Document No.:KE-4025-06

KITZ

Operation Manual

For

KITZ B Series

Pneumatic Valve Actuators

Thank you for choosing KITZ products.

For safe and trouble-free function and performance of the product, make sure to read and understand all items in this manual before handling the product.

Keep this manual accessible to all valve operating personnel

KITZ CORPORATION

Document No.:KE-4025-06

This manual applies to the KITZ B Series Pneumatic Valve Actuators.
For actuators of automatically operated value, refer to the operation manual of relevant actuators prepared by the manufacturers.

CAUTION AND WARNING

For the safe use of the product, read all of the safety precautions listed in this manual before handling the product.

The safety precautions in this manual are determined to ensure safe and proper use of the product and to prevent personal injury and property damage. This manual uses two terms, "Warning" and "Caution", according to the hazard level, to clearly indicate the extent and severity of the risk.

Both "Warning" and "Caution" indicate important safety instructions. Please be sure to follow them.

⚠ WARNING	Indicates an imminently hazardous situation that, if not avoided, may result in serious injury or death.
⚠ CAUTION	Indicates a potentially hazardous situation that, if not avoided, may result in minor to moderate injuries or product damage.


Indicates a "caution" .to alert the users.


Indicates a "prohibited" action that must not be carried out.


Indicates a "mandatory" action that must be followed.

NOTES TO USERS

- This manual is designed to show an appropriate usage of the products for transportation, storage, installation, operation and maintenance. Be sure to read through this manual before handling the products.
- This manual does not cover the whole scope of conceivable usage of the products for transportation, storage, installation, operation and maintenance. If technical assistance beyond the scope of this manual is required, contact KITZ Corporation or its distributor.
- The specifications for transportation, storage, installation, operation and maintenance described in this manual have been determined with valve maintenance taken into consideration. DO NOT use products beyond the specifications.
- The illustrations given in this manual do not show all the details. If more detailed information is required, refer to the relevant approved drawings.

*Any information provided in this operation manual is subject to change without prior notice.

Contents

1 Note for User's System Design

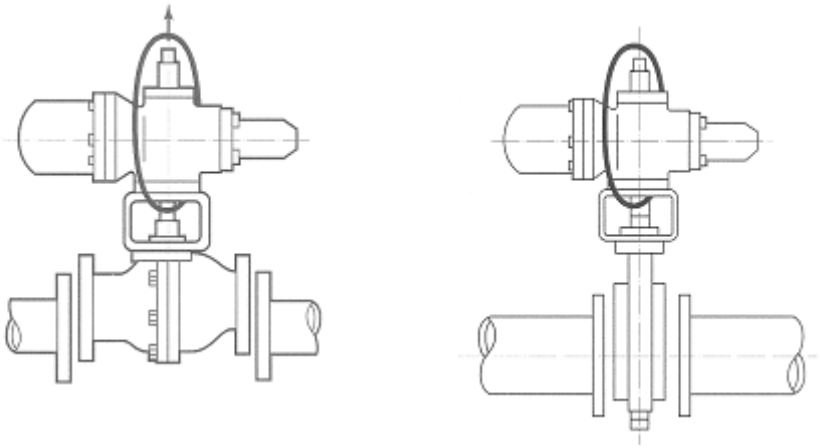
⚠ WARNING	
⚠	● Holding valve position KITZ pneumatic actuators do not assure non-leakage. The actuator does not keep the valve in the predetermined open position for a long time without continuous air supply. When connecting the actuator to the air tank, it may become impossible to hold the valve opening position due to leakage from the actuator. Please periodically perform an inspection to detect leakage from the seal washer, retighten the valve and check the pressure drop in the air tank when a actuator is connected to the air tank. If you need to keep the valve in the predetermined position for a long time, please contact KITZ. ● Residual pressure in the cylinder of the spring return type actuator Output torque of the spring return type actuator indicates the value without internal air residue remains inside the cylinders. Please design the circuit system to be able to exhaust the internal pressure from the cylinder during the spring return action. If internal pressure remains in the cylinder, the output torque will be dropped and the valve may not be closed. ● The actuator may move to the opening direction if pressure is applied to the both sides of the cylinder port of the double action type actuator. If manual operation is needed, the circuit system shall be designed to equalize the cylinder internal pressure and the atmospheric pressure.

⚠ WARNING	
⊘	● DO NOT pressurize the breathing port of the spring return type actuator.
❗	● Prevent dust, rainwater or waste from entering into the actuator through the breathing port.

2. Storage and Handling

⚠ CAUTION	
⊘	● DO NOT store actuators in corrosive atmospheres such as sulfur dioxide gas or chloric gas. Actuators may rust in the corrosive atmospheres. ● DO NOT overload actuators and valves, place any object or step on them. ● DO NOT remove the dust protectors from the product before installation.
❗	● Anti-rust coating is applied the product, but store the product in a cool and dry place to prevent rusting and malfunction. ● When transportation or handling or mounting a actuator-valve unit in size 3 or above, use a rope or a strap as illustrated in Fig. 1.
⚠	● Handle the product with extreme care to prevent damage to the solenoid valves, accessories or copper tubes equipped to the product.

Fig. 1



3. Product Type and Code

B ① S ② W - ③ D ④ 6

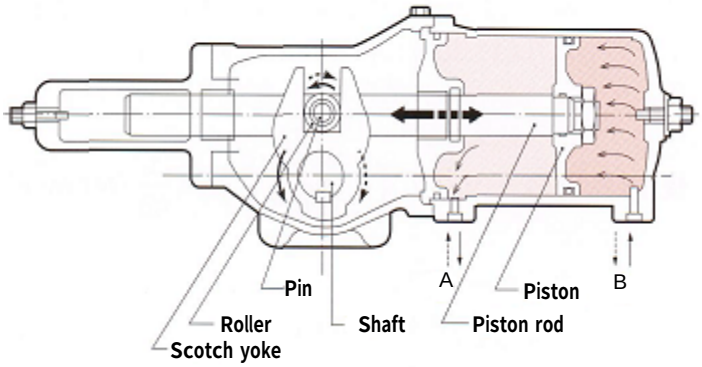
① Driving Mechanism	④ Size
Non ・・・ Double action type	0
S ・・・ Spring return type	1
② Manual Override	2
Non ・・・ No manual override	3
W ・・・ Manual override (Spring return type only)	4
③ Cylinder Structure	5
Non ・・・ Single piston	6
D ・・・ Double piston (type B-6, B-7 only)	7

4 Driving Mechanism

4.1 Type B Double-Action Actuator (Single Piston Type Cylinder)

The air pressure supplied into the port 〈A〉 pushes the piston to the left and energizes its movement to rotate the scotch-yoke counterclockwise. The scotch-yoke converts linear movement of the piston rod to counterclockwise rotational movement of the shaft to open or close the valve, following the preset mode.
Reverse supply of the air pressure into the port 〈B〉 activates the reverse valve operation. Air failure will cause the valve stay at the position.

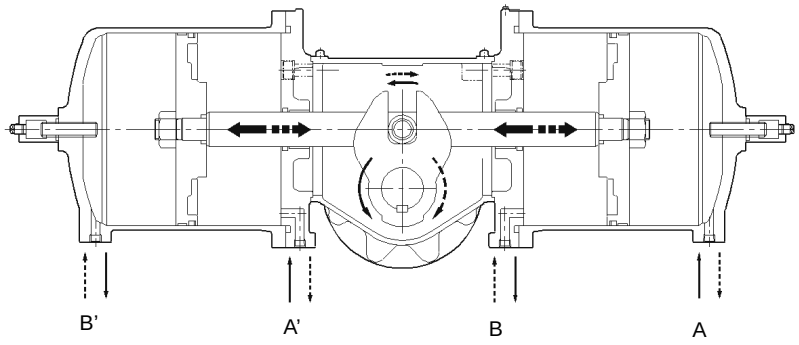
Fig. 2



4.2 Type BD Double-Action and Double Cylinder Actuator (Double Piston Type Cylinder)

The air pressure supplied into the port 〈A〉 and 〈A'〉 pushes the piston to the left and energizes its movement to rotate the scotch-yoke counterclockwise. The scotch-yoke converts linear movement of the piston rod to counterclockwise rotational movement of the shaft to open or close the valve, following the preset mode.
Reverse supply of the air pressure into the port 〈B〉 and 〈B'〉 activates the reverse valve operation. Air failure will cause the valve stay at the position.

Fig. 3



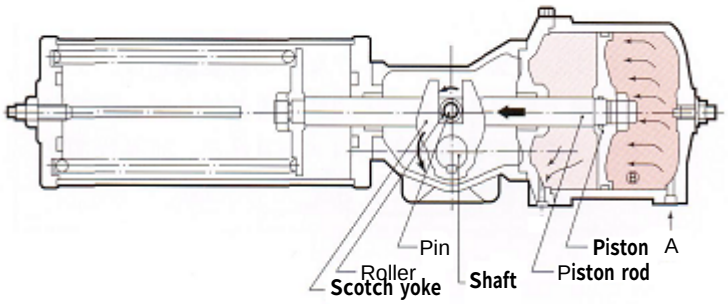
4.3 Type BS or BSW Spring-Return Actuator

The air pressure supplied into the port 〈A〉 pushes the piston to the left and energizes its movement to rotate the scotch-yoke counterclockwise, compressing the spring. The scotch-yoke converts linear movement of the piston rod to counterclockwise rotational movement of the shaft, to open or close the valve, following the preset made.

At the moment the air is discharged to the atmosphere through the solenoid valve, the spring force pushes the piston to the right direction, and the scotch-yoke activates clockwise rotation of the shaft to reversely operate the valve. Air failure will cause the valve return to the original open or closed position automatically, following the preset mode, unlike the value driven by Type B actuator.

Type BSW actuator is combination of Type BS actuator and a hand wheel for manual operation, and its driving mechanism is exactly same as that of Type BS actuator

Fig. 4



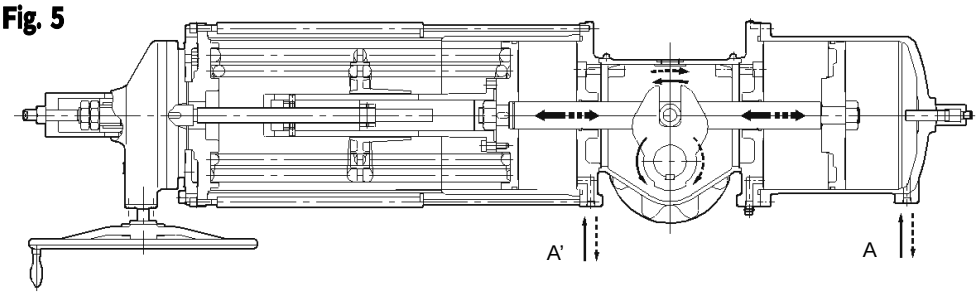
4.4 Type BS-7 or BSW-7 Spring-Return with Manual Operation Equipment

The air pressure supplied into the port 〈A〉 and 〈A'〉 pushes the piston to the left and energizes its movement to rotate the scotch-yoke counterclockwise, compressing the spring. The scotch-yoke converts linear movement of the piston rod to counterclockwise rotational movement of the shaft, to open or close the valve, following the preset made.

At the moment the air is discharged to the atmosphere through the solenoid valve, the spring force pushes the piston to the reverse direction, and the scotch-yoke activates clockwise rotation of the shaft to reversely operate the valve. Air failure will cause the valve return to the original open or closed position automatically, following the preset mode, unlike the value driven by Type B actuator.

Type BSW actuator is combination of Type BS actuator and a hand wheel for manual operation, and its driving mechanism is exactly same as that of Type BS actuator.

Fig. 5



5. Standard Technical Specifications

Operating media	Compressed instrumentation air
Standard operating pressure	0.4MPa; factory preset pressure
Pressure supply range	0.3MPa to 0.7MPa Contact KITZ when other than the standard operating pressure is required.
Standard durability	100,000 cycles under moderate service conditions
Housing test pressure	0.97MPa
Shaft rotation	90 ° (±5 °)
Service temperature range	-20°C to +60°C (No freezing of supply air)

Output Torque

Unit: N-m

Type-Size	Operating Pressure 0.4MPa		
	0 °	45 °	90 °
B-0	14.0	6.9	14.0
B-1	36.4	18.2	36.4
B-2	94.5	47.2	94.5
B-3	238	119	238
B-4	606	303	606
B-5	1517	758	1517
B-6	3680	1840	3680
B-D6	7365	3683	7365
B-7	9215	4607	9215
B-D7	18444	9222	18444

Unit: N-m

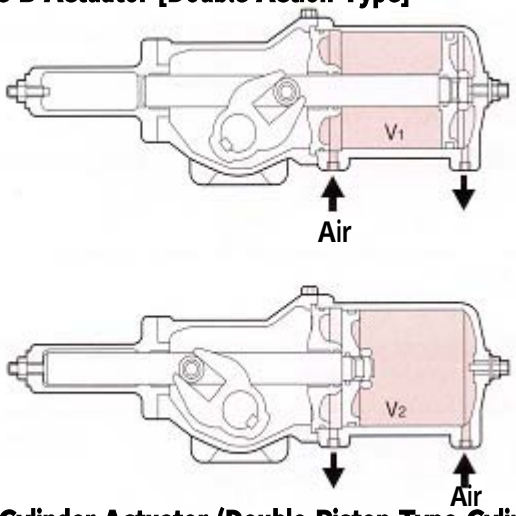
Type-Size	Operation	Operating Pressure 0.4MPa		
		0 °	45 °	90 °
BS-0	Air	16.7	6.8	10.7
	Spring	10.5	6.7	16.5
BS-1	Air	39.1	16.2	25.9
	Spring	25.8	16.1	38.9
BS-2	Air	100	41.7	66.3
	Spring	66.8	41.9	101
BS-3	Air	265	110	177
	Spring	178	111	266
BS-4	Air	685	285	455
	Spring	452	283	682
BS-5	Air	1730	720	1151
	Spring	1150	720	1730
BS-6	Air	4151	1729	2768
	Spring	2873	1733	4158
BS-7	Air	10974	4580	7357
	Spring	7016	4410	10624

6 Cylinder Volume and Air Supply Requirement

■ Cylinder Volume

6.1 Type B Actuator [Double Action Type]

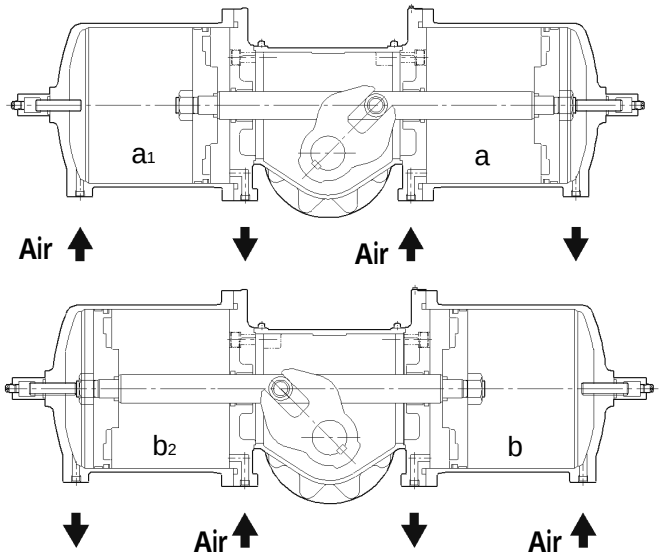
Fig. 6



Unit: liter

Type-size \ Cylinder	V1	V2
B-0	0.05	0.07
B-1	0.17	0.17
B-2	0.43	0.43
B-3	1.04	1.09
B-4	2.69	2.75
B-5	6.53	6.80
B-6	15.90	14.20
B-D6	30.10	30.10
B-7	38.30	39.00
B-D7	77.30	77.30

Double Cylinder Actuator (Double Piston Type Cylinder)



$a_1+a=V_1$

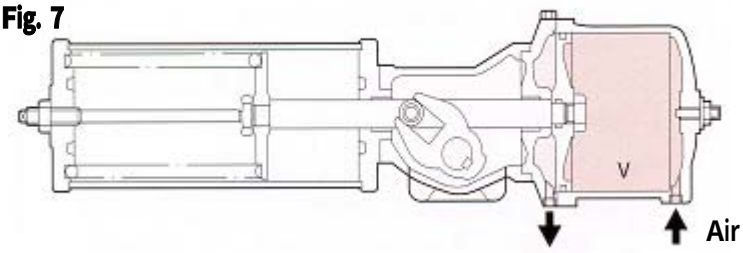
$b_1+b=V_2$

6.2 Type BS or BSW [Spring Return Type]

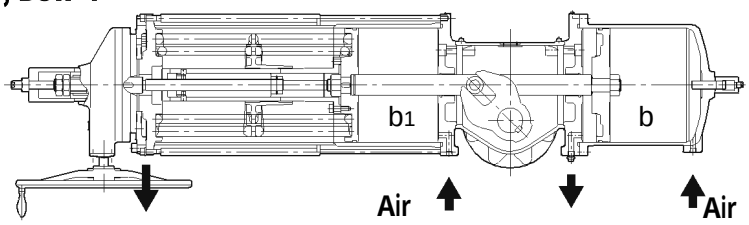
Unit: liter

Cylinder volume of Type BS or BSW actuators

Fig. 7



BS-7, BSW-7



Type-size \ Cylinder	V
BS-0 / BSW-0	0.17
BS-1 / BSW-1	0.33
BS-2 / BSW-2	0.82
BS-3 / BSW-3	2.23
BS-4 / BSW-4	5.39
BS-5 / BSW-5	13.70
BS-6 / BSW-6	30.20
BS-7 / BSW-7	70.90

$b_1+b=V$

BS and BSW have the same cylinder volumes.

6.3 Air Supply Requirement (Flow Rate)

Actuators should be supplied with air sufficient to operate the valve through one full stroke from the open to closed position or vice versa in "t" seconds, as converted into flow rates per minute.

The required air volume "Q" is expressed with the following equation.

$$Q=V\ ((P+0.1013)/0.1013)\times\frac{60}{t}\ (Nl/min.)$$

where

Q=Air volume requirement per minute (Nl/min.)

V=Cylinder Volume (liters)

V1 or V2, whichever larger, for double-action actuators

P=Supply pressure (MPa in gauge)

t =Time required per stroke (seconds)

Nl: Volume of standard air

Condition of standard air

Air temperature: 20°C

Absolute pressure: 760mmHg

Relative humidity: 65%

6.4 Air Consumption

Air consumption means the volume of air discharged into the atmosphere from an actuator operating "n" times forward and backward per hour as converted into volumes per minute. The valve is calculated with the following equation,

Type B actuator [Double action type]

$$Q=(V1+V2)((P+0.1013)/0.1013)n\times\frac{1}{60}\ (Nl/min.)$$

Type BS or BSW actuator [Spring return type]

$$Q=V\ ((P+0.1013)/0.1013)n\times\frac{1}{60}\ (Nl/min.)$$

⚠ CAUTION

- Use clear, dry air filtered to remove dusts and moisture which will deteriorate the housing interior and cause malfunction of the actuator.
- Ensure to correctly calculate the required amount of air in advance and prepare compressors and reservoirs with sufficient capacity.
- Select solenoid valves, air filter-regulators and air supply tubes which have a sufficient capacity to accommodate the airflow rate calculated in advance.
- To determine the practical capacity of a compressor or air tank, addition of extra 30% to the calculated air consumption volume is recommended considering a possible air loss caused by connecting to the accessories and tubes. Insufficient air supply will cause a pulsy stroke and malfunction.

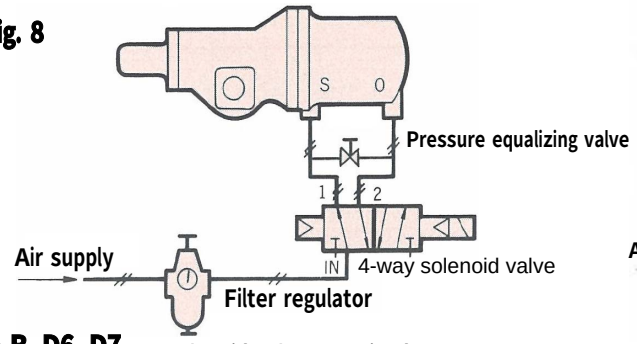
7. Air Tubing and Electric Wiring

7.1 Air Tubing for Actuators

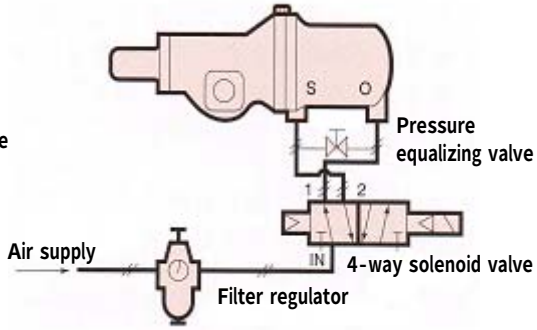
Type B-0 to 7

Fig. 8

Solenoid valve energized to open valve



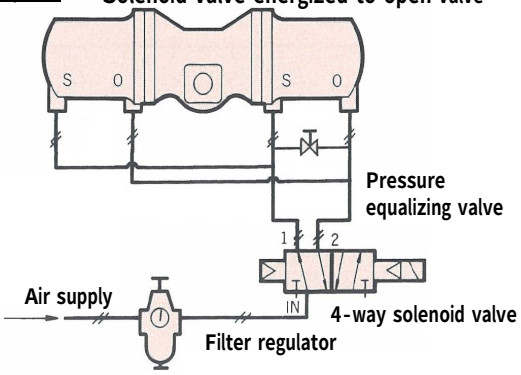
Solenoid valve energized to close valve



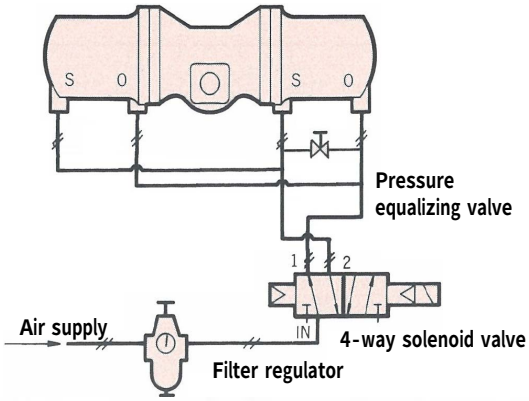
Type B-D6, D7

Fig. 9

Solenoid valve energized to open valve



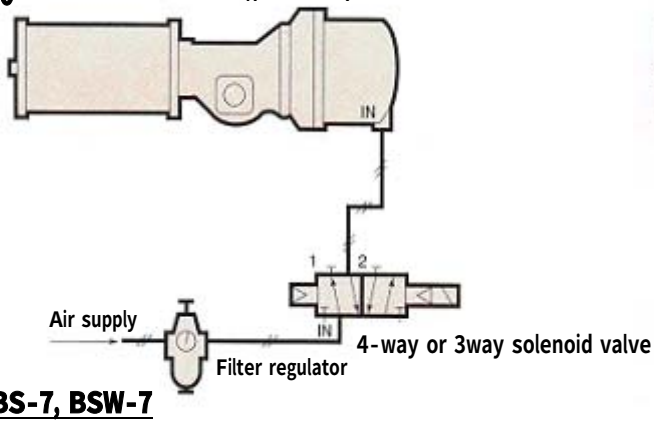
Solenoid valve energized to close valve



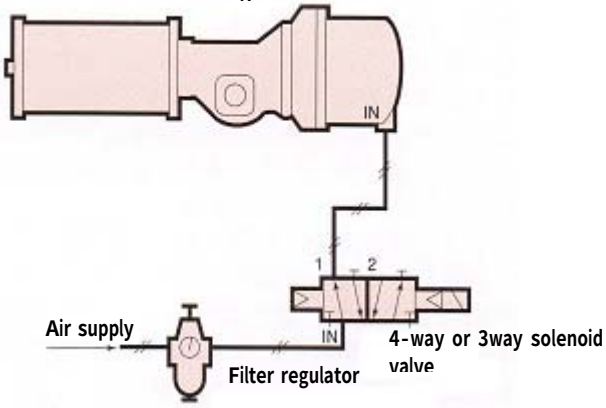
Type BS-0 to 6, BSW-0 to 6

Fig. 10

Solenoid valve energized to open valve



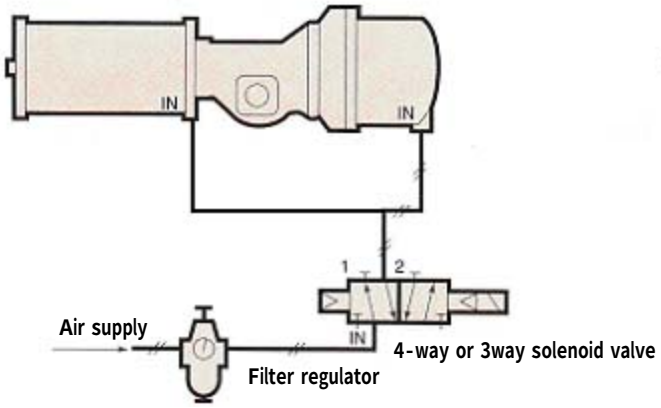
Solenoid valve energized to close valve



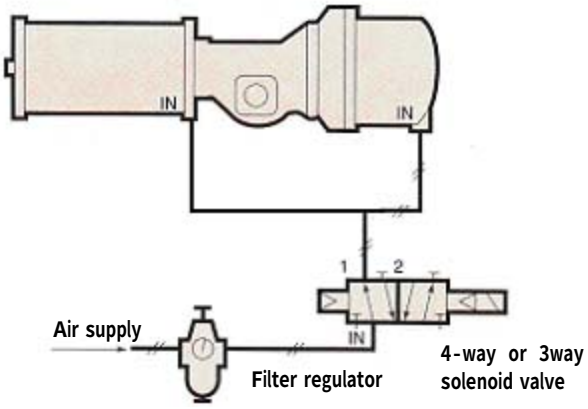
Type BS-7, BSW-7

Fig. 11

Solenoid valve energized to open valve



Solenoid valve energized to close valve



7.2 Air Supply Port

Select copper tubes (covered or uncovered) for air supply and exhaust ports according to the following table:

Nominal size of piping threads (Rc)

Actuator size	0	1	2	3	4	5	6	7
Type B	1/8	1/4	1/4	1/4	1/4	1/2	1/2	1/2
Type BS/BSW	1/8	1/4	1/4	1/4	1/2	1/2	1/2	1/2

7.3 Tubing

Actuator size	0	1	2	3	4	5	6	7
Tube (Outer diameter×Inner diameter)	φ8×φ6					φ10×φ8		

7.4 Specification of Solenoid Valves

Type B actuators need 4-way solenoid valves. 4-way solenoid valves with one OUT port plugged or 3-way solenoid valves can energize Type BS or Type BSW actuators. Electric wiring should be made as shown in Fig. 8 to Fig. 11, depending on the planned mode of operation.

KITZ B Series actuators assembled with solenoid valves at the manufacturer have been complete with copper tubing for air supply and exhaust pens. Users should make air supply tubing between air compressors and solenoid valves.

7.5 Pressure Equalizing Valves (By-Pass Valves)

Manual operation of Type B actuators needs a pressure equalizing valve between the cylinder and the solenoid valve.

7.6 Speed Controllers

Mount a speed controller between the cylinder and the solenoid valve.

7.7 Silencers

Install a silencer directly in the exhaust port of the solenoid valve

⚠ CAUTION

- For manual operation of Type B actuators, the air residue in the cylinder must be discharged to the atmosphere. Ensure to install a pressure equalizing valve between the solenoid valve and the cylinder.
- Connect copper tubes (covered or uncovered) of a suitable diameter and wall thickness between actuators and pressure sources to maintain sufficient air pressure during valve operation.
- Securely seal all of the tubing joints to avoid air leakage through the connections, accessories or tubes. Ensure that loose sealing tape ends do not extend into the tube. It may block the ports and affect the air supply to the actuator.

8. KITZ Optional Accessories

The following are recommended standard accessories for KITZ B Series actuators.

For other accessories, please contact KITZ.

Accessories & Code	Specifications	Remarks
Limit Switch LS Weather-proof LS-F Explosion-proof	LS AC:10A/125V 10A/250V 10A/480V DC:0.8A/115V 0.4A/230V LS-F AC:5A/125V 5A/250V DC:0.8A/125V 0.4A/250V Contact circuit: 2-Circurt double break	For initiating electric signals to check open or close position of the valve; A separate limit switch is recommended for each of open and close indication.
Solenoid Valve SOV Weather-proof SOV-F Explosion-proof	Connecting pipe thread: Rc 1/4 Working pressure: 0～0.97MPa Orifice diameter: 6mm Electric source: 100V/50Hz 100V60Hz 110V/60Hz 200V50Hz 200V60HZ 220V/60Hz	Flow switching over air flow by electric signal 4-way solenoid valves for double-action actuators, 4-way solenoid values for spring-return actuators, with one OUT port plugged, or 3-way solenoid valves used.
Air Filter-Regulator F+R (Complete with pressure gauge)	Connecting pipe thread: Rc 1/4,1/2 Working pressure: Max. inlet pressure; 0.97MPa Max. outlet pressure; 0.04MPa～0.83MPa (8～120psi)	For removing moisture, water and other foreign objects form operating air and for regulating air pressure at a desire level.
Speed Controller SP	Connecting pipe thread: Rc 1/8,1/4,1/2 Operation pressure: 0.97MPa max.	For reducing actuator operating speeds.
Quick Exhaust Valve QE	Connecting pipe thread: Rc 1/4,1/2 Working pressure: 0.97MPa max	For increasing actuator operation speeds; With spring-return actuators, speed increase is possible only in spring-return direction.(Usable only for actuators without positioners.)
Valve Positioner P (Complete with pressure gauge)	Connecting pipe thread: Rc 1/4 (pressure gauge: Rc 1/8) Supply pressure: 0.3~0.7MPa (43~100psi) Signal pressure: 0.02~0.1MPa (3~15psi) Signal Current 4~20mA Air consumption: 20Nl/min. max. (at supply pressure 0.5MPa)	For operating actuators at any desired position, with the flow rate controlled by a valve: Valve positioner may be mounted on both double-action and spring-return actuator. With use of valve positioners, flow rate may be stably controlled. Both air-to-open and air-to-close actuation modes can be obtained by simply reversing air.
Silencer K	Connecting pipe thread: Rc 1/8,1/4,1/2 Working pressure: 0.90MPa max.	For reducing air exhaust noise in solenoid valve: To be installed in the exhaust port of a solenoid valve.
Air Filter F	Connecting pipe thread: Rc 1/4,1/2 Working pressure: 0.97MPa max.	For removing moisture, water and other foreign objects from operating air.
Lubricator L	Connecting pipe thread: Rc 1/4,1/2 Working pressure: 0.97MPa max. Recommended oil: Turbine oil ISO VG32 equivalent	Although KITZ B Series actuators and their standard solenoid valves are designed for no need of lubrication, when other solenoid valves are used, or when actuators are subjected to high operating frequency for long periods of time, lubrication is recommended.
Pressure Equalizing Valve C	Connecting pipe thread: Rc 1/4 Working pressure: 1.37MPa max.	For equalizing internal air pressure to atmospheric pressure to manually operate actuators.

9. Mounting Valve-Actuator Units on Pipe

⚠ CAUTION	
	● Check the valve and actuator for possible damage, bolt loosening or other failures caused during transportation or storage. ● KITZ B Series actuators assembled with KITZ valves can be mounted on the horizontal or vertical piping, or at any angle, depending on the piping or operational convenience. However, the air filter-regulator must be always horizontally positioned against the ground. ● To use an automated valve with a positioner for control services, specify the piping positions when ordering the product. If the piping position is changed, the control position of the valve should be re-adjusted. Contact KITZ for the operation manual for adjustment. ● When a positioner is used for piping which vibrates, controllability may be impaired due to the resonance of the inside parts. Use supporters and support stands to firmly hold the valve and actuator, especially in size 5 or above of BS/BSW actuators, and minimize the influence of vibration (See Fig. 12). ● Allow sufficient space around the unit mounted on the pipe for convenience of subsequent maintenance or servicing work. A space of 300 mm upward, 500 mm downward and 300 mm each for the right and left is recommended. ● -20°C to +60°C is the recommended range of applicable atmospheric temperature. Take appropriate insulating or cooling measures for installation in low or high temperatures. ● Take appropriate measures when the unit is installed in a corrosive (sulfurous acid gas, chlorine gas, etc.) or dusty environment. ● Ensure that valves are free from rust. Particularly when cast iron or cast steel valves are used for water supply line, rust may be generated and get stuck to the seat surfaces of the valve. ● BS and BSW actuators have breathing ports to discharge the internal residual air to the atmosphere. A dust cap is installed on the breathing port. Remove the dust cap before running the automated operation. If the dust cap is not removed, actuator speed may become slow. If an exhaust port of the actuator which is installed outdoors is positioned horizontally to the ground, fit an elbow and a nipple to the exhaust port to prevent the intrusion of rainwater (See Fig.13).
	● The delivered KITZ B Series actuators and valves are properly assembled in the predetermined open and close positions. Do not disassemble and change the valve open and close positions. It may cause an inconsistency between the actual valve operating position and the valve position indicator.

Fig. 12

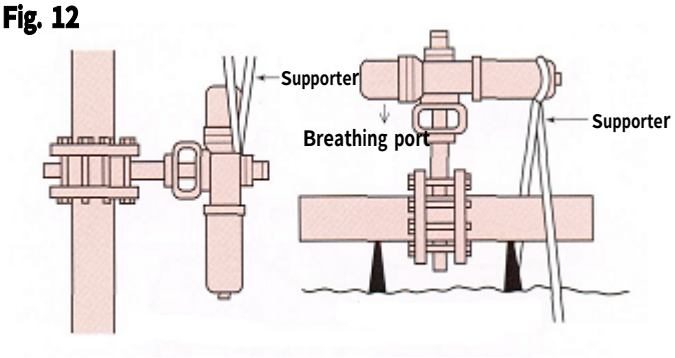
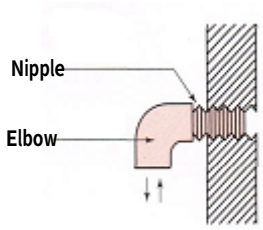


Fig. 13



10 Automated Operation

KITZ B Series actuators are designed for operating at the pressure ranging from 0.3MPa (40psi) to 0.7MPa (100psi) and the standard operating pressure is set to 0.4MPa (60psi) for trouble-free operation, or use the product within the pressure range specified at the time of order placement. Operating media must be compressed air or Nitrogen gas.

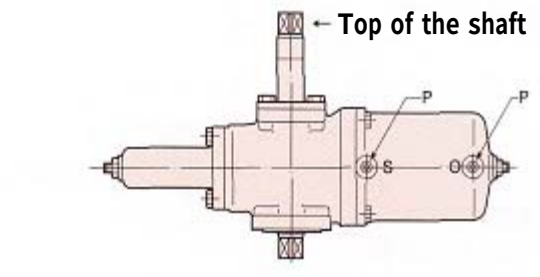
⚠ CAUTION	
❗	● Be sure to use filtered and clean operating media for trouble-free operation. This is particularly important if the product is used in cold and freezing climates. ● Full open the valve and air-blow the valve after installation is completed to thoroughly remove the internal residues.
⃠	● DO NOT operate the valve during air-blow.
❗	● Operate actuators manually a few times before starting automated operation and check that the system has no failure or malfunction. ● Before starting a normal operation, check the following: -No leakage from the air tubing (Use soap solution.) -Adequate line voltage of the solenoid valve -Sufficient air supply (Use air filter-regulator) -Adequate operating pressure -Adequate operating speed, which may be adjusted with a speed controller. -Check the specified valve operating position according to the change of the specific signal, when a positioner is provided. (Contact KITZ for adjustment of positioner.) -If the actuator has not been operated for 3 months or longer, or when the actuator is operated for the first time, the operation torque may exceed the specified torque. In this case, manually operate the valve a few times as a preparatory operation. (Type BS actuators cannot be manually operated. Please specify Type BSW actuators.)

11. Manual Operation

11.1 Type B (Double Action Type)

Type B-0 to B-4 actuators can be manually opened or closed by turning an operating device such as a spanner wrench or lever handle properly fitted to the top of the shaft (Fig. 14). Turn the shaft clockwise to close the valve and counterclockwise to open the valve.

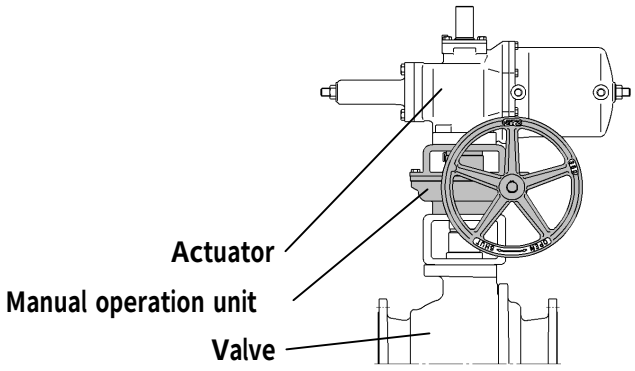
Fig. 14



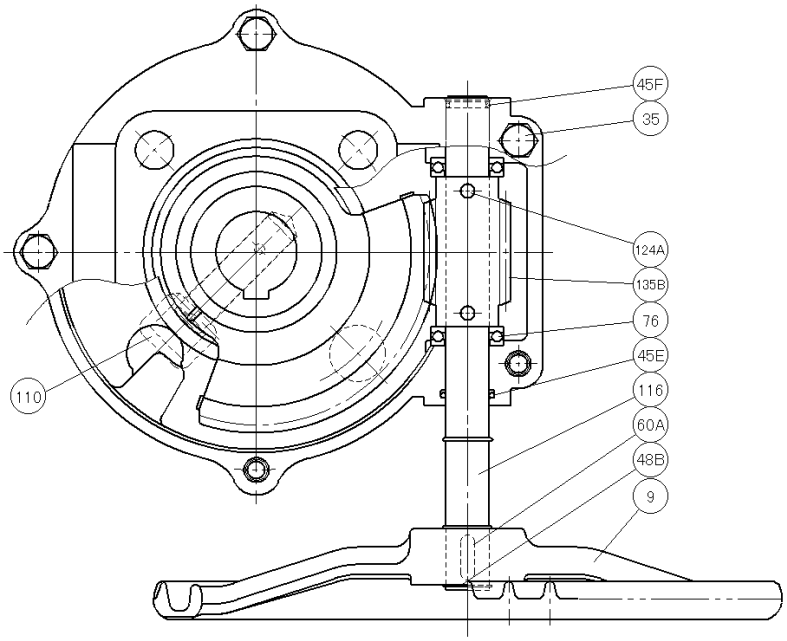
⚠ WARNING	
❗	● Before energizing Type B actuators, make sure to remove the spanner wrench or lever handle used for manual operation. Starting the operation without removing such a manual operating device is extremely dangerous

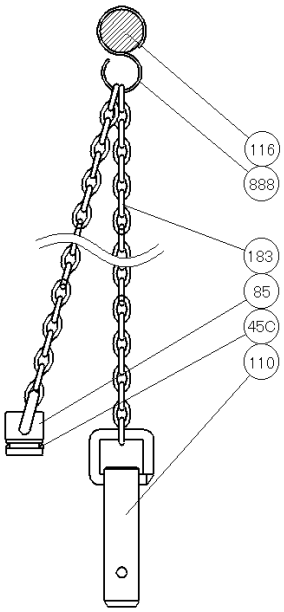
⚠ CAUTION	
❗	● Before operating a Type B actuator manually, open the pressure equalizing valve to discharge the residual air from the actuator housing to the atmosphere. Residual air will disturb the manual operation of the actuator. ● Ensure to securely fit the operating device to the top of the shaft of Type B actuator for manual operation.

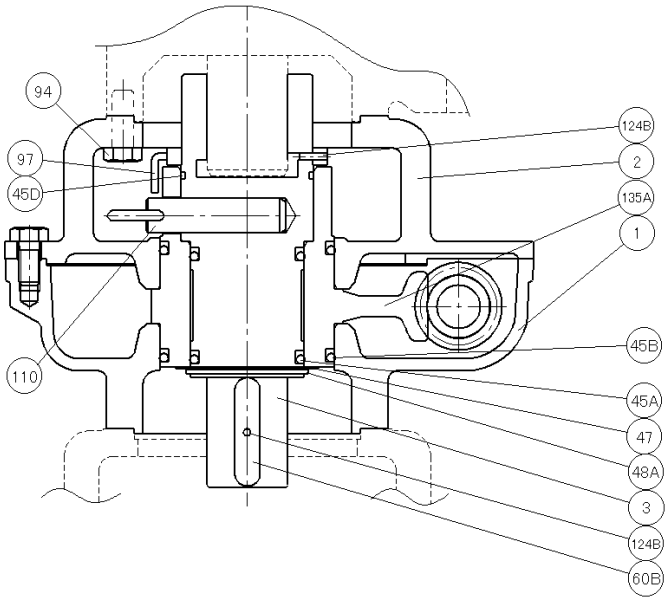
Manual operation with a spanner wrench or a lever handle is not available for Type B-5 to B-7 actuators. Please order an actuator with manual operation unit if you need manual operation for these actuators.



Parts Construction of B-5 to B-7 Actuators Manual Operation Unit







Some parts are different depending on the type of the manual operation unit.
(Manual operation unit for B-5 is illustrated.)

1	Gear case
2	Gear cover
3	Shaft
9	Handle
35	Hexagon headed bolt
45A	O ring
45B	O ring
45C	O ring
45D	O ring
45E	O ring
45F	O ring
47	Thrust bearing
48A	Snap ring
48B	Snap ring
60A	Key
60B	Key
76	Thrust bearing
85	Plug
94	Hexagon headed bolt
97	Indicator
110	Pin assembly
116	Spindle
124A	Spring pin
124B	Spring pin
135A	Worm wheel
135B	Worm
183	Chain
888	Hook

Manual Operation Method of B-5 to B-7 Actuators Manual Operation Unit

⚠ WARNING	
⊘	● DO NOT insert your finger in pin hole of the manual operation unit. A strong force is applied to the internal parts.

⚠ CAUTION	
⊘	● DO NOT operate the valve automatically while a pin is inserted into the pin hole. It may damage the manual operation unit.
❗	● Insert the pin into the pin hole completely for manual operation. The manual operation unit will be damaged if the pin is inserted halfway. ● When the valve is operated automatically, make sure to insert a plug into the pin hole. Without plug, rainwater, dust, etc will enter the manual operation unit and corrode the interior.

(1) Manual Operation

① Stop supplying air to the actuator.
② Open the pressure equalizing valve.
③ Remove the plug.
④ Adjust the indicator position to the pin hole by rotating the handle.
⑤ Insert the pin into the pin hole completely.
⑥ Operate the valve with the handle.

(2) Automated Operation

① Remove the pin form the pin hole.
(If the pin is not easily removed, rotate the handle a little to free the pin.)
② Insert the plug into the pin hole.
③ Close the pressure equalizing valve.
④ Supply air to the actuator.

Troubleshooting of the manual operation unit

Trouble		Possible Causes	Remedial Measures
Automated operation	Not automatically operated	① Operate the valve with the pin is inserted into the pin hole. ② The pressure equalizing valve is opened. ③ No air is supplied.	① Remove the pin from the pin hole and insert a plug into it. ② Close the pressure equalizing valve. ③ Supply air to the actuator.
	The operation speed is slow.	① Malfunction of the valve ② Malfunction of the actuator ③ Air pressure is low. ④ Excessive throttling of speed controller ⑤ Corrosion of internal parts	① Disassembly/check/cleaning the valve and replacement of valve seats ② Disassembly/replacement of actuator parts or replacement of the actuator ③ Readjustment of the filter regulator ④ Readjustment of the speed controller ⑤ Replacement of the manual operation unit
Manual operation	Not manually operated	① The pin is not inserted into the pin hole. ② Air is supplied to the actuator. ③ A pressure equalizing v alve is closed.	① Insert the pin into the pin hole completely. ② Stop supplying air to the actuator and open the pressure equalizing valve. ③ Open the pressure equalizing valve.
	The pin cannot be inserted into the pin hole.	① Indicator is not adjusted to the pin hole. ② A pin hole on a worm wheel and a pin hole on a shaft are not aligned. ③ Foreign objects are stuck on the pin ④ The pin is deformed.	① Adjust the indicator to the pin hole rotating handle. ② Adjust the pin hole on the worm wheel and the pin hole on the shaft by rotating the handle little by little. ③ Clean the pin. ④ Replace the pin.
	Impossible to remove the pin from the pin hole.	① The pin is caught in the internal part. ② Air pressure is supplied.	① Free the pin from the internal parts by rotating the handle little by little. ② Stop supplying the air.

■ Spring Return Type

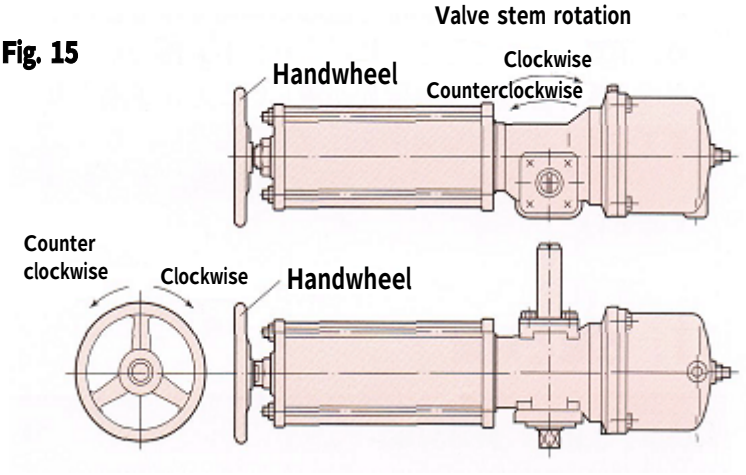
11.2 Type BS-0 to BS-7

Type BS actuators cannot be manually operated due to the spring in the actuator. If a manual operation is required, select Type BSW actuators.

11.3 Type BSW-0 to BSW-7

Turning the handwheel counterclockwise opens the valve and turning the handwheel clockwise closes the valve (Fig. 15). (Specification for airless-close)

Fig. 15



⚠ CAUTION	
❗	● To switch from manual operation of BSW-0 to BSW-7 to automated operation, turn the handwheel clockwise until the handwheel stops and the spindle portion completely gets in the spring case and the spring retainer returns to the rod guide side.
⚠	● Type BS-0 to BS-7 actuators cannot be operated manually.

12 Periodic Inspections and Maintenance of Valves and Actuators

Periodic inspection (at least twice a week, depending on the service conditions) must be carried out for safe and trouble-free operation.

12.1 Valve Operation

(1) Open-Close Operation

Check that the valve can be fully opened and closed according to the ON-OFF control of the actuator. Ensure that the valve opening or closing degree is adequately maintained in response to the signal pressure or signal currency of the actuator and the accessories.

(2) Noiseless and Vibration-Free Operation

If an abnormal noise is detected, air passage through the actuator and the tubing or fluid through the valve bore might have been disturbed by dusts or other foreign objects. Find the source of the noise and vibration, and take appropriate preventive measures.

12.2 Sealing Functions

(1) External Leakage

Apply soap solution over the sealing areas of valve, actuator and air tubing joints. External leakage may result in the replacement of O rings, gaskets and/or packing rings.

(2) Internal Leakage

Check the air exhaust port of the solenoid valve or the air supply port of the actuator to ensure that the air pressure is satisfactorily sealed within the actuator. Internal leakage may result in the replacement of O rings of the actuator.

(3) Firmly Tightened Bolting

Bolts and nuts used to assemble the valve, actuator and accessories must be periodically retightened, because they may become loose during operation.

(4) Many pieces of O rings are used for the critical sealing areas of the B Series actuators. O rings are subject to frictions with moving parts such as pistons, which reduce the life of O rings and the consumables. We recommend a periodic replacement of O rings. Refer to “Chapter 17 Consumables” in this operation manual for ordering specifications.

(5) Seal washer is used for the stopper bolts of the cylinder. Leakage may occur from the seal washer after a long term use. Retighten the nut as required or replace the seal washer.

(6) Leakage test from the breathing port should be done in 15 to 30minuts after pressurizing the actuator.

12.3 Partial Stroke Test

A partial stroke test (PST) shall be carried out on the automated valves equipped with a partial stroke test device periodically to keep the required safety level. See the operation manual of the partial stroke test device for details of the procedures.

⚠ CAUTION	
	● Retighten the valve glands and/or replace the gland-packing rings periodically. ● Where the line temperature excessively fluctuates, connections of the valve and the pipe flanges may get loose and cause leakage through the gaskets. When leakage is detected, retighten the flange bolts and nuts or replace the gaskets. ● The valve body may be frozen and damaged in winter. Drain water from the valve or adequately insulate the valve in advance when freezing is forecast. ● Clogging of air passage may result in an abnormal sound. Take appropriate measures immediately. ● An abnormal sound may be generated due to galling of foreign objects in the valve seat. Replace the damaged seats immediately. ● Excessive vibration may cause external leakage or malfunction. Provide appropriate supports to the pipe and actuator (Fig. 12). ● For Type BSW actuators, lubricate the threaded parts of the spindle periodically with KITZ standard grease “Shell Alvania EP2” to prevent fixing of the spindle to the stopper. ● Check the expiration date for use of the partial stroke test device. Replace it before the expiration date. ● Check the automated open, close and PST operations before starting the operation of the product. ● If any trouble is detected in a partial stroke test, check the actuator and the valve immediately and replace damaged parts.

13 Troubleshooting

Detected Trouble		Causes	Remedial Measures
Valve Malfunction.	Air pressure lower than the specified.	Failure of compressor or lack of compressor capacity	Inspect and repair the compressor as appropriate.
		Air leakage from tubing.	
	No supply of air pressure.	Failure of compressor	Inspect and repair the compressor as appropriate.
		Clogging, breakage or freezing of pipe	Check and repair the tubes as appropriate.
		Failure of filter regulator	Disassembly/check/repair/replacement of filter regulators.
	No activation or disturbed activation of actuators under full air pressure.	Foreign objects stuck to the valve seats	Disassemble and clean the valve.
		Failure of actuators	Replace the part or actuator.
		Increase of valve operating torque due to foreign objects stuck to the valve interior	Disassemble/check/clean the valve and readjust the actuator operation.
		Excessively throttled of speed controllers.	Readjust the speed controller.
		Dust cap is not removed from the exhaust port.	Remove the dust cap.
Troubles of Solenoid Valve.	No activation of energized solenoid valve; Abnormal noise; Excessive temperature raise.	Disconnection of electric circuits.	Check the wiring of the electric circuit and voltage.
		Defective electromagnetic coils	Check the excessive voltage and currency. Replace the coils.
		Water in the electromagnetic coils or terminal.	Take water prevention measures.
		Inadequate voltage or power supply cycles (Hz)	Check the specified voltage and cycle (Hz) with the name plate and replace as appropriate.
		Short circuit in the solenoid valve interior.	Check the solenoid valve and replace it as appropriate.
Abnormal Exhaust Air from Solenoid Valve	Air exhausts from the solenoid valve when actuator is not operated.	Worn-out of the piston O ring	Replace the O ring, or disassemble and reassemble the solenoid valve.
		Foreign objects	Remove the foreign objects.
		Equalizing valves left open.	Close the equalizing valve.
		Worn-out of the sealing parts of the solenoid valve	Check the solenoid valve or replace it as appropriate.

14. Disassembly and Reassembly

Disassembly and reassembly method of the actuators differs depending on the actuator type. When disassembly of the actuator is required for maintenance or repair, follow the procedures described for each actuator type.

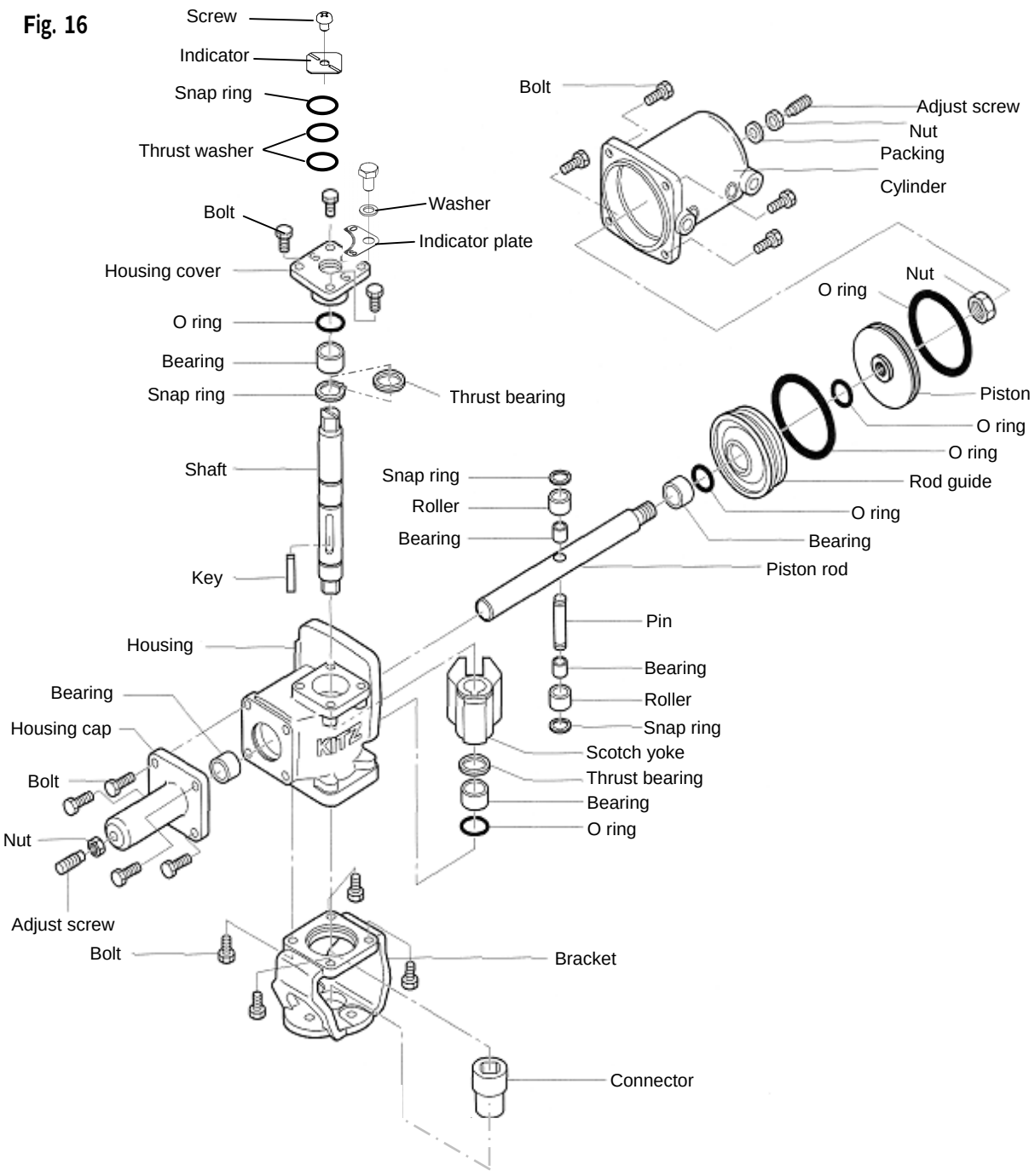
⚠ WARNING	
⊘	● DO NOT use compressed air when disassembling the cylinder. The cylinder may be suddenly ejected.
❗	● A compressed heavy-duty spring is packed within the spring case of the Type BS and BSW actuators. The spring cover may be pushed out and cause personal injury if the tie rod used for fixing the spring case is loosened and removed. When disassembling the spring case, make sure to follow the instructions given in this manual. ● Take care when handing heavy parts during disassembly or reassembly.

⚠ CAUTION	
❗	■ **Disassembly** ● Perform disassembly in a spacious, clean room. ● After air tubing is removed, adequately cover the air supply exhaust port and the open ends of the actuator housings to prevent dust from entering until reassembly of the actuator. ● Prepare tie rods, spring pins and nuts specified for each size before disassembly of Type BS and BSW actuators. ● Release the residual pressure from the cylinder before disassembly. ● The internal surface of the actuator cylinder is coated with fluorocarbon resin. Care should be taken not to scratch the coating during disassembly. ● All sliding parts such as shafts, pistons and bearings must be carefully handled and stored to avoid scratches or damages.

⚠ CAUTION	
❗	■ **Assembly** ● Assemble the actuator in a spacious, clean room. ● Clean the parts with light oil or acetone and air-blow them but never dip the resilient materials such as O rings in acetone or other liquid cleaner longer than 10 minutes. Make them completely dust-free. ● Apply adequate amount of lubricant (KITZ standard Shell Alvania EP2) to the sliding parts, O ring grooves and internal surface of the cylinder. ● If any rust is found on the parts, eliminate it completely. ● Before fixing the piston with a nut, degrease the threaded portion of the nut and apply adequate amount of locking liquid (KITZ standard: LOCTITE No. 263) to prevent loosening. ● Choose O rings for replacement, according to the dimensional information of maintenance consumables provided in Chapter 17 in this operation manual. ● Carefully handle the sealing components to avoid scratches or damages. ● Assemble the piston and piston rod with care so that the sliding parts are not scratched or damaged. ● Firmly tighten the tie rod and bolts so that they may not get loosened. ● After assembly of the actuator, check the valve opening and closing positions and attach the position indicator to the mounting bracket.

Construction Details of Type B (Double Acting Type)

Fig. 16



Type B-3 is illustrated.

Type B-0

■Disassembly

1. Reduce the internal pressure to the atmospheric level and remove the tubing.
2. Remove the hexagonal bolts ⟨94⟩ and disassemble the actuator from the bracket ⟨93⟩
3. Fit a lever handle or a wrench on the top of the shaft ⟨3⟩ and rotate it counterclockwise to draw the piston ⟨177⟩ towards the housing ⟨1⟩ .
4. Remove the hexagonal bolts ⟨35A⟩ and disassemble the cylinder ⟨2⟩ .
5. Remove the piston nut ⟨13⟩ and disassemble the piston ⟨177⟩ .

⚠ CAUTION	
❗	● Remove piston nut <13> carefully. It is tightly threaded and fixed with locking liquid.

6. Remove the hexagonal bolts ⟨35B⟩ and the housing cap ⟨158⟩ .
7. Draw the piston rod ⟨103⟩ towards the housing cap.
8. Remove the snap ring ⟨48B⟩ and roller ⟨153⟩ , then pull out the pin ⟨17⟩ .
9. Remove the snap ring ⟨48A⟩ and thrust bearing ⟨47A⟩ , and push the shaft ⟨3⟩ downwards to remove it.

⚠ CAUTION	
❗	● An anchor key ⟨60⟩ is provided to the shaft to fix the scotch yoke ⟨142⟩ . Be careful not to lose it.

10. Remove the scotch yoke ⟨142⟩ from the housing ⟨1⟩ .

■Assembly

1. For reassembly of actuators, reverse the disassembly procedures.

⚠ CAUTION	
❗	● Before fixing the piston ⟨177⟩ with the nut ⟨13⟩ , degrease the nut threads and apply some locking liquid (KITZ standard: LOCTITE No. 263) to the nut threads and the piston rod to prevent loosing.

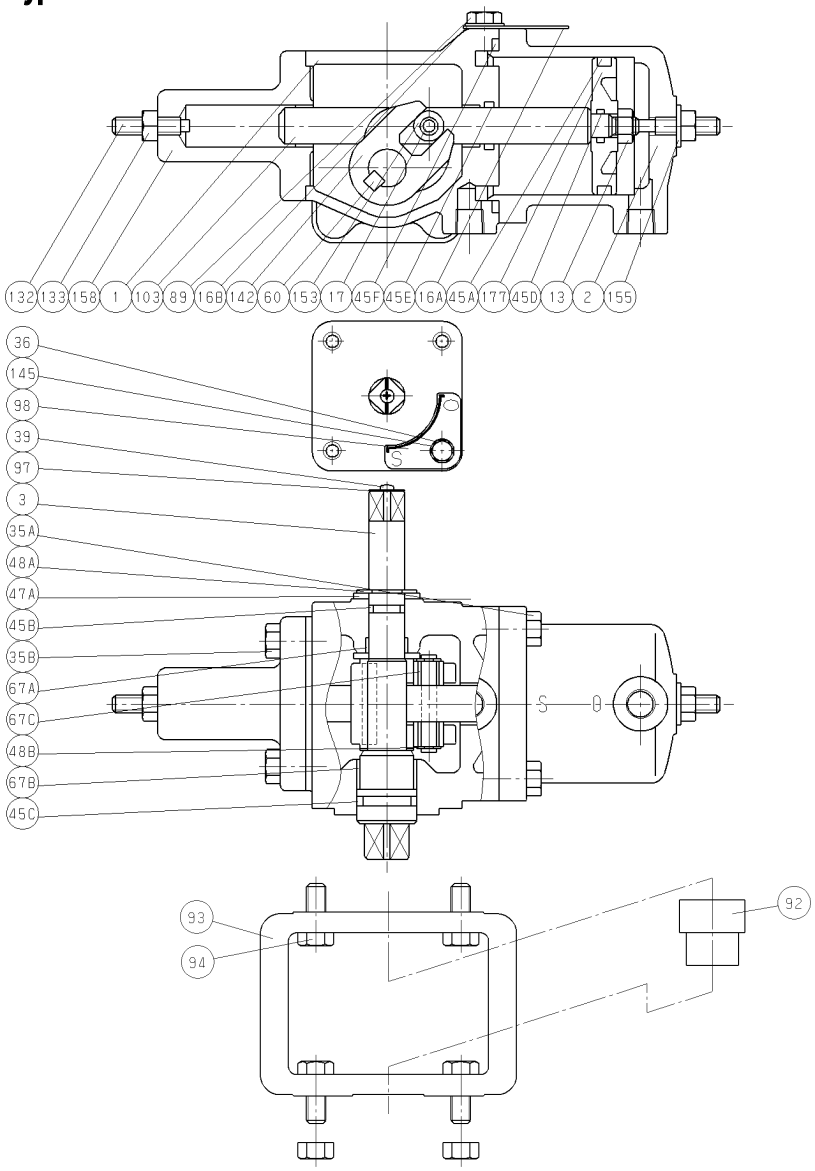
2. It is recommended to replace the piston O rings ⟨45A⟩ and rod guide O rings ⟨45E⟩ because they contact with sliding parts repeatedly.
3. Apply some lubricant (KITZ standard: Shell Alvania EP2) to O ring grooves, cylinder internal surface and all sliding parts.
4. Apply some liquid gasket (KITZ standard: Three bond 1206E) to the contact faces between the housing ⟨1⟩ and the housing cap ⟨158⟩ , and between the housing ⟨1⟩ and the cylinder ⟨2⟩ .
5. After assembly of the actuator, check the valve opening and closing positions with the position indicator, then mount the actuator to the bracket ⟨93⟩ .

■Position Adjustment

1. According to the instructions in Chapter15, set the valve opening and closing positions correctly by adjusting the hexagon socket head cap screw〈132〉.
2. See Chapter 15 for details of adjustment.

Assembly Diagram of Type B-0

Fig. 17



No.	Parts	No.	Parts	No.	Parts	No.	Parts	No.	Parts
1	Housing	35B	Bolt	45F	O ring	89	Bolt	133	Nut
2	Cylinder	36	Bolt	47A	Thrust bearing	92	Connector	142	Scotch yoke
3	Shaft	39	Screw	48A	Snap ring	93	Bracket	145	Washer
13	Nut	45A	O ring	48B	Snap ring	94	Bolt	153	Roller
16A	Plate	45B	O ring	60	Key	97	Indicator	155	Seal washer
16B	Washer	45C	O ring	67A	Bearing	98	Indicator plate	158	Housing cap
17	Pin	45D	O ring	67B	Bearing	103	Piston rod	177	Piston
35A	Bolt	45E	O ring	67C	Bearing	132	cap screw		

Type B-1 to 7 ,D6 and D7

■Disassembly

1. Reduce the internal pressure to the atmospheric level and remove the tubing.
2. Remove the hexagonal bolts ⟨94> and disassemble the actuator from the bracket ⟨93⟩ .
3. Fit a lever handle or a wrench on the top of the shaft ⟨3⟩ and rotate it counterclockwise to draw the piston ⟨177⟩ towards the housing ⟨1⟩ .
4. Remove the hexagonal bolts ⟨35a⟩ and disassemble the cylinder ⟨2⟩ carefully not to scratch its internal surface.
5. For Type B-D6 and D7 actuator, remove the hexagonal bolts ⟨35⟩ and disassemble the cylinder ⟨2⟩ carefully not to scratch its internal surface.
6. Remove the hexagonal bolts ⟨35b⟩ and disassemble the housing cap ⟨158⟩ . For Type B-D6 and D7, repeat the above procedure3 and remove the another cylinder and remove the nut ⟨13⟩ and the piston ⟨177⟩ .
7. Draw the piston rod ⟨103⟩ with piston ⟨177⟩ and rod guide ⟨136⟩ towards the cylinder side.
8. For Type B-6, 7, D6 and D7, remove the nut ⟨141⟩ (bolt ⟨155⟩ for B-7 and D7) from the rod guide ⟨136⟩ , and draw the piston, rod guide and piston rod ⟨103⟩ towards the cylinder side.
9. Remove the snap ring ⟨48B⟩ and roller ⟨153⟩ and then pull out the pin ⟨17⟩ .
10. Remove the piston rod ⟨103⟩ from the rod guide ⟨136⟩ .

⚠ CAUTION	
●	Locking liquid is used for the piston nut ⟨13⟩ to firmly fix the piston. Do not loosen the piston nut unless it is necessary. Keep the piston and piston rod together as a sub-assembly.

Type B-1 to B-5

11. Remove the hexagonal bolts ⟨36⟩ and remove the housing cover and the shaft (3) upwards carefully not to damage the O ring on the shaft .

⚠ CAUTION	
●	An anchor key ⟨60⟩ is provided to fix the scotch yoke ⟨142⟩ to the shaft ⟨3⟩ . Be careful not to lose it.

12. Remove the scotch yoke <142> and thrust bearing <47>from the housing.

Type B-6, 7, D6 and D7

11. Remove the snap ring 〈48A〉 and thrust bearing 〈47〉, and then push the shaft 〈3〉 downwards to remove

⚠ CAUTION	
❗	● An anchor key 〈60〉 is provided to fix the scotch yoke 〈142〉 to the shaft 〈3〉. Be careful not to lose it.

12. Remove the hexagonal bolts 〈36〉 and pull the housing cover upwards to remove.
13. Remove the scotch yoke 〈142〉 from the housing.

■Assembly

1. For reassembly of actuator, reverse the disassembly procedure.

⚠ CAUTION	
❗	● If the piston nut 〈13〉 is loosened, degrease the threaded portion of the piston rod <103> and the nut <13> and apply some locking liquid (KITZ standard: LOCTITE No. 263) before retightening.

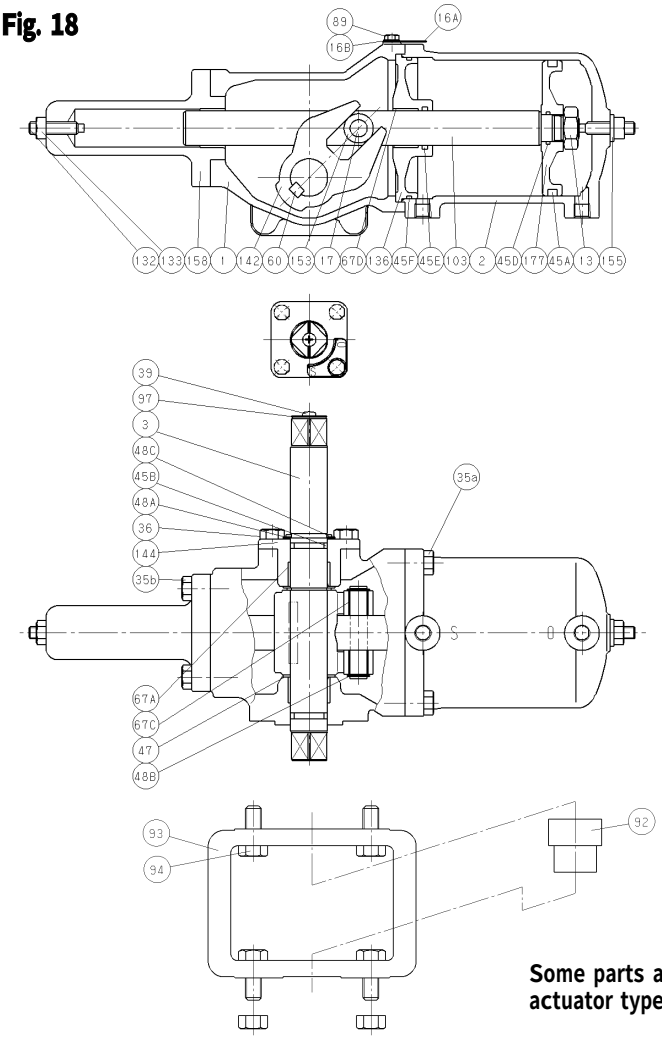
2. It is recommended to replace the piston O rings 〈45A〉 and the rod guide O rings 〈45E〉 because they contact with sliding parts repeatedly.
3. Apply some lubricant (KITZ standard: Shell Alvania EP2) to O ring grooves, cylinder internal surface and sliding parts.
4. Apply some liquid gasket (KITZ standard: Three Bond 1206E) to the contact faces between housing 〈1〉, housing cap 〈158〉, cylinder <2> and the housing cover.
5. After assembly of the actuator, check the valve opening and closing positions with the position indicator and mount the actuator to the bracket 〈93〉.

■Position Adjustment

1. Adjust the valve opening and closing positions by adjusting the bolt <132>
2. See Chapter 15 of this operation manual for details of adjustment.

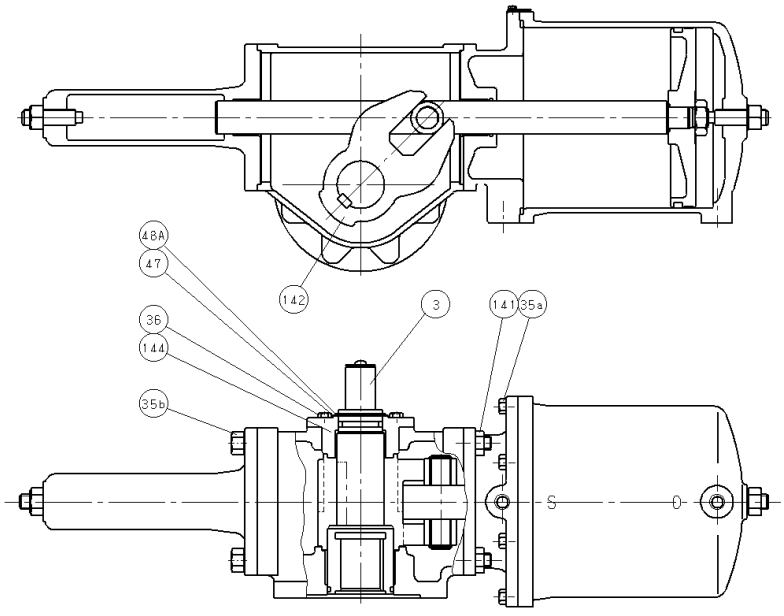
Assembly Diagram of Type B-1 to B-6

Fig. 18



No.	Parts	No.	Parts
1	Housing	67A	Bearing
2	Cylinder	67C	Bearing
3	Shaft	67D	Bearing
13	Nut	89	Bolt
16A	Plate	92	Connector
16B	Washer	93	Bracket
17	Pin	94	Bolt
35a	Bolt	97	Indicator
35b	Bolt	98	Indicator plate
36	Bolt	103	Piston rod
39	Screw	132	Cap Screw
45A	O ring	133	Nut
45B	O ring	136	Rod guide
45D	O ring	142	Scotch yoke
45E	O ring	144	Housing cover
45F	O ring	145	Washer
47	Thrust bearing	153	Roller
48A	Snap ring	155	Seal washer
48B	Snap ring	158	Housing cap
48C	Snap ring	177	Piston
60	Key		

Some parts are different depending on the actuator types.

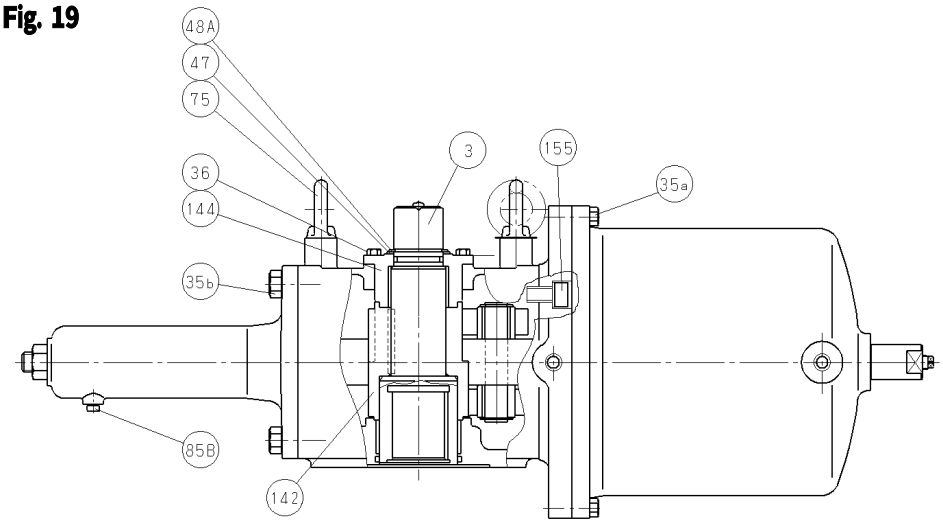


No.	Parts
3	Shaft
35a	Bolt
35b	Bolt
36	Bolt
47	Thrust bearing
48A	Snap ring
141	Nut
142	Scotch yoke
144	Housing cover

B-6 actuator shaft parts

B-7 Actuator Shaft Portion

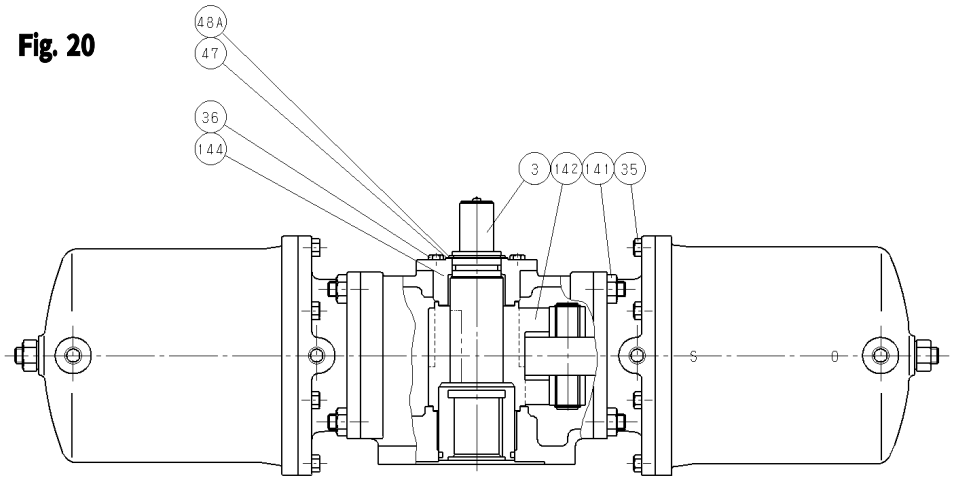
Fig. 19



No.	Parts
3	Shaft
35a	Bolt
35b	Bolt
36	Bolt
47	Thrust bearing
48A	Snap ring
75	Eye bolt
85B	Plug
142	Scotch yoke
144	Housing cover
155	Seal washer

B-D6 Actuator Shaft Portion

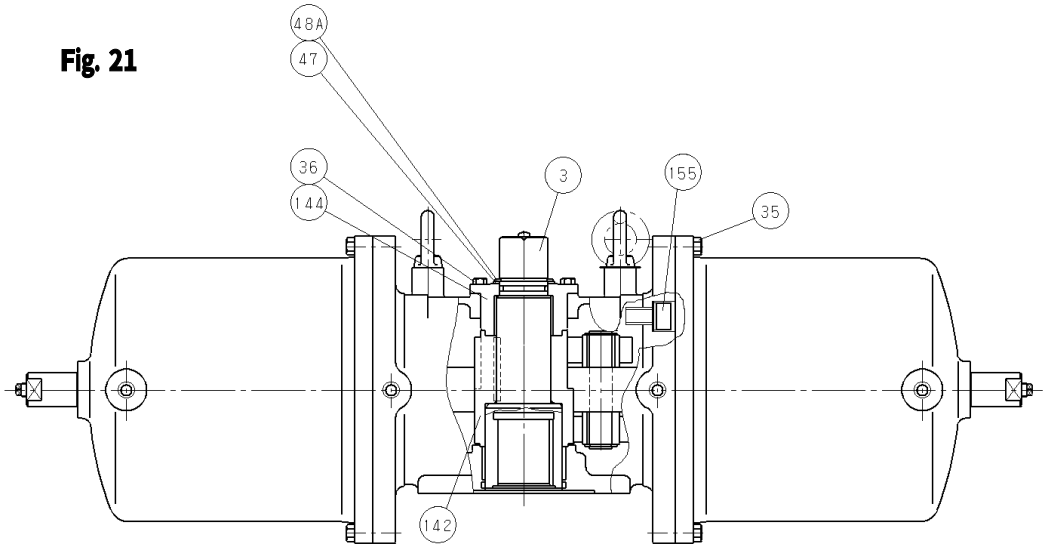
Fig. 20



No.	Parts
3	Shaft
35	Bolt
36	Bolt
47	Thrust bearing
48A	Snap ring
141	Nut
142	Scotch yoke
144	Housing cover

B-D7 Actuator Shaft Portion

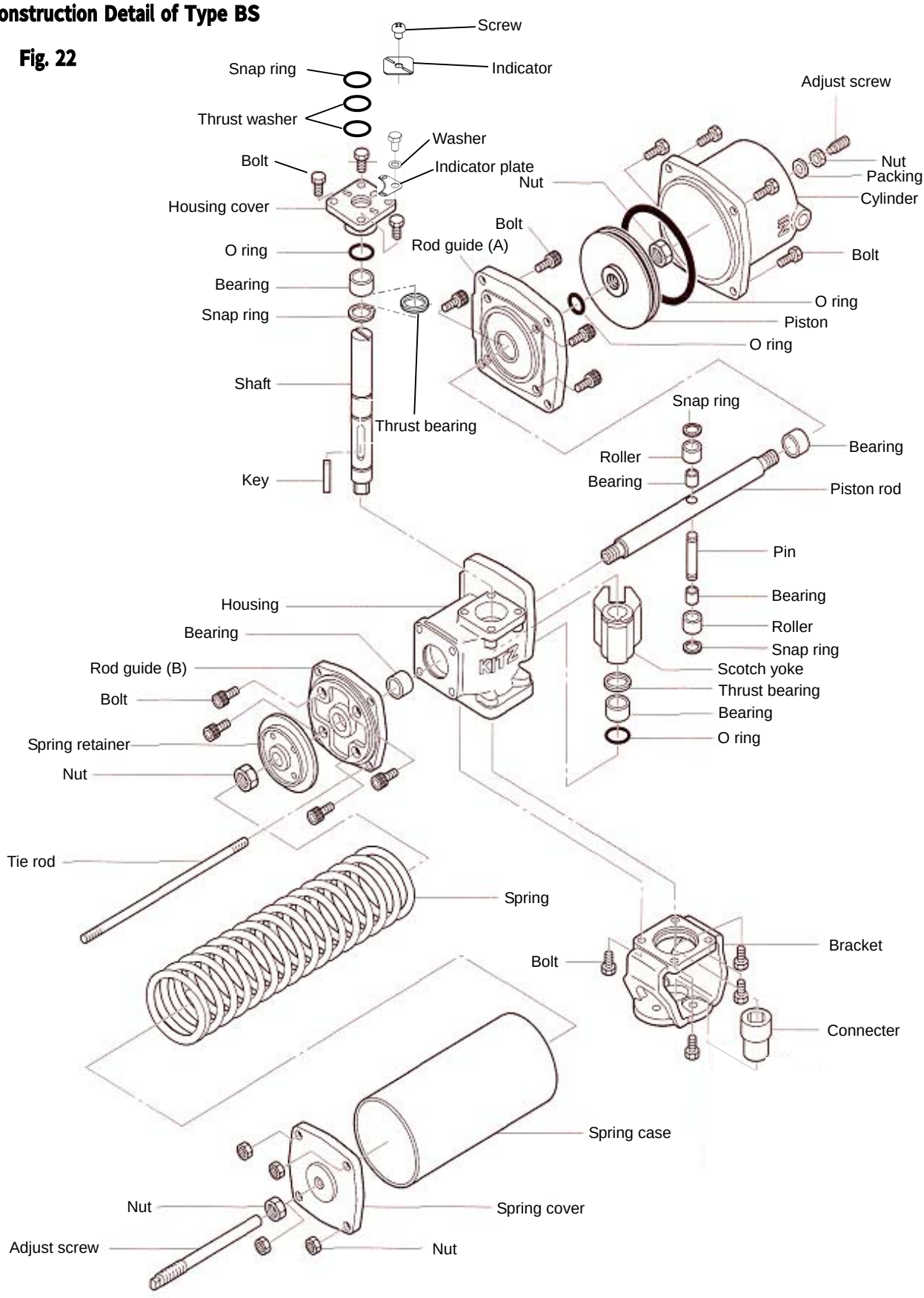
Fig. 21



No.	Parts
3	Shaft
35	Bolt
36	Bolt
47	Thrust bearing
48A	Snap ring
142	Scotch yoke
144	Housing cover
155	Seal washer

Construction Detail of Type BS

Fig. 22



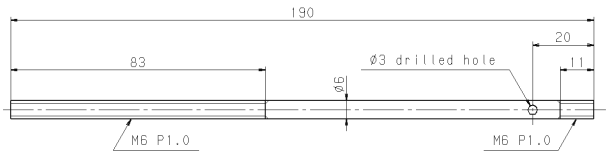
Type BS-3 is illustrated.

Type BS-0

⚠ WARNING	
!	● A compressed heavy-duty spring is packed within the spring case of the Type BS actuators. The spring cover may be pushed out and cause personal injury if the tie rod used for fixing the spring case is loosened and removed. When disassembling the spring case, make sure to follow the instructions given in this manual.

■Preparation

Before disassembling of Type BS-0 actuator, prepare threaded rods, spring pins and nuts as shown in the table below:

Parts	Shape and Dimensions (mm)	Qty
Threaded rod		4
Spring pin	Φ3×16 long	4
Nut	M6 P1.0	4

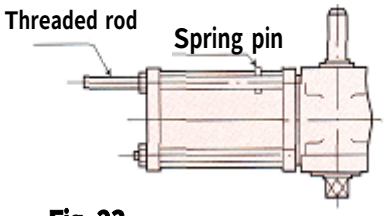


Fig. 23

■Disassembly

1. Reduce the internal pressure to the atmospheric level and remove the air tubing.
2. Remove the hexagonal bolts ⟨94⟩ and disassemble the actuator from the bracket ⟨93⟩ .
3. Remove one of the nuts ⟨55⟩ and the tie rod ⟨56⟩ .
4. Mount one of the four threaded rods in the position where the tie rod was removed and secure it on the spring cover ⟨158⟩ with a nut. Insert a spring pin into a pin hole drilled on the threaded rod so that the threaded rod does not loosen (Fig. 23).
5. Repeat the above procedure using the remaining threaded rods, spring pins and nuts.
6. Gradually, alternately and diagonally loosen the nuts on the spring cover and remove all of them when the spring has lost its recoiling force. Then remove the spring cover ⟨158>, spring case ⟨100⟩ and spring ⟨109⟩ .
7. Remove all of the threaded rods.
8. Move the spring retainer ⟨150⟩ by hand apart from the rod guide B ⟨136B⟩ to move the piston ⟨177⟩ towards the rod guide A ⟨136A⟩ .
9. Remove the hexagonal bolts ⟨35⟩ and disassemble the cylinder ⟨2⟩ from the housing ⟨1⟩ , taking care not to scratch the internal surface.
10. Remove the piston nut ⟨13a⟩ and the piston ⟨177⟩ .

⚠ CAUTION	
●	The piston nut <13a> is tightly threaded and fixed with locking liquid. Remove the piston nut carefully.

11. Remove the hexagonal cap screw ⟨140A⟩ and the rod guide ⟨136A⟩ .
12. Remove the spring retainer nut ⟨13b⟩ and the spring retainer ⟨150⟩ .
13. Remove the hexagonal cap screw ⟨140B⟩ and the rod guide ⟨136B⟩ .
14. Pull out the piston rod ⟨103⟩ towards the spring case.
15. Remove the snap ring ⟨48B⟩ and the roller ⟨153⟩ , and pull out the pin ⟨17⟩ .
16. Remove the snap ring ⟨48A⟩ and thrust bearing ⟨47⟩ , and push the shaft <3> downwards to remove.

⚠ CAUTION	
●	An anchor key ⟨60⟩ is provided to fix the scotch yoke ⟨142⟩ to the shaft. Be careful not to lose it.

17. Remove the scotch yoke ⟨142⟩ from the housing ⟨1⟩ .

■Assembly

1. For reassembly of actuator, reverse the disassembly procedure.

⚠ CAUTION	
●	If the anchor nut ⟨13a⟩ is loosened, apply some locking liquid (KITZ standard: LOCTITE No. 263) to the nut ⟨13a⟩ and the piston rod ⟨103⟩ threads before retightening.

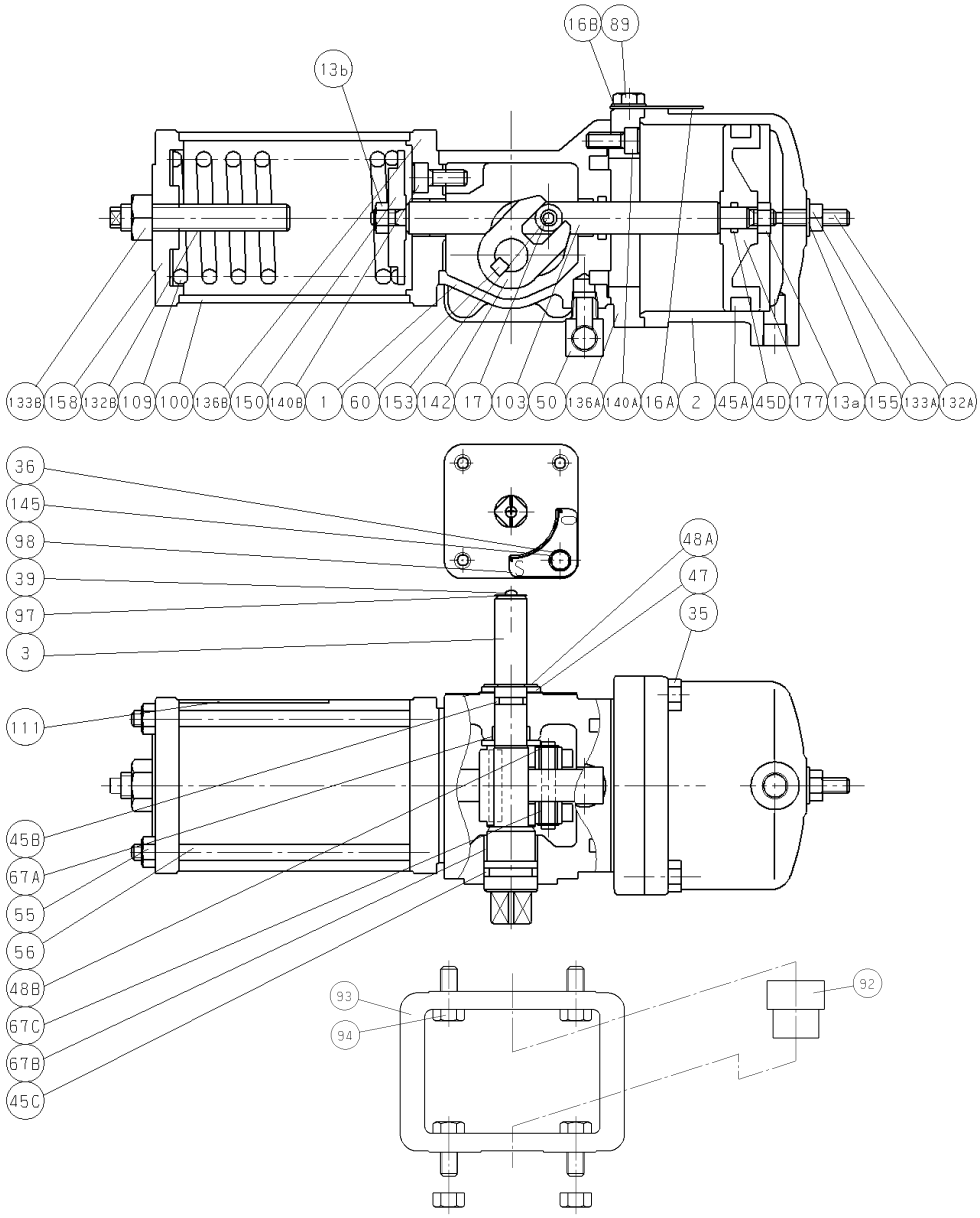
2. It is recommended to replace the piston O ring ⟨45A⟩ because it contacts with the sliding parts repeatedly.
3. Apply some lubricant (KITZ standard: Shell Alvania EP2) to the O ring grooves, cylinder internal surface and sliding parts.
4. Apply some liquid gasket (KITZ standard: Three Bond 1206E) to the contact faces of the housing ⟨1⟩ , rod guide A <136A>, rod guide B <136B>, spring case <100>, spring cover <158> and cylinder <2>.
5. After assembly of the actuator, check the valve opening and closing positions with attached position indicator and mount the bracket ⟨93⟩ .

■Position Adjustment

1. Adjust the valve opening and closing positions by adjusting the bolt <132A> on the cylinder side and the bolt <132B> on the spring cover side.
2. See Chapter 15 of this operation manual for details of adjustment.

Assembly Diagram of Type BS-0

Fig. 24



No.	Parts	No.	Parts	No.	Parts	No.	Parts	No.	Parts
1	Housing	39	Screw	56	Tie rod	98	Indicator plate	136B	Rod guide
2	Cylinder	45A	O ring	60	Key	100	Spring case	140A	Cap screw
3	Shaft	45B	O ring	67A	Bearing	103	Piston rod	140B	Cap screw
13a	Nut	45C	O ring	67B	Bearing	109	Spring	142	Scotch yoke
13b	Nut	45D	O ring	67C	Bearing	111	Caution plate	145	Washer
16A	Plate	47	Thrust bearing	89	Bolt	132A	Adjust screw	150	Spring retainer
16B	Washer	48A	Snap ring	92	Connector	132B	Adjust screw	153	Roller
17	Pin	48B	Snap ring	93	Bracket	133A	Nut	155	Seal washer
35	Bolt	50	Breathing port	94	Bolt	133B	Nut	158	Spring cover
36	Bolt	55	Nut	97	Indicator	136A	Rod guide	177	Piston

Type BS-1 to BS-6

For disassembly of Type BS-7 actuators, contact KITZ before disassembly.

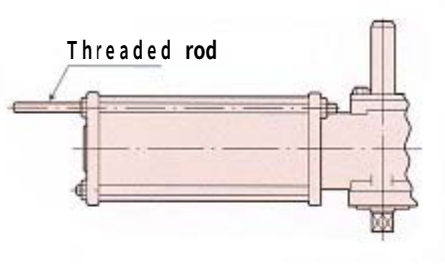
⚠ WARNING	
❗	● A compressed heavy-duty spring is packed within the spring case of the Type BS actuators. The spring cover may be pushed out and cause personal injury if the tie rod used for fixing the spring case is loosened and removed. When disassembling the spring case, make sure to follow the instructions given in this manual.

Preparation

Prior to disassembly of the BS-1 to BS-6 actuators, prepare the threaded rods and nuts as shown in the table below.

Actuator size	Threaded rod			Nut
	Thread	Length (mm)	Qty	Qty
BS−1	M6 P1.0	315	4	8
BS−2	M8 P1.25	450	4	8
BS−3	M10 P1.5	615	4	8
BS−4	M12 P1.75	775	4	8
BS−5	M16 P2.0	1010	4	8
BS−6	M20 P2.5	1300	4	8

Fig. 25



Disassembly

1. Reduce the internal pressure to the atmospheric level and remove the air tubing.
2. Remove the hexagonal bolts ⟨94⟩ and disassemble the actuator from the bracket ⟨93⟩.
3. Remove one of the nuts ⟨55⟩ and one of the tie rod ⟨56⟩ from the actuator.
4. Mount one of the four threaded rods to the position where the tie rod was removed, and secure both ends with the nuts (Fig.25).
5. Repeat this work with all other threaded rods and nuts, one after another.
6. Gradually, alternately and diagonally loosen the nuts and remove all when the spring has lost its recoiling force. Then remove the spring cover ⟨158⟩, spring case ⟨100⟩ and spring ⟨109⟩.
7. Remove all of the threaded rods.
8. Move the spring retainer ⟨150⟩ by hand apart from the rod guide B ⟨136B⟩ to move the piston ⟨177⟩ towards the rod guide A ⟨136A⟩.
9. Remove the hexagonal bolts ⟨35⟩ and disassemble the cylinder ⟨2⟩ from the housing ⟨1>, taking care not to scratch the internal surface.
10. Remove the spring retainer nut ⟨13b⟩ and the spring retainer ⟨150⟩.
11. Remove the cap screw ⟨140b⟩ and the rod guide ⟨136B⟩.

12. Move the piston ⟨177⟩ by hand apart from the rod guide ⟨136A⟩ and remove the cap screws ⟨140a⟩ .
13. Pull out the sub-assembly of piston ⟨177⟩ , rod guide A ⟨136A⟩ and piston rod ⟨103⟩ towards the cylinder.
14. Remove the snap ring ⟨48B> on the roller and then pull out the roller ⟨153⟩ and the pin ⟨17⟩ .
15. Pull out the rod guide A ⟨136A⟩ from the piston rod ⟨103⟩ .

⚠ CAUTION	
❗	• Locking liquid is used for the piston nut ⟨13a⟩ to firmly fix the piston. Do not loosen the piston nut unless it is necessary. Keep the piston and piston rod together as a sub-assembly.

Type BS-1 to BS-5

16. Remove the hexagonal bolts ⟨36⟩ and pull out the housing cover ⟨144⟩ upwards and the shaft, taking care not to damage the O ring on the shaft lower end.

⚠ CAUTION	
❗	• An anchor key ⟨60⟩ is provided to fix the scotch yoke ⟨142⟩ to the shaft. Be careful not to lose it.

17. Remove the scotch yoke (142) and the thrust bearing (47) from the housing.

Type BS-6

16. Remove the snap ring ⟨48A⟩ and thrust bearing ⟨47⟩ , and push out the shaft ⟨3⟩ downwards.

⚠ CAUTION	
❗	• An anchor key ⟨60⟩ is provided to fix the scotch yoke ⟨142⟩ to the shaft. Be careful not to lose it.

17. Remove the bolt <36> on the housing and pull out the housing cover <144> upwards.
18. Remove the scotch yoke ⟨142⟩ from the housing <1>.

■Assembly

1. For reassembly of actuators, reverse the disassembly procedures.

⚠ CAUTION	
❗	• Before attaching the piston nut ⟨13a⟩ , degrease the threaded portion of the piston rod <103> and the nut <13a> and apply some locking liquid (KITZ standard: LOCTITE No. 263) to prevent loosening.

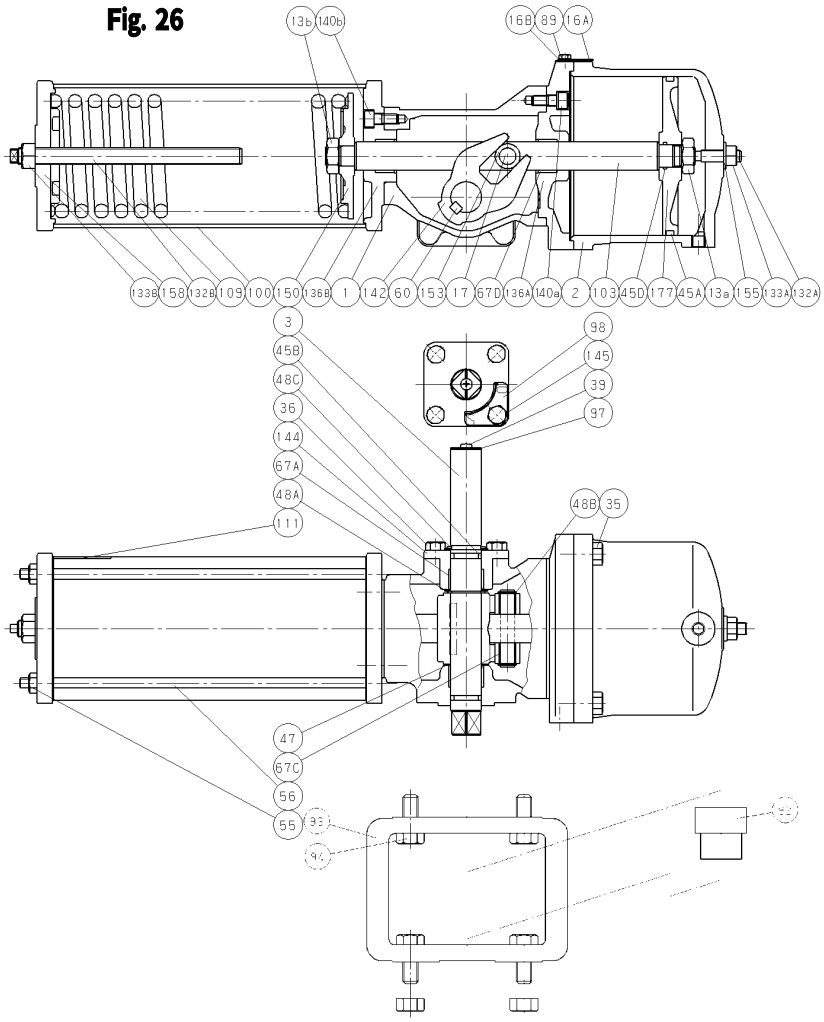
2. It is recommended to replace piston O ring〈45A〉because it contacts with the sliding parts repeatedly.
3. Apply some lubricant (KITZ standard: Shell Alvania EP2) to the O ring grooves, cylinder internal surface and sliding parts.
4. Apply some liquid gasket (KITZ standard: Three Bond 1206E) to the contact faces of the housing〈1〉, rod guide A <136A>, rod guide B <136B>, spring case <100>, spring cover <158>, housing cover <144> and cylinder <2>.
5. After assembly of the actuator, check the valve opening and closing positions with the position indicator and mount the actuator to the bracket〈93〉.

■Position Adjustment

1. Adjust the valve opening and closing positions by adjusting the bolt <132A> on the cylinder side and the bolt <132B> on the spring cover side.
2. See Chapter 15 of this operation manual for details of adjustment.

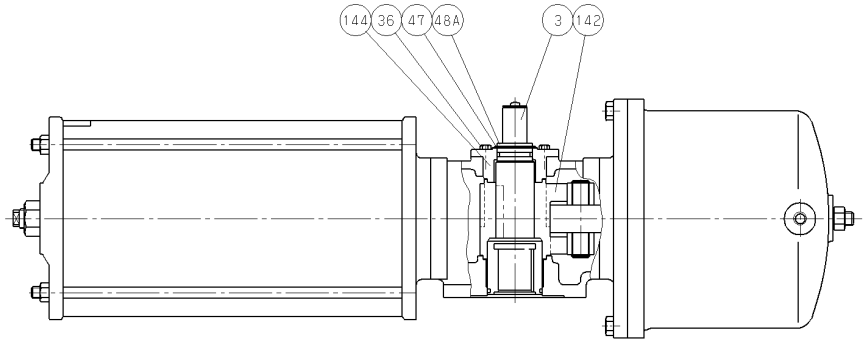
Assembly Diagram of Type BS - 1 to BS - 6

Fig. 26



No.	Parts	No.	Parts
1	Housing	93	Bracket
2	Cylinder	94	Bolt
3	Shaft	97	Indicator
13a	Nut	98	Indicator plate
13b	Nut	100	Spring case
16A	Plate	103	Piston rod
16B	Washer	109	Spring
17	Pin	111	Caution plate
35	Bolt	132A	Adjust screw
36	Bolt	132B	Adjust screw
39	Screw	133A	Nut
45A	O ring	133B	Nut
45B	O ring	136A	Rod guide
45D	O ring	136B	Rod guide
47	Thrust bearing	140a	Cap Screw
48A	Snap ring	140b	Cap Screw
48B	Snap ring	142	Scotch yoke
48C	Snap ring	144	Housing cover
55	Nut	145	Washer
56	Tie rod	146 *1	Backup ring
60	Key	150	Spring retainer
67A	Bearing	153	Roller
67C	Bearing	155	Seal washer
67D	Bearing	158	Spring cover
89	Bolt	177	Piston
92	Connector		

Some parts are different depending on the actuator type.



BS-6 Shaft Portion

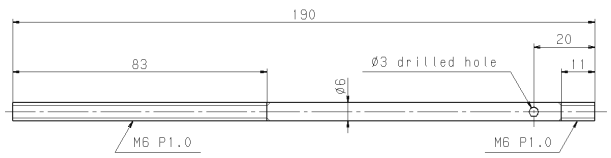
No.	Parts
3	Shaft
36	Bolt
47	Thrust bearing
48A	Snap ring
142	Scotch yoke
144	Hosing cover

Type BSW-0

⚠ WARNING	
❗	● A compressed heavy-duty spring is packed within the spring case of the Type BSW actuators. The spring cover may be pushed out and cause personal injury if the tie rod used for fixing the spring case is loosened and removed. When disassembling the spring case, make sure to follow the instructions given in this manual.

■Preparation

Prior to disassembly of actuators, prepare threaded rods, spring pins and nuts as shown in the table below:

Parts	Shape and dimensions (mm)	Qty
Threaded rod		4
Spring pin	Φ3×16 long	4
Nut	M6 P1.0	4

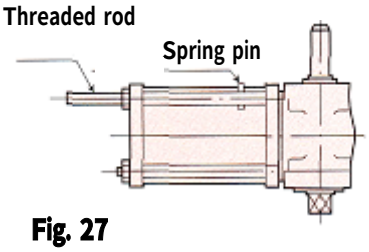


Fig. 27

■Disassembly

1. Reduce the Internal pressure to the atmospheric level and remove the air tubing.
2. Fully rotate the manual hand wheel ⟨9⟩ clockwise.
3. Remove the hexagonal bolts ⟨94⟩ and disassemble the actuator from the bracket ⟨93⟩ .
4. Remove the hexagonal cap screw ⟨10⟩ , spring washer ⟨145⟩ ,wheel washer ⟨43⟩ and the hand wheel ⟨9⟩ .
5. Remove the spring cover nut ⟨133B⟩ and stopper ⟨49⟩ .
6. Remove one of the tie rod ⟨56⟩ and nut ⟨55⟩ from the actuator.
7. Mount one of the four threaded rods prepared in advance where the removed tie rod was mounted, and secure it on the spring cover ⟨158⟩ with a nut. Insert a spring pin into a hole drilled on the threaded rod for secured mounting (Fig.27).
8. Repeat this work with all other threaded rods, spring pins and nuts, one after another.
9. Gradually, alternately and diagonally loosen the nuts and remove all when the spring has lost its recoiling force. Then remove the spring cover ⟨158⟩ , spring case ⟨100⟩ and spring ⟨109⟩ .
10. Remove all threaded rods.
11. Move the spring retainer ⟨150⟩ by hand apart from the rod guide ⟨136B⟩ to move the piston ⟨177⟩ towards another rod guide ⟨136A⟩ .
12. Remove the hexagonal cap screw ⟨35⟩ and disassemble the cylinder ⟨2⟩ from housing ⟨1⟩ , taking care not to scratch the internal surface coating.
13. Remove the piston nut ⟨13a⟩ and the piston ⟨177⟩ .

⚠ CAUTION	
●	The piston nut <13a> is tightly threaded and fixed with locking liquid. Remove the piston nut carefully.

14. Remove the hexagonal cap screw ⟨140A⟩ and the rod guide ⟨136A⟩ .
15. Remove the cap screw ⟨140C⟩ and remove the sub-assembly of guide ⟨108⟩ , guide cap ⟨78⟩ , bearing ⟨76⟩ and spindle ⟨123⟩ .
16. Remove the spring retainer nut ⟨13b⟩ and the spring retainer ⟨150⟩ .
17. Remove the hexagonal cap screw ⟨140B⟩ and the rod guide B ⟨136B⟩ .
18. Pull out the piston rod ⟨103⟩ towards the spring case.
19. Remove the snap ring ⟨48B⟩ and the roller ⟨153⟩ , and pull out the pin ⟨17⟩ .
20. Remove the snap ring ⟨48A⟩ and thrust bearing ⟨47⟩ and push down the shaft <3> to remove.

⚠ CAUTION	
●	An anchor key ⟨60⟩ is provided to fix the scotch yoke ⟨142⟩ to the shaft. Be careful not to lose it.

21. Remove the scotch yoke ⟨142⟩ from the housing ⟨1⟩ .

■Assembly

1. For re-assembly of actuator, reverse the disassembly procedures.

⚠ CAUTION	
●	Before attaching the piston nut ⟨13a⟩ , degrease the threaded portion of the piston rod <103> and the nut <13a> and apply some locking liquid (KITZ standard: LOCTITE No. 263) to prevent loosening.

⚠ CAUTION	
●	Ensure to lubricate the threaded parts of spindle ⟨123⟩ with grease such as “Shell Alvania EP2” to prevent fixing with the stopper ⟨49⟩ .

2. It is recommended to replace piston O rings ⟨45A⟩ , which are subject to repeated contacts with sliding parts.
3. Apply some lubricant (KITZ standard: Shell Alvania EP2) to O ring grooves, cylinder internal surface and all sliding parts and areas.

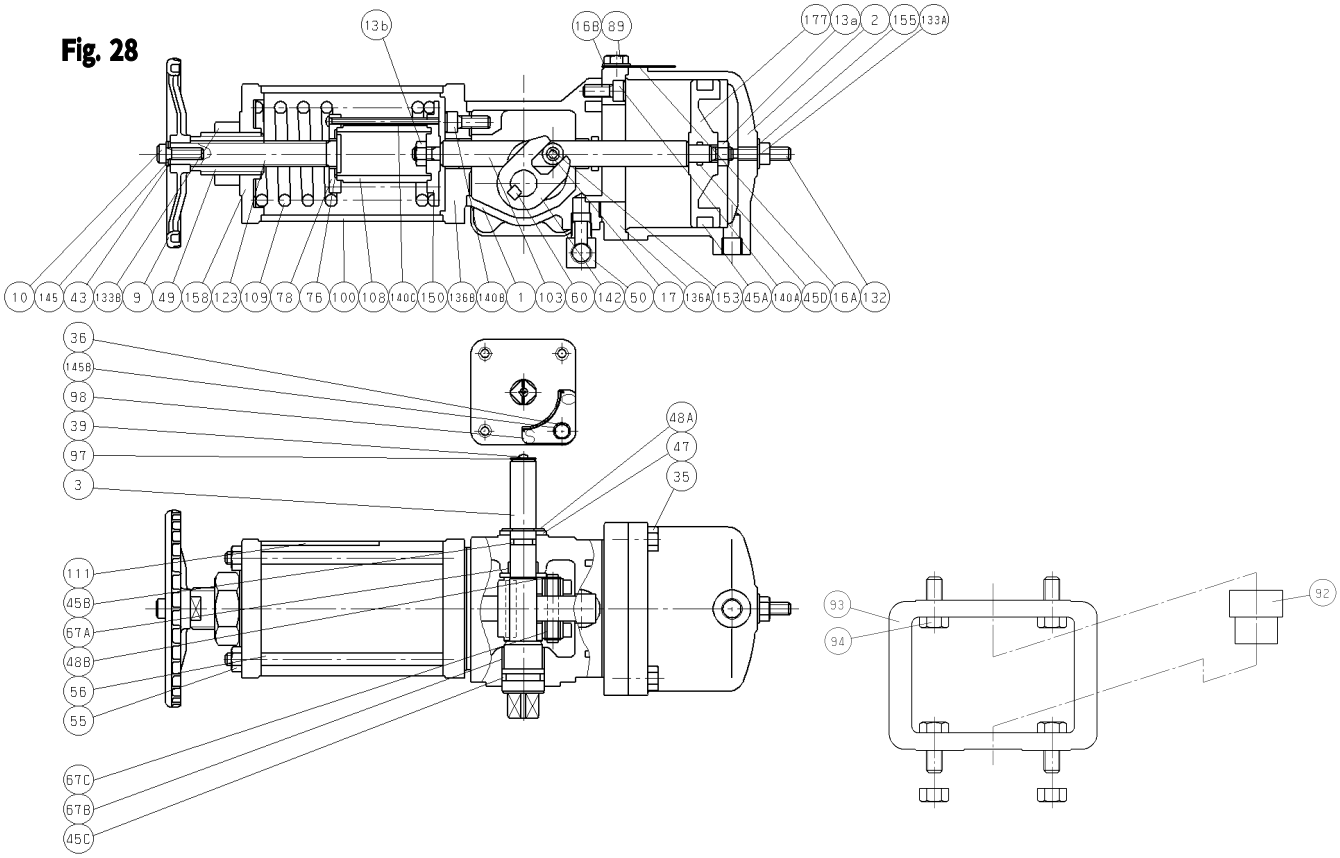
4. Apply some liquid gasket (KITZ standard: Three Bond 1206E) to the contact faces of the housing〈1〉, rod guide A <136A>, rod guide B <136B>, spring case <100>, spring cover <158> and cylinder <2>.
5. After completion of actuator assembly, check the valve opening and closing positions and attached position indicator and mount the bracket〈93〉.

■Position Adjustment

1. Adjust the valve opening and closing positions by adjusting the bolt <132> on the cylinder side and the stopper <49> on the spring cover side.
2. See Chapter 15 of this operation manual for details of adjustment.

Assembly Diagram of Type BSW -0

Fig. 28



No.	Parts	No.	Parts	No.	Parts	No.	Parts	No.	Parts
1	Housing	39	Screw	56	Tie rod	98	Indicator plate	140A	Cap screw
2	Cylinder	43	Handle washer	60	Key	100	Spring case	140B	Cap screw
3	Shaft	45A	O ring	67A	Bearing	103	Piston rod	140C	Screw
9	Handwheel	45B	O ring	67B	Bearing	108	Guide	142	Scotch yoke
10	Cap screw	45C	O ring	67C	Bearing	109	Spring	145A	Spring washer
13a	Nut	45D	O ring	76	Thrust bearing	111	Caution plate	145B	washer
13b	Nut	47	Thrust bearing	78	Guide cap	123	Spindle	150	Spring retainer
16A	Plate	48A	Snap ring	89	Bolt	132	Adjust screw	153	Roller
16B	Washer	48B	Snap ring	92	Connector	133A	Nut	155	Seal washer
17	Pin	49	Stopper	93	Bracket	133B	Nut	158	Spring cover
35	Bolt	50	Breathing port	94	Bolt	136A	Rod guide	177	Piston
36	Bolt	55	Nut	97	Indicator	136B	Rod guide		

Type BSW-1 to BSW-6

For disassembly of Type BSW-7 actuator, contact KITZ before disassembly.

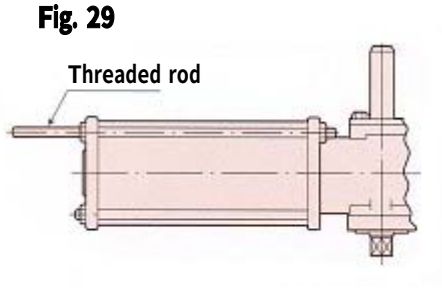
⚠ WARNING	
❗	● A compressed heavy-duty spring is packed within the spring case of the Type BSW actuators. The spring cover may be pushed out and cause personal injury if the tie rod used for fixing the spring case is loosened and removed. When disassembling the spring case, make sure to follow the instructions given in this manual.

■Preparation

Prior to disassembly of the BSW-1 to BSW-6 actuators, prepare the threaded rods and nuts as shown in the table below.

Actuator size	Threaded rod			Nut
	Thread	Length(mm)	Qty	Qty
BS−1	M6 P1.0	315	4	8
BS−2	M8 P1.25	450	4	8
BS−3	M10 P1.5	615	4	8
BS−4	M12 P1.75	775	4	8
BS−5	M16 P2.0	1010	4	8
BS−6	M20 P2.5	1300	4	8

Fig. 29



■Disassembly

1. Reduce the internal pressure to the atmospheric level and remove the air tubing.
2. Rotate the manual handwheel ⟨9⟩ clockwise to the fully open position.
3. Remove the hexagonal bolts ⟨94⟩ and disassemble the actuator from the bracket ⟨93⟩ .
4. Remove the hexagonal cap screw ⟨10⟩ , spring washer ⟨145A⟩ , handwheel washer ⟨43⟩ and handwheel ⟨9⟩ .
5. Remove the spring cover nut ⟨133B⟩ and the stopper ⟨49⟩ .
6. Remove one of the nut ⟨55⟩ and tie rod ⟨56⟩ from the actuator.
7. Mount one of the four threaded rods in the position where the tie rod was removed and secure the both ends with the nuts (Fig.29).
8. Repeat the same procedure for the remaining nut, tie rod and threaded rods.
9. Gradually, alternately and diagonally loosen the nuts for the threaded rods on the housing side and remove all of the nuts when the spring has lost its recoiling force. Then remove the spring cover ⟨158⟩ , spring case ⟨100⟩ and spring ⟨109⟩ .
10. Remove all of the threaded rods.
11. Move the spring retainer ⟨150⟩ by hand apart from the rod guide B ⟨136B⟩ to move the piston ⟨177⟩ towards the rod guide A ⟨136A⟩ .

12. Remove the hexagonal cap screw ⟨35⟩ and carefully disassemble the cylinder ⟨2⟩ from the housing ⟨1⟩ not to scratch the internal surface coating.
13. Remove the hexagonal cap screw ⟨140C⟩ and disassemble the sub-assembly of guide ⟨108⟩ , guide cap ⟨78⟩ , bearing ⟨76⟩ and spindle ⟨123⟩ .
14. Remove the hexagonal nut ⟨13b⟩ and the spring retainer ⟨150⟩ .
15. Remove the hexagonal cap screw ⟨140B⟩ and the rod guide ⟨136B⟩ .
16. Move the piston ⟨177⟩ by hand apart from the rod guide ⟨136A⟩ and remove the hexagonal cap screws ⟨140A⟩ .
17. Pull out the sub-assembly of piston ⟨177⟩ , rod guide ⟨136A⟩ and piston rod ⟨103⟩ towards the cylinder.
18. Remove the snap ring ⟨48B⟩ and the roller ⟨153⟩ and pull out the pin ⟨17⟩ .
19. Pull out the rod guide ⟨136A⟩ from the piston rod ⟨103⟩ .

⚠ CAUTION	
❗	• Locking liquid is used for the piston nut ⟨13a⟩ to firmly fix the piston. Do not loosen the piston nut unless it is necessary. Keep the piston and piston rod together as a sub-assembly.

BSW-1 to BSW-5

20. Remove the hexagonal bolts ⟨36⟩ and carefully pull out the housing cover ⟨144⟩ and the shaft <3> upwards not to damage the O ring on the shaft lower end.

⚠ CAUTION	
❗	• An anchor key ⟨60⟩ is provided to fix the scotch yoke ⟨142⟩ to the shaft. Be careful not to lose it.

21. Remove the scotch yoke ⟨142⟩ and thrust bearing ⟨47⟩ from the housing ⟨1⟩

BSW-6

20. Remove the snap ring ⟨48A⟩ and thrust bearing ⟨47⟩ and push out the shaft downwards.

⚠ CAUTION	
❗	• An anchor key ⟨60⟩ is provided to fix the scotch yoke ⟨142⟩ to the shaft. Be careful not to lose it.

21. Remove the hexagonal bolts ⟨36⟩ and pull the housing cover ⟨144⟩ upwards to remove.
22. Remove the scotch yoke ⟨142⟩ from the housing ⟨1>.

■Assembly

1. For reassembly of actuators, reverse the disassembly procedures.

⚠ CAUTION	
❗	Before attaching the piston nut ⟨13a⟩, degrease the threaded portion of the piston rod <103> and the nut ⟨13a⟩ and apply some locking liquid (KITZ standard: LOCTITE No. 263) to prevent loosening.

⚠ CAUTION	
❗	Lubricate the threaded portions of spindle ⟨123⟩ with grease (KITZ standard: Shell Alvania EP2) to prevent fixing with the stopper ⟨49⟩.

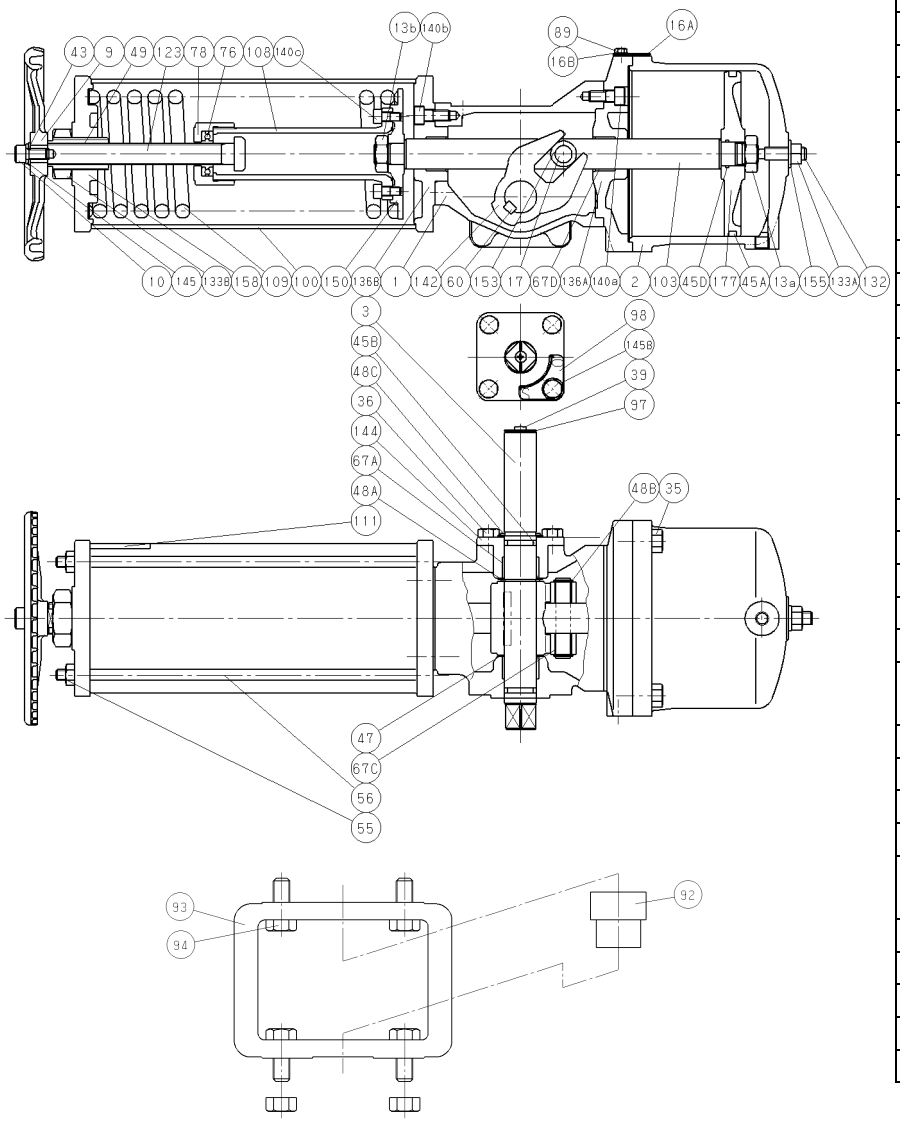
2. It is recommended to replace piston O ring ⟨45A⟩ because it contacts with sliding parts repeatedly.
3. Apply some lubricant (KITZ standard: Shell Alvania EP2) to O ring grooves, cylinder internal surface and sliding parts.
4. Apply some liquid gasket (KITZ standard: Three Bond 1206E) to the contact faces of the housing ⟨1>, rod guide A <136A>, rod guide B <136B>, spring case <100>, spring cover <158>, housing cover ⟨144⟩ and cylinder ⟨2⟩.
5. After assembly of the actuator, check the valve opening and closing positions and with position indicator and mount the actuator to the bracket ⟨93⟩.

■Position Adjustment

1. Adjust the valve opening and closing positions by adjusting the bolt <132> on the cylinder side and the stopper <49> on the spring cover side.
2. See Chapter 15 of this operation manual for details of adjustment.

Assembly Diagram of Type BSW - 1 to BSW - 6

Fig. 30

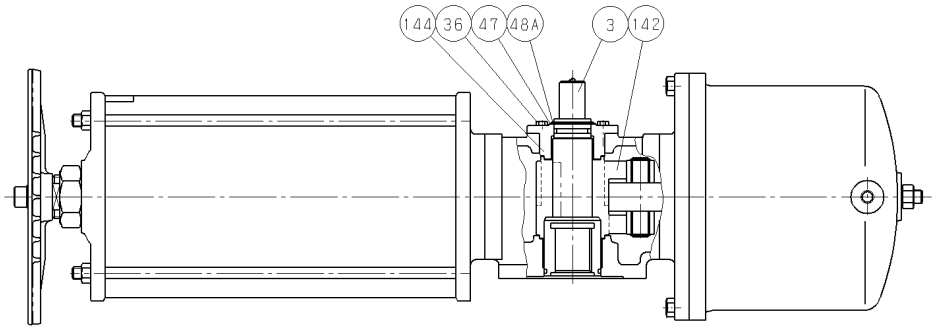


No.	Parts	No.	Parts
1	Housing	89	Bolt
2	Cylinder	92	Connector
3	Shaft	93	Bracket
9	Handwheel	94	Bolt
10	Cap screw	97	Indicator
13a	Nut	98	Indicator plate
13b	Nut	100	Spring case
16A	Plate	103	Piston rod
16B	Washer	108	Guide
17	Pin	109	Spring
35	Bolt	111	Caution plate
36	Bolt	123	Spindle
39	Screw	132	Adjust screw
43	Handle washer	133A	Nut
45A	O ring	133B	Nut
45B	O ring	136A	Rod guide
45D	O ring	136B	Rod guide
47	Thrust Bearing	140a	Cap screw
48A	Snap ring	140b	Cap screw
48B	Snap ring	140c (*1)	Cap screw
48C	Snap ring	142	Scotch yoke
49	Stopper	144	Housing cover
55	Nut	145A	Spring washer
56	Tie rod	145B	Washer
60	Key	146 (*2)	Backup ring
67A	Bearing	150	Spring retainer
67C	Bearing	153	Roller
67D	Bearing	155	Seal washer
76	Thrust Bearing	140a	Spring cover
78	Guide cap	177	Piston

Some parts are different depending on the actuator type.

*1 Only BSW-6

*2 BSW-5 or higher



No.	Parts
3	Shaft
36	Bolt
47	Thrust Bearing
48A	Snap ring
142	Scotch yoke
144	Housing cover

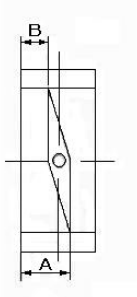
BSW-6 Actuator Shaft Portion

15 Adjustment of Valve Operating Positions

Adjust the valve fully opening and fully closing positions by adjusting the adjustment bolts on the both sides of the actuator.

Adjustment for KITZ Butterfly Valves (*1)

Valve size		A minus B [mm]	
NPS	DN	10DJ	16DJ
1-1/2	40	0 to 2	
2	50	2 to 3	
2-1/2	65	3 to 4	
3	80	3 to 4	
4	100	4 to 5	
5	125	4 to 5	
6	150	5 to 6	
8	200	5 to 7	
10	250	18 to 20	*2
12	300	18 to 20	*2
14	350	*3	

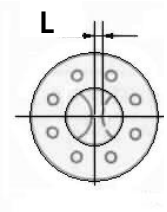


(*1) Set the difference, [A minus B], to zero for KITZ UB Series and SHB Series butterfly valves.

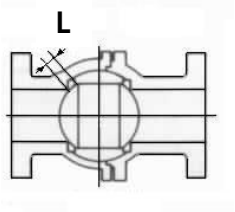
(*2) Contact KITZ for information on Size DN250 and DN300.

(*3) Contact KITZ for information on Size DN350.

Adjustment for KITZ Class 150/300 Full-Bored Floating Ball Valves (*4)



Half open from the fully closed position

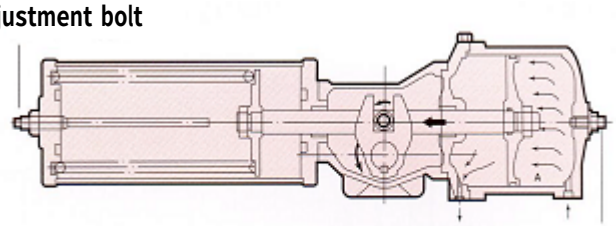


Fully closed

Valve size (full-bore)		
NPS	DN	L [mm]
3/8 to 3/4	10 to 20	5.0
1 to 1-1/2	25 to 40	5.5
2	50	6.0
2-1/4	65	7.0
2-1/2	80	8.0
4	100	9.5
5, 6	125, 150	12.5
8	200	21.0
10	250	26.5

(*4) Applicable to KITZ JIS 10K/20K ASME Class 150/300 full bore floating ball valves.

Fig. 31



Type BS Actuator

16 Product Warranty

If a failure not due to the following matters occurs within 18 months after delivery or within 12 months after trial operation, whichever is shorter, we will repair or replace the product free of charge.

- A case where the product is used outside the specification for the product concerned, and failures and damage which occur as a result of disregard of the precautions shown in this operation manual.
- Failures and damage which occur as a result of inappropriate use of the product, careless use, etc.
- Failures and damage which occur due to a natural disaster, such as fire, flood damage, earthquake and lightning strike.
- Failures and damage which occur as a result of modification/addition carried out by persons other than KITZ employees and service engineers designated by KITZ.
- Failures and damage which occur as a result of aged deterioration (rusting, color fading, chemical change, etc.)

Repair of failures and damage due to the above-mentioned reasons and replacement of consumables will be at the expense of the customer.

17. Consumables

●NBR O Rings for KITZ B Series Actuators

Refer to the following tables for replacement of O rings.
Shaft O ring dimensions were changed in November 1998. Refer to the table on the next page.

B-0	partNo.	size	product code	Q'ty
For piston	45A	P40	8710-0040-00	1
	45D	P8	8710-0008-00	1
For rod guide	45E	P12	8710-0012-00	1
For housing	45F	G50	8720-0050-00	1
For drive shaft	45B	P9	8710-0009-00	1
	45C	P16	8710-0016-00	1

BS-0・BSW-0	partNo.	size	product code	Q'ty
For piston	45A	P60	8710-0060-00	1
	45D	P8	8710-0008-00	1
For drive shaft	45B	P9	8710-0009-00	1
	45C	P16	8710-0016-00	1

B-1	partNo.	size	product code	Q'ty
For piston	45A	P48A	8710-0A10-00	1
	45D ☆	P10	8710-0010-00	1
For rod guide	45E	P14	8710-0014-00	1
	45F	G55	8720-0055-00	1
For drive shaft	45B	P12	8710-0012-00	2

BS-1・BSW-1	partNo.	size	product code	Q'ty
For piston	45A	P70	8710-0070-00	1
	45D ☆	P10	8710-0010-00	1
For drive shaft	45B	P12	8710-0012-00	2

B-2	partNo.	size	product code	Q'ty
For piston	45A	P70	8710-0070-00	1
	45D ☆	P14	8710-0014-00	1
For rod guide	45E	P20	8710-0020-00	1
	45F	G80	8720-0080-00	1
For drive shaft	45B	P18	8710-0018-00	2

BS-2・BSW-2	partNo.	size	product code	Q'ty
For piston	45A	P100	8710-0100-00	1
	45D ☆	P14	8710-0014-00	1
For drive shaft	45B	P18	8710-0018-00	2

B-3	partNo.	size	product code	Q'ty
For piston	45A	P100	8710-0100-00	1
	45D ☆	P22	8710-0022-00	1
For rod guide	45E	P28	8710-0028-00	1
	45F	G110	8720-0110-00	1
For drive shaft	45B	P24	8710-0024-00	2

BS-3・BSW-3	partNo.	size	product code	Q'ty
For piston	45A	P145	8710-0145-00	1
	45D ☆	P22	8710-0022-00	1
For drive shaft	45B	P24	8710-0024-00	2

B-4	partNo.	size	product code	Q'ty
For piston	45A	P145	8710-0145-00	1
	45D ☆	P26	8710-0026-00	1
For rod guide	45E	P35	8710-0035-00	1
	45F	G150	8720-0150-00	1
For drive shaft	45B	P39	8710-0039-00	2

BS-4・BSW-4	partNo.	size	product code	Q'ty
For piston	45A	P200	8710-0200-00	1
	45D ☆	P26	8710-0026-00	1
For drive shaft	45B	P39	8710-0039-00	2

B-5	partNo.	size	product code	Q'ty
For piston	45A	P200	8710-0200-00	1
	45D ☆	P32	8710-0032-00	1
For rod guide	45E	P40	8710-0040-00	1
	45F	G210	8720-0210-00	1
For drive shaft	45B	P44	8710-0044-00	2

BS-5・BSW-5	partNo.	size	product code	Q'ty
For piston	45A	P285	8710-0285-00	1
	45D ☆	P32	8710-0032-00	1
For drive shaft	45B	P44	8710-0044-00	2

B-6	partNo.	size	product code	Q'ty
For piston	45A	P255	8710-0255-00	1
	45D ☆	P32	8710-0032-00	1
For rod guide	45E	P50	8710-0050-00	1
	45F	G280	8720-0280-00	1
For drive shaft	45B	P55	8710-0055-00	1
	45C	P90	8710-0090-00	1

BS-6・BSW-6	partNo.	size	product code	Q'ty
For piston	45A	P360	8710-0360-00	1
	45D ☆	P32	8710-0032-00	1
For drive shaft	45B	P55	8710-0055-00	1
	45C	P90	8710-0090-00	1

B-7	partNo.	size	product code	Q'ty
For piston	45A	P375	8710-0375-00	1
	45D ☆	P45	8710-0045-00	1
For rod guide	45E	P70	8710-0070-00	1
	45F	P400	8710-0400-00	1
For drive shaft	45B	P65	8710-0065-00	1
	45C	P120	8710-0120-00	1
For stopper bolt	45G	P34	8710-0034-00	1

B-D6	partNo.	size	product code	Q'ty
For piston	45A	P255	8710-0255-00	2
	45D	P32	8710-0032-00	2
For rod guide	45E	P50	8710-0050-00	2
	45F	G280	8720-0280-00	2
For drive shaft	45B	P55	8710-0055-00	1
	45C	P90	8710-0090-00	1

B-D7	partNo.	size	product code	Q'ty
For piston	45A	P375	8710-0375-00	2
	45D	P45	8710-0045-00	2
For rod guide	45E	P70	8710-0070-00	2
	45F	P400	8710-0400-00	2
For drive shaft	45B	P65	8710-0065-00	1
	45C	P120	8710-0120-00	1
For stopper bolt	45G	P34	8710-0034-00	2

●**Refer to the following tables for O rings for the products manufactured before November 1998.**

B-1	partNo.	size	product code	Q'ty
For drive shaft	45B	P16	8710-0016-00	2

BS-1・BSW-1	partNo.	size	product code	Q'ty
For drive shaft	45B	P16	8710-0016-00	2

B-2	partNo.	size	product code	Q'ty
For drive shaft	45B	P22	8710-0022-00	2

BS-2・BSW-2	partNo.	size	product code	Q'ty
For drive shaft	45B	P22	8710-0022-00	2

B-3	partNo.	size	product code	Q'ty
For drive shaft	45B	P30	8710-0030-00	2

BS-3・BSW-3	partNo.	size	product code	Q'ty
For drive shaft	45B	P30	8710-0030-00	2

B-4	partNo.	size	product code	Q'ty
For drive shaft	45B	P45	8710-0045-00	2

BS-4・BSW-4	partNo.	size	product code	Q'ty
For drive shaft	45B	P45	8710-0045-00	2

B-5	partNo.	size	product code	Q'ty
For drive shaft	45B	P50	8710-0050-00	2

BS-5・BSW-5	partNo.	size	product code	Q'ty
For drive shaft	45B	P50	8710-0050-00	2

B-6	partNo.	size	product code	Q'ty
For drive shaft	45C	P100	8710-0100-00	1

BS-6・BSW-6	partNo.	size	product code	Q'ty
For drive shaft	45C	P100	8710-0100-00	1

P/G: JIS B2401 standard product Type 1-A
When ordering O rings, please specify the product code (e.g. 8710-0040-00) and the size (e.g. P40).

Note) Piston O ring〈45D〉for B/BS/BSW-1 to 6 should not be replaced, unless it directly causes leakage. When replacement is required, degrease the threaded portion of the piston rod and the nut and apply some locking liquid (KITZ standard: LOCTITE No.263) to the threaded portion to prevent loosening.

● **Seal Washer for Actuator Parts**

B-0 BS-0 BSW-0 B-1	6360-6812-01	QTY 1
BS-1 BSW-1 B-2	6360-6812-02	QTY 1
BS-2 BSW-2 B-3	6360-6812-03	QTY 1

BS-3 BSW-3 B-4	6360-6812-04	QTY 1
BS-4 BSW-4 B-5	6360-6812-06	QTY 1
BS-5 BSW-5 B-6 BS-6 BSW-6	6360-6812-07	QTY 1
B-D6	6360-6812-07	QTY 2

18 Contact for Technical Assistance

When requesting repair, etc. of the product, check the following items and contact your dealer or the nearest KITZ sales office.

- Date of purchase / installation
- Name of the store from which the product is purchased
- Product name (Product code / bore)
- Fluid type / pressure / temperature
- Frequency of use / operation conditions
- Environment in the piping portion
- Details of failure, repair request, etc.
- Company name, address of installation place, phone number, division in charge and name of person in charge