

## CAUTIONS ON USE

### ● VALVES

- ① Install a solenoid valve so that the spool is positioned horizontally.
- ② The maximum flow of a solenoid valve varies depending on the model, the hydraulic circuit configuration, the operating conditions, and other factors.
- ③ Since a valve can malfunction if air enters it during installation, be sure to bleed the air before operating the valve.
- ④ A valve may fail to operate if the solenoid is kept energized or de-energized for a long time with pressure applied. If a valve is to be used for such an application, please consult us.
- ⑤ The no spring detent type (2WD-BcA) is used in applications where the spool position has to be held in the de-energized state.  
Where there is excessive vibration in T port back pressure, momentary flow, vibration and/or contamination, keep the valve energized to secure the spool position.
- ⑥ When operating the solenoid valve manually, push in the axial direction horizontally. Do not push with a sharp tool. If the internal diameter section where the manual pin slides is damaged, it will cause operation failure or external leakage.
- ⑦ Be sure to use mounting bolt of the strength of Class 12.9 or higher.
- ⑧ Tighten the valve mounting bolts to a tightening torque 6 to 8 N·m. Poor tightening will cause external leakage and excessive tightening will cause operation failure.

### ● ELECTRICITY

- ① When an AC double solenoid type is used, take care not to energize SOLa and SOLb simultaneously. The solenoid may burn.
- ② When a DC solenoid is used with a contact relay, generation of spark is restricted by the surge absorbing device incorporated in the terminal box. However, the relay deposition varies depending on the operating conditions (relay type and switching frequency).
- ③ The varistor voltage is 110 V for the DC type and 470 V for the AC type. If an SSR is used, check that the load voltage range of the SSR is not exceeded. Where a PLC is connected directly, select a type with the PLC output card or M12-4 pin connector type to protect the PLC output card.
- ④ When a diode is used to prevent generation of back electric force, it is advisable to use RH2F (Sanken Electric).
- ⑤ Use of the diode above is also recommended to prevent an indicator lamp from lighting erroneously when the power circuit is shut off by an emergency stop button, using a transistor output card.
- ⑥ Shut off the power supply before connecting cables.
- ⑦ A double-solenoid type valve is provided with a COM short-circuit jumper in the terminal base to facilitate wiring work. Connecting a cable to either of the power source common terminals allows the valve to be put into operation. When SOLa and SOLb do not use the COM, use after removing the COM short-circuit jumper from the terminal block.
- ⑧ The tightening torque specification of the terminal screws (M3) is 0.8 Nm  $\pm$ 10%.
- ⑨ The tightening torque specification of the self-tapping screws on the lid is 1 Nm  $\pm$ 10%.
- ⑩ Since a lamp is wired in parallel with a solenoid, it turns on regardless of the solenoid status when the power is supplied to the terminal block.
- ⑪ Do not apply a voltage other than that specified to the terminal block.
- ⑫ Since the coil surface becomes hot if a valve is used continuously, do not touch the coil directly by hand.
- ⑬ Use the cable type and size appropriate for the valve.
- ⑭ When connecting M12-4 pin type connector, tighten to 0.39 to 0.49 N·m.

### ● FLUID

- ① Use petroleum-base fluid (equivalent to ISO VG22, VG32, or VG46) in a temperature range from 0°C to 65°C. Using fluid outside the specified temperature range will cause operation failure. When replacing the fluid, always use fluid of the same brand.
- ② Maintain fluid cleanliness at a level better than oil contamination level ISO 11218 class 12 (NAS1638 Class 12). Use of contaminated fluid will shorten valve life and cause valve failure.
- ③ Take due care to ensure that no fluid of any other kind, coolant etc. enters the fluid being used.
- ④ Generally, standard specification solenoid valves can be used for water-glycol or fatty acid ester. However, it is advisable to check if the O-ring is compatible with the fluid to be used.

## ■ SPOOL TYPES AND REPRESENTATION

Spool type is classified as shown in the table below depending on the how the fluid flows in the valve when the spool is in the neutral position.

Category	Spool Type Representation	Symbol	Spool Position and Valve Passages (Spool in Neutral Position)	Function and Use
Spring Center Type	BCA			All ports are closed and there is no oil flow when the spool is in the neutral position. Due attention must be paid to leaks and surge pressure generated during switching. Due attention must be paid when the valve is used to hold the cylinder at the fixed position for a long time.
	BDA			This type of spool is used in applications where the pump is unloaded and the cylinder is floated when the spool is in the neutral position. Due attention must be paid since the cylinder may operate depending on the back pressure at the R port.
	BD1A			This type of spool is similar to the BDA type spool, but all ports are semi-opened when the spool is in the neutral position. Less shock is generated compared to the BCA type. Due attention must be paid since the cylinder may operate depending on the back pressure at the R-port.
	BGA			This type of spool is used to hold the P port pressure and float the cylinder when the spool is in the neutral position. This type is appropriate in a cylinder holding circuit where a check valve is used. Due attention must be paid to the surge pressure at the P port. Due attention must be paid to cylinder pop-out.
	BG1A			This type of spool is similar to the BGA type spool, but the flow from the A and B ports to the R-port is throttled. This type is used for preventing cylinder pop-out.
	BMA			This type of spool is used to close the P and A ports and open the B port when the spool is in the neutral position. Due attention must be paid when the valve is used to hold the cylinder at the fixed position for a long time. Due attention must be paid to the surge pressure at the P port. Due attention must be paid to cylinder pop-out.
	BM1A			This type of spool is similar to the BMA type spool, but the flow from the B port to the R port is throttled. This type is used for preventing popping out of a cylinder.
	AEB			This type of spool is used to unload a pump and close the A and B ports when the spool is in the neutral position. Although valves can be connected in series and used alternately, due attention must be paid to the pressure loss and the back pressure at the R port. Due attention must be paid when the valve is used to hold the cylinder at the fixed position for a long time. Due attention must be paid to the fact that the fluid passage symbols at the switching position are the reverse of those on other types.
	BHA			This type of spool is used to unload a pump and close only the B port when the spool is in the neutral position.
No-spring Type	BcA			With this type of spool, all ports are closed and there is no fluid flow during the switching period. Due attention must be paid to the surge pressure generated during switching. The solenoid must always be energized. Due attention must be paid to the valve installation direction. NOTE: A valve with a detent mechanism is available.
	BdA			All ports are connected with each other to allow fluid flow through them during the switching period. Due attention must be paid to the pressure drop at the P, A and B ports that occurs during switching. The solenoid must always be energized. Due attention must be paid to the valve installation direction.
	BgA			Only the P port is closed during the switching period. Due attention must be paid to the surge pressure generated at the P port. Due attention must be paid to the pressure drop at the P, A and B ports that occurs during switching. The solenoid must always be energized. Due attention must be paid to the valve installation direction.

Category	Spool Type Representation	Symbol	Spool Position and Valve Passages (Spool in Neutral Position)	Function and Use
Spring-offset Type	BcA			With this type of spool, all ports are closed and there is no fluid flow during the switching period. Due attention must be paid to the surge pressure generated during switching.
	BdA			All ports are connected with each other during the switching period. Due attention must be paid to the pressure drop at the P, A and B ports that occurs during switching.
	BgA			Only the P port is closed during the switching period. Due attention must be paid to the surge pressure generated at the P port. Due attention must be paid to the pressure drop at the A and B ports that occurs during switching.
	KcP			With this type of spool, all ports are closed and there is no fluid flow during the switching period. Due attention must be paid to the surge pressure generated during switching. The R port must not be plugged and must be piped to the reservoir.
	BC			When the spool is offset by spring, all ports are closed and there is no fluid flow during the switching period. Due attention must be paid to leaks and surge pressure generated during switching.
	BG			This type of spool is used to float a cylinder when the spool is offset by spring. Due attention must be paid to the surge pressure generated at the P port.
	CA			With this type of spool, all ports are closed and there is no oil flow when SOLa is energized, but due attention must be paid to leaks and surge pressure generated during switching.

**(Reference) Valve Passage Types**

The valve passage is configured by the combination of passages opened at each spool position. The passage opened at each spool position is classified as shown in the table below according to the port connection state in the valve, and the valve passage is expressed by arranging the letters that represent the opened passage at the relevant spool position.

Character	A	B	C	D	E	F	G	H	K
Passage Symbol									
Character	M	N	P	Q	R	S	D1	G1	M1
Passage Symbol									

NOTE 1: P represents a pressure port, A and B represent connection ports to a cylinder or other actuator, and R represents a connection port to a reservoir.

NOTE 2: To express the transient state, a lower case letter is used.

NOTE 3: The numeral 1 in the characters indicates throttling of the A and/or B port passage.

(The size of the numeral is the same as an upper case letter.)