 1

- 32 — ① Inside diameter of connector port
- N — ② Materials of body and sheet
- B — ③ Optional equipment
- M — ④ Manual operating device
- 1 — ⑤ Voltage

① Inside diameter of connector port

Symbol	Meaning
10	Rc3/8
15	Rc1/2
20	Rc3/4
25	Rc1
32	Rc1 1/4
40	Rc1 1/2
50	Rc2

② Materials of body and sheet

Symbol	Meaning		
	Body	Sheet	
N	Stainless steel	PTEE	Oil-less type

Note 1: The ones with manual operating device are offered with connector port diameters of 32, 40, or 50.

③ Optional equipment

Symbol	Meaning
No symbol	5-wire cable (w/signal pick-up)
T	3-wire cable
B	W/terminal box
L	W/lamp (lights when valve is open)
R	W/lamp (lights when valve is closed)

④ Manual

Symbol	Meaning
No symbol	W/o manual operating device (standard)
M	W/manual operating device

⑤ Voltage

Symbol	Meaning
1	100 VAC (50/60 Hz)
2	200 VAC (50/60 Hz)
3	24 VDC
4	12 VDC

10.2 Specifications for the product

Table 10-1 Specifications for the product

Designation		MXB1-10	MXB1-15	MXB1-20	MXB1-25	MXB1-32	MXB1-40	MXB1-50
Withstanding pressure MPa		2 (water pressure)						
Fluid used		Cold/hot water, air, or oil (500 mm^2/s or less)						
Fluid pressure MPa		0 to 1						0 to 0.5
Fluid temperature ℃		0 to 80 (No condensation allowed.)						
Ambient temperature ℃		-10 to 50						
Ambient humidity %		95 or less						
Power consumption W	AC	7				15		
	24VDC	16.8				26.4		
Operating frequency		2 cycles/minute or less (1 cycle/minute for DC models)				1 cycle/minute or less (0.5 cycle/minute for DC models)		
Permissible voltage variation		±10% of rated voltage						