
KITZ

Operation Manual

For

KITZ C/CS Series Pneumatic Actuators

Thank you for choosing KITZ products.

For safe and trouble-free function and performance of the product, ensure to read and understand all items of this manual before valve mounting and operation.

Keep this manual in a convenient place for your valve operators' easy access.

NOTES TO USERS

This manual applies to the KITZ C/CS Series Pneumatic Valve Actuators.

For actuators of automatically operated value, refer to the operation manual of relevant actuators prepared by the manufacturers.

SAFETY CAUTIONS

This manual calls users' careful attention to the dangers and hazards that may be caused to personnel or properties during handling, storage, installation, operation or maintenance of the product. Such dangers and hazards are specifically highlighted in the operation manual with either one of the following marks.



WARNING

A warning indicates a potentially hazardous condition that may result in serious injury or death of personnel, if such a warning is ignored.



CAUTION

A caution indicates a potentially hazardous condition that may result in minor injury to personnel or damage to properties, if such a caution is ignored.



Indicate to call attention of an action.



Indicates prohibition of an action.



Indicates mandatory implementation of an action.



- ◆ This manual provides users with the instructions on correct use of KITZ C/CS pneumatic valve actuators. Ensure to carefully read all the items of this manual before handling, storage, installation, operation and maintenance of the product.
- ◆ This manual covers the normal use of the product as a general guide to users, but does not necessarily cover every condition or situation that may be caused to users while using the product. If technical assistance beyond the scope of this manual is required, users are recommended to contact KITZ Corporation or the distributors in their locations.
- ◆ Numerical limits given in this manual such as operating pressures and service temperatures are specified in consideration of safe and trouble-free operation of the products. It is forbidden to use the product in any condition that may exceed such numerical limits.
- ◆ Drawings and illustrations of the product in this manual provide users with only the basic information. Ask KITZ Corporation or the distributors for detailed assembly drawings of the products, if needed.
- ◆ Any information provided in this manual is subject to from-time-to-time change without notice for error rectification, product discontinuation, design modification, or any other causes that KITZ Corporation considers necessary.




If any item of this manual is not strictly followed by users, KITZ Corporation shall have no responsibility for any resulting accident or failure of the product.

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1. Attention for user's system

 WARNING	
	<p>① Holding valve position KITZ pneumatic actuators Do not assure no leakage. Actuators do not hold valve positions long time without continuous air supply. If you need to hold valve position long time without continuous air supply, contact KITZ Corporation or its distributors.</p> <p>② Internal air residue of spring return type actuators Out put torques of spring return type actuators indicate values without internal air residue remains inside their cylinders. Please design your systems to be able to exhaust internal air residue at spring return action. If internal air residue remains in the cylinders, out put torque will be small and valves do not open or close by spring return action.</p>

 WARNING	
	① Do not pressurize spring return type actuator's breathing port.
	② Prevent entering dust, rainwater or waste into actuators through the breathing port.

2. Product Features

This product is a pneumatic actuator developed for automatic opening and closing operation of small-bore ball valves.

- ◆ Small size and light weight in the double-piston structure.
- ◆ Rack and pinion structure by double pistons, suitable for 90° opening and closing operation of small-bore valves.
- ◆ Direct-connected structure allowing the valve and actuator to be separated easily during maintenance or at the time of an abnormality.
- ◆ Highly reliable design with minimum part configuration.

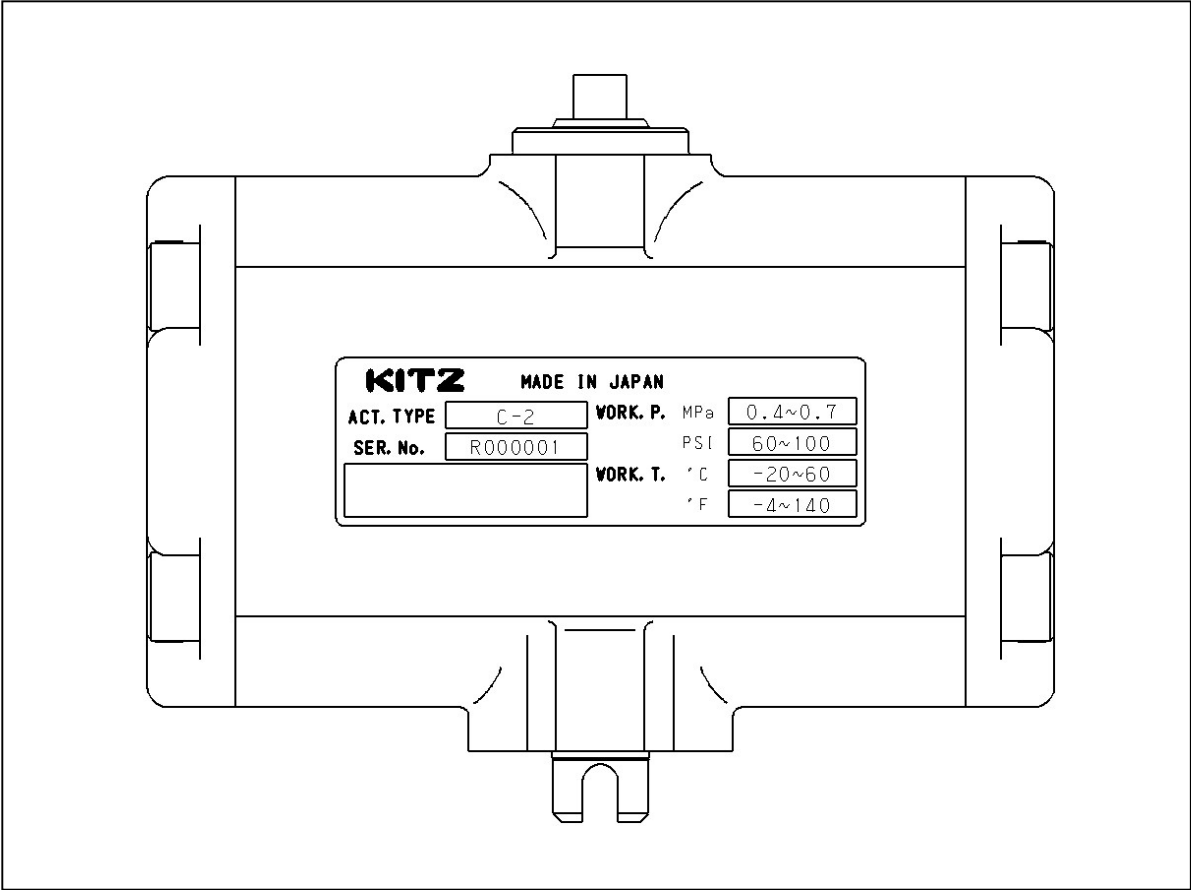
3. Product Codes

C S - 1

① ②

①Types of operation	②Actuator size
No code...Double action	1...Size 1
S.....Spring return	2...Size 2

Detail of nameplate



4. Design Specifications

TYPE OF ACTUATOR	C-1	C-2	CS-1	CS-2
Operating media	Air			
Standard operation pressure	0.4 MPa			
Operating pressure range	0.4 ~ 0.7 MPa			
Output torque ^{*1}	3.9 N-m	8.5 N-m	1.3 N-m	3.1 N-m
Housing shell test pressure	0.97 MPa			
Angle of Revolution	90° (+1° ~ +5°)			
Cylinder Volume (Litter)	0.073	0.160	0.033	0.071
Operation Time ^{*2}	Max. 1 sec.			
Service Temperature range ^{*3}	-20°C ~ +60°C -4° F ~ +140° F			
Ambient Condition ^{*4}	Indoor			

Notes:

*1 At supply pressure, 0.4MPa

*2 On a condition of KITZ standard air equipments and no load on a valve

*3 Free from freezing of supply air and pay attention for optional equipments service temperature range

*4 For outdoor service, consult a KITZ Engineer

5. KITZ Optional Accessories

C type actuators has a direct mount type exclusive solenoid valve. It makes piping-less and compact mounting.

This exclusive solenoid valve is not waterproof type. Prevent water if you use them outdoor.

◆ Exclusive Solenoid Valve

Structure	Normal Type
Electrical connection	Lead wire type
Working pressure range	0.15~0.7MPa
Ambient temperature range	5~50°C
Air inlets	Rc1/8
Effective area of valve	4.0mm ²
Power supply	AC100,110V/50,60Hz:±10% AC200,220V/50,60Hz:±10% DC24:±10%

◆ Limit Switch

Structure	Normal Type
Sensing position	1 position
Power supply	AC: 5A-125VAC 5A-250VAC DC: 0.5A-115VDC 0.25A-230VDC
Ambient temperature range	-10~70°C
Electrical connection	Conduit type
Electric wire diameter	φ5.8-φ7.8

◆ Filter-Regulator

Structure	Relief type
Maximum working pressure	1MPa
Working pressure range	0.04~0.83MPa
Ambient temperature range	5~65°C
Nominal filtration rating	5 μm
Air inlets	Rc1/4

◆ Silencer

Connection	Rc1/8
Effective area	15mm ²
Noise reduction	18dB
Maximum working pressure	0.9MPa
Ambient temperature range	5~60°C

◆ Speed Controller

Structure	Restrictor	Exhaust restrictor	Exhaust restrictor with silencer
Working pressure range	0.05~1MPa	0.1~1MPa	0~1MPa
Ambient temperature range	5~60°C	-5~60°C	0~60°C
Air inlets	Rc1/8	R1/8·Rc1/8	R1/8

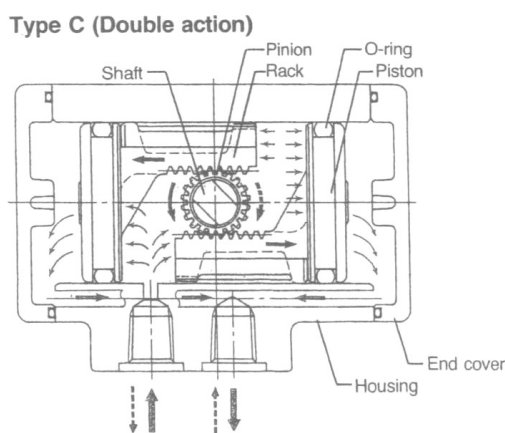
6. Actuator Driving Mechanism

◆ C-Type Actuator (Double-action Type)

The air pressure applied to the piston of actuator from the air supply port energizes its movement to actuator the pinion gear through the rack which is integral with piston as illustrated below.

The rack and pinion gear convert linear movement of the piston to rotational movement of drive shaft by 90° .

The air supply pressure supplied from the opposite side of air supply port drives the shaft in the opposite direction.

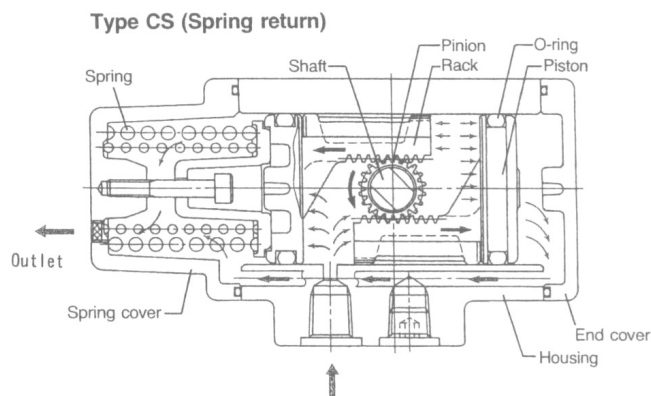


◆ CS-Type Actuator (Spring-return Type)

The air pressure applied to the piston of actuator from the air supply port energizes its movement to actuator pinion gear through the rack which is integral with piston as illustrated below, compressing the spring.

The rack and pinion gear convert linear movement of the piston to counterclockwise rotational movement of drive shaft by 90° .

When the air pressure is exhausted from the piston chamber by energizing or de-energizing of the solenoid valve, the compressed spring rotates the drive shaft clockwise through the piston, rack and pinion gear.



7. Supply of Air Operation Pressure

- (1) For the actuator factory-assembled with a solenoid valve, provide the air tubing between the air compressor and the solenoid valve. Air inlets are Rc 1/8.
- (2) Use copper, coated copper or plastic tubes of an adequate diameter and wall thickness. Clean tube bores to remove all foreign residues and tightly seal all connections to avoid leakage of air during a travel from the compressor.
- (3) If you want to mount your own solenoid valves other than those factory-assembled, select the following type.

C-Type Actuator (Double-action Type): Four (4) -way solenoid valves

CS-Type Actuator (Spring-return Type): Three (3) -way solenoid valves or four (4) -way solenoid valves with plugged port

- (4) Air inlets are Rc1/8. Use $\phi 6$ mm diameter tubes and hexagonal fittings of 12mm and smaller width of flat .
- (5) The required air pressure must be kept constant at the air inlet of an actuator. Insufficient air supply causes intermittent piston drive and results in malfunction of actuators.

$$Q = V (P + 0.1013) / 0.1013 \times n / 60 \quad [\text{l}/\text{min}(\text{ANR})]$$

Q = air consumption per minute $[\text{l}/\text{min}(\text{ANR})]$

V = cylinder volume $[\text{l}]$

P = supply pressure $[\text{MPaG}]$




n = number of piston cycles per hour

ANR = standard air (temperature: 20°C Absolute pressure: 760mmHg Humidity 65%)

To calculate the capacity of the compressor or air reservoir, a surplus of some 30% should be added as a safe margin to protect the operation of the actuator from possible leakage or loss from the piping connections.

8. Handling and Storage of Actuators and Actuated Valves

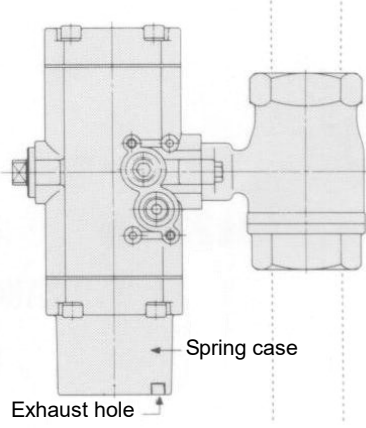
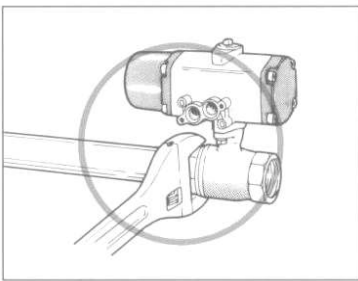
- (1) Store actuators and valves indoor where is protected form sunlight and dust.
- (2) Don't unpack them and don't remove protectors until you are ready to install them on pipes.
- (3) Overloading actuators and valves must be prevented. Don't fall them on the ground
- (4) Store actuators and valves in cool, dry, corrosion-free environment for long-term.

 CAUTION	
	① Care must be taken to handle actuators equipped with solenoid valves and other accessories during storage or transportation.
	<p>② Actuators or actuated valves are individually packed and all openings and connections are sealed for dust prevention. Don't unpack them and don't remove protectors until you are ready to install them on pipes.</p> <p>③ Store actuators or actuated valves in cool, dry, corrosion-free environment to keep them rust-free and prevent their malfunction or failure.</p> <p>④ Modification of actuators or actuated valves is forbidden, unless accepted by KITZ Corporation or the authorized modification shops in advance.</p>

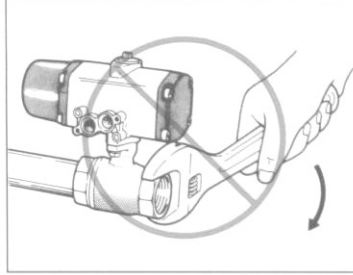
9. Installation

- (1) Clean the valve and pipe bores to remove dusts, scales or any other foreign objects.
- (2) Check if the valve specification fully satisfies the service conditions.
- (3) The unit may be mounted on the pipeline either horizontally mounted.
- (4) After the valve mounting, air-blow the inside of pipes and fully opened valve prior to the pilot operation of the system.

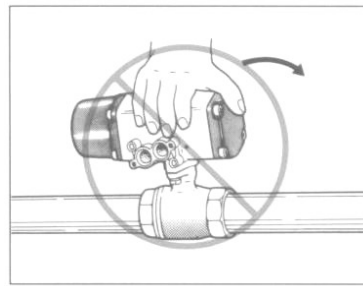
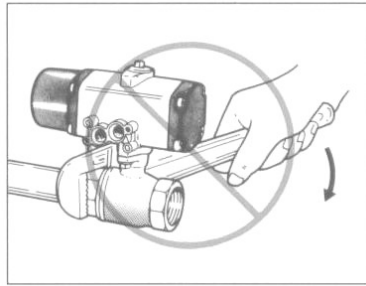
⚠ WARNING	
⊘	<p>① Be sure to employ explosion-proof type solenoid valves and limit switches, in any explosive, flammable, or corrosive environments.</p>

⚠ CAUTION	
!	<p>① For CS-type (spring-return type) actuator, protective measure should be taken to avoid the immersion of raindrops or water to air outlet of actuator.</p> <div style="text-align: center;">  <p style="margin-left: 100px;">← Spring case</p> <p style="margin-left: 50px;">Exhaust hole</p> </div> <p>② As illustrated here, set a spanner to the valve body near the connected pipe end.</p> <div style="text-align: center;">  </div>

- ③ Don't over load the threaded pipe end to connect. The valve may get broken or malfunction may occur.
- ④ As illustrated here, don't set the spanner to the valve body far from the connected pipe end. Large load on the valve body may break the valve.



- ⑤ As illustrated here, don't set a pipe wrench to the valve body or load on the actuator. Large load on the valve body may break the valve.

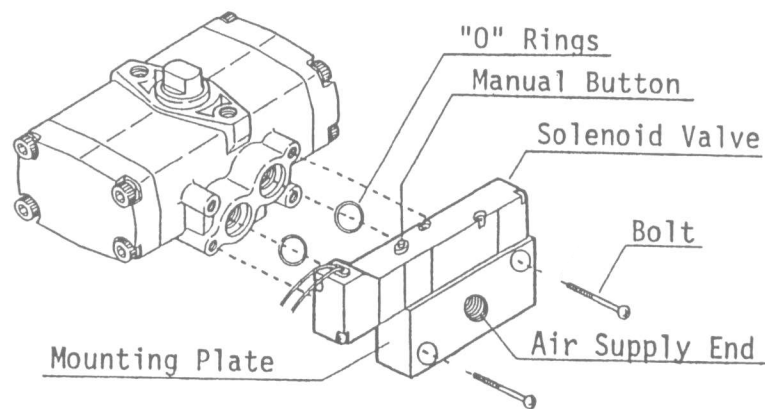


- ⑥ Don't load valves in such a way as the threaded body caps may not get loosened off the valve body. External leakage may occur.
- ⑦ Never step on the valve or don't cause any excessive load on the unit during installation. It may cause a trouble on the valve and/or the actuator.

10. Mounting KITZ Optional Accessories on Actuators

1 Mounting Procedure for Exclusive Solenoid Valves

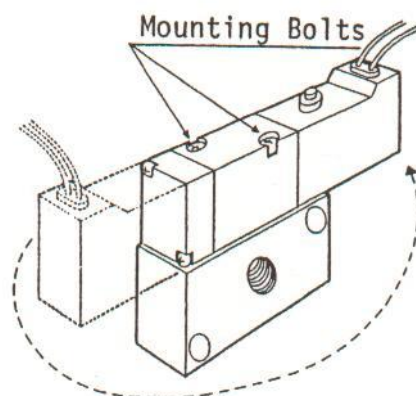
- (1) Clean the end connection of actuator and solenoid valve.
- (2) Mount the "O" rings on the end connection of actuator, and install the solenoid valve on the actuator by two mounting bolts, as illustrated below. O-ring size: P10A (JIS Standard)
- (3) For C-type actuator
Operation Mode: Energize to valve Open



(4) For C-type Actuator

Operation Mode: Energize to valve close

Remove the mounting bolts from the solenoid valve, and turn it by 180° as illustrated below.



(5) For CS-type actuator



Operation Mode: Airless to valve close/ energize to valve open

The same mounting procedure as (3) of above.

(6) For CS-type actuator

Operation Mode: Airless to valve close/ energize to valve close

The same mounting procedure as (4) of above.



 CAUTION	
	<ul style="list-style-type: none">① Take care that wiring with limit switches and solenoid valves is free from leakage or short circuit.② The system should be protected from inclusion of rainwater during wiring works.

2 Mounting Procedures for Accessories

- (1) If speed controller is mounted on the C-type actuator, it shall be installed on the exhaust end of solenoid valve.
- (2) If speed controller is mounted on the CS-type actuator for controlling of supply air, it shall be installed on the supply end of solenoid valve.
- (3) If silencer is mounted on the solenoid valve, it shall be installed on the exhaust end of solenoid valve.
- (4) Factory mounted limit switches have been duly adjusted before shipment and require no further adjustment, except change of the operating angle is required.

11. Automatic Operation of Actuators

- (1) KITZ F Series pneumatic valve actuators are operated with the standard air pressure of 0.4MPa , however, can be set for operation with minimum 0.4MPa and maximum 0.7MPa air pressure. Actuators equipped with air filter-regulators are set for operation with 0.4MPa.
- (2) Compressed instrumentation air (or nitrogen gas) is the standard operation medium. Use of air filters and air dryers are recommended to keep the air in the housing dry and clean for trouble-free operation of actuators.
- (3) Operate the actuator manually a few times before starting pneumatic operation to confirm that the system has no failure or malfunction.
- (4) Check the following points during pilot operation of your actuators.
 - Check air leakage from the air tubing through a travel from a compressor to the actuator. If the operation mode of the equipped solenoid valve is changed from AIR-TO-OPEN to AIR-TO-CLOSE or vice versa, the gasket connection between the solenoid valve and its adaptor must be also checked for air leakage.
 - Check if a solenoid valve is provided with your required specifications.
 - Check if the operating pressure has been set with your required specification.
 - If a speed controller is equipped, adjust the flow rate of the exhaust air to match your required operation speed.

 CAUTION	
	<ol style="list-style-type: none"> ① Use either compressed instrumentation air or nitrogen gas for operation of actuators. Use of any other operating medium may affect the function of actuators. ② Use of operation pressure exceeding 0.7MPa may damage actuators or accessories. ③ Keep the operation medium completely dry. High humidity causes rust and may result in malfunction or failure of actuators or accessories.

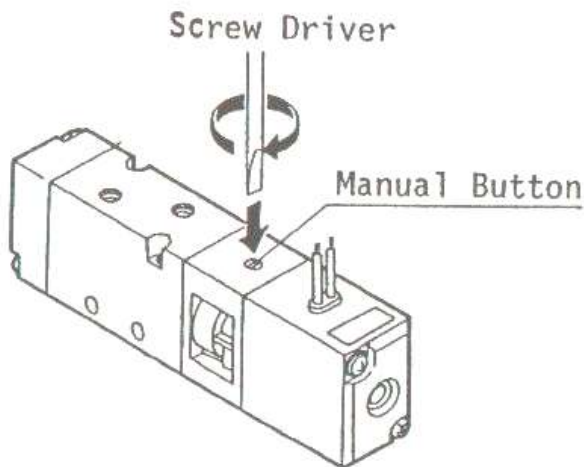
12. Manual Operation of Actuators

C-type actuators

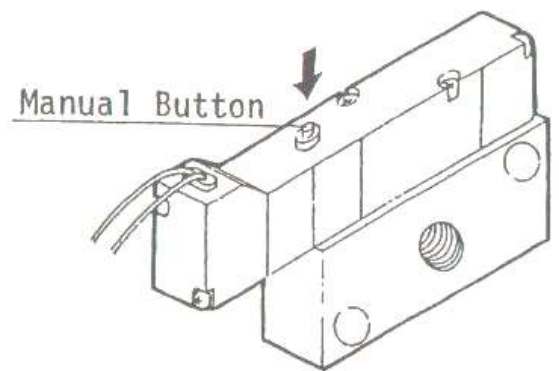
- (1) When power supply is cutoff, but air supply is living

The manual button provided on the solenoid valve as illustrated below can operate actuators.

Lever type



Button type



- (2) When air supply is cutoff

C-type actuators can be manually operated with a lever handle or a wrench fitted properly to the shaft of the actuator.

CS-type actuators

- (1) When power supply is cutoff, but air supply is living

Manual operation is available to same procedure as C-type actuators.

- (2) When air supply is cutoff

CS-type actuators cannot be manually operated, because they are not designed for temporary provision of manual operation such as a lever handle or a wrench.




CAUTION



- ① Don't forget to remove the spanner or the wrench used for manual operation after the actuator is reset for automated operation. Otherwise the spanner or the wrench may jump out and injure nearby personnel and damage nearby properties.

13. Inspection and Maintenance of Actuators and Actuated Valves

- (1) Actuators are of lubrication-free design and maintenance is not required except replacement of worn parts.
- (2) If contact fails due to atmospherical corrosion, we recommend you to replace the equipment. Factory mounted accessories are made to our own standard, and you should contact your dealer in case special requirement should be made on the specifications of our accessories.
- (3) Air filters should be regularly drained off to remove internal residuals.
- (4) Ensure to carry out the following inspections periodically. Do it as frequently as possible for safe and trouble-free operation of actuators and actuated valves.
 - Check the fully open or closed position of a valve.
 - Check the air leakage through all air tubing connections and valves.
 - Check an abnormal noise generated from the air tubing or valves.
 - Check vibration of actuators and valves.
 - Ensure that all bolts and nuts are securely tightened.

 CAUTION	
	① Don't use any spindle oil or gear oil for lubrication of actuators and accessories.
	<p>② An abnormal noise may be generated due to valve seat galling (valve seats getting stuck with foreign objects) or blockage of actuator air tubing caused by internal residues. Take corrective measures immediately, since damage of valve seats and malfunction of actuators and valves may be caused by negligence of such problems.</p> <p>③ Leaving an abnormal vibration of actuators and valves also causes equipment failure. Support the piping system securely.</p>

14. Disassembly and Reassembly of Actuators

KITZ C Series pneumatic valve actuators are available in two types, depending on the basic drive mechanism. While Type C actuators are designed for double action drive, Type CS actuators are designed for spring return drive. When you disassemble or reassemble these actuators for inspection or maintenance, the utmost care must be taken to respect the warnings and cautions mentioned here.

CAUTION

Disassembly of actuators

- ① Place work benches for actuator disassembly in a wide, dust-free room.
- ② Cover the air supply/exhaust ports and the open ends of actuator housings adequately to keep them dust-free until actuator re-assembly.
- ③ Release excessive air residue trapped within the actuator housing, prior to disassembly.
- ④ Actuator shafts, pistons and bearings must be carefully handled and stored to avoid scratch or damage, until actuator re-assembly.



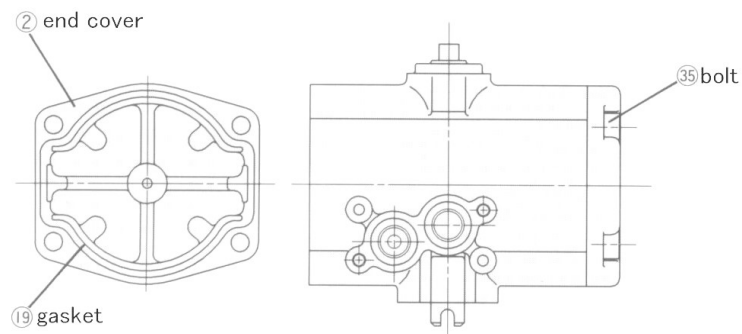
Disassembly of actuators

- ⑤ Place work benches for actuator assembly in a wide, dust-free room.
- ⑥ Clean all actuator parts and components and check them dust-free.
- ⑦ If any parts have rust, clean up to make them completely rust-free.
- ⑧ In case of replacing O-rings, use same material and same size O-rings mentioned at "14. Maintenance Parts" in this manual.
- ⑨ Carefully handle sealing components to avoid scratch or damage.
- ⑩ Carefully handle shafts, pistons and bearings to avoid scratch or damage.
- ⑪ Firmly and evenly tighten all bolts and nuts not to loose during operation.
- ⑫ After assembling the actuator, mount it on a valve with care for an alignment between the actuator shaft and the valve position.

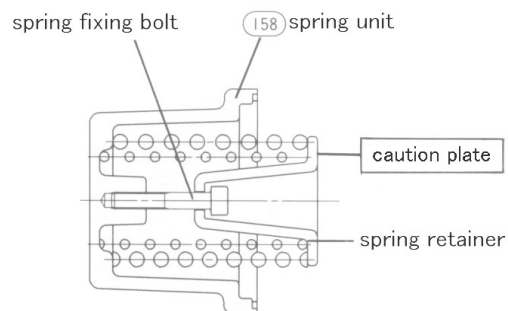
Procedure for disassembling the actuator

① Detaching the end covers

- Remove the four bolts (35) and detach the right and left end covers (2) which are fixed.
- In the case of the CS type, one half is the spring unit (158). This part should also be detached as with the end cover.
- A gasket is attached inside the end cover (spring unit). Take care not to lose it.

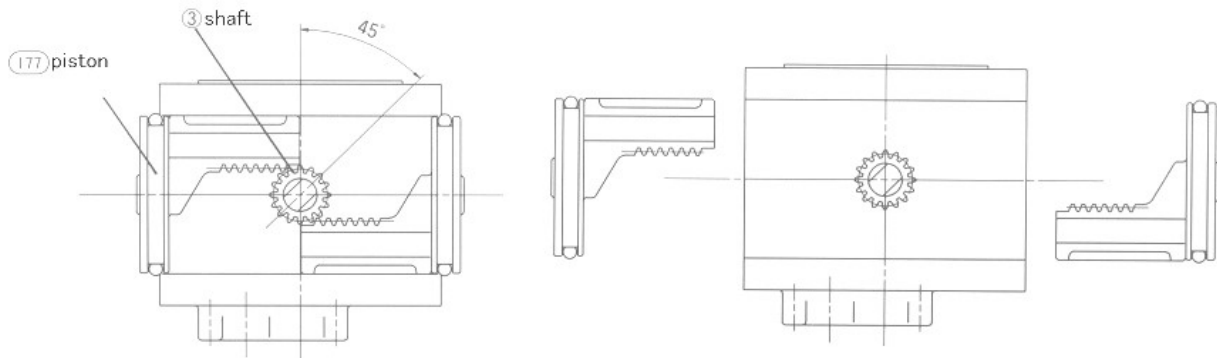
**⚠ WARNING**

- ① The spring unit houses a strongly compressed spring. Careless disassembling may cause the spring to pop out, resulting in damage. Never loosen the spring fixing bolt in the spring retainer portion.



② Detaching the piston

- Hook the spanner in the spanner hooking portion of the shaft (3) in the upper portion of the actuator. Then, rotate it in the opening direction (counterclockwise direction).
- Remove the shaft and piston tooth portion and take out the right and left pistons (177) by pulling them out by hand.

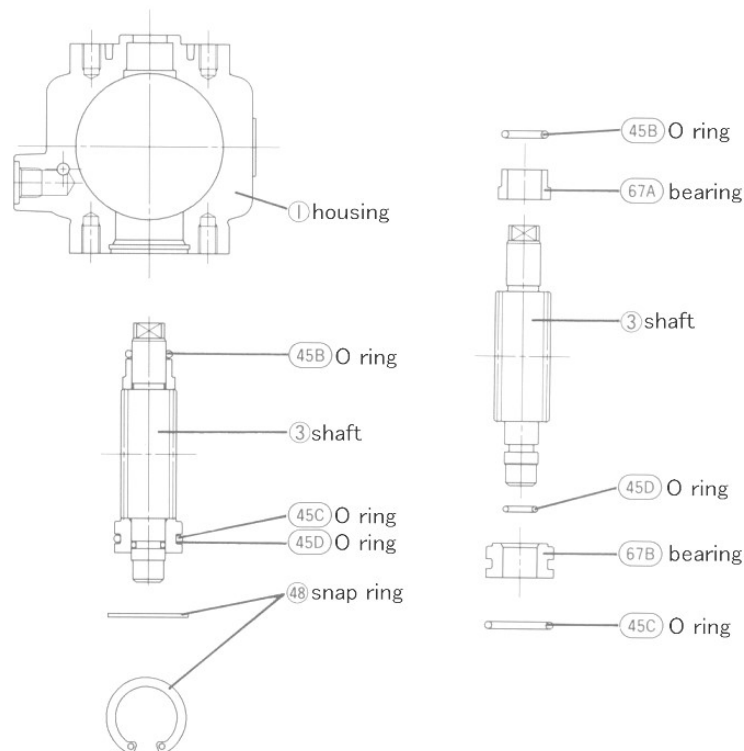


③ Pulling out the shaft

- Remove the snap ring (48) on the shaft in the lower portion of the actuator.
- Pull out the shaft (3) downward and take it out from the actuator.

④ Detaching the bearings

- Remove the O rings (45B)/ (45C) in the upper and lower portions of the shaft.
- Pull out the bearings (67A) / (67B) in the upper and lower portions of the shaft to remove them.
- Remove the O ring (45D) in the lower portion of the shaft.



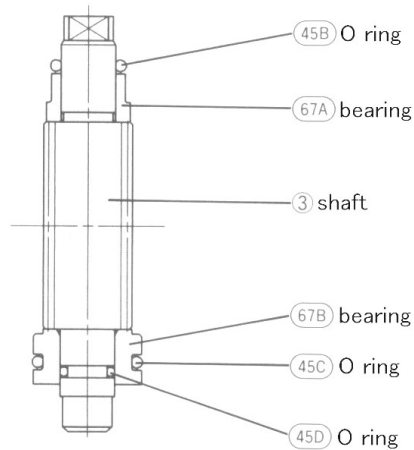
Procedure for assembling the actuator

① Cleaning the parts

- Clean each part with light oil, etc. and apply air blow to them.
- Check the shaft and piston tooth surface for any damage, etc.
- We recommend that O rings and gaskets in each portion be replaced with new ones during assembling.
- When cleaning O rings, use light oil or kerosene.

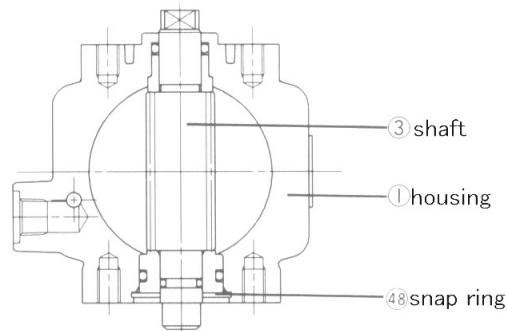
② Assembling O rings and bearings

- Assemble greased O rings and bearings to the shaft. Grease to be used should be Shell Alvania EP2.
- Assemble the O ring (45D) to the shaft.
- Insert the bearing (67B) with the O ring (45C) assembled into the shaft.
- Insert the bearing (67A) into the shaft.
- Assemble the O ring (45B) to the shaft.



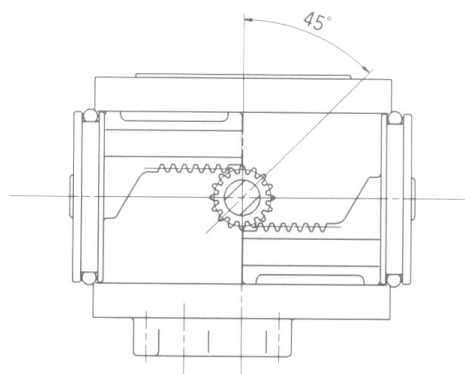
③ Assembling the shaft

- Apply grease to the shaft tooth surface and bearing portion.
- Insert the shaft with the bearings mounted, from the lower portion of the body (1).
- Attach the snap ring (48).



④ Assembling the piston

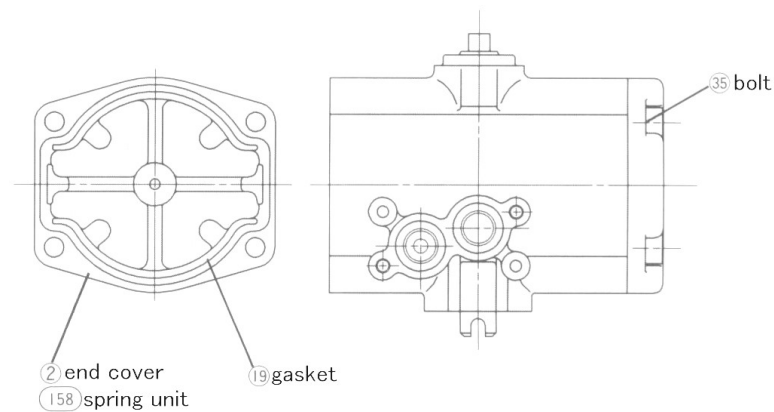
- Apply a thick coating of grease to the internal surface of the body.
- Set the body in such a way that its air pressure supply and exhaust opening (air port) is located on the near side.
- Set the shaft (3) in an approximately 45° position as shown in the figure.
- Push in the pistons (177), with the greased O ring (48A) assembled, from left and right at the same time as shown in the figure.
- After the piston is assembled, hook the spanner in the spanner-hooking portion in the upper portion of the shaft. Then, check the operation, and opening and closing position.



⑤ Installing the end covers (spring case)

- Insert the gasket (19) into the end cover (2) (spring unit (158) on one side in the case of the CS type).
- Using the four bolts (35), install the end cover (2) (or spring unit (158)) on the body (1).
- The bolt tightening torque is as shown below. The bolts should be tightened uniformly without uneven tightening.

C(S)-1	1.37 ~ 1.76 N·m
C(S)-2	2.75 ~ 3.43 N·m



⑥ Check list after assembling actuators

- Supply actual air pressure to the actuator and check external and internal leakage.
- Check automatic operation without any trouble.

⑦ Check list after mounting valves

- Supply actual air pressure to the actuator and check smooth automatic operation.
- Supply actual air or water pressure to the valve and check external and internal leakage.
- Check automatic operation without any trouble.

15. KITZ Standard Spare Parts

Please replace sealing parts below in case of overhaul maintenance.

C Series standard spare parts

Material: NBR

Description		Part No.	Type C-1/CS-1			Type C-2/CS-2		
			Part number	Size	Quantity	Part number	Size	Quantity
O RING	Piston	45A	8710-0029-QB	P29	2	8710-0042-QB	P42	2
	Shaft	45B	8710-0011-QB	P11	1	8710-0011-QB	P11	1
	Shaft	45C	8710-0014-QB	P14	1	8710-0018-QB	P18	1
	Shaft	45D	8710-0008-QB	P8	1	8710-0008-QB	P8	1
GASKET	End cover	19	AN14-2205-P0	---	2	AN14-2304-P0	---	2

16. Trouble Shooting

	Troubles	Possible causes	Remedial measures
Valve malfunctions.	<ul style="list-style-type: none"> Supply air pressure is too low. 	<ul style="list-style-type: none"> Malfunction or too small capacity of the compressor. Air leaks in piping between compressor and actuator. 	<ul style="list-style-type: none"> Check compressor. Repair piping.
	<ul style="list-style-type: none"> No supply of air pressure. 	<ul style="list-style-type: none"> Compressor is defective. Piping is clogged, damaged, or frozen. Filter regulator is in trouble. 	<ul style="list-style-type: none"> Check compressor. Check and repair air piping. Disassemble, check, and repair or replace filter regulator.
	<ul style="list-style-type: none"> No actuation with sufficient air supply, or disturbed valve operation. 	<ul style="list-style-type: none"> Foreign matter has stuck around ball seats. Drive mechanism is in trouble. Operating torque has increased due to collection of foreign objects within the valve. Speed controller has been incorrectly adjusted. 	<ul style="list-style-type: none"> Disassemble, check, and clean valve components. Replace parts or actuator. Disassemble, check, and clean valve Readjust actuator. Increase supply air pressure and adjust speed controller.
Solenoid valve malfunctions.	<ul style="list-style-type: none"> No activation when energized. Generation of unusual noises. Excessive raise of temperature. 	<ul style="list-style-type: none"> Electric lines are disconnected. Solenoid coil is disconnected. Solenoid coil and terminals are affected by rain water. Supply voltage and frequency are inadequate. Current leaks in solenoid. 	<ul style="list-style-type: none"> Check electric lines and voltage. Replace solenoid coil (check for overvoltage and overcurrent.) Provide weatherproof provision. Check if supply voltage and frequency are correct. Solenoid will not be activated if voltage is too low. Overcurrent results from inadequate supply frequency. Check and replace solenoid valve.
Abnormal exhaust from solenoid valve.	<ul style="list-style-type: none"> Exhaust from solenoid valves while the actuator is not activated. 	<ul style="list-style-type: none"> O-rings of actuator and piston are worn or affected by internal existence of foreign objects. Pressure equalizing valve is left open. Sealing parts of solenoid valve are worn 	<ul style="list-style-type: none"> Replace O-rings. Disassemble, reassemble, and adjust valve. Close pressure equalizing valve. Check and replace solenoid valve.

17. Notes to Users

- ◆ This document does not explain all the matters assumed for operation, maintenance, checking, etc. of automatically operated valves. For any unclear matters, contact our company.
- ◆ Figures used in this document indicate the basic portions. For details, refer to the delivered item drawing of a product concerned.
- ◆ Do not disassemble small automatic valve (Type C, CS for pneumatic actuated valves, Type EA for electric actuated valves) except for replacing spare parts. Any parts including actuator and valve are not for sale.
- ◆ Reference values and limit values in the specification defined in this document, and operation, maintenance, checking, etc. take into account the safety in use, maintenance and management. Therefore, use the product within this limit.

18. 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.

1. 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 document defining the handling of this document.
2. Failures and damage which occur as a result of inappropriate use of the product, careless use, etc.
3. Failures and damage which occur as a result of acts of providence, such as fire, flood damage, earthquake and lightning strike.
4. Failures and damage which occur as a result of modification / addition carried out by persons other than those at our company and service establishments designated by our company.
5. Failures and damage which occur as a result of aged deterioration (rusting, color fading, chemical change, etc.)

For information, repair of failures and damage due to the above matters, as well as replenishment with consumables will be at the expense of customers.

19. Emergency Call for Technical Assistance

When requesting repair, etc. of the product concerned, confirm the following matters, and then, contact your dealer or nearest business office of our company.

- ◆ Date of purchase / installation
- ◆ Name of store from which the product is purchased
- ◆ Product name (Product symbol / 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