
KITZ

Operation Manual

for

KITZ F Series Pneumatic Valve Actuators

Thank you for having chosen KITZ products.

For safe and trouble-free use of the products, ensure to carefully read all instructions of this manual before handling of the product. Keep this manual in a convenient place for easy access of all valve operating personnel.

NOTES TO USERS

This manual applies to the KITZ F 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.



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



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 F Series 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.

Contents

	Page
1. Attentions for user's system design	1
2. Product Features	1
3. Product Codes	1
4. Mounting of Actuators on Valves	1
5. Dimensions and Mass	2
6. Design Specifications	3
7. Product Identification Plates	3
8. Actuator Driving Mechanism	4
9. Output Torques	5
10. Supply of Air Operation Pressure	6
11. Air Consumption	7
12. Handling and Storage of Actuators and Actuated Valves	8
13. Valve Opening Positions Set for Shipment	9
14. Mounting Actuators on Valves	9
15. Adjusting Valve Opening Range	12
16. Mounting KITZ Optional Accessories on Actuators	14
17. Optional Design Specifications	16
18. Automatic Operation of Actuators	16
19. Manual Operation of Actuators	17
20. Inspection and Maintenance of Actuators and Actuated Valves	18
21. Disassembly and Reassembly of Actuators	19
22. KITZ Standard Spare Parts for KITZ Type FA/FAS Actuators	30
23. Trouble Shooting	31
24. Notes to Users	32
25. Product Warranty	32
26. Emergency Call for Technical Assistance	32
 Appendix: Engineering Modifications of Actuators for Optional Specifications	 33

1. Attentions for user's system design

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

2. Product Features

2-1.KITZ F Series pneumatic valve actuators are provided with output torque characteristics suitable for operation of both KITZ ball valves and KITZ butterfly valves.

2-2. KITZ F Series pneumatic valve actuators are designed for direct modular mounting of KITZ optional accessories on the actuator housing.

3. Product Codes

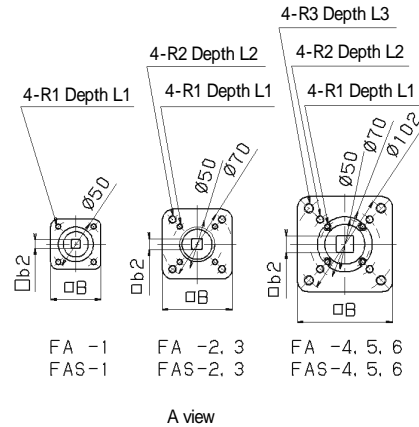
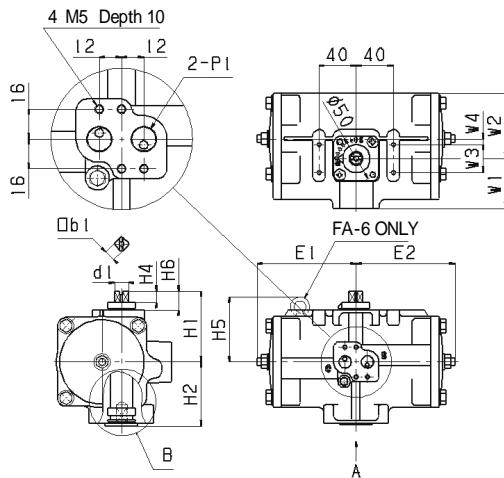
KITZ F Series pneumatic valve actuators are available in two types, depending on the drive mechanism. Type FA is for the double action drive. Type FAS is for the spring return drive. For operation of valves of various sizes, both types are available with the Size 1 through Size 6, which are identified by the last digit of each product code, such as FA-1 or FAS-2.

4. Mounting of Actuators on Valves

KITZ F Series pneumatic valve actuators are mounted on KITZ ball valves with a factory supplied bracket connector, or directly mounted on ISO mounting pads of KITZ butterfly valves.

5. Dimensions and Mass

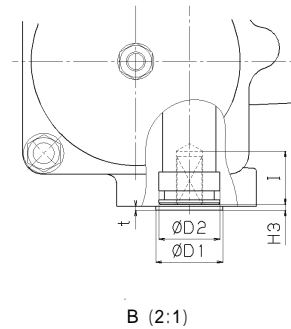
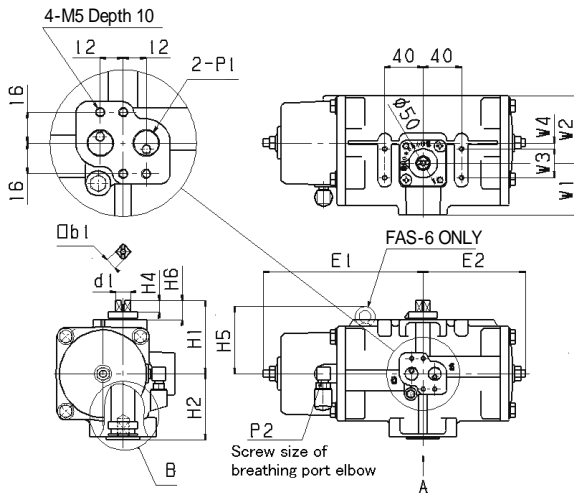
Type FA double action actuators



	W1	W2	W3	W4	E1	E2	H1	H2	H4	H5	H6	H7	b1	d1	P1
FA-1	50	54	30	0	87	87	70	55	12	20	76	12	15	Rc1/4	
FA-2	54	70	30	6	107	107	80	68	12	20	86	12	15	Rc1/4	
FA-3	57	87	30	13	128	128	86	78	12	20	92	17	21	Rc1/4	
FA-4	68	111	30	21	160	160	108	96	12	20	114	17	21	Rc1/4	
FA-5	78	135	30	30	208	208	132	116	20	30	138	23	29	Rc1/4	
FA-6	101	178	30	45	268	268	152	125	20	157	30	158	32	41	Rc1/4

	b2	B	R1 x L1	R2 x L2	R3 x L3	R4 x L4
FA/FAS-1	9	50	M6 x 9	M8 x 12	M5 x 7.5	M5 x 7.5
FA/FAS-2	11	70	M6 x 9	M8 x 12	M5 x 7.5	M5 x 7.5
FA/FAS-3	13	70	M6 x 9	M8 x 12	M5 x 7.5	M5 x 7.5
FA/FAS-4	17	95	M6 x 9	M8 x 12	M10 x 15	M5 x 7.5
FA/FAS-5	27	113	M8 x 12	M10 x 15	M12 x 18	M5 x 7.5
FA/FAS-6	27	134	M8 x 12	M10 x 15	M12 x 18	M5 x 7.5

Type FAS spring return actuators



	W1	W2	W3	W4	E1	E2	H1	H2	H4	H5	H6	H7	b1	d1	P1	P2
FAS-1	50	54	30	0	132	87	70	55	12	20	76	12	15	Rc1/4	Rc1/8	
FAS-2	54	70	30	6	166	107	80	68	12	20	86	12	15	Rc1/4	Rc1/8	
FAS-3	57	87	30	13	203	128	86	78	12	20	92	17	21	Rc1/4	Rc1/8	
FAS-4	68	111	30	21	290	160	108	96	12	20	114	17	21	Rc1/4	Rc1/8	
FAS-5	78	135	30	30	363	208	132	116	20	30	138	23	29	Rc1/4	Rc1/8	
FAS-6	101	178	30	45	483	268	152	125	20	157	30	158	32	41	Rc1/4	Rc1/8

	H3	D1	D2	l	t
FA/FAS-1	3	35	25	16	2
FA/FAS-2	3	35	30	16	2
FA/FAS-3	3	35	32	25	2
FA/FAS-4	4	55	40	27	3
FA/FAS-5	5	55	50	34	3
FA/FAS-6	5	70	60	34	3

Main dimensions and total mass

	W (= W1+W2)	E (= E1+E2)		H (= H1+H2)	mass[k g]	
	FA/FAS	FA	FAS	FA/FAS	FA	FAS
FA/FAS-1	104	174	219	121	1.7	2.1
FA/FAS-2	124	214	273	144	2.9	3.8
FA/FAS-3	144	256	331	164	4.4	6.4
FA/FAS-4	179	320	450	204	8.0	12.8
FA/FAS-5	213	416	571	248	13.6	23.4
FA/FAS-6	279	536	751	277	28.2	50.0

6. Design Specifications

	FA/FAS-1	FA/FAS-2	FA/FAS-3	FA/FAS-4	FA/FAS-5	FA/FAS-6
Shaft rotating range	90 ° ± 7 °					
Cylinder volume (L)	0.15	0.31	0.61	1.29	2.29	5.27
Standard operation pressure	0.4 MPa					
Operation pressure range *1	0.3 ~ 0.7 MPa					
Housing shell test pressure	0.97 MPa					
Valve opening position indicator	90 ° with 7 division marks including [O] and[S]					
Service temperature range *2	- 20 ~ + 80					
Bottom pad for mounting on valves	ISO5211					

*1. Contact KITZ for technical advice, if the operating pressure is lower than 0.4MPa.

*2. The air supply must not be frozen.

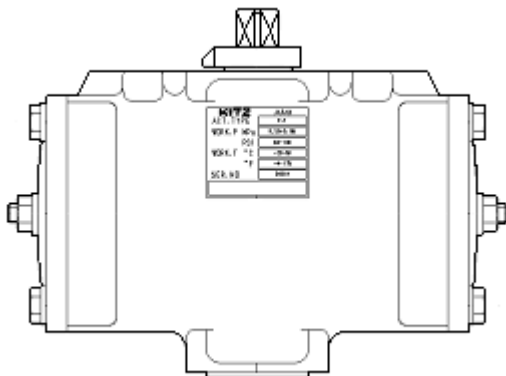
7. Product Identification Plate

For the identification of the product code and service conditions, a metal plate is attached to the actuator housing.

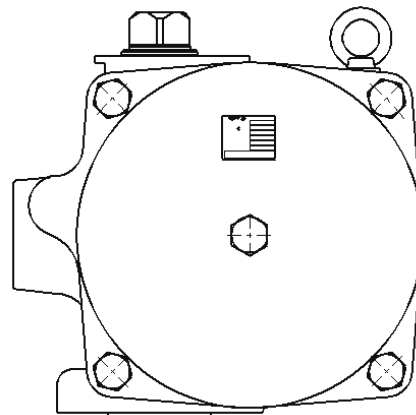
ID plate for FA-1 actuator

KITZ	MADE IN JAPAN
ACT. TYPE	FA-1
WORK. P. MPa	0.4~0.7
PSI	60~100
WORK. T °C	-20~80
°F	-4~176
SER. NO	000001

ID plate location



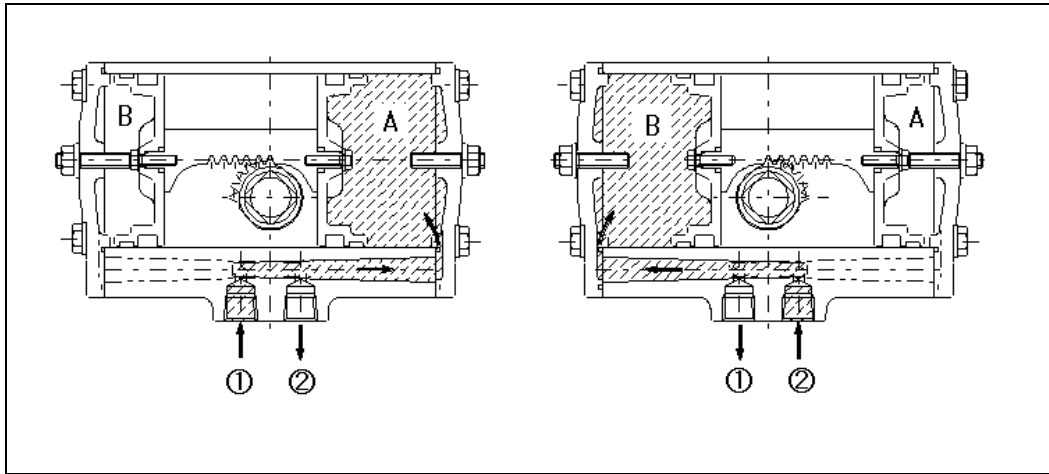
FA / FAS-1 ~ 3



FA / FAS-4 ~ 6

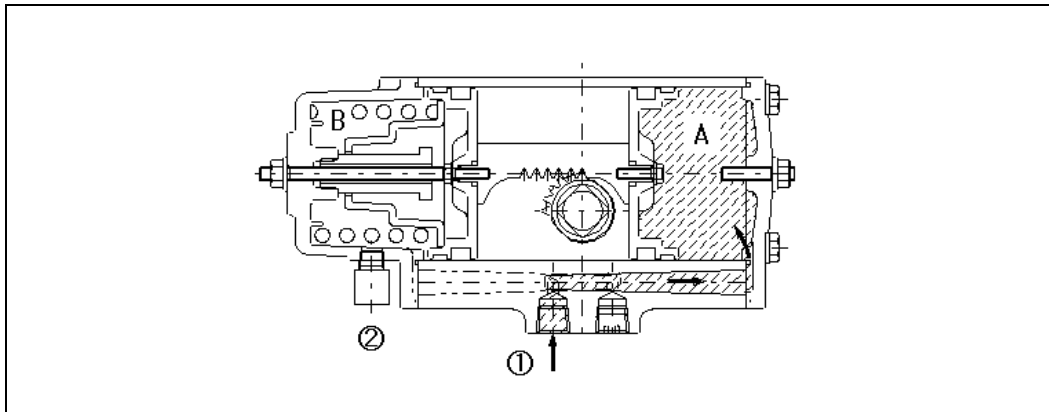
8. Actuator Driving Mechanism

8.1 Type FA double action actuators



The air pressure supplied into Chamber[A] through Port ① pushes the pistons and the gear rack outwards, and releases the air left in Chamber[B] through Port ②. The gear rack rotates the piston gear and the shaft counter-clockwise to drive the valve. Reverse supply of the air pressure reversely activates valve operation.

8.2 Type FAS spring return actuators



The air pressure supplied into Chamber [A] through Port ① pushes the pistons and the gear rack outwards, compressing the spring, and releases the air left in Chamber[B] through Port ②. The gear rack rotates the piston gear and the shaft counter-clockwise to drive the valve. At the moment the air in Chamber [A] is discharged through the solenoid valve, the spring force pushes the pistons to the reverse direction, and the gear rack rotates the pinion gear and the shaft clockwise to reversely drive the valve.

9. Output Torques

9.1 Output torques of Type FA double action actuators

UNIT: N·m

Actuator type	Operation pressure (air)		
	0.3 MPa	0.4 MPa	0.5 MPa
FA-1	14.12	18.83	23.54
FA-2	33.41	44.54	55.68
FA-3	67.37	89.83	112.3
FA-4	134	179	223
FA-5	249	332	415
FA-6	588	784	980

9.2 Output torques of Type FAS spring return actuators

UNIT: N·m

Actuator type	Type of spring	Driven by operation pressure (air)						Driven by spring	
		0.3 MPa		0.4 MPa		0.5 MPa		0 ° 3	90 ° 4
		0 ° 1	90 ° 2	0 °	90 °	0 °	90 °		
FAS-1	3K	9.25	6.51	-	-	-	-	5.18	7.92
	4K	-	-	11.66	7.64	-	-	7.58	11.6
	5K	-	-	-	-	14.6	9.6	9.44	14.45
FAS-2	3K	20.19	13.68	-	-	-	-	13.21	19.71
	4K	-	-	26.76	18.02	-	-	17.76	26.5
	5K	-	-	-	-	33.39	22.43	22.26	33.22
FAS-3	3K	42.83	30.72	-	-	-	-	23.68	35.79
	4K	-	-	53.52	35.54	-	-	35.16	53.14
	5K	-	-	-	-	66.79	44.41	44.06	66.43
FAS-4	3K	83.00	59.40	-	-	-	-	55.60	79.10
	4K	-	-	110	74.60	-	-	74.30	110
	5K	-	-	-	-	138	93.20	93.10	138
FAS-5	3K	155	109	-	-	-	-	101	147
	4K	-	-	203	138	-	-	138	203
	5K	-	-	-	-	255	171	171	254
FAS-6	3K	354	249	-	-	-	-	237	342
	4K	-	-	473	326	-	-	326	475
	5K	-	-	-	-	591	392	394	593

*1. For starting an actuator travel to open a fully closed valve:

*2. For ending an actuator travel to open a fully closed valve.

*3. For ending an actuator travel to close a fully open valve.

*4. For starting an actuator travel to close a fully open valve.

10. Supply of Air Operation Pressure

10.1 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 1/4.

10.2 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.

10.3 If you want to mount your own solenoid valves other than those factory-assembled, select the following type. For Type FA actuators, 4-way solenoid valves are used. For Type FAS actuators, 3-way or 4-way solenoid valves with plug up just one port are used.

10.4 Air inlets are Rc1/4. Use 6mm or smaller tubes, and hexagonal fittings of 19mm and smaller width of flat . Contact KITZ Corporation for technical advice, if you want to use larger tubes for faster operation of actuators.

10.5 Keep the air always free from dust and moisture (-15 or lower dew point under the atmospheric pressure), using air-filters and air-dryers.

10.6 Choose the capacities of your own accessories and the sizes of auxiliary air tubing, in consideration of possible loss of air pressure during a travel from the compressor.

10.7 The exact volume (Q) of air supply required per minute for actuators must be known before the air tubing installation so that the provided operation pressure may be sufficient to properly drive actuators and valves. Calculate your air supply requirement with the following equation.

10.8 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.

$$Q = V(P + 0.1013) / 0.1013 \times 60/t \text{ [L /min.(ANR)]}$$

V: Volume of actuator housing [L] (V1 or V2 in Section 10)

P: Air operation pressure [MPaG]

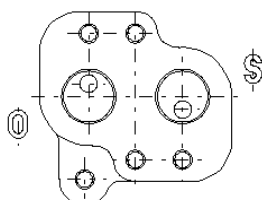
t: Time required per stroke [second] under 0.4MPa operation pressure, where no valve nor accessory is provided. (Refer to **Table 1**)

ANR: Air supply volume under the standard condition of 20 (68 ° F), 760mmHg absolute pressure and 65% relative humidity

Table 1.

Time [t] required per stroke under 0.4MPa operation

Actuator type	Time[sec]
FA/FAS-1	0.2
FA/FAS-2	0.3
FA/FAS-3	0.4
FA/FAS-4	0.6
FA/FAS-5	1.0
FA/FAS-6	2.0



Design of solenoid valve mounting pad (air inlet/outlet ports)

11. Air Consumption

Air consumption means the volume (Q) of the air released to the atmosphere from an actuator operating [n] times forward and backward per hour as converted to the average volume per minute. Decide the capacity of an air compressor using the result of the following calculation. We recommend to use an air reservoir of an adequate size to constantly operate an actuator at the preset time.

Air consumption of Type FA double action actuators:

$$Q = (V_1 + V_2)(P + 0.1013) / 0.1013 \times n/60 \quad [\text{L}/\text{min.}(\text{ANR})]$$

Air consumption of Type FAS spring return actuators:

$$Q = V_3 (P + 0.1013) / 0.1013 \times n/60 \quad [\text{L}/\text{min.}(\text{ANR})]$$

V₁, V₂ and V₃: Volume of actuator housing [L]

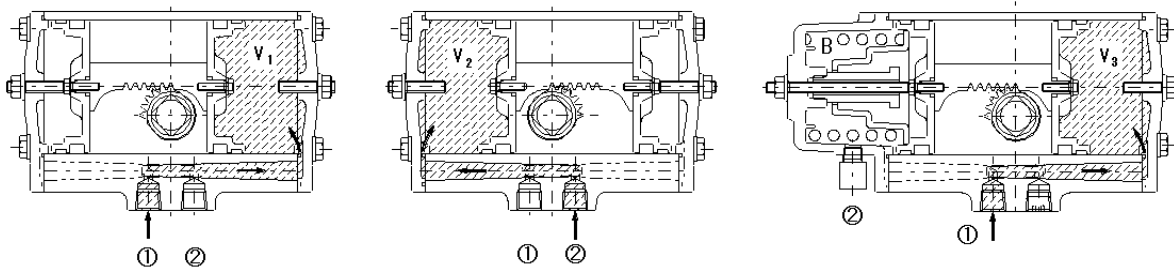
Refer to **Table 2** and the illustration shown below.




P: Air operation pressure [MPaG]

n: Number of operation cycles per hour

Table 2 Volume of actuator housing [L]

Actuator	V ₁	V ₂	Actuator	V ₃
FA - 1	0.15	0.15	FAS - 1	0.15
FA - 2	0.31	0.31	FAS - 2	0.31
FA - 3	0.61	0.61	FAS - 3	0.61
FA - 4	1.29	1.29	FAS - 4	1.29
FA - 5	2.29	2.29	FAS - 5	2.29
FA - 6	5.27	5.27	FAS - 6	5.27






 CAUTION	
	<ul style="list-style-type: none"> ● The required capacity of an air compressor depends on the availability and the volume of an air reservoir, the number of hourly operations, the time required for valve stroke and whether the air compressor is used exclusively or otherwise for the actuator.
	<ul style="list-style-type: none"> ● To decide the practical capacity of air compressors and reservoirs, adding some extra 30% to the calculated air consumption volume is recommended to absorb possible loss of air caused during a travel through air tubing and accessories. ● Use an air-filter to continually supply clean, dry air to an actuator. ● Use plastic tapes for tightly sealing piping connection, ensuring that tape ends do not enter into the tube bore and block the port. ● Also ensure that there is no leakage of air through all tubing connections. Insufficient supply of air pressure causes malfunction or failure of an actuator. ● Appropriately design the total length of air tubing. Too long air tubing causes pressure loss or insufficient flow rate of the air, and results in malfunction or failure of an actuator.

12. Handling and Storage of Actuators and Actuated Valves

12.1 Store actuators and valves in cool, dry, corrosion-free environment to keep them rust-free and prevent their malfunction, although surfaces are appropriately finished for primary protection.

12.2 Actuators and actuated valves are provided with dust protectors and packed individually for damage prevention. Don't unpack them and don't remove protectors until you are ready to install them on pipes.

12.3 Overloading actuators and valves must be prevented. Don't fall them on the ground. Don't place any other objects on them. Don't step on them.

 CAUTION	
	<ul style="list-style-type: none"> ● 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. ● Modification of actuators or actuated valves is forbidden, unless accepted by KITZ Corporation or the authorized modification shops in advance.
	<ul style="list-style-type: none"> ● Carefully handle actuators packed particularly in cardboard cases, since the cases might have become very fragile due to moisture and other causes. ● Care must be taken to handle actuators equipped with solenoid valves and other accessories during storage or transportation. ● Store actuators or actuated valves in cool, dry, corrosion-free environment to keep them rust-free and prevent their malfunction or failure.

13. Valve Opening Positions Set for Shipment

13.1 KITZ ball valves actuated with Type FA double action actuators are shipped with the ball set fully open, if actuators are not equipped with solenoid valves or positioners.

13.2 KITZ ball valves actuated with Type FA double action actuators are shipped in the following conditions, if actuators are equipped with solenoid valves, air valves or positioners.

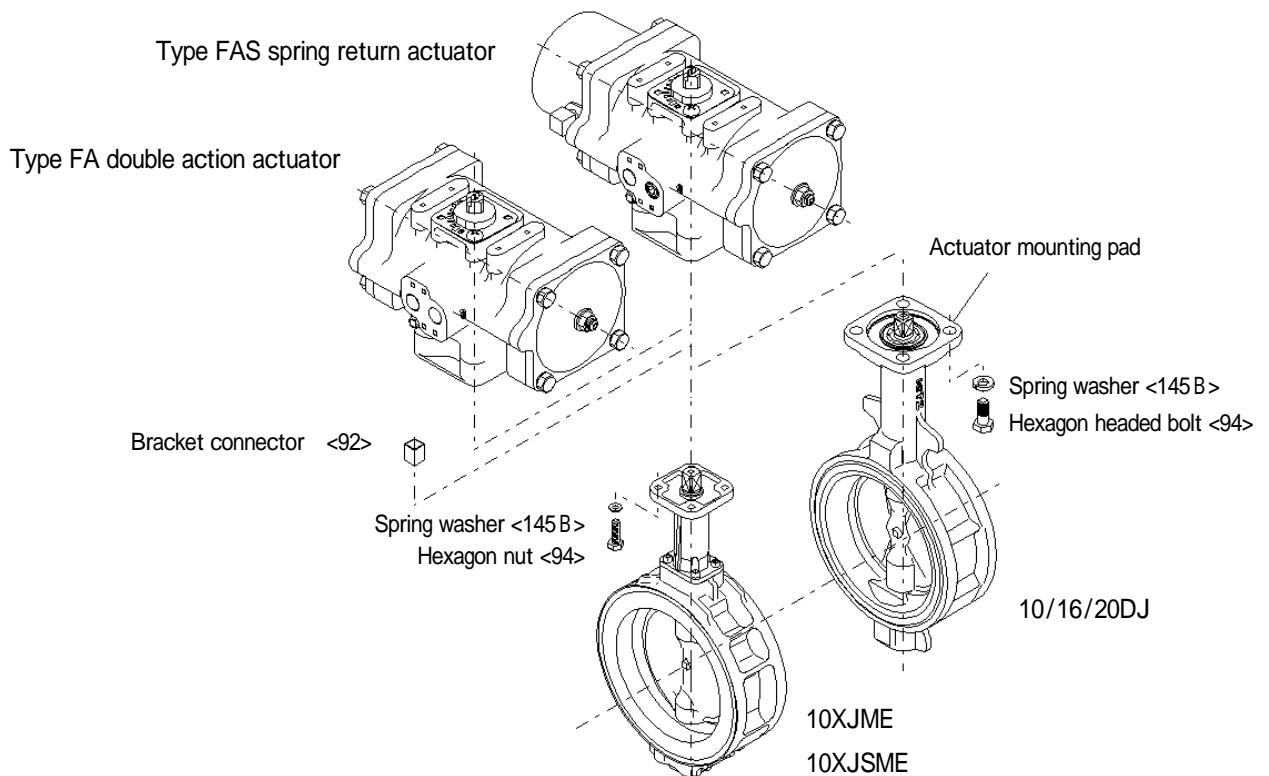
- (1) If solenoid valves are set for AIR-TO-OPEN mode (or positioners are set for reverse action), valves are fully closed.
- (2) If solenoid valves are set for AIR-TO-CLOSE mode (or positioners are set for direct action), valves are fully open.

13.3 KITZ butterfly valves equipped with Type FA double action actuators are all shipped with the disc set fully closed.

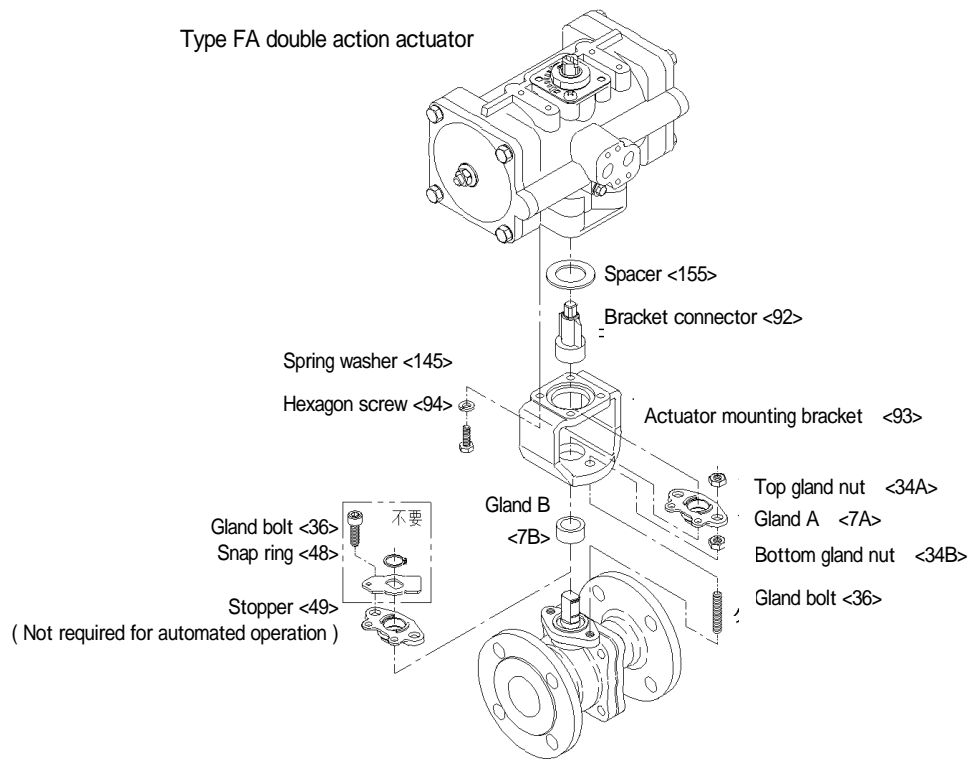
13.4 KITZ ball and butterfly valves equipped with Type FAS spring return actuators are all shipped in the de-energized condition.

14. Mounting Actuators on Valves

14.1 Mount F Series actuators on KITZ butterfly valves, referring to the illustration provided below.

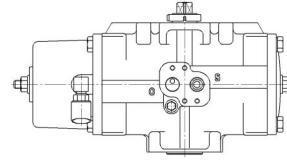
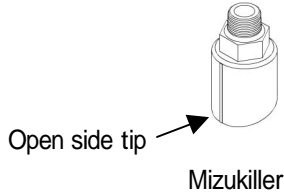


14.2 Mount F Series actuators on KITZ ball valves, referring to the illustration provided below.



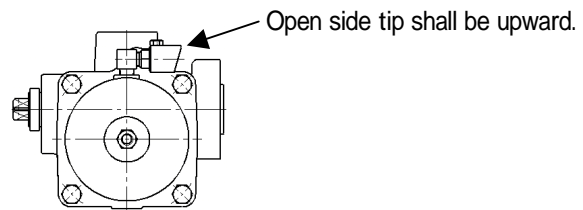
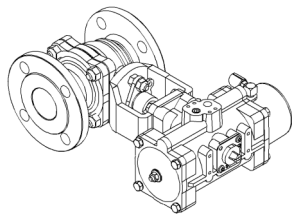
⚠ CAUTION

When Type FAS spring return actuator is used outside or wet condition, water may enter into a spring unit in some actuator orientation. Rotate a part avoiding entering water ("Mizukiller") clockwise and set it adequate position that open side tip of Mizukiller shall be upward.

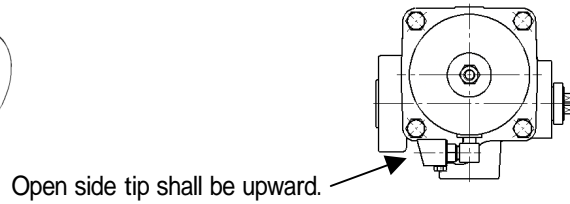
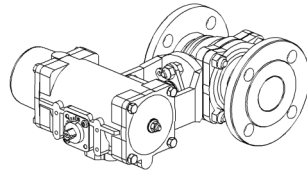


Normal position of Mizukiller

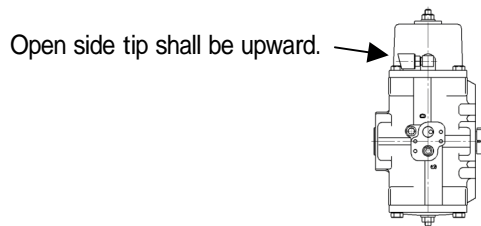
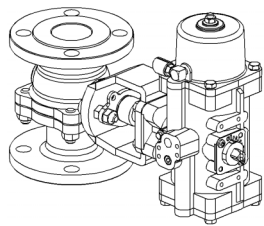
(1) Actuator supply port faces upward.



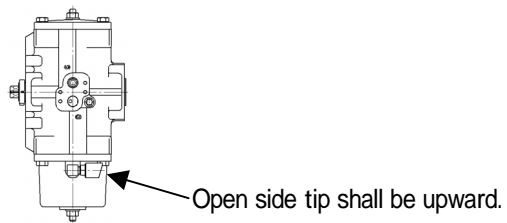
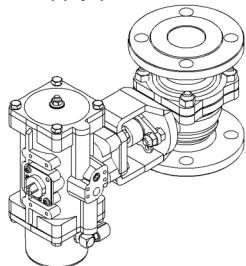
(2) Actuator supply port faces ground.



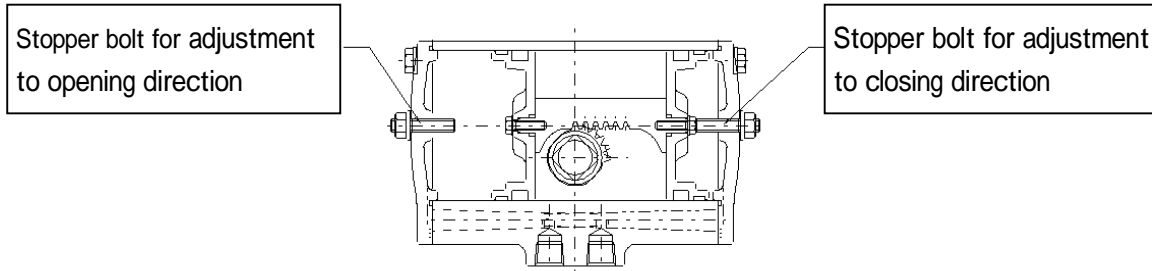
(3) Actuator supply port faces side and spring case is upward.



(4) Actuator supply port faces side and spring case is downward.



15. Adjusting Valve Opening Range

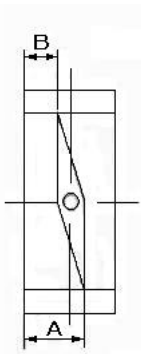


15.1 Release the compressed air from the actuator housing. Loosen a hexagon nut and adjust the position of either one of two stopper bolts illustrated above for your desired valve opening position. The dimensional requirements of butterfly valve discs (A less B in **Table 3**) or ball valve balls ([L] in **Table 4**) must be satisfied. Refer to **Table 5** on the sizes of stopper bolts.

15.2 Clockwise rotation of the stopper bolt makes the valve operation range smaller, and counter-clockwise rotation makes it larger.

15.3 After having tightened the nuts, supply the compressed air to the port and check the valve opening range. Repeat this work until you have a satisfactory result.

Table 3: Adjustment for KITZ butterfly valves (*1)

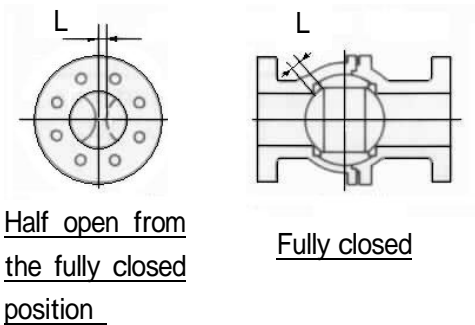


Valve size		A less B [mm]	
NPS	DN	10XJ	10/16/20DJ
1 1/2	40	2 ~ 3	---
2	50	2 ~ 3	2 ~ 3
2 1/2	65	2 ~ 3	3 ~ 4
3	80	4 ~ 6	3 ~ 4
4	100	9 ~ 11	4 ~ 5
5	125	11 ~ 13	4 ~ 5
6	150	12 ~ 14	5 ~ 6
8	200	12 ~ 14	5 ~ 7
10	250	20 ~ 22	18 ~ 20 (*2)
12	300	24 ~ 26	18 ~ 20 (*2)

(*1) Set [A less B] to zero for KITZ UB Series butterfly valves.

(*2) Contact KITZ Corporation for information on 16/20DJ250 and 300 butterfly valves.

Table 4: Adjustment for KITZ Class 150/300 full-bored floating ball valves (*3)



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

(*3) In the case of 3-way ball valves, adjust the center of the ball bore so that it may align with the center of the valve end flange bore. During adjustment, you can monitor the work through either side opening of the valve end flanges.

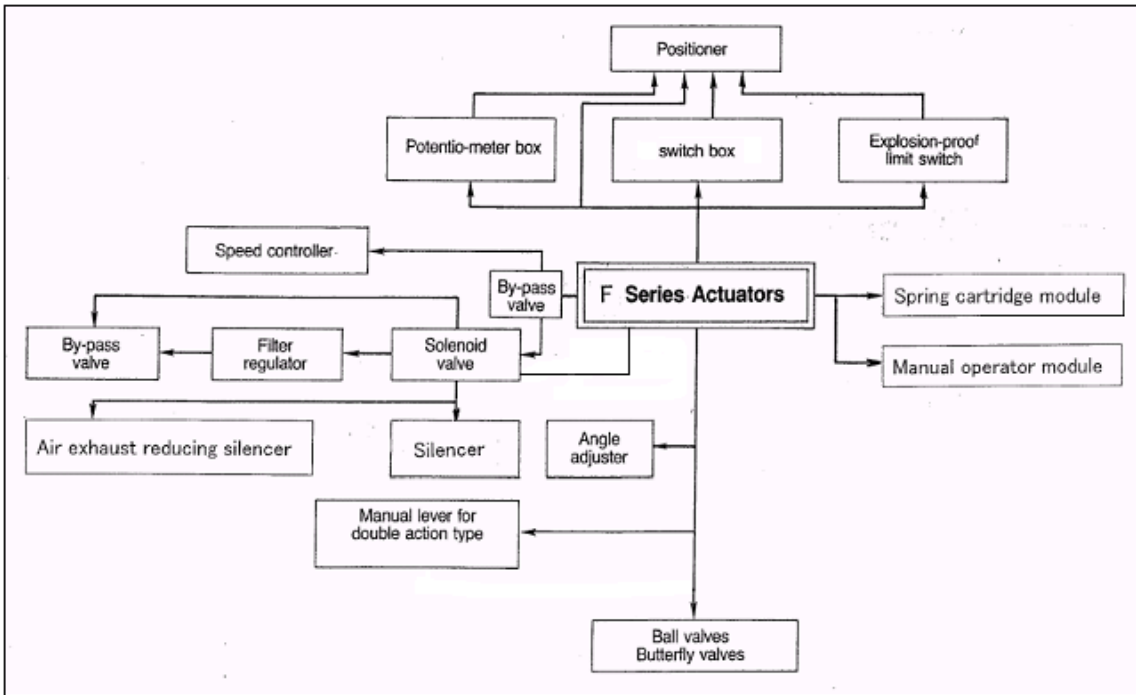
Table 5: Sizes of stopper bolts (Hexagon socket set screws)

Actuator type	Bolt size
FA / FAS - 1	M6
FA / FAS - 2	M8
FA / FAS - 3	M10
FA / FAS - 4	M12
FA / FAS - 5	M16
FA / FAS - 6	M20

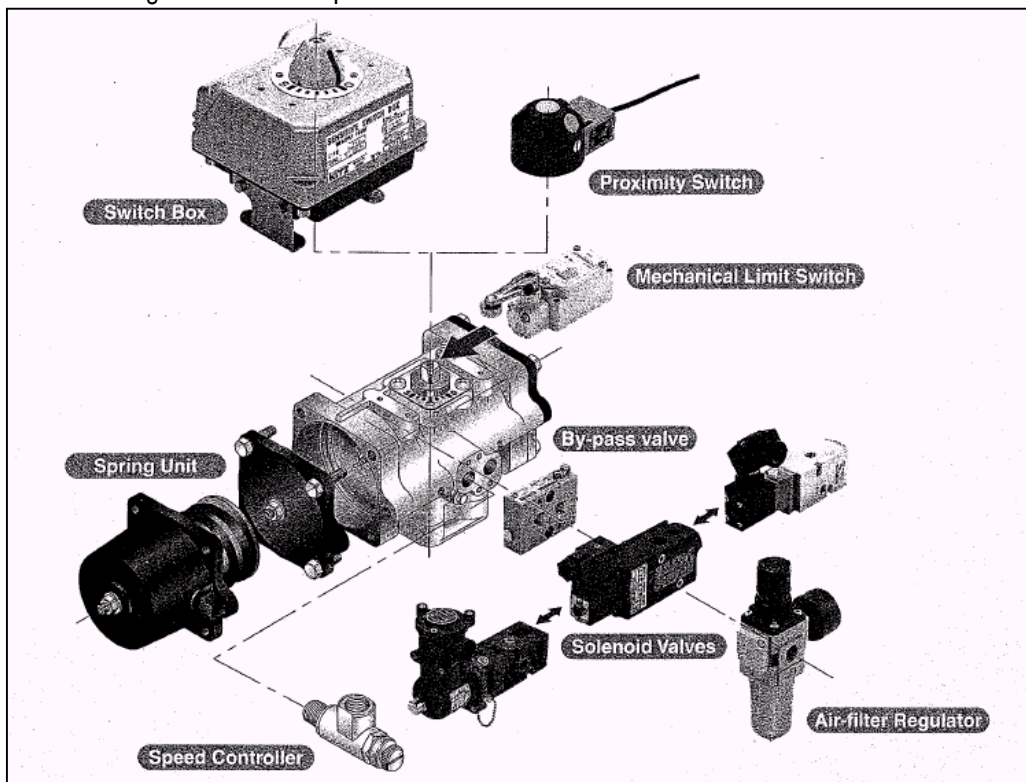
16. Mounting KITZ Optional Accessories on Actuators

KITZ F Series pneumatic valve actuators employ NAMUR dimensions for an accessory mounting pad on the top. Any NAMUR dimensioned solenoid valve can be directly mounted on the actuator without tubing. For detailed information on mounting KITZ optional accessories on F Series actuators, refer to the operating instructions provided for each optional accessory.

Mounting diagram of KITZ optional accessories



Mounting view of KITZ optional accessories



Design specifications of KITZ optional accessories

Accessories	Specification
NAMUR solenoid valves Explosion proof Weather proof indoor use Weather proof outdoor use	Power supply : AC100V / 110V 50 / 60Hz : AC200V / 220V 50 / 60Hz : DC24V Air inlets : Rc1/4 Maximum working pressure : 0.7MPa
Switch boxes With built-in sensitive switches With built-in proximity switches	Switch boxes with built-in sensitive switches Resistive load : 11A AC125V / 250V : 0.5A DC125V : 0.25A DC250V Inductive load : 7A AC125/250V Switch boxes with built-in proximity switches Power supply : DC10 ~ 36V Maximum output current (instantaneous and continuous) : 200mA
Limit switches Weather proof Explosion proof	Weather proof : 10A - 125V / 250V / 480V AC : 0.8A - 125V / 0.4A - 250V DC Explosion proof : 5A - 125V / 250V / 480V AC : 0.8A - 125V / 0.4A - 250V DC
Proximity switch	Power supply : 20-250V AC / DC Switching current : AC350mA / DC100mA
Air filter-regulator	Working pressure : Inlet Max0.97MPa : Outlet Max0.4 ~ 0.7MPa Connection : Rc1/4
Speed controller	Connection : Rc1/4 Maximum working pressure : 0.97MPa
Silencer	Connection : Rc1/4 Maximum working pressure : 0.90MPa
Positioner	Connection : Rc1/4 (Pressure gauge : Rc1/8) Supply pressure : 0.3 ~ 0.7MPa Signal pressure : 0.02 ~ 0.10MPa Signal current : 4 ~ 20mA Air consumption : 20NL/min.(Max.) [Supply pressure : 0.5MPa]
By-pass valve	Connection : Rc1/4 Maximum working pressure : 0.7MPa

17. Optional Design Specifications

The following design specifications can be optionally accommodated for KITZ F Series pneumatic valve actuators. For details, refer to **Appendix** of this manual.

Optional Design Specifications

Options		Design specifications
Service temperatures	Low temperature	-40 (-40 ° F) to +60 (+140 ° F) ambient
	High temperature	-20 (-4 ° F) to +100 (+212 ° F) ambient
Spring cartridges	5K	for 0.5MPa operating pressure
	3K	for 0.3MPa operating pressure
AIR-FAIL-OPEN mode		to open valves with spring repulsing force
Adjustment of valve opening range		to stop valve travel at a desired position
Manual operation	Double action	with manual lever
	Spring return	with manual lever
NPT threading		for air inlet/outlet ports

18. Automated Operation of Actuators



18.1 KITZ F Series pneumatic valve actuators are operated with the standard air pressure of 0.4MPa , however, can be set for operation with minimum 0.3MPa and maximum 0.7MPa air pressure. Actuators equipped with air filter-regulators are set for operation with 0.4MPa.

18.2 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.

18.3 Check the following points during pilot operation of your actuators.

- (1) In case of spring return type actuators, check a cap on the breathing port is removed before running automated operation.
- (2) Check trouble-free function of the actuator by manually or automatically operating it a few cycles.
- (3) 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.
- (4) Check if a solenoid valve is provided with your required specifications.

- (5) Check if the operating pressure has been set with your required specification.
- (6) Check if an equipped air regulator has been set for your required operation pressure.
- (7) If a speed controller is equipped, adjust the flow rate of the exhaust air to match your required operation speed.



 CAUTION	
	<ul style="list-style-type: none"> ● Use either compressed instrumentation air or nitrogen gas for operation of actuators. Use of any other operating medium may affect the function of actuators. ● Use of operation pressure exceeding 0.7MPa may damage actuators or accessories. ● Keep the operation medium completely dry. High humidity causes rust and may result in malfunction or failure of actuators or accessories. ● A part to avoid entering water into a spring case (“Mizukiller”) is installed on spring return type actuator’s breathing port. And The Mizukiller is sealed with a sticker. Remove the sticker before running automated operation. (For products shipped before December 2009, a cap is installed on spring return type actuator’s breathing port instead of the Mizukiller. Remove the cap before running automated operation. If the cap remains, actuator speed may become slow.) ● When Type FAS spring return actuator is used outside or in wet condition, the Mizukiller has to be installed into it. If the Mizukiller is not installed, water may enter into a spring unit and cause a malfunction.

19. Manual Operation of Actuators

19.1 Manual operation of F Series pneumatic valve actuators is available for Type FA double action drive, as a standard feature. Manual operation of Type FAS spring return actuators is optionally possible as provided in **Appendix** of this manual.

19.2 Manual operation of de-energized Type FA double action actuators

- (1) If the actuator is not equipped with a by-pass valve and a solenoid valve, disassemble the air tubing to equalize the housing pressure with the atmospheric level, and rotate the shaft on top of the housing with a spanner or a wrench, to manually operate the actuator.
- (2) If the actuator is equipped with a by-pass valve but with no solenoid valve, set the valve to the “manual” position to equalize the housing pressure with the atmospheric level to manually operate the actuator. Refer to the instructions provided on the identification plate attached to the by-pass valve.
- (3) If the actuator is equipped with a solenoid valve, but with no by-pass valve nor pressure equalizer valve, follow the instructions given in Item 18.2 (1) to manually operate the actuator.
- (4) If the actuator is equipped with a solenoid valve and a pressure equalizer valve (CKD Model V1000-08), rotate the operation handle of the equalizer valve to 90 ° against the flow direction to equalize the housing pressure to the atmospheric level. The actuator is now ready for manual operation as provided in Item 19.2 (1). This procedure also applies to the actuators being energized.

 CAUTION	
	<ul style="list-style-type: none"> ● 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. ● Ensure to equalize the housing pressure with the atmospheric level before manual operation. Leaving the residual air pressure in the housing is too hazardous to nearby personnel and properties.

19.3 Manual operation of energized Type FA double action actuators

- (1) All KITZ optional solenoid valves are provided with a manual switch. Choose any one of the following solenoid valves for manual operation of the actuators being energized.

KOGANEI Model A180

Keep pressing a switch with the tip of a screwdriver for manual operation. Removal of the screwdriver returns the actuator to the original automated operation mode.

CKD Model 4F310

Rotate a knob for manual operation.

KANEKO Model MK15G

Pull out a switch for manual operation.

ASCO SCXD551

Set the position of a manual operation thread, with a screwdriver, to Position [O] of the indicator for manual operation. Set it to Position [1] to energize the actuator for automated operation mode.

20. Inspection and Maintenance of Actuators and Actuated Valves

20.1 Both actuators and actuated valves are designed for lubrication-free operation, and maintenance or replacement of parts and components is not usually needed, except consumable sealing materials.

20.2 If aging or highly frequent use has caused malfunction or failure of actuators or actuated valves, use KITZ genuine parts for replacement.

20.3 If actuators are equipped with air filter-regulators, periodically clean the bore of drain cocks to remove all internal residues.

20.4 Replace sealing materials such as O-rings and gaskets, if any leakage is detected through sealed connections of actuators and accessories.

20.5 If a lubricator is used, the quality of the lubricant must be appropriately controlled. We recommend use of Turbine Oil Class 1 ISO VG32, or the equivalent for refill.

20.6 Seal washers are used for cylinder's stopper bolts. Leakage may occur from the seal washers after long-term use. Then retighten nuts or replace seal washers.

20.7 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.




Ensure that the valve opening or closing range is correctly maintained in accurate response to a signal currency or a signal pressure of actuators and accessories.

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	
	<ul style="list-style-type: none"> ● Don't use any spindle oil or gear oil for lubrication of actuators and accessories.
	<ul style="list-style-type: none"> ● 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. ● Ensure to replace terminals of electric devices, if needed, with those designed with the same specifications. Different design specifications could be a cause of technical troubles. ● Leaving an abnormal vibration of actuators and valves also causes equipment failure. Support the piping system securely.

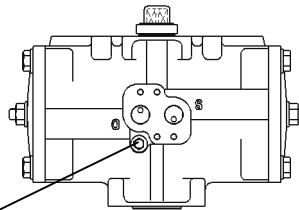
21. Disassembly and Reassembly of Actuators

21.1 KITZ F Series pneumatic valve actuators are available in two types, depending on the basic drive mechanism. While Type FA actuators are designed for double action drive, spring cartridge modules are added to Type FA mechanism to make Type FAS spring return actuators. 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.

WARNING



- Before disassembly of spring cartridges from Type FAS actuator, evenly loosen all of 4 spring cover bolts (but don't completely remove them from the cover) and check if the spring has been released from the compression force and bolts can be rotated by hand.
- If the spring cover bolts are found too tight to be rotated by hand, the spring still remains energized, possibly due to damage of the spring cartridge or the housing pressure remaining higher than the atmospheric level. In such a case, disassembly work must be immediately discontinued to prevent the spring cartridge from jumping out.
- If you have a concern of damage of a spring cartridge, securely retighten spring cover bolts, and replace the actuator itself without removal of the spring cartridge.
- Before disassembling, loosen the hexagon headed bolt under air port to depressurize the housing.

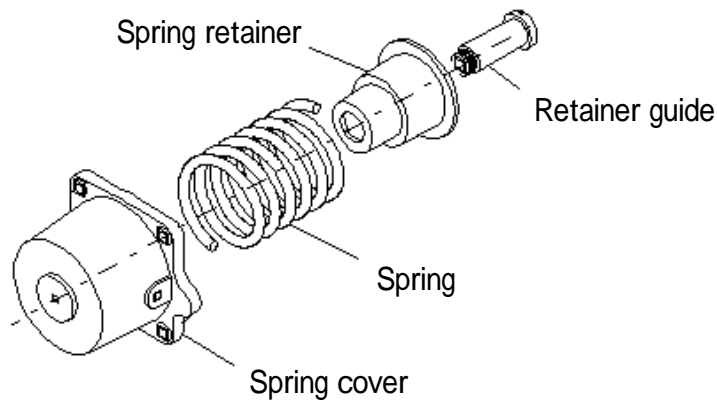


Hexagon headed bolt

WARNING



- Disassembling F type actuator is prohibited. Please ask KITZ or authorized maintenance shops to disassemble them for maintenances or disposal.



- A compressed heavy-duty spring is packed in a spring cartridge of Type FAS spring return actuators. Careless disassembly of the cartridge may cause the spring to jump out and result in damage of properties or injury of personnel. Don't loosen a retainer guide from the spring cover.
- Don't fall or step on a spring cartridge. Careless or rude handling may cause an unintended separation of the highly energized spring from the cartridge.
- Don't remove an end cover from a pressurized actuator housing. Disassembly of any energized actuator is forbidden.
- Don't use compressed air as the measure of disassembly of an actuator. A piston may hazardously jump out.

 **CAUTION**

On disassembly of KITZ F Series pneumatic valve actuators:



- Place work benches in a spacious, clean room.
- Equalize the housing pressure with the atmospheric level, before disassembly.
- After the air tubing has been disassembled, appropriately protect air inlet/outlet ports of an actuator to keep them dust-free until subsequent reassembly.
- The internal surface of the housing and sliding parts such as shafts, pistons and bearings must be carefully handled and stored to avoid scratches or damages, until subsequent reassembly.

 **CAUTION**

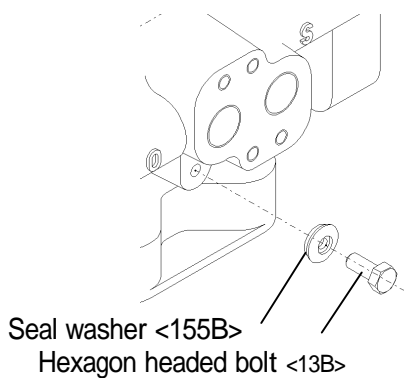
On reassembly of KITZ F Series pneumatic valve actuators:



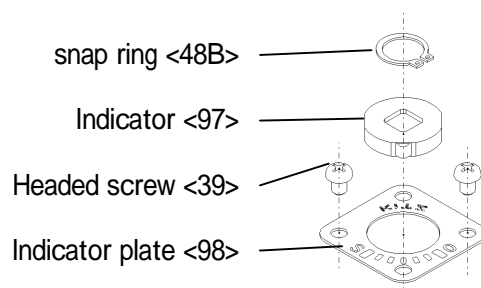
- Place work benches in a spacious, clean room.
- Clean all parts and components, and ensure that they are free from dust and rust.
- Lubricate pistons, bearings, shafts and the internal surface of the housing with Kyodo Oil MULTEMP AC-J or the equivalent. Contact KITZ Corporation for advice, if this lubricant is not available to you.
- Use KITZ genuine parts to replace O-rings, gaskets and other consumables, referring to Section 21 of this manual.
- Carefully mount all sealing parts not to cause scratches or damages to the sealed surface of an actuator housing and adjacent parts.
- Assemble a gear rack with the housing, paying a careful attention to the mounting direction and position.
- Assemble pistons and shafts with the utmost care not to cause scratches or damages to adjacent sliding surfaces.
- Securely tighten all bolts and nuts.

21.2 Disassembly of KITZ F Series pneumatic valve actuators

- (1) Make the air pressure the same as the atmospheric level.
- (2) Gradually loosen all air tubing fittings and ensure that the housing pressure has been equalized with the atmospheric level. Dismantle an actuated valve from the pipeline and disassemble an actuator from the valve.
- (3) Unthread a hexagon headed bolt and a seal washer near the solenoid valve mounting pad. It is possible that piston O-rings are worn and cause air leakage and pressurize the interior of the housing. Therefore, before working on disassembly of an actuator, gradually loosen the hexagon headed bolt and check that the housing pressure has been equalized with the atmospheric level (Fig.1).



(Fig.1)



(Fig.2)

- (4) Remove a snap ring (with snap ring pliers), a position indicator, headed screws and an indicator plate (Fig.2).
- (5) Remove two end covers together with inside O-rings from Type FA double action actuator. Remove an end cover and a spring cover from Type FAS spring return actuator, after having ensured that a spring cartridge is de-energized (Fig.3).

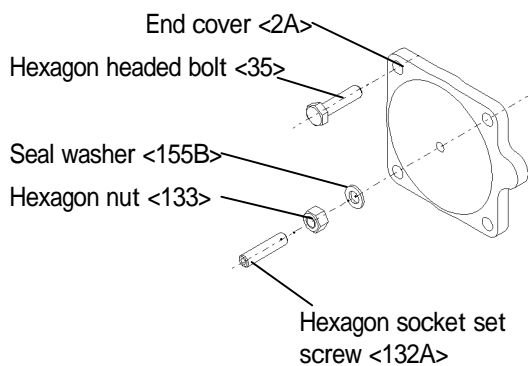


Fig.3

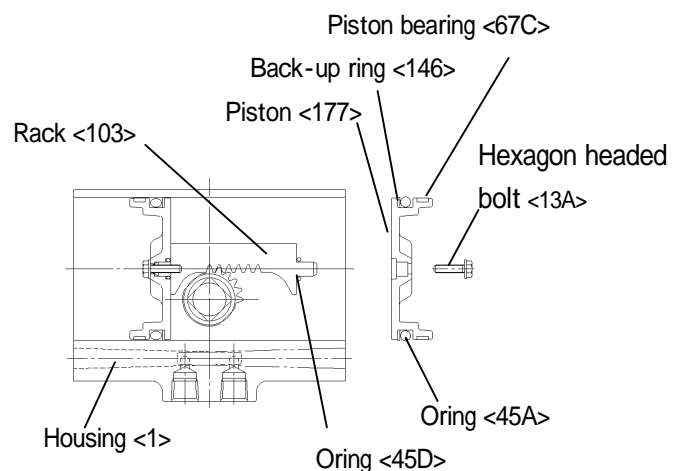


Fig.4

- (6) Loosen a hexagon headed bolt and remove a piston from the housing, by picking an outside rib with pliers (Fig.4).

(7) Rotate the shaft and move another piston toward the end cover opening. Loosen a hexagon headed bolt and remove the second piston from the housing. Also remove a gear rack (**Fig.5**).

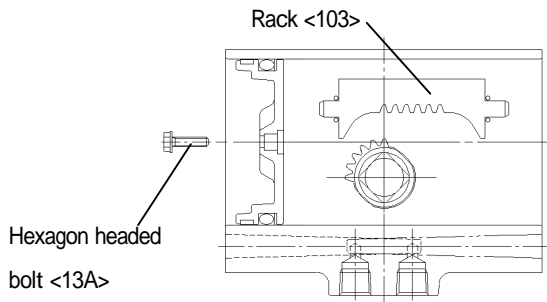


Fig.5

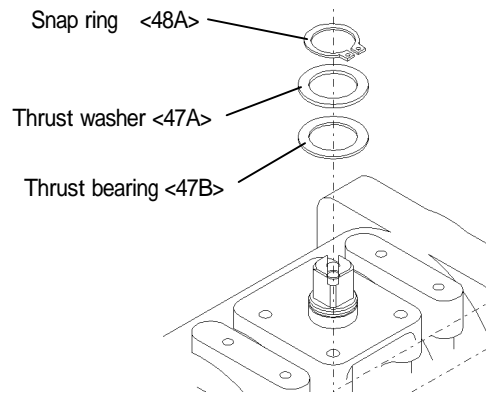


Fig.6

(8) Remove a snap ring (with snap ring pliers), a thrust washer and a thrust bearing from the shaft (**Fig.6**).

(9) Remove the shaft slowly through the bottom of the housing, holding a pinion gear and a bearing by hand. Another bearing is removed together with the shaft (**Fig.7**) to complete disassembly of the actuator.

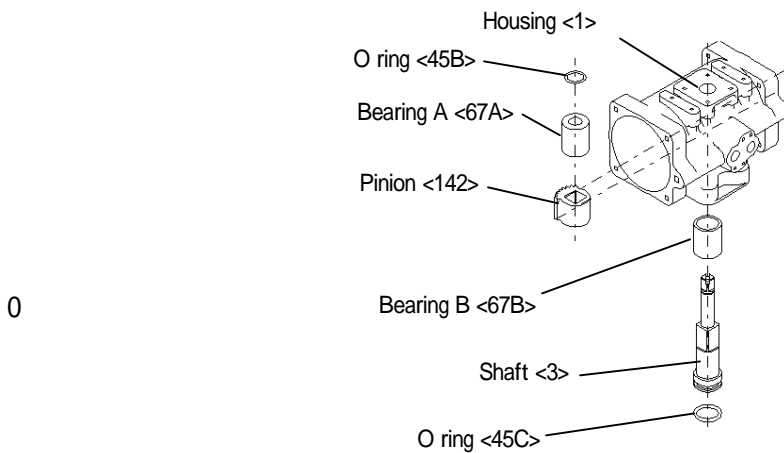


Fig.7

Type FAS spring return actuator is provided with a spring cartridge, in place of an end cover. Don't disassemble the cartridge unit internally holding a compressed heavy-duty spring.

21.3 Reassembly of KITZ F Series pneumatic valve actuators

- (1) Lubricate a larger O-ring, a smaller O-ring, a bearing, and a back-up ring with Kyodo Oil MULTEMP AC-J lubricant or the equivalent, and assemble them with the piston (Fig.8). Contact KITZ Corporation for advice, if this lubricant is not available.

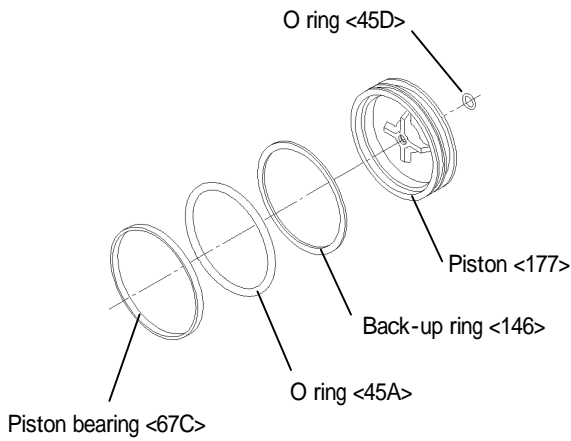


Fig.8

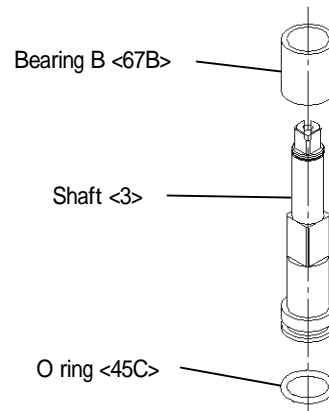


Fig.9

- (2) Lubricate an O-ring and a bearing, and assemble them with the shaft (Fig.9).

- (3) Lubricate an O-ring, a bearing, a pinion gear and the shaft, and assemble them with the housing (Fig.10). The pinion teeth and the NAMUR groove on top of the shaft must be positioned each other as shown in Fig.11.

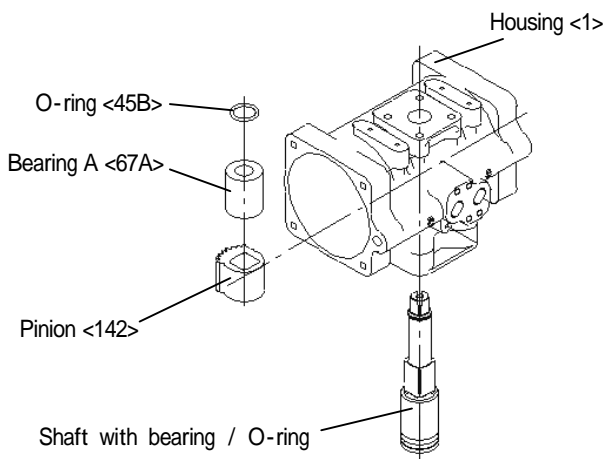


Fig.10

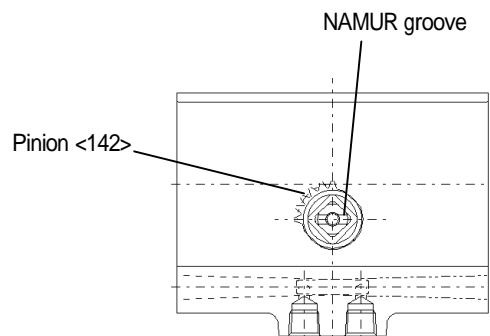


Fig.11

(4) Lubricate the shaft assembled with the housing. Mount a thrust washer and a thrust bearing on the shaft securely with a snap ring (Fig.12).

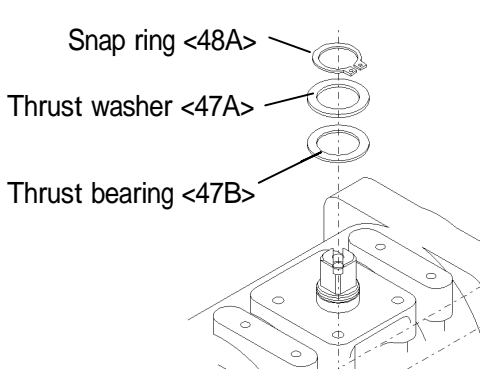


Fig.12

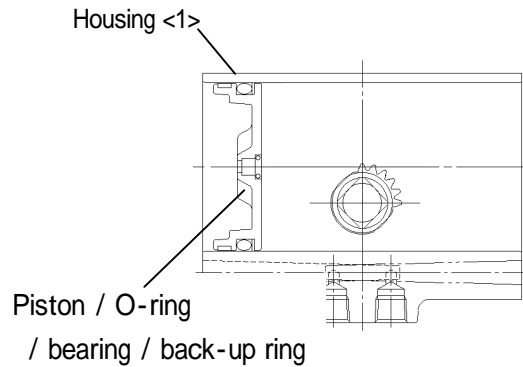


Fig.13

(5) Lubricate the internal surface of the housing and assemble the piston (complete with O-rings, a bearing and a back-up ring) with the housing (Fig.13).

(6) Lubricate the gear rack teeth and assemble it with the piston as follows: Mesh the first tooth of the pinion with the first space (bottom of tooth) of the rack, and insert the projection of the rack into the center hole of the piston. Temporarily assemble the piston and the rack with a hexagon headed bolt. Apply LOCKTITE No.262 or the equivalent to the bolt beforehand for secured assembly (Fig.14).

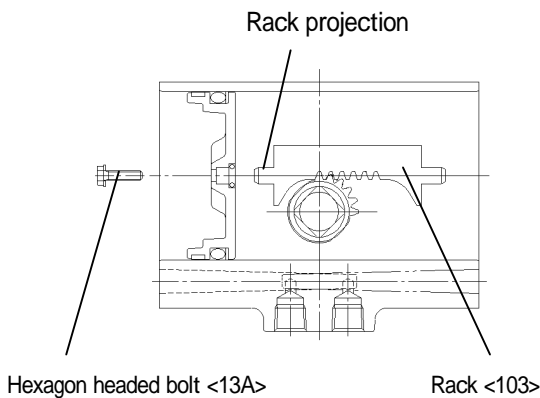


Fig.14

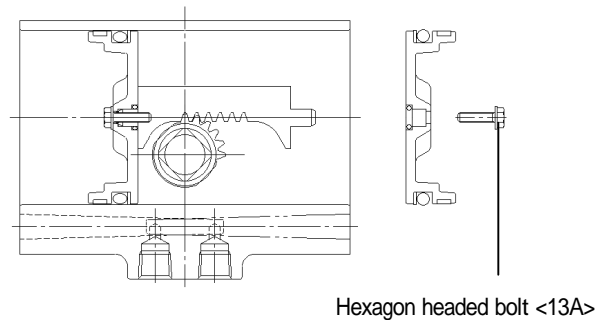


Fig.15

(7) Assemble another piston with another projection of the rack. Securely tighten it with a hexagon headed bolt and a flat washer. Also at this time tighten the first piston and the first rack projection securely (Fig.15).

- (8) Mount a stopper bolt, a seal washer and a hexagon nut on an end cover. Lubricate an O-ring and assemble it with the end cover (Fig.16). Mount the end cover on the housing opening with hexagon headed bolts (Fig.17). For reassembly of Type FAS spring return actuators, the spring cartridge must be mounted on the housing opening , instead of the end cover .

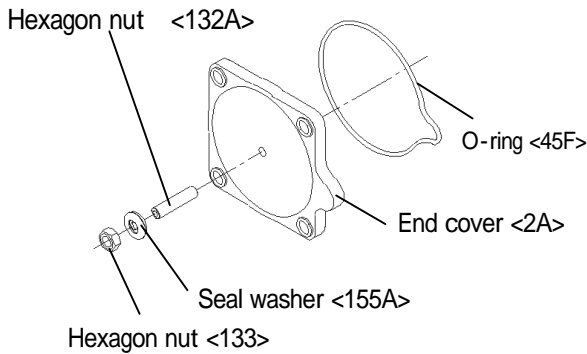


Fig.16

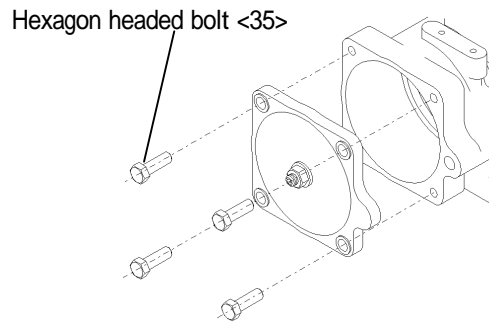


Fig.17

- (9) Adjust the shaft rotating angle (valve opening range), according to Section 14 of this manual.
- (10) Check the leakage of air from an actuator with soap solution, according to the following procedures:

Apply the operating pressure to Port [O] and check if any external air leakage is detected through the contact of the housing with the end cover, the stopper bolt and the seal washer in the right-hand side (Fig.18).

Apply the operating pressure to Port [S] and check if any external leakage detected through the contact of the housing with another end cover, another stopper bolt and another seal washer in the left-hand side (Fig.18).

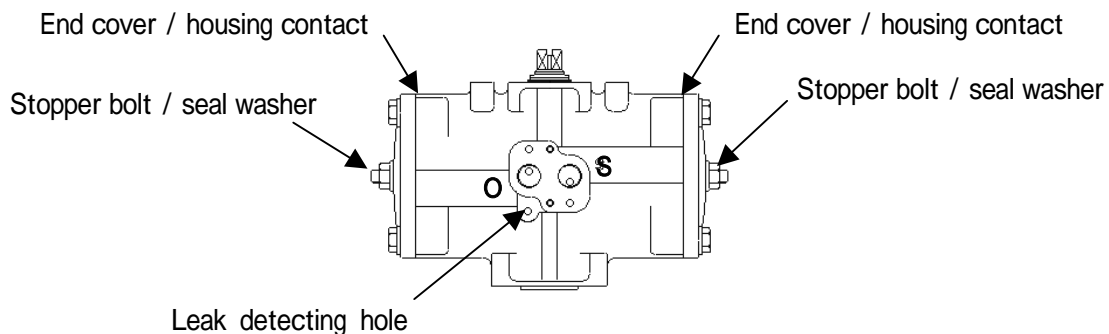


Fig.18

Cover the leak detecting hole below the solenoid valve mounting pad with a soap film, and check if any air leakage is detected there during a travel of the piston. Don't apply the soap film directly to the opening, since the soap may penetrate inside the housing and cause malfunction of an actuator.

Leak test should be done after 15minuits to 30minuts past since pressurizing actuators. If not, internal air residue remains and the leak test cannot be done with accuracy.

Wipe off all soap solution afterwards.

If any leakage has been detected, disassemble the actuator again to check if any part or component is scratched, deformed or worn, and replace them, if necessary, with KITZ genuine parts.

- (11) Plug the leak detector hole with a seal washer and a hexagon headed bolt, to complete reassembly of an actuator (**Fig.19**).
- (12) Mount an indicator plate on top of the housing with two headed screws so that Mark [O] may point (a) the left-hand of the housing for ball valves, or (b) the air inlet/outlet ports for butterfly valves as shown in **Fig.20**. After checking correct mounting of the indicator plate, assemble a position indicator through the shaft securely with a snap ring.

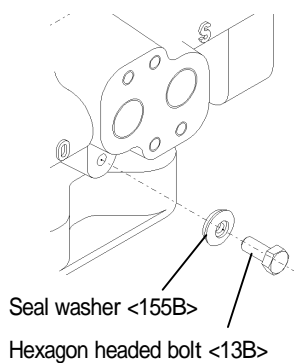


Fig.19

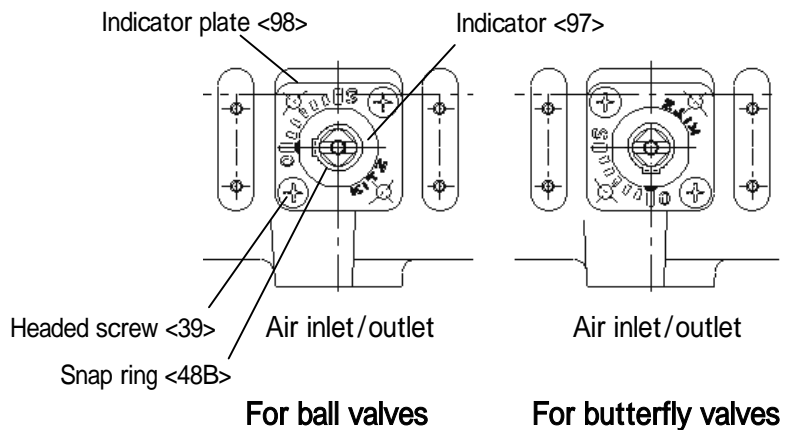


Fig.20

- (13) Check trouble-free operation of reassembled actuators and mount them on valves.

21.4 Bolt tightening torques

All bolts and screws shall be securely tightened with the torques recommended below:

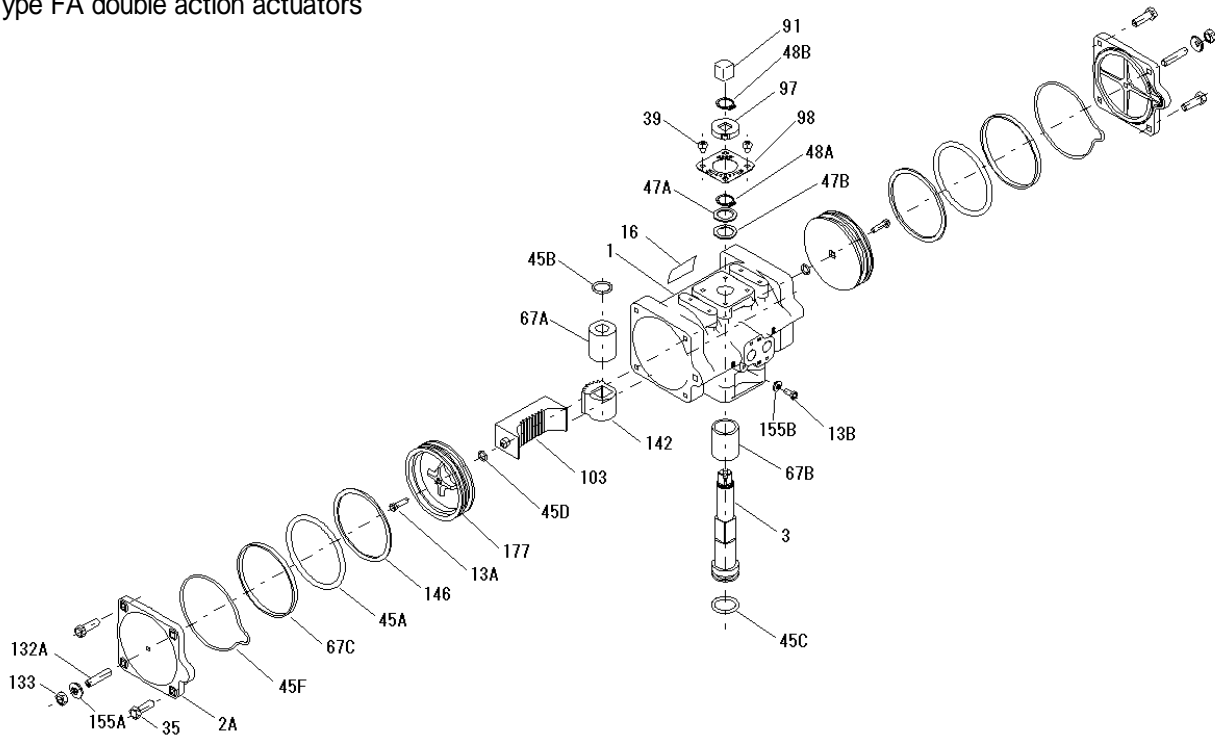
Recommended bolt tightening torques

[N·m]

Actuator size	FA/FAS-1	FA/FAS-2	FA/FAS-3	FA/FAS-4	FA/FAS-5	FA/FAS-6
Piston / rack assembly	M5 ; 2 ~ 3	M5 ; 2 ~ 3	M6 ; 4 ~ 5	M10 ; 17 ~ 20	M12 ; 29 ~ 34	M16 ; 71 ~ 84
End cover / spring cover mounting	M6 ; 4 ~ 5	M8 ; 9 ~ 10	M10 ; 17 ~ 20	M10 ; 17 ~ 20	M12 ; 29 ~ 34	M16 ; 71 ~ 84
Opening range adjuster bolt	M6 ; 3 ~ 5	M8 ; 5 ~ 8	M10 ; 9 ~ 15	M12 ; 25 ~ 30	M16 ; 40 ~ 50	M20 ; 100 ~ 120
Leak detector hole plugging	M5 ; 2 ~ 4					

21.5 Construction details and list of parts

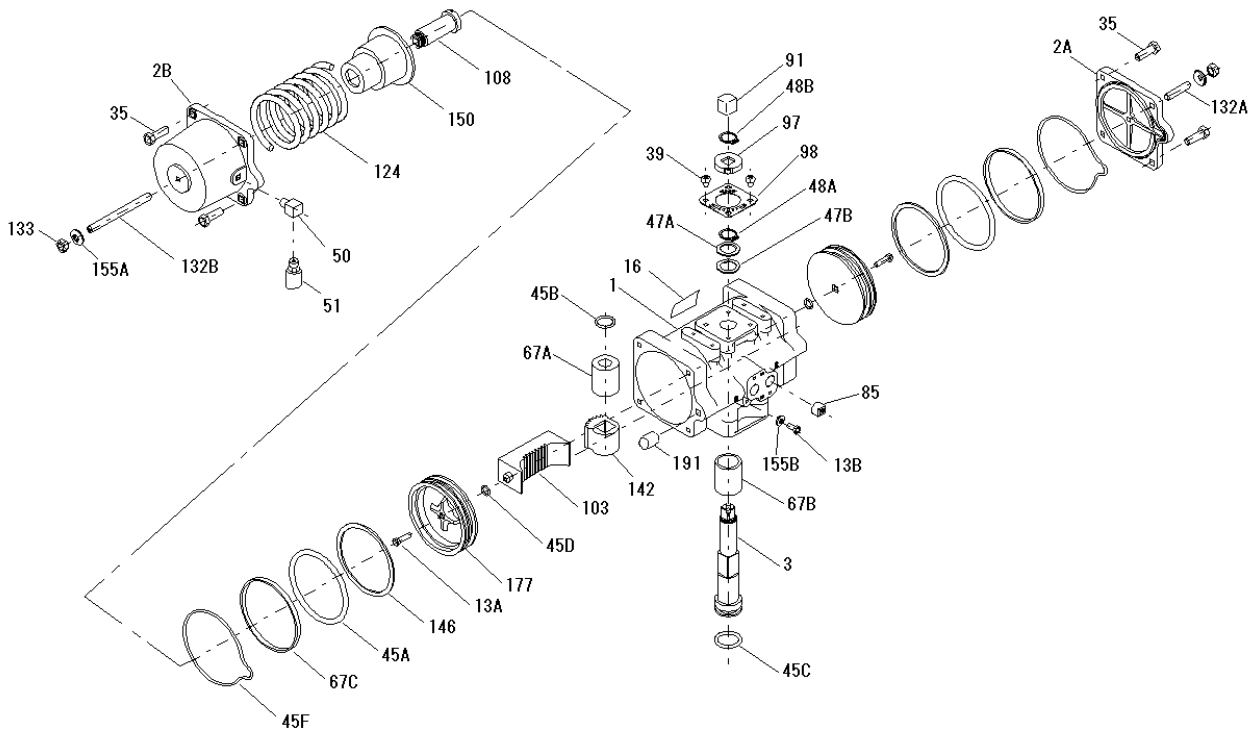
Type FA double action actuators



Materials

Part No.	Parts name	Material	JIS	EQ.ASTM	Part No.	Parts name	Material	JIS	EQ.ASTM
1	Housing	Cast aluminum	ADC12	B85-95-383.0	67A	Stem bearing	Bronze	PPS	B62 or B584 No.C83600
			AC4C	B26M-97-356.0					
			AC2A	—					
2A	End cover	Cast aluminum	ADC12	B85-95-383.0	67B	Stem bearing	Bronze	PPS	B62 or B584 No.C83600
3	Shaft	Carbon steel	S45C	A181 Gr.1	67C	Piston bearing	PTFE/POM	—	—
13A	Bolt	Stainless steel	SUS304	A193 Gr. B8	91	Shaft cap	PVC	—	—
13B	Bolt	Stainless steel	SUS304	A193 Gr. B8	97	Indicator	Nylon	—	—
16	Name Plate	Polyester	—	—	98	Indicator plate	Aluminum	A1050P	B209 Gr. 1060
35	Bolt	Stainless steel	SUS304	A193 Gr. B8	103	Gear rack	Cast aluminum	ADC12	B85-95-383.0
39	Bolt	Stainless steel	SUS304	A193 Gr. B8	132A	Stopper bolt	Stainless steel	SUS304	A193 Gr. B8
45A ~D, F	O-ring	NBR	—	—	133	Nut	Stainless steel	SUS304	A194 Gr. 8
47A	Thrust washer	Stainless steel	SUS430	A276 Type 430	142	Pinion	Sintered metal	SMF4040 /FCD450-10	—
47B	Thrust bearing	PTFE	—	—	146	Back-up ring	PTFE	—	—
48A	Snap ring	Stainless steel	SUS304 CSP	A167 Type 304	155A	Seal washer	NBR + Stainless steel	SUS304 +NBR	—
48B	Snap ring	Stainless steel	SUS304 CSP	A167 Type 304	155B	Seal washer	NBR + Stainless steel	SUS304 +NBR	—
					177	Piston	Cast aluminum	ADC12	B85-95-383.0

Type FAS spring return actuators



Materials of spring unit

Part No.	Parts name	Material	JIS	EQ.ASTM
2B	Spring cover	Cast aluminum	ADC12	B85-95-383.0
50	Breathing plug	Brass	C3604BD	B16
51	Mizukiller	Resin (POM)	—	—
85	Plug	Alloy steel	SCM435	—
108	Retainer guide	Carbon steel	C3604BD	A563 Gr. A
124	Spring	Carbon steel	SWP-B/SUP-9	A228 or ANSI 9260
132B	Stopper bolt	Stainless steel	SUS304	A193 Gr. B8
150	Spring retainer	Cast aluminum	ADC12	B85-95-383.0
191	Rubber plug	NBR	FAS-6 only	

22. KITZ Standard Spare Parts for KITZ Type FA/FAS Actuators

Description	Part No.	FA/FAS-1			FA/FAS-2			FA/FAS-3			
		Product code	Size	Quantity	Product code	Size	Quantity	Product code	Size	Quantity	
O-ring	Piston	45A	8710-0060-00	P60	2	8710-0080-00	P80	2	8710-0100-00	P100	2
	Shaft	45B	8710-0016-00	P16	1	8710-0018-00	P18	1	8710-0A04-00	P22A	1
	Shaft	45C	8710-0021-00	P21	1	8710-0024-00	P24	1	8710-0026-00	P26	1
	Gear rack	45D	8710-0009-00	P9	2	8710-0009-00	P9	2	8710-0A01-00	P10A	2
	End cover	45F	87B0-0075-00	S75	2	87B0-0095-00	S95	2	87B0-0115-00	S115	2
Thrust bearing	47B	8620-1612-40	—	1	8620-1817-40	—	1	8620-2218-40	—	1	
Piston bearing	67C	8620-6502-40	—	2	8620-8501-40	—	2	8621-0503-40	—	2	
Back-up ring	146	8730-0060-80	P60	2	8730-0080-80	P80	2	8730-0100-80	P100	2	
Seal washer	155A	6360-9811-01	M6	2	6360-9811-03	M8	2	6360-9811-04	M10	2	
Seal washer	155B	6360-9811-02	M5	1	6360-9811-02	M5	1	6360-9811-02	M5	1	
Spare Parts Kit Product No.		5910-3001-00			5910-3002-00			5910-3003-00			

Description	Part No.	FA/FAS-4			FA/FAS-5			FA-6			
		Product code	Size	Quantity	Product code	Size	Quantity	Product code	Size	Quantity	
O-ring	Piston	45A	8710-0130-00	P130	2	8710-0155-00	P155	2	8710-0205-00	P205	2
	Shaft	45B	8710-0025-00	P25	1	8710-0032-00	P32	1	8710-0045-00	G45	1
	Shaft	45C	8710-0034-00	P34	1	8710-0044-00	P44	1	8720-0055-00	G55	1
	Gear rack	45D	8710-0022-00	P22	2	8710-0026-00	P26	2	8710-0034-00	P34	2
	End cover	45F	87B0-0145-00	S145	2	87B0-0175-00	S175	2	87B0-0235-00	S235	2
Thrust bearing	47B	8620-2218-40	—	1	8620-3008-40	—	1	8620-4203-40	—	1	
Piston bearing	67C	8621-3502-49	—	2	8621-6501-49	—	2	8622-1910.5	—	2	
Back-up ring	146	8730-0130-80	P130	2	8730-0155-80	P155	2	8730-0209-80	P209	2	
Seal washer	155A	6360-6812-11	M12	2	6360-6812-12	M16	2	6360-6812-14	M20	2	
Seal washer	155B	6360-9811-02	M5	1	6360-9811-02	M5	1	6360-9811-02	M5	1	
Spare Parts Kit Product No.		5910-3004-00			5910-3005-00			5910-3006-00			

Description	Part No.	FAS-6			
		Product code	Size	Quantity	
O-ring	Piston	45A	8710-0205-00	P205	2
	Shaft	45B	8710-0045-00	P45	1
	Shaft	45C	8720-0055-00	P55	1
	Gear rack	45D	8710-0034-00	P34	2
	End cover	45F	87B0-0235-00	S235	1
	Spring cover	45G	87B0-0225-00	S225	1
Thrust bearing	47B	8620-4203-40	—	1	
Piston bearing	67C	8622-1901-49	—	2	
Back-up ring	146	8730-0209-80	P209	2	
Seal washer	155A	6360-6812-14	M20	2	
Seal washer	155B	6360-9811-02	M5	1	
Spare Parts Kit Product No.		5910-3007-00			

Note: Spare parts for the discontinued KITZ Type F and FS actuators are exactly the same as those used for Type FA and FAS actuators.

23. Trouble Shooting

Detected Troubles		Causes of Troubles	Remedial Measures
Troubles with Actuators	Disturbed supply of air pressure	Malfunction or insufficient capacity of compressors	Check/repair of compressors; check/repair of tubing systems
		Air leakage from tubing between compressors and actuators	
		Air flow disturbed by foreign objects within tubes; Too small tubing sizes; Pipe damage or freezing	Check/repair of tubes
		Defective regulators	Repair/replacement of regulators
	No activation of actuators under full air pressure	Foreign objects stuck with valve seats	Disassembly/maintenance/repair of valves
		Excessive raise of valve operating torque	Disassembly/maintenance/repair of valves; Increase of operating pressure (Max 0.7 MPa, 100 psi)
		Excessively throttled speed controllers	Readjustment of speed controllers
		Rejective actuators	Repair/replacement of actuators
Troubles with Solenoid Valves	No Activation of energized solenoid valves;	Breaks of electric circuits	Check/repair of electric circuits
		Defective electromagnets	Check/adjustment of voltage; replacement of coils
	Unusual noise	Water intrusion into electromagnets or terminals	Water prevention; replacement of coils
		Inadequate voltage	Check/adjustment of voltage; Check of solenoid valve specs; replacement of coils
	Excessive temperature raise	Foreign objects stuck in solenoid valve interior	Disassembly/cleaning/replacement of solenoid valves
	Excessive leak from exhaust ports of solenoid valves	Worn piston O-ring; Foreign objects stuck to piston O-rings	Disassembly/cleaning of actuators; Replacement of O-rings
		Worn seating parts of solenoid valves ; Foreign objects stuck to sealing parts of solenoid valves	Check/replacement of solenoid valves

24. Notes to users

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 they use 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 product. 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.

25. Product Warranty

Failed or damaged products shall be repaired or replaced at no cost to users, if the failure or damage occurred within 12 months after pilot operation, but not exceeding 18 months after shipment from KITZ factories, and the following conditions are satisfied:

- (1) The product has been correctly handled, stored, installed, operated and maintained according to this manual within the scope of design specifications and service conditions of the product.
- (2) The product has not been modified by any party other than KITZ Corporation or its authorized modification shops.
- (3) The product function and performance has not been deteriorated by aging.
- (4) The product has not been damaged due to an act of God or a natural disaster.

26. Emergency Call for Technical Assistance

Should users need to contact KITZ Corporation, its distributors or its authorized service shops on technical problems of the products, they are recommended to inform the following:

Arrival date of shipment and date of pilot operation

Name of distributors

KITZ product code and size

In-site service conditions such as the kind and conditions of the fluid, the line pressure range and cycles, and the line temperature range and cycles

Frequency of operation and any other functional conditions

Environmental conditions for piping installation

Detail of troubles

Company name, address, section and phone number

Engineering Modifications of Actuators for Optional Specifications
Appendix to Operation Manual of KITZ F Series Pneumatic Valve Actuators

1. Replacement of O-rings
2. Conversion to AIR-FAIL-OPEN Mode
3. Adjustment of Intermediate Valve Opening Range
4. Change of Spring Cartridge Units
5. 90 ° Turn of Actuator-to-Valve Mounting Orientation
6. Actuation of KITZ 3-way Ball Valves
7. Conversion of Actuator Drive Modes
8. Spring Return Drive with Manual Operator Units

1. Replacement of O-rings

1.1 Standard NBR O-rings are for the temperature range of -20 to +80 (-4 ° F to +176 ° F). Optional FPM O-rings are for the range of -20 to +100 (-4 ° F to +212 ° F), while low temperature NBR O-rings are for the range of -40 to +60 (-40 ° F to +140 ° F). Refer to Section 20 of the operation manual on O-ring replacement .

1.2 Our standard NBR O-rings are shown in **Table 1**.

Table 1. Standard NBR O-rings

Part No.	Description	Pcs.	Used to seal
45A	O-ring P type	2	Piston outside circumference
45B	O-ring P type	1	Top of shaft
45C	O-ring P type	1	Bottom of shaft
45D	O-ring P type	2	Piston inside circumference
45F	O-ring S type	2	End cover

1.3 Information on KITZ optional O-rings is detailed in **Table 2-1** and **2-2**.

Table 2-1. Product codes of optional O-rings for Actuator Size 1 to 3

Application	Actuator	Part No.	Type-Size	Material	Pcs.	Product code
High temp.	FA/FAS - 1	045A	P60	FKM	2	8710-0060-10
		045B	P16	FKM	1	8710-0016-10
		045C	P21	FKM	1	8710-0021-10
		045D	P9	FKM	2	8710-0009-10
		045F	S75	FKM	2	87B0-0075-10
	FA/FAS-2	045A	P80	FKM	2	8710-0080-10
		045B	P18	FKM	1	8710-0018-10
		045C	P24	FKM	1	8710-0024-10
		045D	P9	FKM	2	8710-0009-10
		045F	S95	FKM	2	87B0-0095-10
	FA/FAS-3	045A	P100	FKM	2	8710-0100-10
		045B	P22A	FKM	1	8710-0A04-10
		045C	P26	FKM	1	8710-0026-10
		045D	P10A	FKM	2	8710-0A01-10
		045F	S115	FKM	2	87B0-0115-10
Low temp.	FA/FAS - 1	045A	P60	L.T.NBR	2	8710-0060-01
		045B	P16	L.T.NBR	1	8710-0016-01
		045C	P21	L.T.NBR	1	8710-0021-01
		045D	P9	L.T.NBR	2	8710-0009-01
		045F	S75	L.T.NBR	2	87B0-0075-01
	FA/FAS-2	045A	P80	L.T.NBR	2	8710-0080-01
		045B	P18	L.T.NBR	1	8710-0018-01
		045C	P24	L.T.NBR	1	8710-0024-01
		045D	P9	L.T.NBR	2	8710-0009-01
		045F	S95	L.T.NBR	2	87B0-0095-01
	FA/FAS-3	045A	P100	L.T.NBR	2	8710-0100-01
		045B	P22A	L.T.NBR	1	8710-0A04-01
		045C	P26	L.T.NBR	1	8710-0026-01
		045D	P10A	L.T.NBR	2	8710-0801-01
		045F	S115	L.T.NBR	2	87B0-0115-01

Note. L.T.NBR means NBR for low temperature service.

Table 2-2. Product codes of optional O-rings for Actuator Size 4 to 6

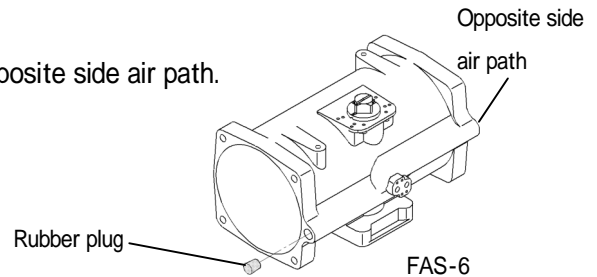
Application	Actuator	Part No.	Type-Size	Material	Pcs.	Product code
High temp.	FA/FAS-4	045A	P60	FKM	2	8710-0130-10
		045B	P25	FKM	1	8710-0025-10
		045C	P34	FKM	1	8710-0034-10
		045D	P22	FKM	2	8710-0022-10
		045F	S145	FKM	2	87B0-0145-10
	FA/FAS-5	045A	P155	FKM	2	8710-0155-10
		045B	P32	FKM	1	8710-0032-10
		045C	P44	FKM	1	8710-0044-10
		045D	P26	FKM	2	8710-0026-10
		045F	S175	FKM	2	87B0-0175-10
	FA-6	045A	P205	FKM	2	8710-0205-10
		045B	P34	FKM	1	8710-0A04-10
		045C	G55	FKM	1	8720-0055-10
		045D	G45	FKM	2	8720-0045-10
		045F	S235	FKM	2	87B0-0235-10
	FAS-6	045A	P205	FKM	2	8710-0205-10
		045B	P34	FKM	1	8710-0A04-10
		045C	G55	FKM	1	8720-0055-10
		045D	G45	FKM	2	8720-0045-10
		045F	S235	FKM	1	87B0-0235-10
045G		S225	FKM	1	87B0-0225-10	
Low temp.	FA/FAS-4	045A	P60	L.T.NBR	2	8710-0130-01
		045B	P25	L.T.NBR	1	8710-0025-01
		045C	P34	L.T.NBR	1	8710-0034-01
		045D	P22	L.T.NBR	2	8710-0022-01
		045F	S145	L.T.NBR	2	87B0-0145-01
	FA/FAS-5	045A	P155	L.T.NBR	2	8710-0155-01
		045B	P32	L.T.NBR	1	8710-0032-01
		045C	P44	L.T.NBR	1	8710-0044-01
		045D	P26	L.T.NBR	2	8710-0026-01
		045F	S175	L.T.NBR	2	87B0-0175-01
	FA-6	045A	P205	L.T.NBR	2	8710-0205-01
		045B	P45	L.T.NBR	1	8710-0045-01
		045C	G55	L.T.NBR	1	8720-0055-01
		045D	P34	L.T.NBR	2	8710-0A04-10
		045F	S235	L.T.NBR	2	87B0-0235-01
	FAS-6	045A	P205	L.T.NBR	2	8710-0205-10
		045B	P45	L.T.NBR	1	8710-0045-10
		045C	G55	L.T.NBR	1	8720-0055-10
		045D	P34	L.T.NBR	2	8710-0A04-10
		045F	S235	L.T.NBR	1	87B0-0235-10
045G		S225	L.T.NBR	1	87B0-0225-10	

Note. L.T.NBR means NBR for low temperature service.

2. Conversion to AIR-FAIL-OPEN Mode

The standard AIR-FAIL-CLOSE mode of KITZ Type FAS spring return actuator can be converted to AIR-FAIL-OPEN mode, without changing its counter-clockwise opening operation (**Fig.1**).

- (1) Check that the housing pressure has been equalized to the atmospheric level, loosen 4 hexagon headed bolts and disassemble the end cover.
- (2) Also disassemble the spring cartridge unit.
- (3) For FAS-6, remove the rubber plug and put it into the opposite side air path.



- (4) Mount the spring cartridge to the opposite end opening of the housing.
- (5) Also mount the end over to the opposite end opening of the housing, in place of the spring cartridge unit.
- (6) Move a port stopper plug from Port [S] to Port [O].

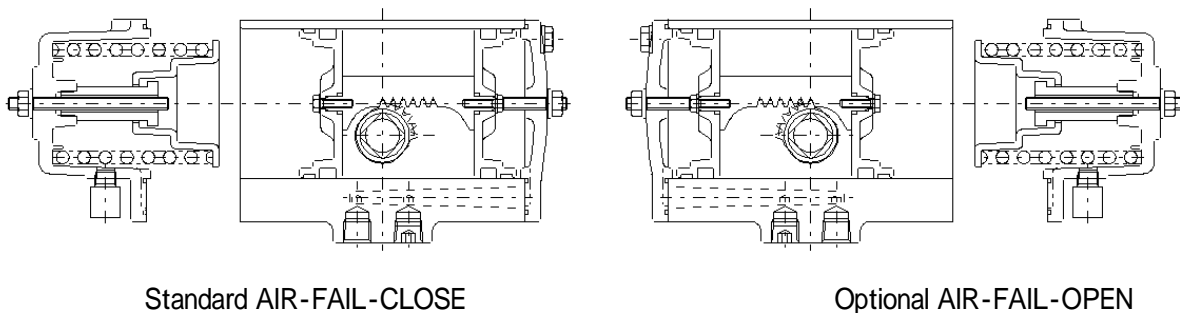


Fig.1

- (7) Apply the actual operation pressure to Port [S] and detect external air leakage with using soap solution, through the contact of the end cover with the housing, the stopper bolt and the seal washer (**Fig.2**).

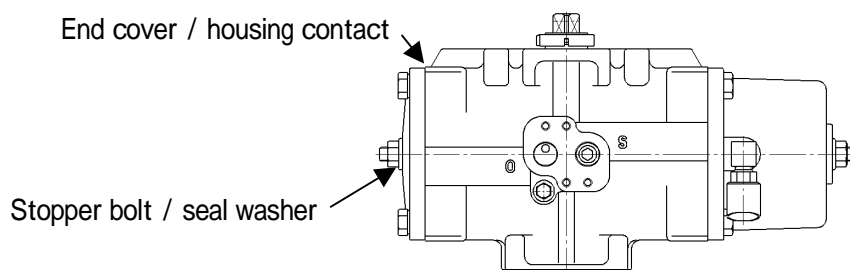




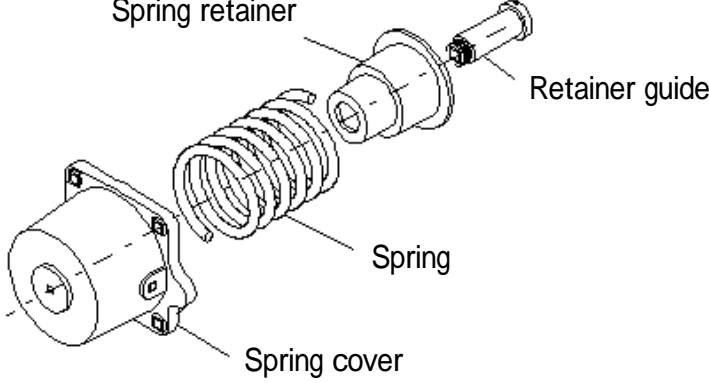


Fig.2

- (8) Then, energize the actuator for trial operation to ensure trouble-free function.
- (9) Insert Mizukiller on a breathing port of a spring case.

 WARNING	
	<ul style="list-style-type: none">● Before disassembly of spring cartridges from Type FAS actuator, evenly loosen all of 4 spring cover bolts (but don't completely remove them from the cover) and check if the spring has been released from the compression force and bolts can be rotated by hand.● If the spring cover bolts are found too tight to be rotated by hand, the spring still remains energized, possibly due to damage of the spring cartridge or the housing pressure remaining higher than the atmospheric level. In such a case, disassembly work must be immediately discontinued to prevent the spring cartridge from jumping out.● If you have a concern of damage of a spring cartridge, securely retighten spring cover bolts, and replace the actuator itself without removal of the spring cartridge.

 WARNING	
	<div style="text-align: center;"><p>Spring retainer</p><p>Retainer guide</p><p>Spring</p><p>Spring cover</p></div> <ul style="list-style-type: none">● A compressed heavy-duty spring is packed in a spring cartridge of Type FAS spring return actuators. Careless disassembly of the cartridge may cause the spring to jump out and result in damage of properties or injury of personnel. Don't loosen a retainer guide from the spring cover.● Don't fall or step on a spring cartridge. Careless or rude handling may cause an unintended separation of the highly energized spring from the cartridge.● Don't remove an end cover from a pressurized actuator housing. Disassembly of any energized actuator is forbidden.● Don't use compressed air as the measure of disassembly of an actuator. A piston may hazardously jump out.

3. Adjustment of Intermediate Valve Opening Range

3.1 By use of an optional longer stopper bolt as a kit, the valve opening range can be adjusted within a range of -7° to 97° . The kit shall be mounted on the left hand end cover for adjustment of the opening range, while it shall be mounted reversely for adjustment of the closing range (**Fig.3**). Follow the working instructions provided below.

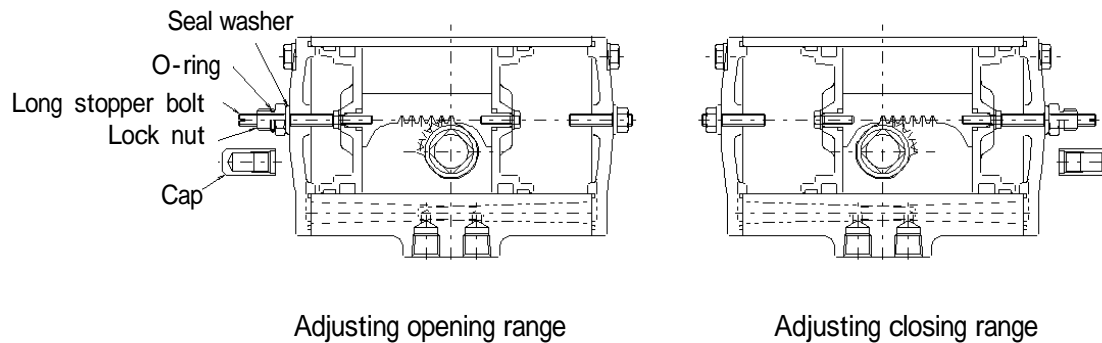


Fig.3

- (1) Equalize the housing pressure with the atmospheric level, by means of operation of an equalizer valve or disassembly of the air tubing.
- (2) Remove a hexagon nut, a seal washer and a stopper bolt (a hexagon socket set screw) from the end cover of either side, depending on how to make adjustment.
- (3) Mount an optional long stopper bolt on the end cover, and temporarily tighten it with a seal washer and a lock nut also being provided as an optional kit.
- (4) Rotate the long stopper bolt and adjust the valve opening (or closing) range.
- (5) Tighten the lock nut with the torque specified in **Table 3** below:

Table 3. Lock nut tightening torque

Actuator	Lock nut tightening torque
FA/FAS-1	3 to 5 N·m
FA/FAS-2	5 to 8 N·m
FA/FAS-3	9 to 15 N·m
FA/FAS-4	25 to 30 N·m
FA/FAS-5	40 to 50 N·m
FA/FAS-6	100 to 120 N·m

- (6) Put an O-ring over the stopper bolt and tighten a cap on the locknut securely.
- (7) Apply the actual operation pressure to both Port [O] and Port [S], and detect air leakage with soap solution, through the adjustment kit parts. Wipe off the soap solution afterwards.

(8) Then, energize the actuator for trial operation to ensure trouble-free operation.

(9) An optional adjustment kit includes the following parts:

- Long stopper bolt (hexagon socket set screw)
- Lock nut
- O-ring
- Cap nut
- Seal washer (for replacement)

The standard stopper bolt, the hexagon nut and the replaced seal washer are not used anymore.

3.2 Product code numbers of the kit parts are introduced in **Table 4**.

Table 4. Product codes of optional adjustment kit parts

Actuator	Adjusting	Adjustment kit parts				
		Lock nut	O-ring	Stopper bolt	Cap	Seal washer
		Brass	NBR	304 S.S.	Brass	---
FA-1	Open/Close	AC34-3201-70	87B0-0008-00 (S8)	AC24-4201-50	AC44-3202-70	6360-9811-01
FAS-1	Close			AC24-4202-50		
	Spring side					
FA-2	Open/Close	AC34-4301-70	87B0-0014-00 (S14)	AC24-4301-50	AC44-3401-70	6360-9811-03
FAS-2	Close			AC24-4302-50		
	Spring side					
FA-3	Open/Close	AC34-3301-70		AC24-4401-50		6360-9811-04
FAS-3	Close			AC24-4402-50		
	Spring side					
FA-4	Open/Close	AC34-4501-70	8710-0016-00 (P16)	AC24-4501-50	AC44-4501-70	6360-6812-11
FAS-4	Close			AC24-4502-50		
	Spring side					
FA-5	Open/Close	AC34-4601-70	8710-0020-00 (P20)	AC24-4601-50	AC44-4601-70	6360-6812-12
FAS-5	Close			AC24-4602-50		
	Spring side					
FA-6	Open/Close	AC34-4701-70	8710-0024-00 (P24)	AC24-4701-50	AC44-4701-70	6360-6812-14
FAS-6	Close			AC24-4702-50		
	Spring side					

4. Change of Spring Cartridge Units

4.1 KITZ Type FAS spring return actuators are factory-assembled with a standard 4K spring cartridge unit (for 0.4MPa operating pressure). This can be optionally changed to either 3K unit (for 0.3MPa) or 5K unit (for 0.5MPa) with the procedures provided below (**Fig.4**).

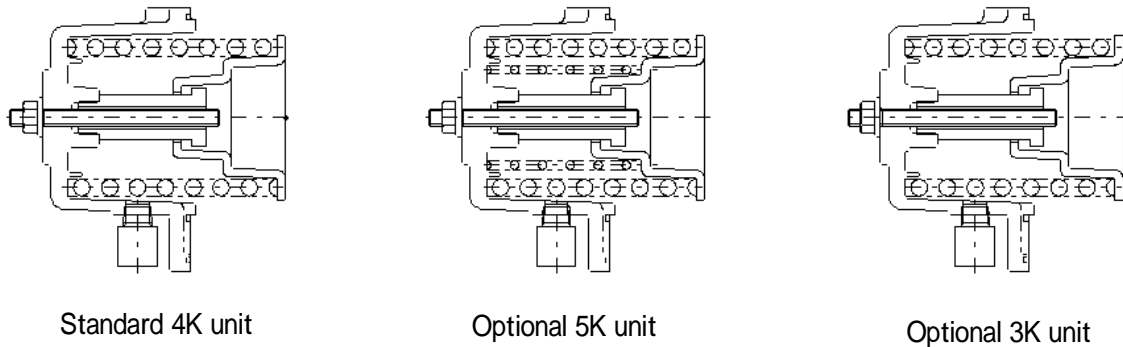


Fig.4

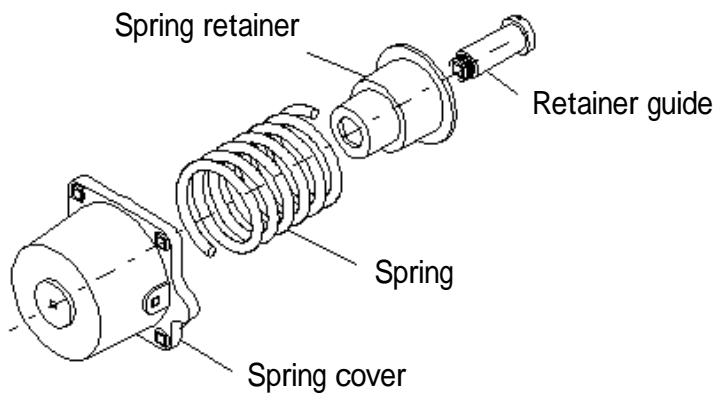
- (1) Disassemble the air tubing and equalize the housing pressure with the atmospheric level.
- (2) Loosen 4 hexagon bolts and disassemble the standard 4K spring cartridge unit from the housing.
- (3) Mount your preferred, optional 3K or 5K unit securely to the housing with hexagon bolts.
- (4) Adjust the valve opening angle, following the instructions provided in Section 14 of the operation manual.
- (5) Energize the actuator for trial operation to ensure trouble-free function.

4.2 Product codes of all optional spring cartridge units are provided in **Table 5**. Each unit consists of a spring, a spring retainer, a retainer guide and a spring cover. Other small parts such as a stopper bolt, a seal washer, a hexagon nut, hexagon bolts and a breathing hole plug used for 4K unit may be used for assembly of 3K or 5K spring cartridges as they are.

Table 5. Product Codes of Optional Spring Cartridge Units

Actuator	Description	Product code
FAS-1	3K unit	AE04-4202-10
	5K unit	AE04-4203-10
FAS-2	3K unit	AE04-4302-10
	5K unit	AE04-4303-10
FAS-3	3K unit	AE04-4402-10
	5K unit	AE04-4403-10
FAS-4	3K unit	AE04-4502-10
	5K unit	AE04-4503-10
FAS-5	3K unit	AE04-4602-10
	5K unit	AE04-4603-10
FAS-6	3K unit	AE04-4702-10
	5K unit	AE04-4703-10

⚠ WARNING	
!	<ul style="list-style-type: none">● Before disassembly of spring cartridges from Type FAS actuator, evenly loosen all of 4 spring cover bolts (but don't completely remove them from the cover) and check if the spring has been released from the compression force and bolts can be rotated by hand.● If the spring cover bolts are found too tight to be rotated by hand, the spring still remains energized, possibly due to damage of the spring cartridge or the housing pressure remaining higher than the atmospheric level. In such a case, disassembly work must be immediately discontinued to prevent the spring cartridge from jumping out.● If you have a concern of damage of a spring cartridge, securely retighten spring cover bolts, and replace the actuator itself without removal of the spring cartridge.

⚠ WARNING	
⊘	<div style="text-align: center;"></div> <ul style="list-style-type: none">● A compressed heavy-duty spring is packed in a spring cartridge of Type FAS spring return actuators. Careless disassembly of the cartridge may cause the spring to jump out and result in damage of properties or injury of personnel. Don't loosen a retainer guide from the spring cover.● Don't fall or step on a spring cartridge. Careless or rude handling may cause an unintended separation of the highly energized spring from the cartridge.● Don't remove an end cover from a pressurized actuator housing. Disassembly of any energized actuator is forbidden.● Don't use compressed air as the measure of disassembly of an actuator. A piston may hazardously jump out.

5. 90 ° Turn of Actuator-to-Valve Mounting Orientation

The actuator mounting orientation with a valve may be turned by 90 ° for local piping convenience or operation ease. In this case, a position indicator must be relocated so that [O] indication becomes parallel to the axis of the piping or the direction of fluid flow. An position indicator must be also relocated according to the new location of the indicator plate and the valve opening position (**Fig.5**). Follow the procedures provided below.

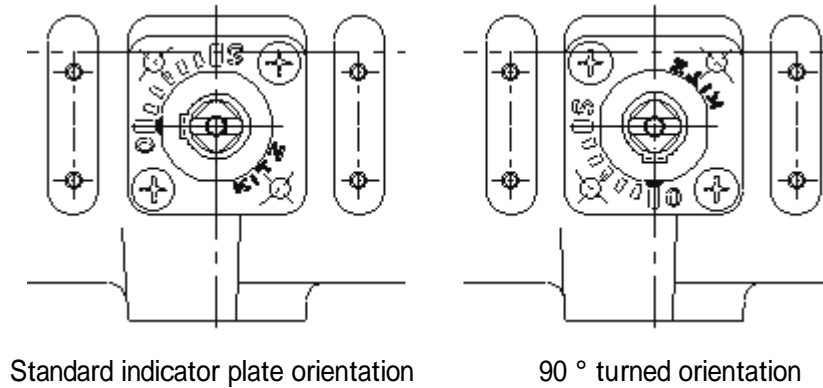


Fig.5

- (1) Mount an actuator on a valve with your desired orientation by turning 90 ° .
- (2) Loosen a snap ring (with snap ring pliers), and remove a position indicator from the shaft.
- (3) Relocate the indicator plate on top of the actuator so that [O] indication becomes parallel to the axis of the piping or the direction of fluid flow.
- (4) Mount the position indicator, correctly matching to the new location of the indicator plate and the valve opening position. Securely fix it with a snap ring.

6. Actuation of KITZ 3-way Ball Valves

KITZ 3-way ball valves may be operated with F Series pneumatic actuators by means of adding special position indicators to the standard one as instructed below (**Fig.6** and **Fig.7**). The position indicator plate is not needed for actuation of 3-way ball valves.

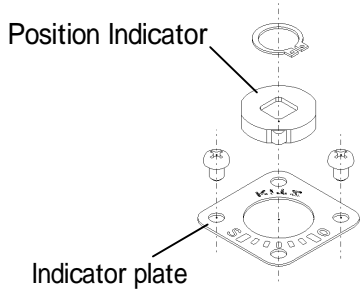


Fig.6

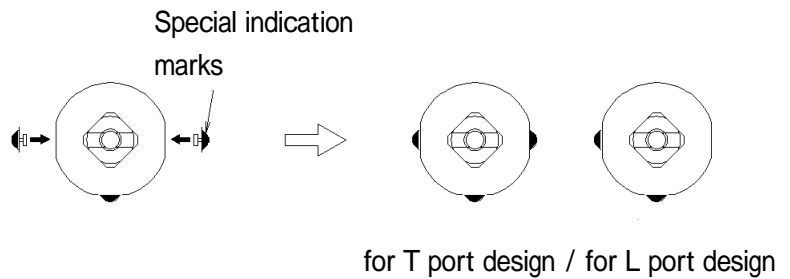


Fig.7

- (1) Loosen a snap ring (with snap ring pliers) and remove a position indicator and an indicator plate from the housing.
- (2) Add one special indication mark to L port design, or two special indication marks to T port design. These special indication marks are optionally available. Refer to **Table 6** for product codes of indication marks.

Table 6. Product code of indication marks

	Actuator	Color*	Product code
indication marks	FA/FAS-1 ~ 4	Yellow	AD14-4001-B0
	FA/FAS-1 ~ 4	Black	AD14-4002-B0
	FA/FAS-5, 6	Black	AD14-4602-20

* Yellow marks are for red position indicators. Black marks are for yellow position indicators.

- (3) Mount the position indicator on the shaft of an actuator, following the valve opening direction. The indicator plate is not needed for operation of 3-way ball valves.

7. Conversion of Actuator Drive Mode

7.1 Type FA double action actuators can be converted to Type FAS spring return actuators by replacement of several parts.

(1) Disassemble the air tubing, equalize the housing pressure with the atmospheric level and remove the left hand end cover (with air inlet/outlet ports facing to the front) of an actuator set for the standard AIR-FAIL-CLOSE mode. If you now want the opposite AIR-FAIL-OPEN mode, remove the right hand end cover instead (**Fig.8**).

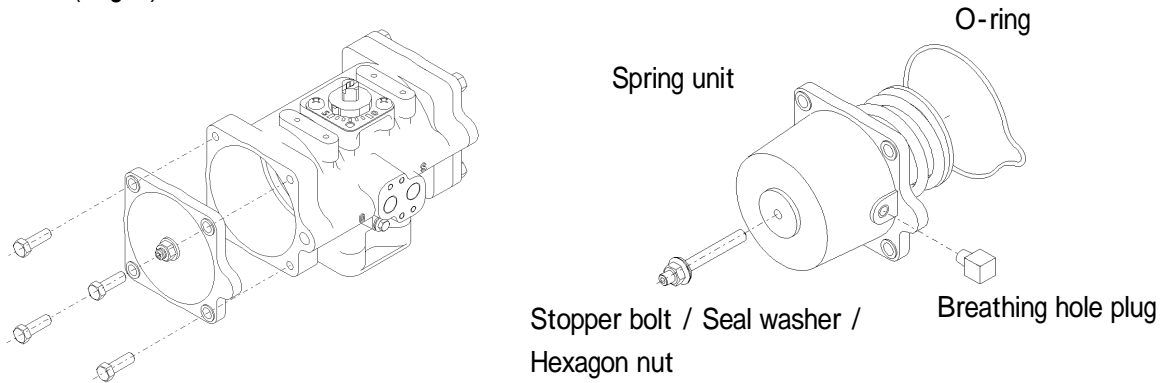


Fig.8

Fig.9

(2) Mount a stopper bolt, a seal washer, a hexagon nut and a breathing hole plug on a spring cartridge unit (**Fig.9**). Put the O-ring removed from the end cover, or a new O-ring if needed, on the spring cartridge unit.

(3) Insert the spring cartridge unit into the end cover opening, and securely fix it with 4 hexagon headed bolts. (**Fig.10**).

(4) Put a plug to Port [S] (**Fig.10**).

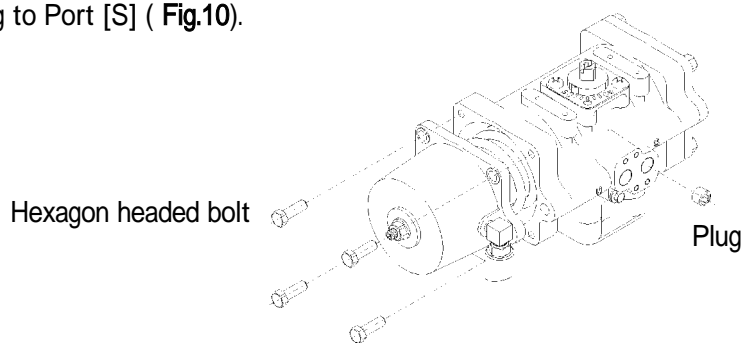




Fig.10



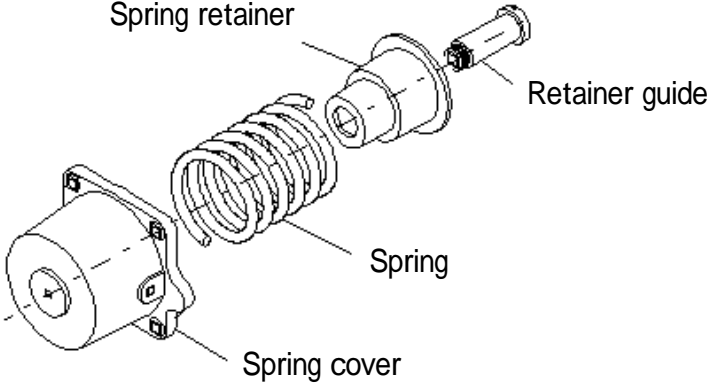
(5) Adjust the valve opening range, following Section 14 of the operation manual.

(6) Energize the actuator for trial operation to ensure trouble-free function.

(7) Insert Mizukiller on a breathing port of a spring case.

7.2 For conversion of the spring return mode to the double action mode, remove the spring cartridge from the housing and mount the end cover instead. After adjustment of the valve opening range, following Section 14 of the operation manual, detect external air leakage with soap solution, through the contact of the end cover and the stopper bolt with the housing.

 WARNING	
	<ul style="list-style-type: none"> ● Before disassembly of spring cartridges from Type FAS actuator, evenly loosen all of 4 spring cover bolts (but don't completely remove them from the cover) and check if the spring has been released from the compression force and bolts can be rotated by hand. ● If the spring cover bolts are found too tight to be rotated by hand, the spring still remains energized, possibly due to damage of the spring cartridge or the housing pressure remaining higher than the atmospheric level. In such a case, disassembly work must be immediately discontinued to prevent the spring cartridge from jumping out. ● If you have a concern of damage of a spring cartridge, securely retighten spring cover bolts, and replace the actuator itself without removal of the spring cartridge.

 WARNING	
	<div style="text-align: center;">  </div> <ul style="list-style-type: none"> ● A compressed heavy-duty spring is packed in a spring cartridge of Type FAS spring return actuators. Careless disassembly of the cartridge may cause the spring to jump out and result in damage of properties or injury of personnel. Don't loosen a retainer guide from the spring cover. ● Don't fall or step on a spring cartridge. Careless or rude handling may cause an unintended separation of the highly energized spring from the cartridge. ● Don't remove an end cover from a pressurized actuator housing. Disassembly of any energized actuator is forbidden. ● Don't use compressed air as the measure of disassembly of an actuator. A piston may hazardously jump out.

7.3 **Table 7** provides the information on the parts required to accommodate the spring return mode for the double action actuators.

Table 7. Parts required for conversion of double action mode to spring return mode

Part	Actuator	Description	Product code	Quantity
Spring cartridge	FA-1	Spring set F(A)S-1	AE04-4201-10	1set
	FA-2	Spring set F(A)S-1	AE04-4301-10	1set
	FA-3	Spring set F(A)S-1	AE04-4401-10	1set
	FA-4	Spring set FAS-4	AE04-4501-10	1set
	FA-5	Spring set FAS-5	AE04-4601-10	1set
	FA-6	Spring set FAS-6	AE04-4701-10	1set
Stopper bolt with washer and nut	FA-1	BS set F(A)S-1 M6*75	AC24-4204-50	1set
	FA-2	BS set F(A)S-2 M8*95	AC24-4304-50	1set
	FA-3	BS set F(A)S-3 M10*115	AC24-4404-50	1set
	FA-4	Stopper bolt M12*170	7731-2902-60	1
		Seal washer size 12	6360-6812-11	1
		Nut M12	7441-2000-60	1
	FA-5	Stopper bolt M16*210	7731-6901-60	1
		Seal washer size 16	6360-6812-12	1
		Nut M16	7441-6000-60	1
	FA-6	Stopper bolt M20*270	7732-0901-60	1
		Seal washer size 20	6360-6812-14	1
		Nut M20	7442-0000-60	1
Breathing hole plug	FA-1 ~ 4	Elbow joint DAV 01-01	6380-1511-04	1
	FA-5, 6	Elbow joint DAV 02-01	6380-1511-02	1
Hexagon bored plug	FA-1 ~ 6	Hexagon bored plug R1/4	5585-0216-80	1
O-ring	FA-1	O-ring S75	87B0-0075-00	1
	FA-2	O-ring S95	87B0-0095-00	1
	FA-3	O-ring S115	87B0-0115-00	1
	FA-4	O-ring S145	87B0-0145-00	1
	FA-5	O-ring S175	87B0-0175-00	1
	FA-6	O-ring S225	87B0-0225-00	1
Mizukiller	FA-1 ~ 4	Mizukiller 17	AN94-4001-P0	1
	FA-5, 6	Mizukiller 23	AN94-4002-P0	1

8. Spring Return Drive with Manual Operator Units

8.1 KITZ Type FAS spring return actuators can be manually operated with FSW manual operator units, for either AIR-FAIL-CLOSE mode (Fig.11) or AIR-FAIL-OPEN mode (Fig.12), following the instructions provided below. Product codes of FSW units and O-rings are shown in Table 8 and Table 9.

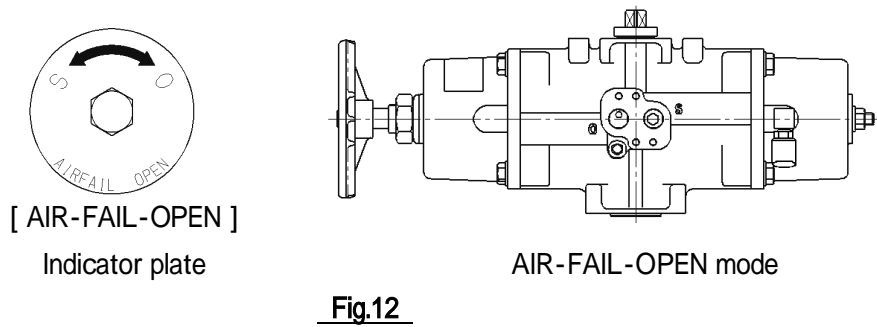
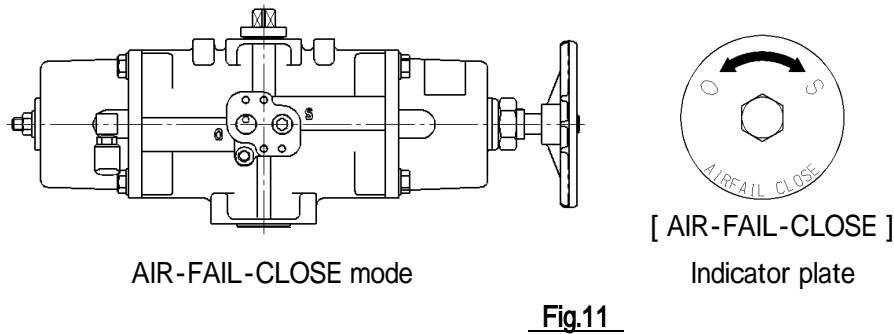


Table 8. Product code of FSW manual operator units

Actuator	Unit product code
FAS-1	AF04-4201-00
FAS-2	AF04-4301-00
FAS-3	AF04-4401-00
FAS-4	AF04-4501-00
FAS-5	AF04-4601-00
FAS-6	AF04-4701-00

Table 9. O-ring product codes of FSW manual operator units

Actuator	Material	Size	Product code
FAS-1	NBR	S75	87B0-0075-00
	NBR	P7	8710-0007-00
FAS-2	NBR	S95	87B0-0095-00
	NBR	P9	8710-0009-00
FAS-3	NBR	S115	87B0-0115-00
	NBR	P10A	8710-0A01-00
FAS-4	NBR	S145	87B0-0145-00
	NBR	P10A	8710-0A01-00
FAS-5	NBR	S175	87B0-0175-00
	NBR	P31.5	8710-0A08-00
FAS-6	NBR	S225	87B0-0225-00
	NBR	P39	8710-00.4-00

8.2 FSW manual operator units can be mounted on Type FAS spring return actuators for AIR-FAIL-CLOSE mode as follows.

- (1) Rotate the handwheel of a FSW manual operator unit clockwise till it completely stops (**Fig.13**).

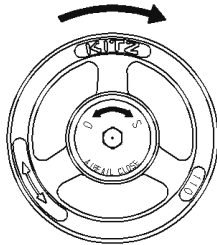


Fig.13

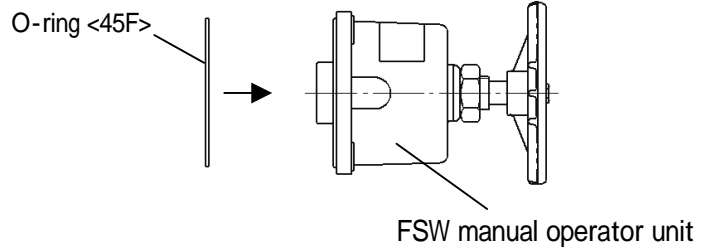


Fig.14

- (2) Mount an O-ring on the bottom of the FSW unit (**Fig.14**).
- (3) Equalize the housing pressure with the atmospheric level, and remove an end cover from Type FAS spring return actuator (**Fig.15**).

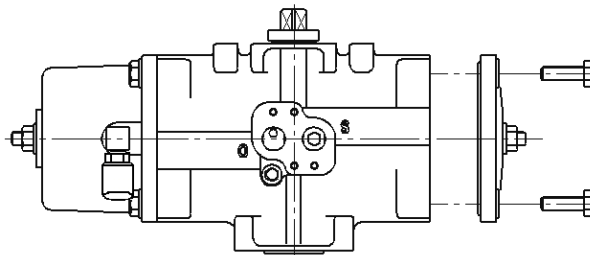


Fig.15

- (4) Mount the FSW unit on the end cover opening of the housing, ensuring that the O-ring does not swell out through the contact of the unit with the housing (**Fig.16**).

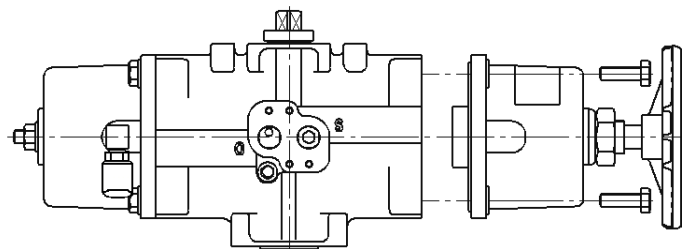


Fig.16

- (5) Pressurize the actuator with the actual operation pressure through Port [O] and [S] and check external air leakage with soap solution. Wipe off the soap solution afterwards.
- (6) Energize the actuator for trial operation to ensure trouble-free function. We recommend to carefully read Section 8.4 of this document before manually operating spring return actuators.

8.3 In the case of Type FAS spring return actuators with manual operator units (AIR-FAIL-OPEN mode), FSW units shall be mounted on the reverse side of actuators as shown in Fig.17.

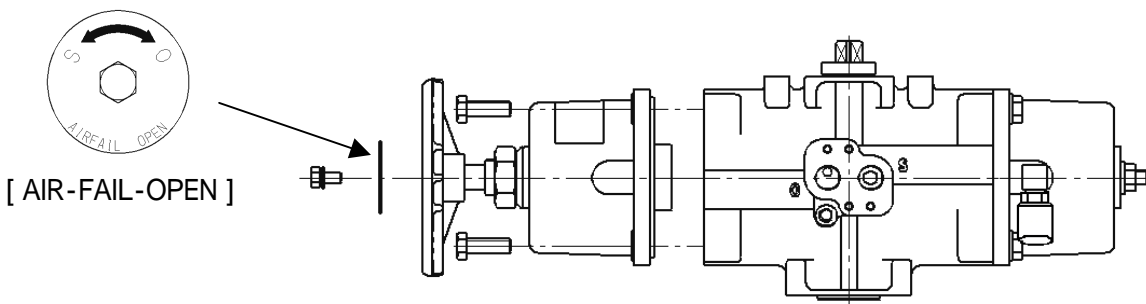


Fig.17

8.4 For operation of Type FAS spring return actuators equipped with FSW manual operators, read the following instructions carefully before handling.

8.4.1 Manual operation

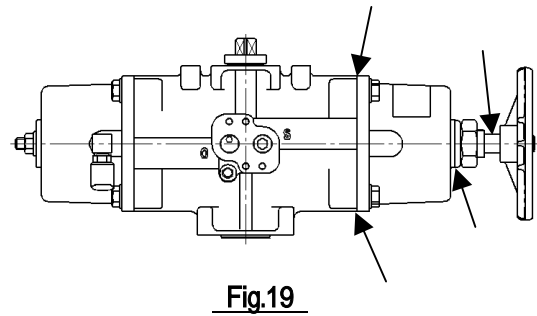
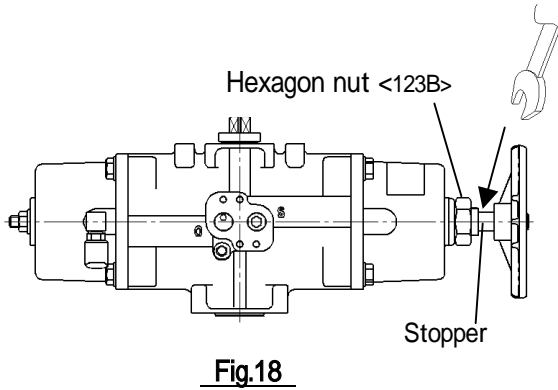
- (1) Equalize the housing pressure with the atmospheric level.
- (2) Rotate a handwheel counter-clockwise to open the valve.
- (3) At the end of the handwheel travel, a position indicator of an actuator will indicate that the valve is fully open. Adding any further load to the handwheel may cause damage or failure of the actuator.
- (4) Rotate the handwheel clockwise to close the valve.
- (5) At the end of the reverse travel of the handwheel, the position indicator will indicate that the valve is fully closed. Adding any further load may cause damage or failure of the actuator.

⚠ WARNING	
	<ul style="list-style-type: none"> ● Don't use levers or wrenches to rotate handwheels of FSW units. An excessive load to the handwheels may cause damage or failure of actuators.

⚠ WARNING	
	<ul style="list-style-type: none"> ● When manual operation of an actuator is changed to automated operation, ensure to rotate a handwheel clockwise till it completely stops. Otherwise, subsequent automated operation of an actuator may cause inadequate valve opening range and damage of the actuator.

8.4.2 Adjustment of valve opening range

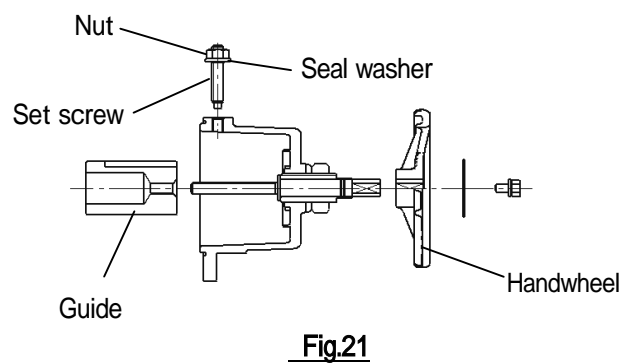
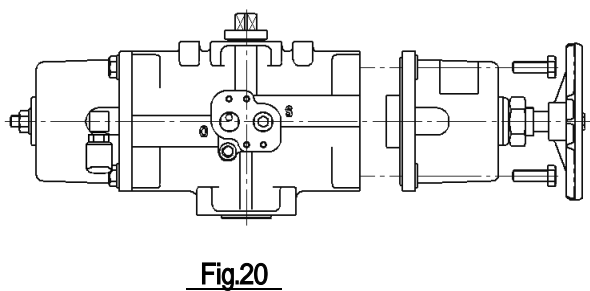
- (1) Equalize the housing pressure with the atmospheric level.
- (2) Loosen a hexagon nut and rotate the stopper with a spanner to adjust the valve opening range (**Fig.18**).
- (3) Ensure to securely retighten the hexagon nut afterwards (**Fig.18**).



- (4) Supply the actual operating pressure to the housing through Port [O] and check external air leakage through the contact of a FSW unit with the housing (**Fig.19**).

8.5 Disassembly of FSW manual operator unit

- (1) Disassemble the air tubing and equalize the housing pressure with the atmospheric level.
- (2) Disassemble the unit from the housing (**Fig.20**).



- (3) Remove a handwheel, a guide, a set screw, a nut and a seal washer from the unit (**Fig.21**).

(4) Remove a spindle from the bottom of the unit (Fig.22).

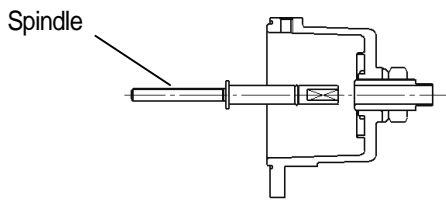


Fig.22

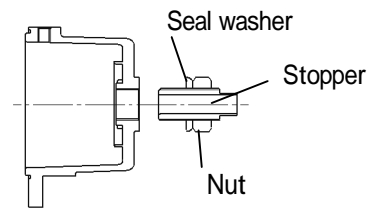


Fig.23

(5) Remove a stopper, a nut and a seal washer from the cover of the unit (Fig.23).

8.6 Reassembly of FSW manual operator units

(1) Thread the stopper into the cover of the unit until the top of the stopper projects through the bottom by 2mm to 3mm (Fig.24).

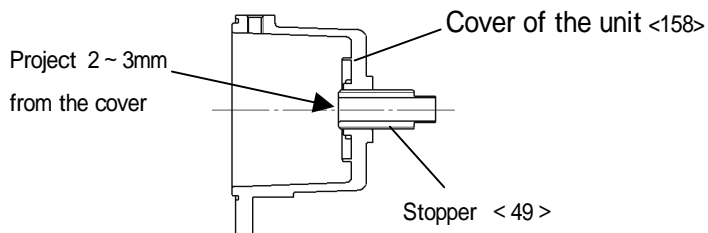


Fig.24

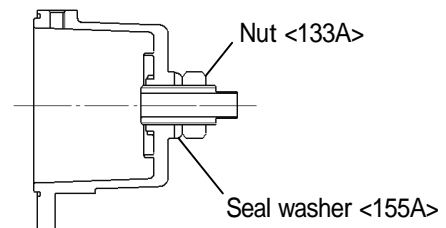


Fig.25

(2) Tighten the stopper with the seal washer and the nut (Fig.25).

(3) Lubricate the spindle and the O-ring with Kyodo Oil MULTEMP AC-J or the equivalent, and assemble them together (Fig.26). Contact KITZ Corporation for advice, if this lubricant is not available.

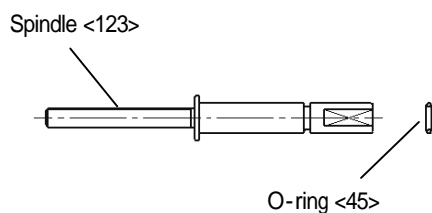


Fig.26

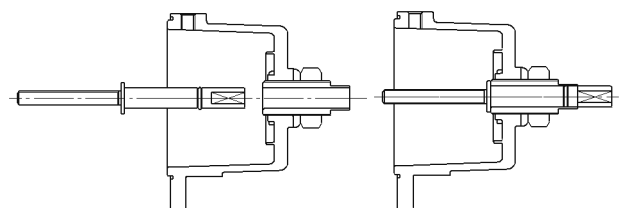


Fig.27

(4) Insert the spindle into the stopper through the bottom of the unit till the guard will contact the stopper (Fig.27).

(5) Lubricate the spindle threads with Kyoudo Oil MULTEMP AC-J or the equivalent, and insert the guide onto the spindle till it contacts the spindle guard (**Fig.28**).

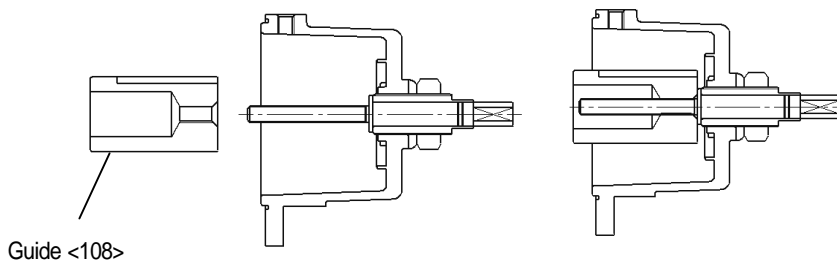


Fig.28

(6) Rotate the guide so that a guide groove may face to the hole bored through the cover of the unit for the set screw. Thread the set screw through the cover (**Fig.29**).

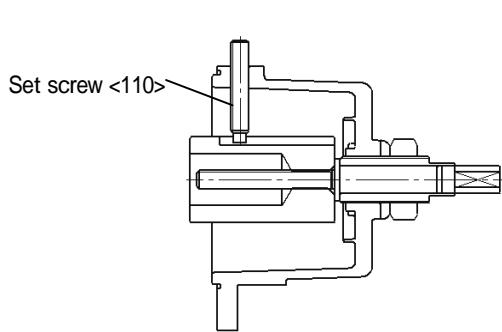


Fig.29

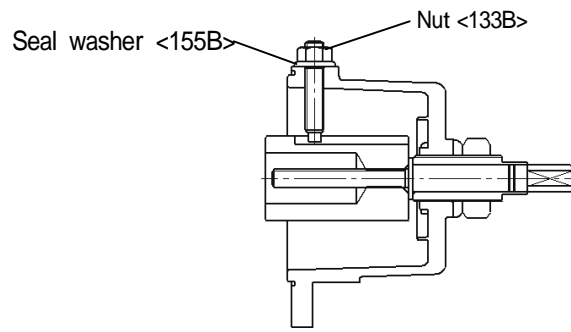


Fig.30

(7) Ensure that the end of the set screw tightly contacts the bottom of the guide groove, rotate the set screw reversely by a turn, and tighten it with the seal washer and the nut (**Fig.30**).

(8) Mount the handwheel and the indicator plate on top of the spindle, and tighten them with a hexagon set screw lubricated with LOCKTITE No.262 or the equivalent (**Fig.31**).

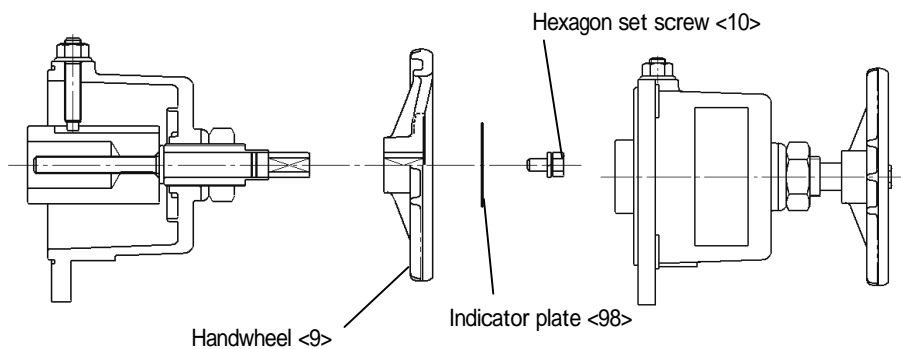


Fig.31

- (9) Assemble a FSW unit with Type FAS actuator, and check if the manual operation functions correctly to fully open or close the valve. Rotate the unit clockwise till the handwheel completely stops (Fig.32). If necessary, adjust the valve opening range by rotating the stopper with a spanner. Tighten the stopper with the hexagon nut afterwards (Fig.33).

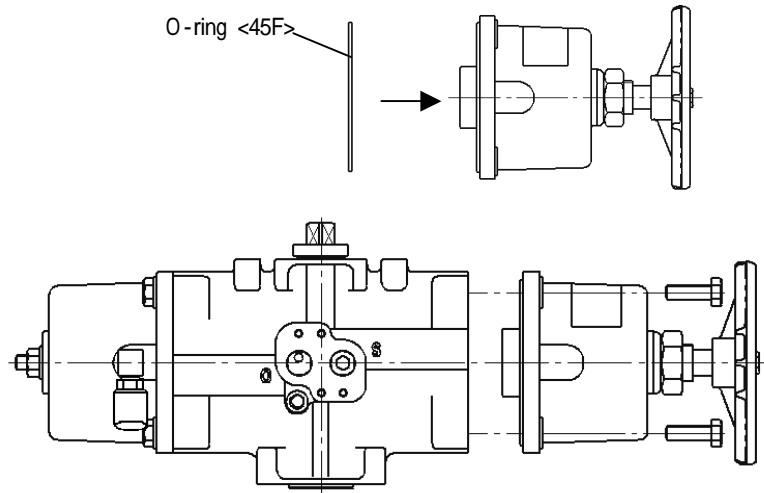


Fig.32

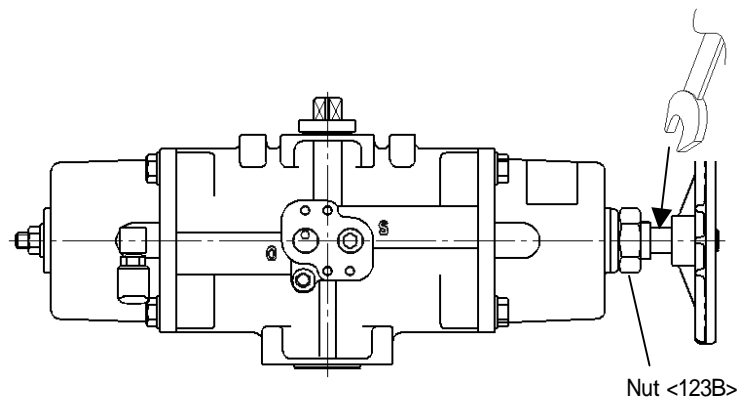


Fig.33

- (10) Supply the actual operation pressure to the housing through Port [O] and check external air leakage through a FSW unit (Fig.34).

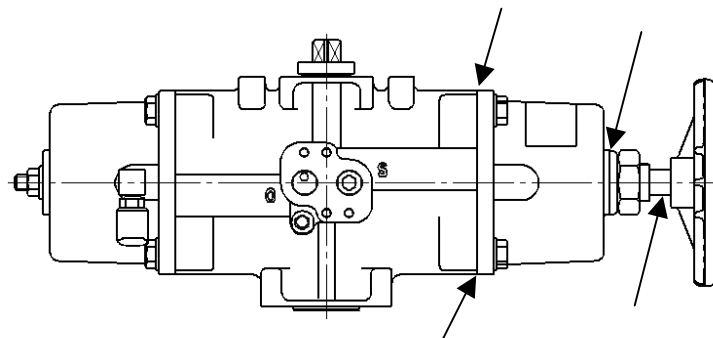


Fig.34