

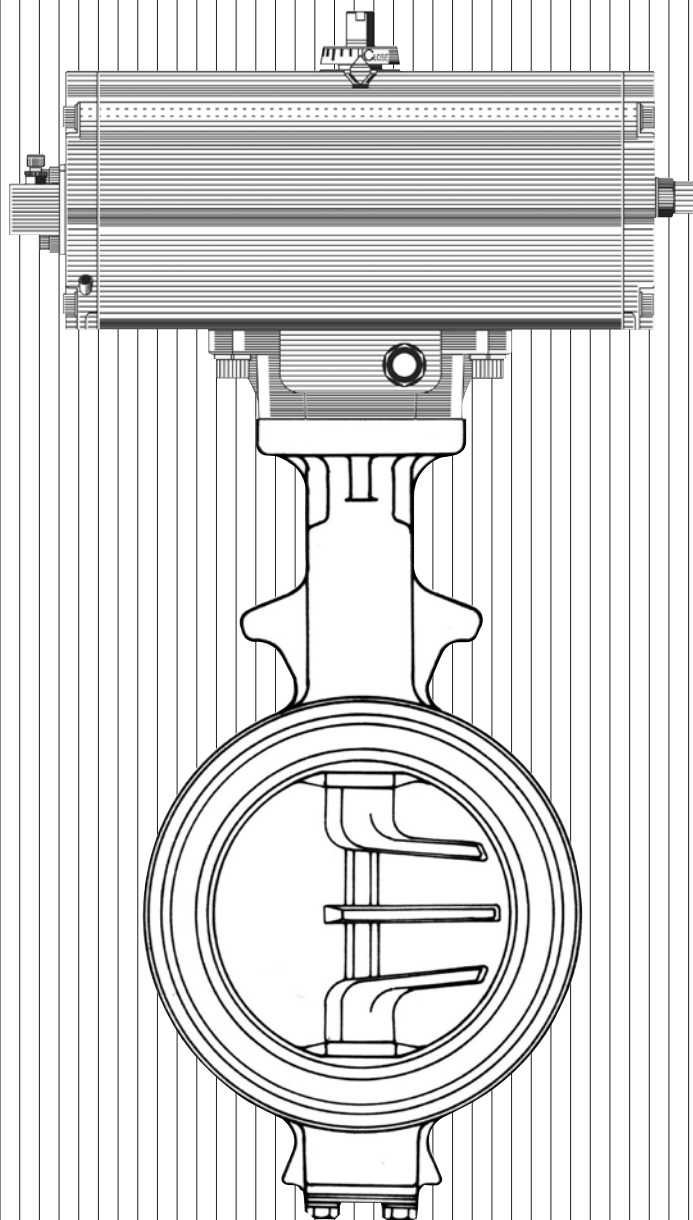
Compact, Lightweight, High-output Pneumatic Actuator

INSTRUCTION MANUAL

New

T-DYNAMO (7E/7F/7G)

Pneumatic Cylinder Series



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FOR YOUR SAFE USAGE

The following instructions should always be followed.

The instructions hereunder are for long-lasting service of T-DYNAMO (hereinafter "this product") without loss or hazard.

Please read this manual thoroughly before use in order to ensure correct use of the product. Separate information for the safety precautions for handling valves should also be observed.

- We will indicate level of danger or damage caused by neglecting these cautions as the following:



WARNING

This mark indicates "possibility of death or serious injury".



CAUTION

This mark indicates "possibility of injury to personnel or physical damage only".

- We will indicate the following marks for your attention. (The following are examples of marks.)



This mark indicates items that "you must not do".



This mark indicates items "you must do".

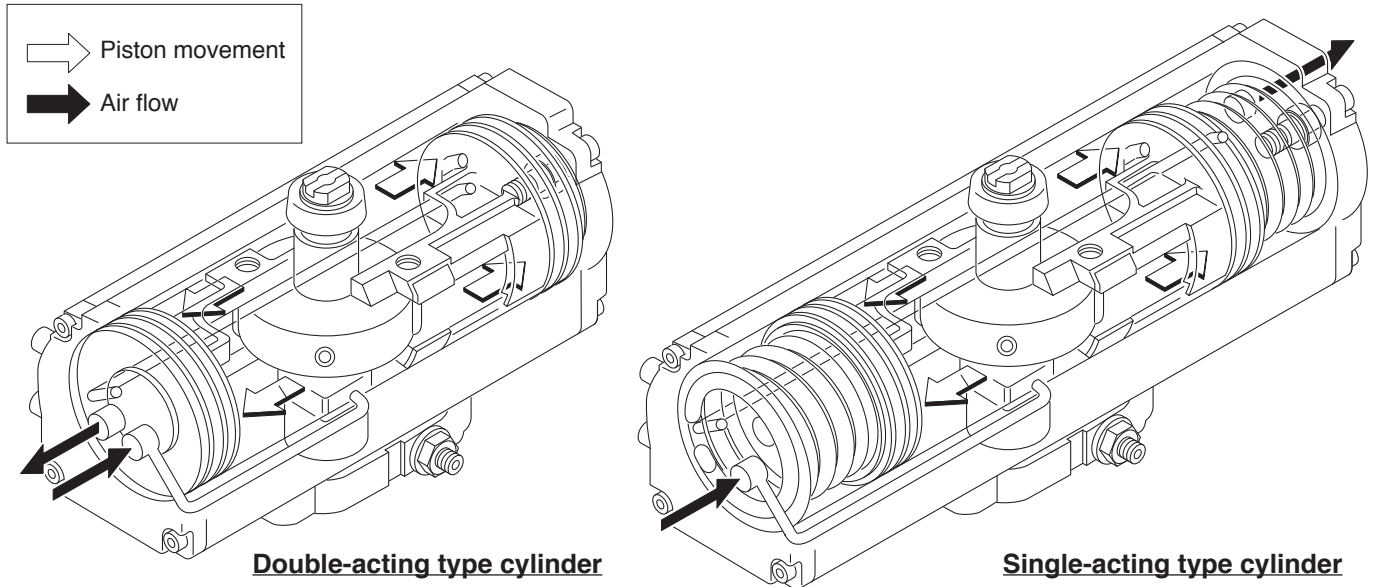
Introduction

- Be sure to read this instruction manual before transportation, storage, piping installation, operation, and maintenance and inspection.
- This instruction manual does not describe all the assumed conditions on transportation, storage, piping installation, operation, maintenance and inspection of this product. If there are any questions, please contact our sales department.
- Reference values and limit values for operation, maintenance, and inspection specified in this instruction manual have been determined in consideration of maintenance management of this product. This product should be used within the range of the reference values and the limit values.
- This product should be used by connecting only to a valve with an opening/closing angle of 90 degrees or less.
- Be sure to store this instruction manual in a readily accessible place for future reference after installation and operation start. If a staff in charge is changed, information on the storage place of the instruction manual and operation should be communicated to the next staff.
- If dents or scratches are made on impact, stop using the product for safety and replace the product.
 - * Details of this instruction manual are subject to change without notice.

1. PRODUCT FEATURES

1-1 Product features

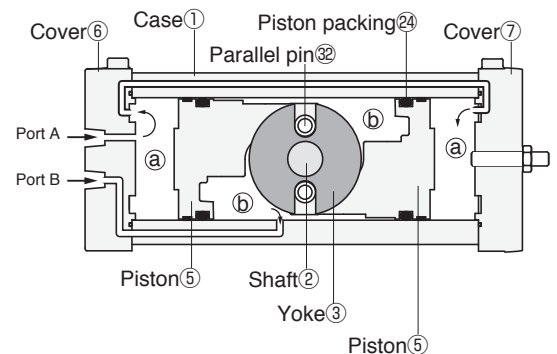
This product is a pneumatic rotary actuator driven by pneumatic pressure of 0.4 to 0.7 MPa for the purpose of actuating a 90° butterfly valve. The case is of aluminum alloy which is fabricated by means of extrusion. This manufacturing method enables the cylinder to be light weight, compact in design and highly accurate. The attachment installation member complies with the NAMUR standard. NAMUR standard attachment parts can be installed directly.



1-2 Operating principle

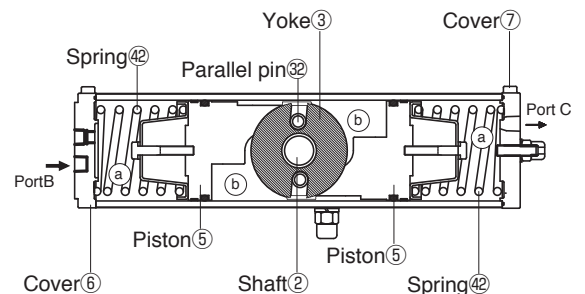
■ Double-acting type cylinder

- (1) The cylinder space which is enclosed by the case ① and the covers ⑥ and ⑦ is divided into airtight chambers (a) and (b) by the pistons ⑤ and the piston packing ⑳.
- (2) The shaft ② penetrates the chamber (b) of the case. The yoke ③ is fitted in the hole across the shaft in such a way that it allows it to slide in the hole. The top of the yoke is connected with the parallel pins ㉔ so it rotates in accordance with the movement of the pistons.
- (3) The compressed air enters chamber (a) through port A and pushes the pistons. The air in chamber (b) is exhausted through port B as the pistons move due to a pressure difference between the two chambers. Integrated with these pistons, the parallel pins ㉔ also move and torque in the shaft is generated.



■ Single-acting type cylinder

- (1) The cylinder space which is enclosed by the case ① and the covers ⑥ and ⑦ is divided into airtight chambers (a) and (b) by the pistons ⑤ and the piston packing ⑳.
- (2) The shaft ② penetrates the chamber (b) of the case. The yoke ③ is fitted in the hole across the shaft in such a way that it allows it to slide in the hole. The top of the yoke is connected with the parallel pins ㉔ so it rotates in accordance with the movement of the pistons.
- (3) The compressed air enters chamber (b) through port B and pushes the pistons. The air in chamber (a) is exhausted through port C as the pistons ⑤ move and the spring ④② is squeezed due to a pressure difference between the two chambers. Integrated with these pistons ⑤, the parallel pins ㉔ also move and torque in the shaft is generated.
- (4) When air supply to Port B is stopped, the pistons are pushed back due to the force of the spring ④② and torque in the shaft is generated.



1-3 Type description

Double-acting type cylinder (7E)	Single-acting type cylinder (7F/7G)
 T 85 ① ②	 T 85 S ① ② ③
① Identification of this product	① Identification of this product
② Output torque (*)	② Identification of type
	③ Operation type: Spring return

* The output torque of single-acting type differs from that of double-acting type. Please refer to **1-4 Standard specifications**.

1-4 Standard specifications

Type	Double-acting type cylinder (7E)					Single-acting type cylinder(7F/7G)			
	T35	T85	T200	T380	T750	T85S	T200S	T380S	T750S
Torque (N·m) (When supply pressure is 0.4MPa and rotation angle is 0°)	35	85	200	380	750	30	65	116	240
Supply air pressure condition/temperature	Dehumidified air / -10°C ~ +60°C								
Air supply pressure (MPa)	0.4 ~ 0.7MPa								
Body shell max (MPa)	1.05MPa								
Air connection (Rc)	Rc (PT)1/4								
Rotating angle	90°								
Ambient temperature	-10°C ~ +60°C								
Travel time (sec) With speed controller *	1~15	2~15	3~15	7~20	12~25	2~15	6~15	8~20	15~25

* The opening and closing times are the times in the case of a single unit of a cylinder with a standard speed controller (SP-K017-Z03-006) and a solenoid valve (PCS2408-NB-100MC) when the air supply pressure is 0.4 MPa.

The opening and closing times depend on pneumatic piping system, etc.

2. PRECAUTIONS FOR USE

2-1 Safety measures



2.1.1 Handling of this product

This product should be handled by knowledgeable and experienced technicians only.

Compressed air, etc. is hazardous if wrongly handled. Assembly, operation, maintenance of a machine or a unit utilizing compressed air should be handled by technicians who have read the instruction manual (hereinafter "this manual") thoroughly and understand the contents completely.



2.1.2 Safety check

Handling or dismantling of the machine or the unit must not be carried out until safety precautions are ensured.

The machine should only be dismantled after checking the following items to ensure safety.

- ① Safety precautions for this product, such as preventions against falling of parts, material or other accidental happenings, have been taken.
- ② The surface temperature of this product is a temperature where the surface can be touched.
- ③ Supply air, etc. that are power sources and compressed air in the air piping system have been removed.
- ④ No fluid flows in the pipelines.
- ⑤ The power of the system has been shut off.

Before restarting of the unit, check the following items.

- ① This product is fixed to a valve securely.
- ② There is no failure or damage on the appearance of this product, or loss of parts.
- ③ Tools have not been left on this product.
- ④ Nothing hinders operation of this product (operation of the cylinder, opening/closing of the valve).
- ⑤ There is no leakage of electrical and pneumatic signals.
- ⑥ There is no leakage of compressed air, etc.



2.1.3 Fail-safe design

When the unit is used for the point where fail-safe design is required, adopt a method where the system responds in a way that will cause no harm using a single-acting type cylinder (spring back cylinder), a lock-up valve, etc. in case of loss of all or a part of power that controls the machine.



2.1.4 Water hammer

Design should be performed in consideration of water hammer. Water hammer may occur even within the opening and closing times in the range of the product specifications, depending on the pipeline conditions or valve operating conditions.



2.2.1 Mass

Products with large mass (approx. 20 kg) should be transported using equipment or a machine, not by man power alone. See the catalog issued by our company, product drawings, etc. for the mass of this product. Qualified personnel should perform work with a forklift or a crane, or slinging work in accordance with laws and regulations, and safety provisions of business establishments.



2.2.2 Falling

When this product is unloaded or transversely held, it should be held appropriately to prevent it from falling and being damaged.



2.2.3 Dust-proofing, water-proofing

The plug (tentative seal plug) connected to the piping connection should not be removed until pneumatic piping work is performed. If dust-proofing and water-proofing measures are not taken, dirt, dust, rainwater, etc. will infiltrate this product, causing defective operation. If the plug is lost, take protective measures using a cover or protection tape instead. For single-acting type cylinders, orient the elbow of the exhaust port downwards to prevent infiltration of dirt, dust, rainwater, etc.



2.2.4 Storage

This product should be stored as follows to prevent contamination, discoloration, and material deterioration.

- ① This product should be stored in a place with no dust or water droplet while avoiding direct sunlight, high temperatures and humidity.
- ② This product should be stored in a packed state or with equivalent protective measures.
- ③ When this product which has been stored for more than 1 year is used, the operational status of the product should be checked. If any abnormal condition is found, overhaul, and replacement of deformed or degraded parts should be performed.

2-3 Installation and working environment



2.3.1 Obtaining space for installation location

For installation location, work space should be obtained around this product. If work space cannot be obtained, parts may not be removed at maintenance.

2.3.2 Installation location and working environment

In the following installation locations or working environments, special actions, such as compliance with laws and regulations, may be required in some cases as well as functional conformance to specifications. If there are any questions, please contact our sales department at planning stage.

- ① Special working environments which are not described in the specifications.
- ② In the case where substantial damage to human beings, assets, environments, etc. is predicted if the product fails.
e.g.: Facilities related to High Pressure Gas Safety Act, facilities related to Industrial Safety and Health Act, Nuclear power related facilities, vehicles, medical facilities, etc.



2.3.3 Atmosphere of installation location

The following measures should be taken depending on the atmosphere of the location where this product is installed.

- ① Locations which are exposed to gas containing salt, corrosive gas, chemical solution, organic solvent, steam, etc. should be avoided. For some kinds of atmosphere, anti-corrosive measures can be taken. Please consult with our sales department.
- ② If there is a possibility that this product is exposed to direct radiant heat or chemicals, the product and attachments should be protected with a cover, etc.
- ③ When a single-acting type cylinder is used outdoors or in a location where the unit is exposed to water, the elbow of the exhaust port should be oriented downwards to prevent infiltration of dirt, dust, rainwater, etc.
- ④ This product should not be submerged.



2.3.4 Temperature of installation location

The following measures should be taken depending on the temperature of the location where this product is installed.

Using the product out of the specified temperature range causes thermal degradation or hardening of O-rings, thermal expansion of parts, defective operation due to difference of thermal shrinkage, etc.

- ① The ambient temperature of the installation location should be based on the specifications.
- ② The supplied compressed air, etc. should be based on the specifications.
- ③ If the product is exposed to direct sunlight, the working temperatures of this product and attachments should not exceed the upper limit.
- ④ This product should be kept away from heat sources, and installed in a location where the temperature is within the specified temperature range. Particularly, ambient temperature may exceed the specified temperature range near a motor, an air compressor, etc.
- ⑤ The attachments should be used within the appropriate temperature range of the attachments.



2.3.5 Vibration and impact at installation location

The following measures should be taken if there is vibration or impact at the location where this product is installed.

- ① When this product is used with the following conditions, after checking vibration or impact conditions (particularly acceleration value, etc.), consult with our sales department.
 - 1) Location where excessive vibration or impact is exerted
 - 2) Location where vibration or impact is exerted continuously
- ② Installation sections and connecting sections, etc. of this product should be locked to fix and fasten securely. Particularly, when the product is used under highly frequent opening/closing conditions, fastening should be performed with a significant margin in consideration of fatigue resistance.
- ③ Vibration isolation measures should be taken to reduce vibration or impact on the machine. Pipelines should be fixed with supports, or vibration isolation material should be installed.
- ④ Joints should be checked periodically against looseness and deformation. In case of abnormal conditions, bolts should be retightened or parts should be replaced. Coming off of fastening bolts may cause falling off or rotation in an unexpected direction of this product.



2.3.6 Design of a connection part between a valve and this product

The following items should be checked when a connection part between a valve and this product is designed.

- ① Thrust load and lateral load should not be applied to the output shaft of this product.
- ② An independent retainer should be installed to the valve stem of the valve to prevent travel in the shaft direction. If the output shaft of this product is used as a retainer for the valve stem of the valve, the valve stem may protrude due to fluid pressure when this product is removed.
- ③ The dimension to fit the output shaft of this product and the valve stem of the valve should be secured sufficiently. Please refer to separate dimensional outline drawings for appropriate fit dimension. If the fit dimension is insufficient, strength at fitting section may become insufficient, resulting in damage.



2.3.7 Precautions at pneumatic piping

Pneumatic pipelines should be connected to this product while paying attention to the following items. If dents or scratches are made on impact, to ensure safety stop using the product and replace the product.

- ① This product, attachments, and pneumatic pipelines should be kept free from external force or shock. Rough handling may cause deformation of the output shaft, or air leakage due to damage of O-rings.
- ② Standing on this product should be avoided at connecting pipelines. This product should not be inserted by hitting the product.
- ③ Before connecting pipelines, pipeline members and fittings, particularly the air filter secondary-side should be thoroughly cleaned by air blowing (flushing) or other suitable cleaning method to remove cutting dust, oils and other debris.
- ④ When the pipelines and fittings are screwed into the unit, care must be taken to avoid infiltration of any cutting dust or sealant into this product.
- ⑤ When the fittings are screwed into the unit, excessive force may cause damage. After the joints are screwed in lightly, the joints should be retightened in a 1/4 turn as a guide. The reference value of the tightening torque is approx. 10 – 14 Nm.
- ⑥ In order to prevent infiltration of foreign substances into the piping air ports and vents, plugs (tentative seal plugs) have been installed before shipping. Remove all of them before using.



2.3.8 Precautions for attachments

The following items should be checked on the attachments of this product.

- ① The speed controller that is standard equipment of this product is fully opened when shipped. Before using, please turn it in the closing direction (clockwise) and adjust the opening and closing times. Please refer to **4-2 Speed controller** for operation procedure of the speed controller.
- ② The rotation speed should be adjusted with the speed controller. No speed adjustment should be attempted by means of a pressure reducing valve. High speed opening/closing may cause water hammer of the valve. Therefore, care should be taken in speed adjustment.
- ③ If the opening and closing times of this product influence system operation timing, leave a sufficient margin for the opening and closing times. The opening and closing times may change due to conditions, such as fluid pressure and temperature.
- ④ In order to prevent damage during transportation, parts, such as resin silencers, may be packed without being installed. Please install them before operation after completing valve installation.

2-4 Use and adjustment



2.4.1 Operating air

The following items should be checked on operating air of this product.

- 1) Use clean operating air to operate this product.
- 2) It should be checked that compressed air, etc. supplied to this product should be within the range between 0.4 MPa and 0.7 MPa.
- 3) Supplied air should be filtered with an air filter etc. to remove foreign substances. The filter should be of 40 µm or finer mesh.
- 4) Supplied air should be dehumidified with an air dryer, etc. (dew-point temperature at atmospheric barometric pressure is -15°C or lower) to remove moisture from the air.
- 5) Compressed air, etc. should be kept free from the following to prevent defective or abnormal operation of the unit.
 - Chemicals, synthetic oils with organic solvent base, corrosive gas, deteriorated compressor oil
- 6) Attachments (solenoid valve, regulator, filter, pneumatic line size, joint, etc.) should be selected with consideration of pressure loss so that the air pressure is within the range of the specified pressure at the air inlet port of this product. Otherwise the opening and closing times may slow down.
- 7) In case of lack of supply of compressed air, etc. to this product, intermittent operation of the pistons occur, or the valve is stuck. Care should be taken to avoid lack of air supply amount and air supply pressure. When the pneumatic pipeline is 5 m or more, take measures, such as use of a large-diameter pipeline, etc.
- 8) Cylinder capacity of a pneumatic actuator varies largely subject to type of actuator. Please select the suitable air compressor capacity. Please refer to **3-4 Air consumption**.



2.4.2 Supply pressure adjustment

Piping should be designed so that suitable compressed air amount and pressure are supplied to this product. Insufficient air supply amount or air supply pressure may affect opening/closing operation of the valve. In cases of pneumatic devices in which the pneumatic pipeline inlet of this product or the end of the plant pipeline is connected with a long pipeline, air supply amount and air supply pressure may be insufficient for this product due to loss at pipelines. An auxiliary air tank should be installed, etc. as needed.



2.4.3 Operation check

When this product is purchased separately, operation check should be performed with the following procedure.

- ① It should be checked that there is no flaw in the appearance, damage or loss of parts.
- ② This product should be checked separately for proper operation.
- ③ After connecting to the valve, adjust the valve opening. (Please refer to **4-3 Adjustment of valve position** for details.)
- ④ Valve opening/closing operation should be checked.

When this product integrated with a valve (hereinafter "finished product") is purchased, operation check should be performed with the following procedure.

- ① It should be checked that there is no flaw in the appearance, damage or loss of parts.
- ② It should be checked that pipelines for compressed air and electric signals are connected.
- ③ It should be checked that there is no air leakage from pipeline connecting sections and this product.
- ④ Valve opening/closing operation should be checked.



2.4.4 Valve opening adjustment

Valve opening should be adjusted while paying attention to the following points.

- ① When finished products are purchased, the stopper bolts at the closing side should not be loosened. If the stopper bolts at the closing side are loosened, the valve full closing position changes, and valve seat leakage may occur.
- ② Before adjustment, compressed air, etc. should be discharged from this product. If there is any residual pressure due to compressed air, the stopper bolts may fall out.
- ③ After adjustment, it should be checked that there is no air leakage from the stopper bolts.



2.4.5 Opening and closing time

If the opening and closing time is shorter than the minimum time of the product specifications, durability of this product may be deteriorated.



2.4.6 Modification

This product should not be modified. Deterioration of durability or breakage of this product may pose a danger to the environment.



CAUTION

2.4.7 External manual operation

Care must be taken for the following items at external manual operation.

- ① For only double-acting type cylinders, a valve can be opened or closed manually by turning the output shaft of the actuator with a spanner after the supply and exhaust pressures become the same with the bypass valve (except Type T750).
Please note that, when the bypass valve is opened, the valve opening changes due to fluid pressure. (Please refer to **4-4 Manual operation procedure** for how to use the bypass valve.)
- ② The manual operation torque may change abruptly depending on the valve opening, and you may lose balance, resulting in falling. Manual operation should be performed while securing safety with scaffolding, space, etc.
- ③ In the case of Type T750, large operating force is required and operation with small tools is dangerous. Thus external manual operation should not be performed with a spanner or a monkey wrench. Please use a manual gear for the operation.
- ④ For single-acting type cylinders, manual opening/closing operation should not be performed with a spanner, a monkey wrench, or a manual lever for double-acting type cylinders (hereinafter "dedicated lever"). If the output shaft is turned with a spanner, a monkey wrench, or the dedicated lever, the shaft is rotated backwards by the spring force, which is dangerous. Please use the manual screw handle.
- ⑤ The spanner, monkey wrench, or special lever used at manual operation must be removed at completion of the operation. In case of automatic operation with them mounted, the spanner, monkey wrench, or special lever may come off and fall out, which may cause personal injuries or machine damage.
- ⑥ In the case of a unit with a manual gear, before switching operation to automatic operation after manual operation, check that the manual gear is at the position of automatic operation and the bypass valve is closed. (They are not returned automatically.)

2.4.8 Others

- ① If air supply is stopped for a long period of time after compressed air, etc. is supplied to this product, the valve opening position may not be kept.
- ② When operation is restarted after a long downtime (5 days or more), operation time may be longer than usual due to increase in grease viscosity or valve resistance, etc.

2-5 Maintenance



WARNING

2.5.1 Residual pressure

Even after supply of compressed air, etc. to this product is stopped, compressed air may gush out or unexpected operation may occur due to residual pressure in the cylinder. Installation work and maintenance should be performed after removing residual pressure from the cylinder.



CAUTION

2.5.2 Maintenance and inspection of this product

Maintenance and inspection should be performed according to **5-1 Disassembly procedure** in this manual. At maintenance and inspection of this product, inspection should be made while paying attention to the following items.

- ① For single-acting type cylinders, the cover may fall out due to the force of the internal spring even if compressed air, etc. is not supplied, which may cause injury or damage.
- ② Bolts should not be loosened, while compressed air, etc. are supplied, or this product or the valve can be operated. Compressed air may gush out or unexpected operation may occur.



2.5.3 Daily check

Daily check including the following items on this product should be performed.

- ① Water accumulated in the filter regulator etc. should be drained from the drain exhaust port.
- ② During operation of this product, visual check and noise check should be performed from a safe location. Inspection should be made on defective appearance, such as looseness of the bolts, abnormal noise during operation, rattling, air leakage to the outside, air leakage from exhaust vents and piping joints, etc.
- ③ If compressed air, etc. is supplied even if operation of this product is stopped, inspection should be made on looseness of the bolts, air leakage to the outside, and air leakage from exhaust vents and piping joints.



2.5.4 Periodical inspection

Periodical inspection including the following items on this product should be performed.

- ① After opening and closing 50,000 times or 1 year of use, whichever one is earlier, inspection should be made on looseness of each bolt and air leakage. The bolts should be retightened and consumables should be replaced as needed.
- ② From the second year, the above-mentioned inspection should be made every year.



2.5.5 Removal and installation

- ① Before this product is removed from the valve power and compressed air, etc. must be shut off and residual pressure must be removed from the machine and pipelines completely. Otherwise compressed air may gush out or unexpected operation may occur.
- ② When two or more valves and the products are removed, numbers or symbols shall be put on the valves and the products to identify the corresponding valve and product. Mistaken installation may cause failure or defective operation of the unit.
- ③ Match marks should be made on the top plates of this product and the valve to indicate the installation orientation of this product. Mistaken installation orientation may cause defective operation.
- ④ Loosen the hexagon bolts which fix this product on the valve to remove this product. If joints are included in the valve, please be careful not to lose them. Loss of joints may cause defective operation.
- ⑤ When this product is removed, the valve full closing position may be changed. Valve seat leakage should be checked. In case of leakage, the full closing position should be adjusted. Please refer to **4-3 Adjustment of valve position** for adjustment of the full closing position.
- ⑥ At installation, it should be checked that opening of the valve and the opening of this product are the same. If the openings are not the same, opening and closing operation is performed in the reverse way.



2.5.6 Replacement of consumable parts

The product should be disassembled and assembled in a clean location which is free from dust and dirt. Please refer to **5-1 Disassembly procedure** for replacement procedure of consumables. Consumable parts of single-acting type cylinders should be replaced according to **5-2 Single-acting type cylinder side cover disassembly procedure**.

2.5.7 Lubricant

Grease has been applied to the sliding elements of this product. Lubrication by supply air is not required. However, it is recommended to apply grease after opening and closing 50,000 times or 1 year of use, whichever one is earlier.

2.5.8 Safety check

During maintenance and inspection, all workers should be informed of the following conditions: power and compressed air, etc. are shut off, residual pressure is discharged completely, or power and compressed air, etc. are supplied again.

2.5.9 Disposal

This product should be disposed while paying attention to the following items.

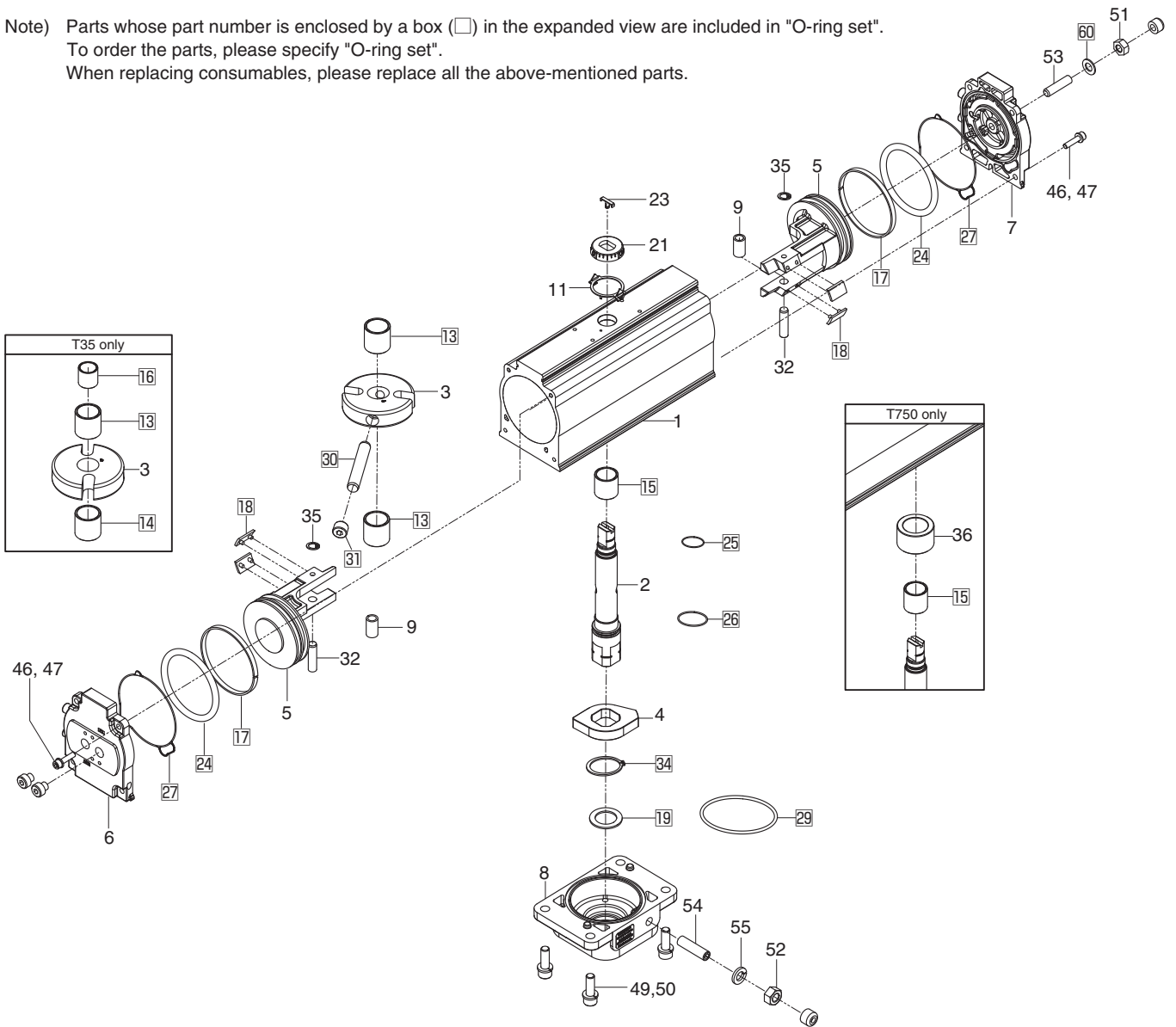
- ① This product should not be disposed of by incineration. There is a risk of toxic gas generation and bursting. Therefore please dispose of it as general industrial waste. The product does not contain materials which cannot be disposed of as general industrial waste.
- ② When this product is disposed after sorting, materials should be classified according to the materials specified on drawings.
- ③ When a single-acting type cylinder is disassembled and disposed of, care should be taken to springs flying out.
At disassembly of the single-acting type cylinder, please refer to **5-2 Single-acting type cylinder side cover disassembly procedure**.
- ④ This product should be disposed in accordance with laws and regulations.



3. STRUCTURE

3-1 Expanded view (Double-acting type)

Note) Parts whose part number is enclosed by a box (□) in the expanded view are included in "O-ring set".
 To order the parts, please specify "O-ring set".
 When replacing consumables, please replace all the above-mentioned parts.



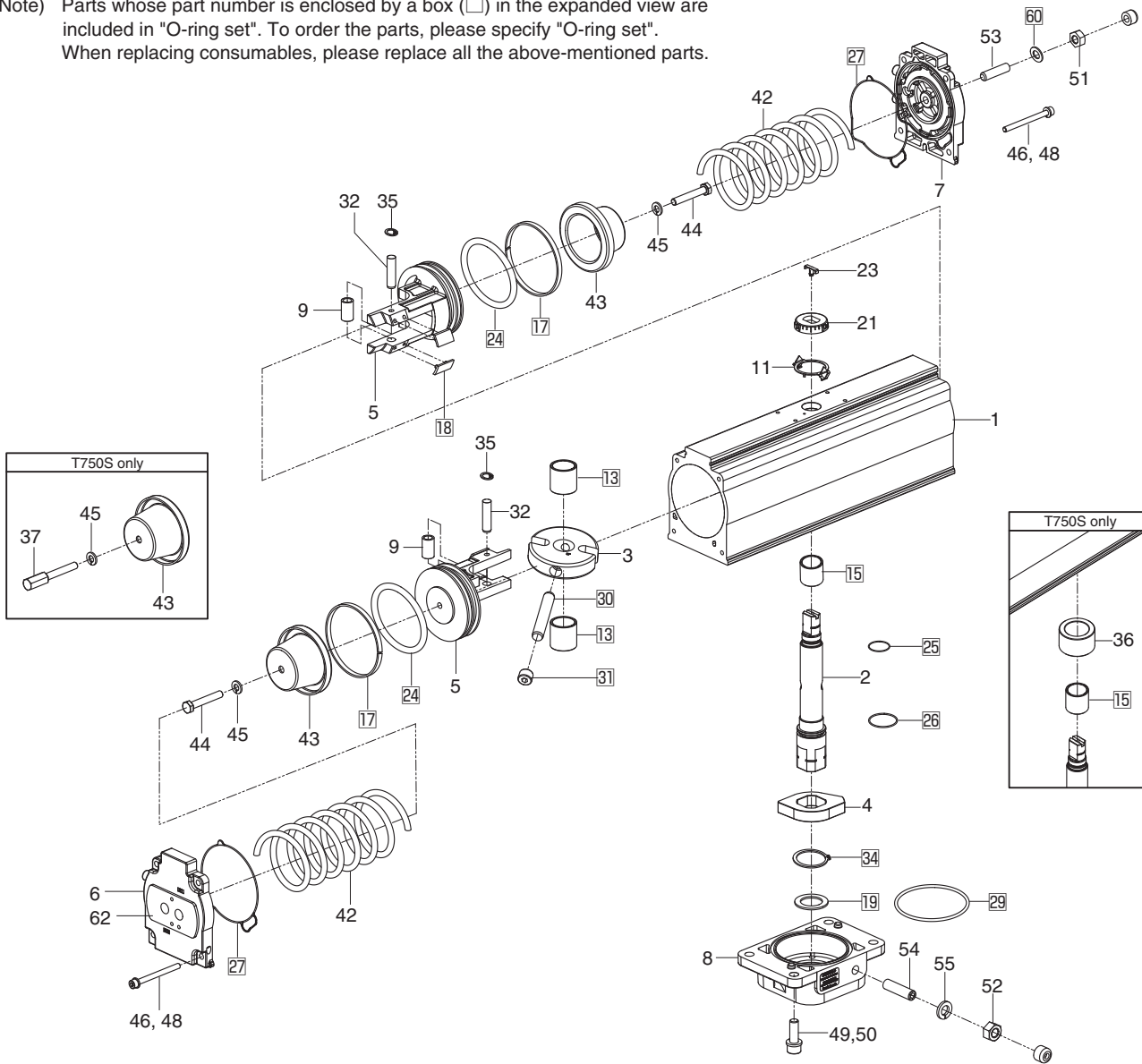
Note) Parts indicated by "★" in Remarks are included in "O-ring set". To order the parts, please specify "O-ring set". When replacing consumables, please replace all the parts indicated by "★".

No.	Description	Q'ty	Remarks
1	Case	1	
2	Shaft	1	
3	Yoke	1	
4	Stopper	1	
5	Piston	2	
6	Cover 1	1	
7	Cover 2	1	
8	Base plate	1	
9	Bearing	2	
11	Indicator plate	1	
13	Bearing 1 (shaft-piston)	2	★ T35: 1 pc
14	Bearing 2	1	★ T35 only
15	Bearing 3 (lower shaft)	1	★
16	Bearing 4 (upper shaft)	1	★ T35 only
17	Wear ring	2	★
18	Piston support	4	★
19	Thrust plate	1	★
21	Position indicator	1	
23	Slit cover	1	
24	Piston packing	2	★

No.	Description	Q'ty	Remarks
25	O-ring for rotating shaft (top)	1	★
26	O-ring for rotating shaft (bottom)	1	★
27	Cover packing	2	★
29	O-ring (base plate)	1	★
30	Connecting pin (shaft-yoke)	1	★
31	Sunk plug (shaft-yoke)	1	★
32	Parallel pin (piston)	2	
34	C-retainer (lower shaft)	1	★T85~T750
35	C-retainer (piston)	2	T85~T750
36	Bearing housing	1	T750 only
46	Spring washer (cover 1, 2)	8	
47	Hexagon socket head cap screw (cover 1, 2)	8	
49	Hexagon socket head cap screw (base plate)	4	T35: 2pcs
50	Spring washer (base plate)	4	T35: 2pcs
51	Hexagon nut (opening side stopper)	1	
52	Hexagon nut (closing side stopper)	1	
53	Hexagon stop screw (opening side)	1	
54	Hexagon stop screw (closing side)	1	
55	Spring washer (closing side stopper)	1	
60	Seal washer	1	★

3-2 Expanded view (Single-acting type)

Note) Parts whose part number is enclosed by a box (□) in the expanded view are included in "O-ring set". To order the parts, please specify "O-ring set".
When replacing consumables, please replace all the above-mentioned parts.

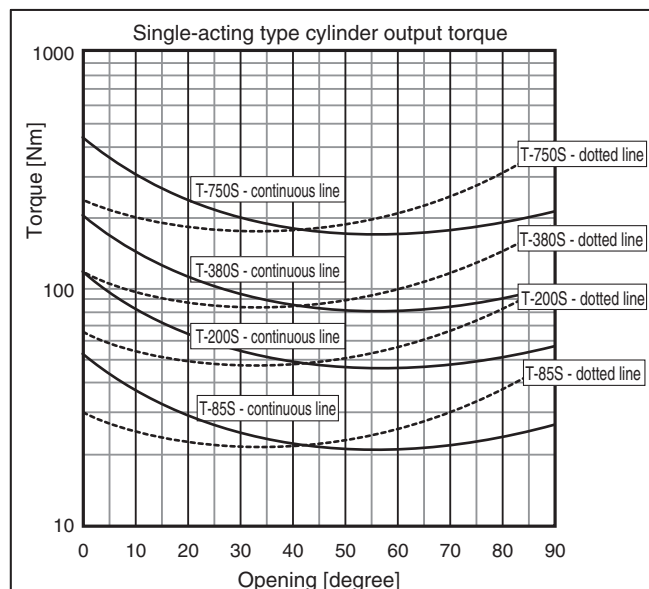
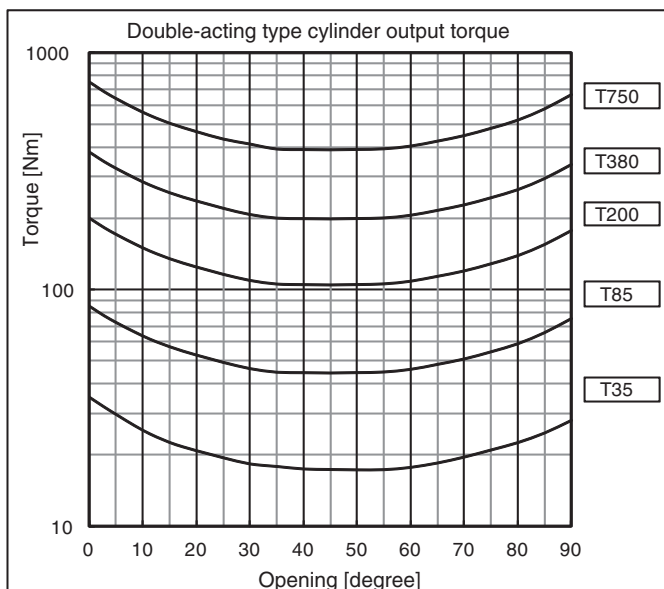


Note) Parts indicated by "★" in Remarks are included in "O-ring set". To order the parts, please specify "O-ring set". When replacing consumables, please replace all the parts indicated by "★".

No.	Description	Q'ty	Remarks
1	Case	1	
2	Shaft	1	
3	Yoke	1	
4	Stopper	1	
5	Piston	2	
6	Cover 1	1	
7	Cover 2	1	
8	Base plate	1	
9	Bearing	2	
11	Indicator plate	1	
13	Bearing 1 (shaft-piston)	2	★
15	Bearing 3 (lower shaft)	1	★
17	Wear ring	2	★
18	Piston support	4	★
19	Thrust plate	1	★
21	Position indicator	1	
23	Slit cover	1	
24	Piston packing	2	★
25	O-ring for rotating shaft (top)	1	★
26	O-ring for rotating shaft (bottom)	1	★
27	Cover packing	2	★
29	O-ring (base plate)	1	★

No.	Description	Q'ty	Remarks
30	Connecting pin (shaft-yoke)	1	★
31	Sunk plug (shaft-yoke)	1	★
32	Parallel pin (piston)	2	
34	C-retainer (lower shaft)	1	★
35	C-retainer (piston)	2	
36	Bearing housing	1	T750S only
37	Stopper bolt	1	T750S only
42	Spring	2	
43	Spring guide	2	
44	Hexagon bolt (spring guide)	2	
45	Spring washer (spring guide)	2	
46	Spring washer (cover 1, 2)	8	
48	Hexagon socket head cap screw (cover 1, 2)	8	
49	Hexagon socket head cap screw (base plate)	4	
50	Spring washer (base plate)	4	
51	Hexagon nut (cover 2)	1	
52	Hexagon nut (base plate)	1	
53	Hexagon stop screw (cover 2)	1	
54	Hexagon stop screw (base plate)	1	
55	Spring washer (base plate)	1	
60	Seal washer (cover 2)	1	★
62	Hexagon socket head taper plug (cover 1)	1	

3-3 Output torque curves

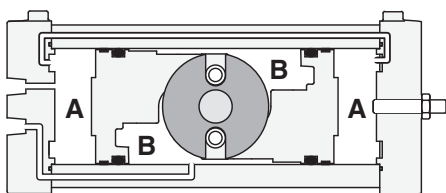


- ① The table shows the torque at an operating air pressure of 0.4 MPa.
- ② Output torque for an operating air pressure of P MPa is given by : = P x (torque value obtained from the table)/0.4. (Only double-acting type cylinder)
- ③ In the case of single-acting type cylinders, the spring force does not change even if the operating air pressure is changed. Thus the torque indicated by the dotted lines is constant regardless of the operating air pressure.
- ④ In the case of single-acting type cylinders, the output torque value at open→close is different from that at close→open. The continuous lines and dotted lines indicate the torques respectively.

	7G (Open with pressure)	7F (Close with pressure)
Continuous line	Torque at close→open with air pressure	Torque at close→open with spring
Dotted line	Torque at open→close with spring	Torque at open→close with air pressure

- ⑤ A valve for the single-acting type cylinder should be selected referring to the torque indicated with a dotted line.

3-4 Air consumption



(1) Required air consumption

Double-acting type

$$VD=(A+B) \left(\frac{P+0.1013}{0.1013} \right) N$$

Single-acting type

$$VS=(B) \left(\frac{P+0.1013}{0.1013} \right) N$$

VD: Double-acting type cylinder air consumption (Nl)
 VS: Single-acting type cylinder air consumption (Nl)
 A,B: Cylinder capacity (l)
 P: Operating pressure (MPa)
 N: Operating frequencies in a given time (1 round trip = 1)

(2) Air consumption within a unit time

Double-acting type $CD= \frac{VD}{t}$

Single-acting type $CS= \frac{VS}{t}$

CD: Double-acting type cylinder air consumption (Nl/sec)
 CS: Single-acting type cylinder air consumption (Nl/sec)
 t: Unit time (sec)

(Note) The compressor should have a larger capacity than air consumption calculated in above (1) and (2).

■Double-acting type(7E)

Cylinder Type	Cylinder capacity(l)	
	A	B
T35	0.2	0.2
T85	0.4	0.5
T200	0.8	1.1
T380	1.8	2.1
T750	3.2	4.6

■Single-acting type(7F/7G)

Cylinder Type	Cylinder capacity(l)
---	---
T85S	0.5
T200S	1.1
T380S	2.1
T750S	4.6

4. CYLINDER SYSTEM CONFIGURATION

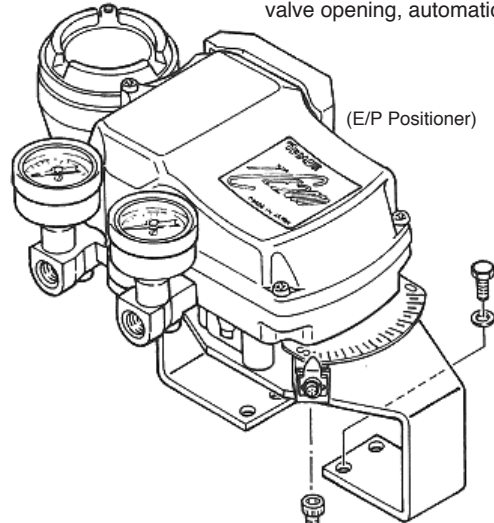
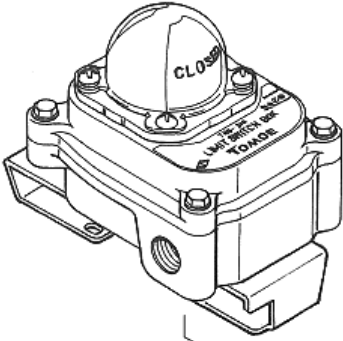
4-1 System configuration

Positioner unit (E/P Positioner and P/P Positioner)

This unit features a function that allows total control of the valve opening, automatically and remotely.

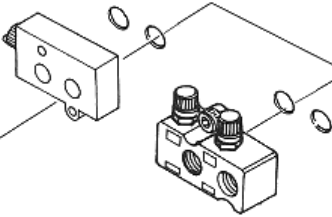
Limit switch box

This switch box is for remotely displaying the open/close status of the valve.



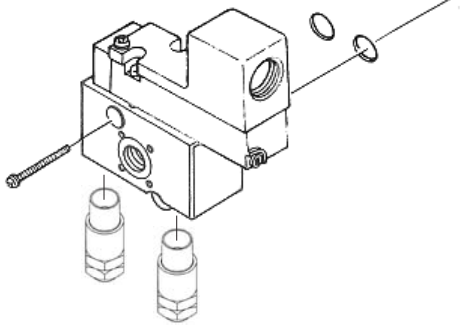
Bypass valve

For manual operation, open the bypass valve and equalize the pressure in the left and right cylinder chambers.



Speed controller (standard)

This unit can adjust the opening and closing speed of the valve.

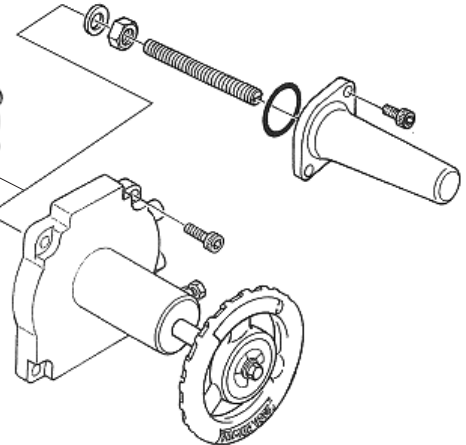


Stroke adjuster

This adjuster enables the free setting of the valve position.

The opening can be set to 90 degrees or less by turning the adjusting screw clockwise.

(When the manual screw handle is not installed in double-acting type cylinder and in pressure-opening single acting type cylinder)



Manual screw handle

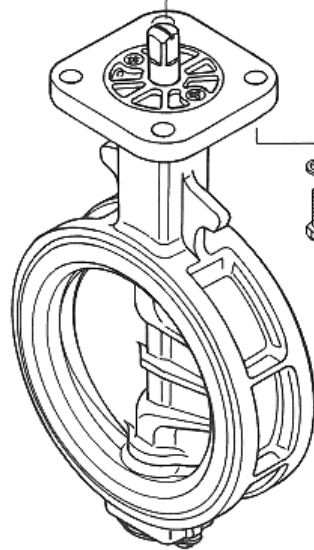
This unit works to allow manual operation for single-acting type cylinders.

(Change of cylinder components is required.)

Pilot type 5-port 2-position non-explosion-proof solenoid valve unit (Single solenoid)

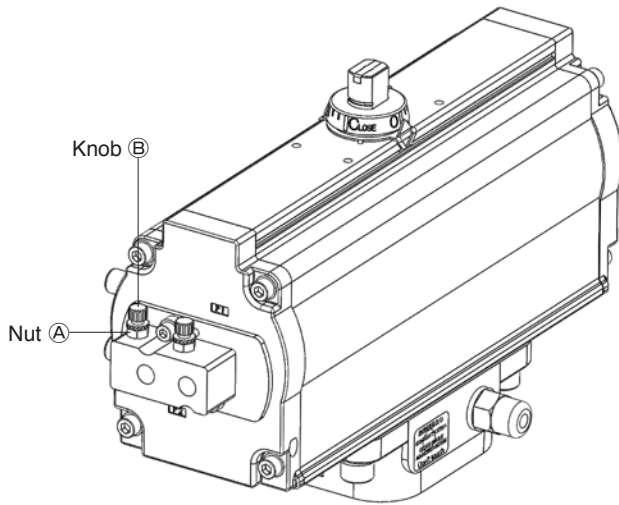
This unit opens and closes the valve following a remote electrical signal that switches the airflow.

(When a solenoid valve is included, the configuration of the speed controller may be changed.)



[Fig. 1]

4-2 Speed controller



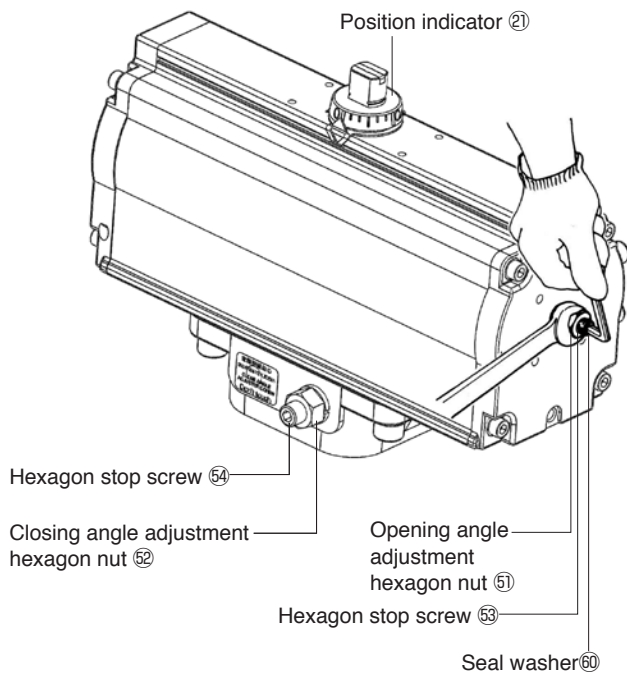
[Fig. 2]

How to handle speed controller

The speed controller is fully open when shipped. Please adjust the speed before using it.

- (1) For an adjustment of the actual speed of this product, release the nut **A** and turn the knob **B**. Turn it clockwise to reduce the speed. Be careful, as excessive turning will stop operation of this product.
For double-acting type cylinders, adjust the opening speed with the right knob and adjust the closing speed with the left knob.
For single-acting type cylinders, only the speed when operating air is discharged can be adjusted. Adjust the speed only with the right knob. For pressure-opening (7G), the closing speed can be adjusted. For pressure-closing (7F), the opening speed can be adjusted.
- (2) After adjustment of the speed, fix the knob **B** and tighten the nut **A**.

4-3 Adjustment of valve position



[Fig. 3]

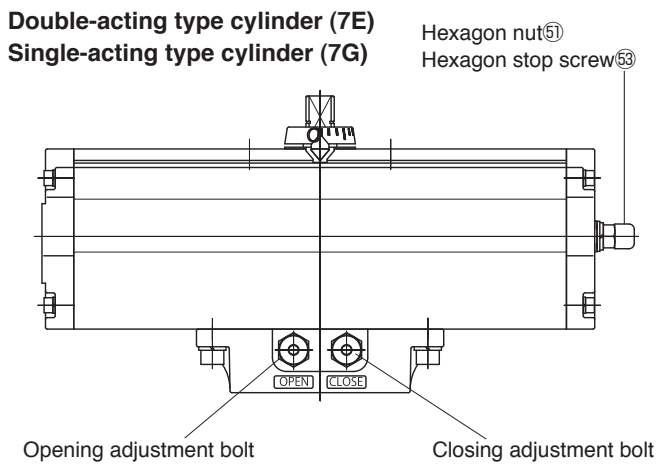
<Full-close position adjustment procedure (Full-close side adjustment)>

- (1) Set position to open on this product. Check that the position indicator ⑳ indicates O (Open).
- (2) Remove the air pipelines and set inside pressure to atmosphere.
- (3) Release the hexagon nut ㉙.
- (4) Use a hexagonal wrench to rotate the hexagon stop screw ㉜ to the required angle. The hexagon stop screw ㉜ is rotated clockwise, and the valve full-close position becomes shallow. Please refer to [Table 1] for rotation angles.



CAUTION

For pressure-closing single-acting type cylinders (7F), the opening adjustment position is different from this figure. Perform the full opening side adjustment by adjusting the bolt at the [OPEN] side of the base plate. The tightening torque should be the torque of "Closing side stopper bolt" in [Table 2] for both the open and close sides. Do not release the hexagon nut ㉙ and the hexagon stop screw ㉜ to prevent danger. [Fig. 4]



Single-acting type cylinder (7F)

[Fig. 4]

<Full-open position adjustment procedure (Full-open side adjustment)>

- (1) Set position to close on this product. Check that the position indicator ② indicates Close.
- (2) Remove the air pipelines and set inside pressure of the product to atmosphere.
- (3) Release the hexagon nut ⑤¹. [Fig. 3]
- (4) In case of deformation or breakage of the seal washer ⑥⁰, replace it with a new seal washer. Otherwise, air leakage may occur.
- (5) Use a hexagonal wrench to rotate the hexagon stop screw ⑤³ to the required angle. The hexagon stop screw ⑤³ is rotated clockwise, and the valve full-open position becomes shallow. Please refer to [Table 1] for rotation angles.

<How to restore after adjustment>

- (1) Hold the hexagon stop screw ⑤³ or ⑤⁴ in position with a hexagonal wrench, and tighten the hexagon nut ⑤¹ or ⑤² with a spanner. Please refer to [Table 2] for the tightening torque.
- (2) Apply air pressure to the cylinder and check that the rotation angle of the output shaft is obtained, and there is no air leakage.
- (3) If readjustment is required, repeat the above procedure from (1).

Note) Full-close/full-open position is adjusted when shipped.

Table 1 Shaft rotation angle given by one turn of the stopper bolt (degrees)

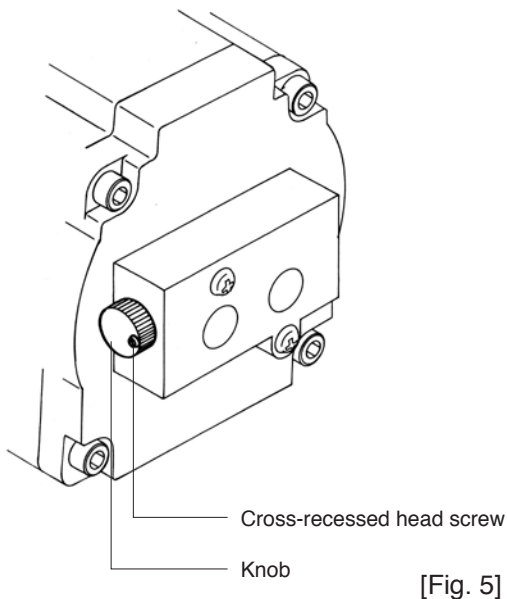
	Type Model no.	Type				
		T35	T85	T200	T380	T750
Close side	7E · 7G · 7F	2	1.3	1	0.9	0.6
	7E · 7G	2.6	1.9	1.7	1.6	1.5
Open side	7F	2	1.3	1	0.9	0.6

Table 2 Stopper bolt tightening torque

Type	Open-side stopper bolt		Close-side stopper bolt	
	Bolt	Torque	Bolt	Torque
T35	M8	20 Nm	M8	20 Nm
T85 · T85S	M8	20 Nm	M10	35 Nm
T200 · T200S	M10	35 Nm	M12	53 Nm
T380 · T380S	M12	38 Nm	M16	115 Nm
T750 · T750S	M16	115 Nm	M20	200 Nm

4-4 Manual operation procedure

Automatic operation (Bypass valve closed)



[Fig. 5]

When setting the position to open or close on this product manually, follow the procedures below.

(1) Preparation before manual operation

When the bypass valve (option) is not installed

- ① Remove the solenoid valve or the air pipeline of this product and equalize the air pressure in both the left and right cylinder chambers for the piston.

When the bypass valve (option) is installed

- ① Loosen the cross-recessed head screw on the bypass valve. [Fig. 5]
- ② Pull out the knob fully. [Fig. 6]
- ③ Once the knob is pulled out fully, the bypass valve will open and the pressure in both the left and right cylinder chambers for the piston will equalize.

(2) Manual operation procedure

When the manual gear and the manual screw handle are not installed

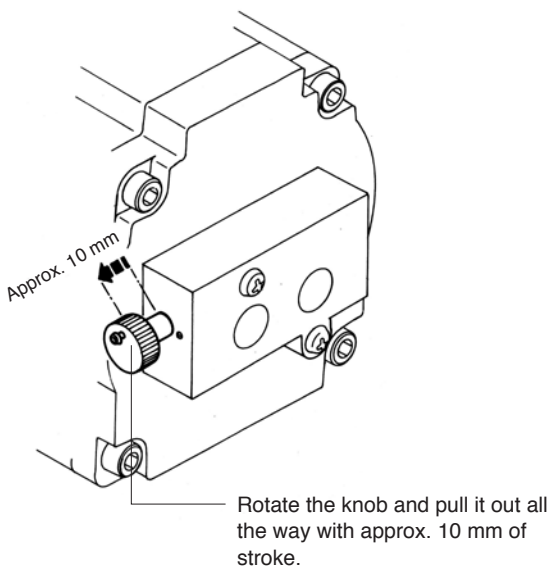


CAUTION

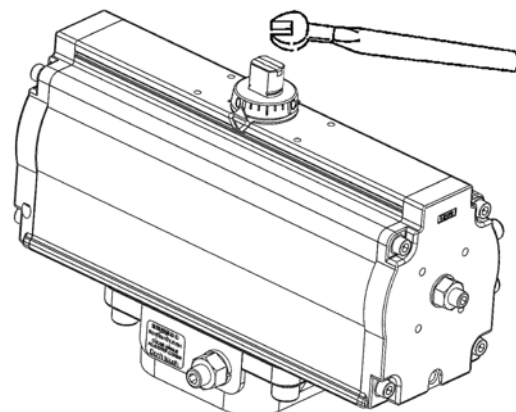
- Do not use a spanner, a monkey wrench, or the special lever in the following cases as it could result in a dangerous situation.
 - (1) For single-acting type cylinders, do not set the position to open or close manually using a spanner, a monkey wrench, or the special lever. Otherwise, the spanner, the monkey wrench, or the special lever is pushed back by the spring force, which may cause injury. Use a manual screw handle.
 - (2) For T750, since the operating force is large and therefore dangerous, do not perform external manual operation using a spanner or a monkey wrench. Use a manual gear.
- Depending on the type of accessories, the special lever may not be usable.

- ① As the center axis of this product is width across flat, use a spanner, a monkey wrench, or the special lever to set the position to open or close on this product.

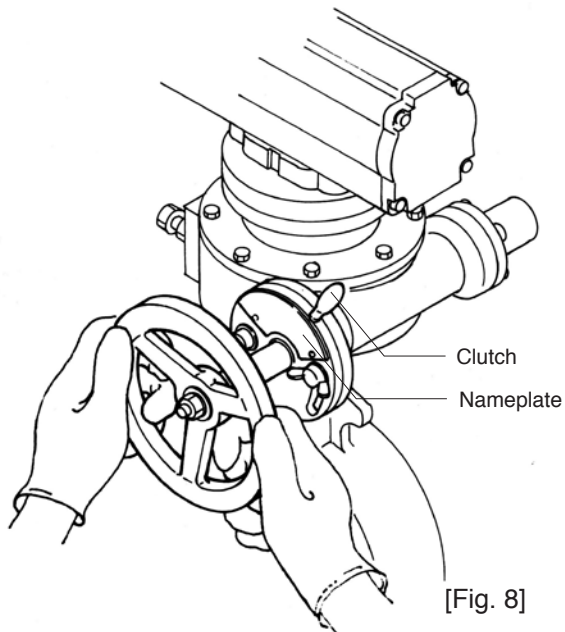
Manual operation (Bypass valve open)



[Fig. 6]



[Fig. 7]



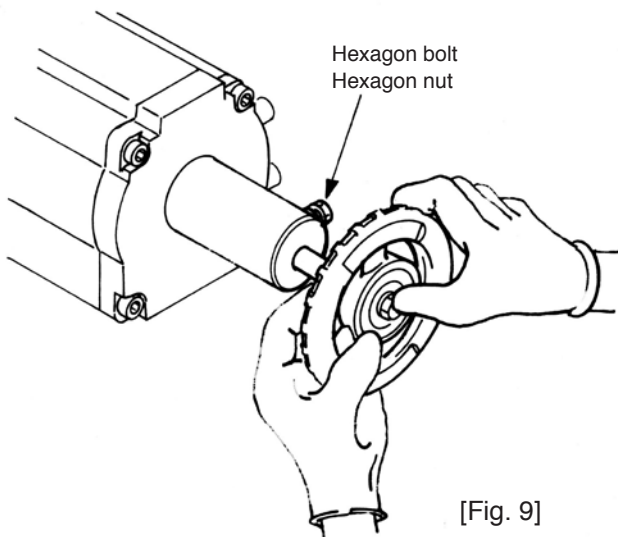
[Fig. 8]

When the manual gear (option of double-acting type cylinder) is installed

- ① Operate the clutch in accordance with the instructions on the nameplate on the gear, and turn the handwheel to open and close the valve. [Fig. 8]
- ② After operation, always return the clutch to the automatic position setting.

When the manual screw handle (option of single-acting type cylinder) is installed

- ① Loosen the hexagon nut and the hexagon bolt located at the base of the handle shaft. [Fig. 9]
- ② Turn the handwheel in accordance with the direction indicated on the nameplate located in the middle of the manual screw handle to open and close the valve. [Fig. 9]



[Fig. 9]

(3) Recovery after completion of manual operation

When the bypass valve is installed

- ① Push in the knob all the way, and tighten the cross-recessed head screw to lock the knob.
- ② Reconnect the solenoid valve or the air pipeline.

When the manual gear and the manual screw handle are not installed

- ① Remove spanner, monkey wrench, or special lever.
- ② Reconnect the solenoid valve or the air pipeline.

When the manual gear (option of double-acting type cylinder) is installed

- ① After operation, always return the clutch to the automatic position setting.
- ② Reconnect the solenoid valve or the air pipeline.

When the manual screw handle (option of single-acting type cylinder) is installed

- ① After manual operation, always turn the handwheel all the way in the reverse direction of manual operation until the handle shaft is at its shortest possible position. [Fig. 9]
- ② After returning the handle shaft to its shortest possible position, tighten the hexagon nut and the hexagon bolt to fix the handwheel.
- ③ Reconnect the solenoid valve or the air pipeline.

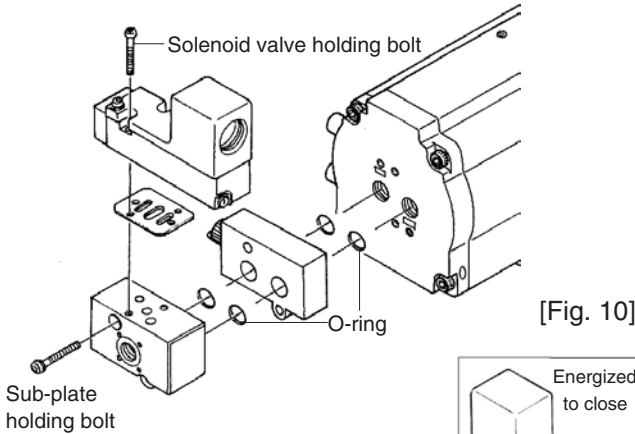
4-5 Solenoid valve

Solenoid valve unit (non explosion-proof type)

PCS2406-K090-Z03-132-**

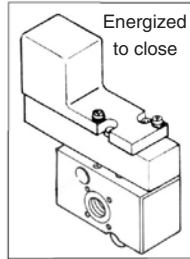
PCD2406-K090-Z04-120-**

(The figure shows mounting orientation for "Energized to open").



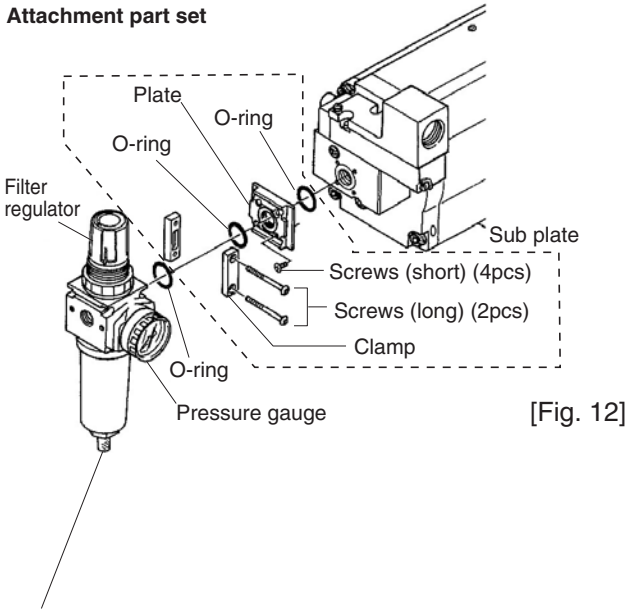
[Fig. 10]

For pressure-closing single-acting type cylinders (7F), "Energized to open" is replaced with "Energized to close" in the figure.



[Fig. 11]

Attachment part set



[Fig. 12]

Drain exhaust port
Make sure to put the filter regulator drain exhaust port downwards.

The unit is operated by an electric signal from a remote place in order to open or close an air supply valve.

Standard specifications

Table 3 Solenoid valve (non explosion-proof type) standard specifications

Port size	Rc1/4
Operating pressure range	0.4~0.7MPa
Ambient temperature	-5~50°C
Rated voltage	AC100/110V, AC200/220V, DC24V
Frequency	50/60 Hz
Allowable voltage fluctuation	AC: -10~10%, DC:-15~10%
Wiring method	G1/2 Conduit terminal

Double solenoid type and explosion-proof solenoid type are also available.

Installation procedure

- (1) Install the sub plate onto this product using the sub-plate holding bolts and the two tapped holes for solenoid valve installation located on the front surface of this product. [Fig. 10]
- (2) The solenoid valve installation orientation depends on whether the valve is opened or closed when energized. To reverse the orientation, remove the solenoid valve holding bolts, reverse the solenoid valve orientation, and re-install the unit [Fig. 11].

Filter regulator (direct installation)

Filter regulator (FR) can be directly fitted to the non explosion-proof type solenoid valve unit.

FR is used to remove oil, moisture, and dust from operating air (air filter) in order to protect pneumatic equipment (solenoid valve, cylinder etc.), and to keep appropriate constant operation pressure (regulator).

Standard specifications

Table 4 Filter regulator standard specifications

Type	P31EA22MMBNNP
Port size	Rc1/4
Operating pressure range	0.4~0.7MPa
Ambient temperature	Max 50°C

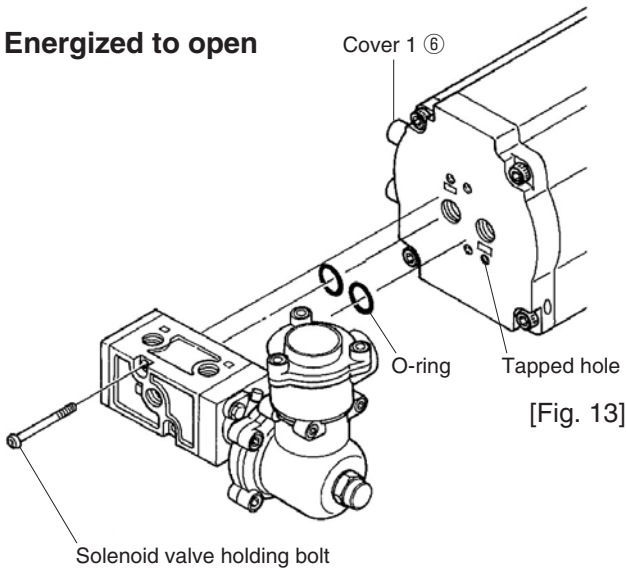
Installation procedure

- (1) Fasten the attachment part set (plate) to the sub plate with screws (short).
- (2) Sandwich the attachment part (plate) and the filter regulator with the attachment part (clamp).
- (3) Fasten the attachment part (clamp) with screws (long). [Fig. 12]

Solenoid valve (explosion-proof type)

Manufactured by KANEKO SANGYO
MK15G-8-✱-DMI
MK15DG-8-✱-DM

Energized to open

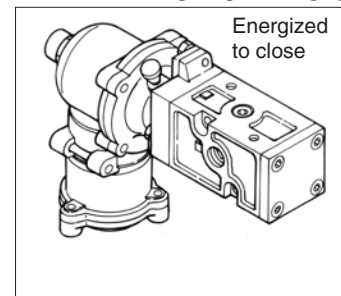


For pressure-closing single-acting type cylinders (7F), "Energized to open" is replaced with "Energized to close" in the figure.

Installation procedure

- (1) Install the solenoid valve unit to this product using the solenoid valve holding bolts and the two tapped holes for solenoid valve installation located on cover 1 of this product. [Fig. 13]
- (2) The solenoid valve installation orientation depends on whether the valve is opened or closed when energized. To reverse the orientation, remove the solenoid valve holding bolts, reverse the solenoid valve orientation, and re-install the unit. [Fig. 14]

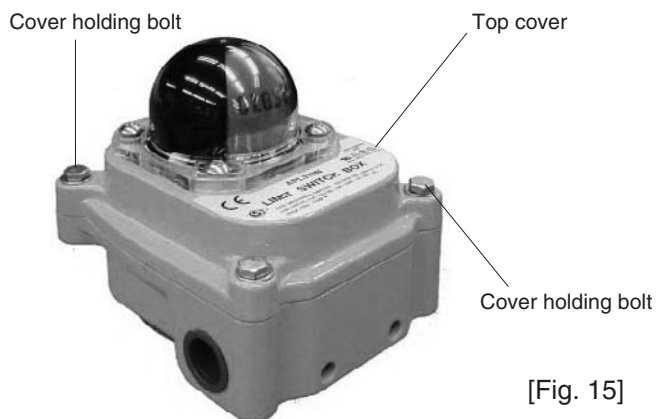
For double-acting/single-acting spring open



[Fig. 14]

4-6 Limit switch

TMS Limit Switch Box

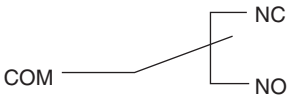


[Fig. 15]

Limit switches are used to convert the valve position (full close, full open, half open) into electric signals for lamp indication at a remote location. The contact is opened or closed by mechanical action.

Standard specifications

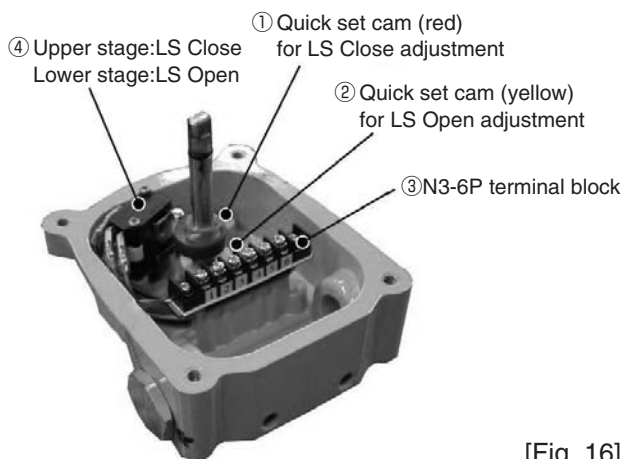
Table 5 TMS limit switch box standard specifications

Circuit	Monopolar double-throw (1C, SPDT) x 2 
Protective construction	IP67
Rated voltage	AC250V-16A DC125V-0.6A
Ambient temperature	-10~60°C
Wiring method	2-G1/2
Contacts	Switch detection with one (2 switches inside)

Adjustment procedure



The output position of the limit switch is adjusted by adjusting the quick set cam. When adjusting the quick set cam, stop supplying compressed air, etc. Otherwise this product may operate unexpectedly, resulting in a very dangerous situation.



[Fig. 16]

- (1) Set the position to full close on this product.
- (2) Loosen the cover holding bolts at the four corners of the limit switch box and remove the top cover. [Fig. 15]
- (3) Pull the top cover out upward.
- (4) Rotate the red quick set cam while pressing it downwards. Then return the quick set cam at the position where the limit switch operates. The quick set cam returns by the spring automatically. The quick set cam can be adjusted with an interval of approx. 2 degrees. [Fig. 16]
- (5) Set the position to full open on this product.
- (6) Rotate the yellow quick set cam while pulling it upwards. Then return the quick set cam at the position where the limit switch operates. The quick set cam returns by the spring automatically. The quick set cam can be adjusted with an interval of approx. 2 degrees.
- (7) Set the position to open and close on this product to ensure that the limit switch outputs a signal at the desired position.
- (8) Set the position to full close on this product.
- (9) After checking that the indicator indicates "Full close", install the top cover.
- (10) Tighten the cover holding hexagon bolts.

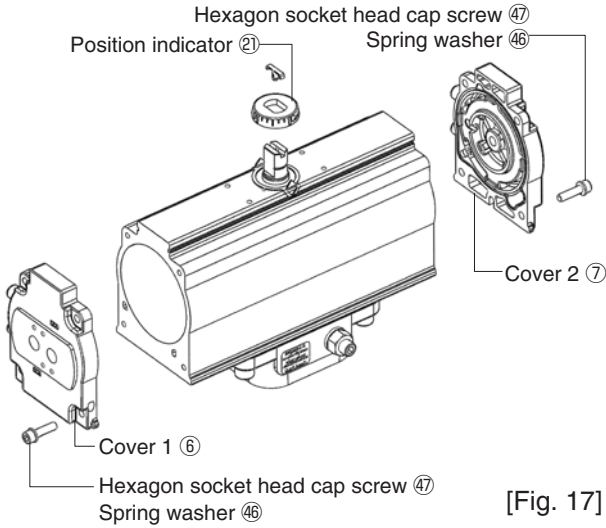
5. CYLINDER MAINTENANCE

5-1 Disassembly procedure

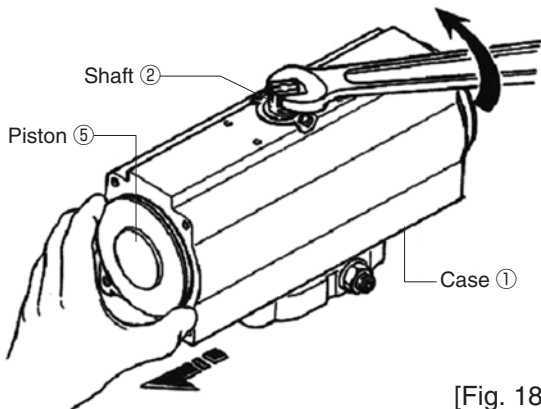


CAUTION

Before disassembly, be sure to read "FOR YOUR SAFE USAGE" of this manual once again.



[Fig. 17]



[Fig. 18]

For periodical inspection or replacement of packing and other worn out sliding elements, refer to the internal assembly drawings and follow the instructions given below.

Removal of the unit from the valve

- (1) Take out the pneumatic pipelines and electric wiring from this product.
- (2) Remove the bolts and spring washers that fasten this product to the valve, then take out this product from the valve.

Disassembly procedure

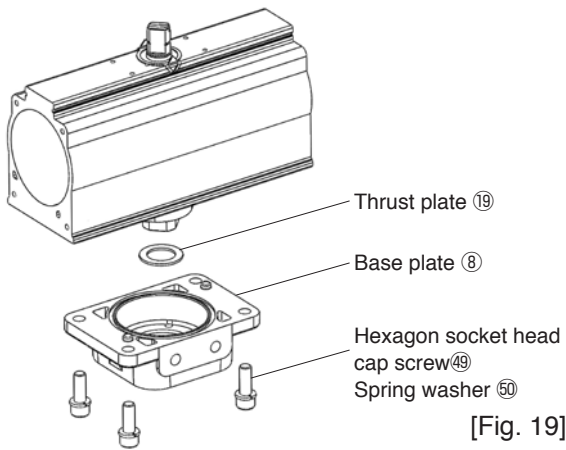


CAUTION

If covers of single-acting type cylinders are removed forcibly, the spring may fly out, resulting in a dangerous situation.

When taking out the covers of single-acting type cylinders, follow the instructions in **5-2 Single-acting type cylinder side cover disassembly procedure.**

- (1) Loosen and remove the hexagon socket head cap screws (47) that fasten the cover 1 (6), the cover 2 (7) and the spring washer (46). Take out both covers. [Fig. 17]
- (2) Take out the position indicator (21) using a flat-blade screwdriver, etc.
- (3) Turn the shaft (2) counterclockwise as viewed from above, and take out two pistons (5) from the case (1). [Fig. 18]



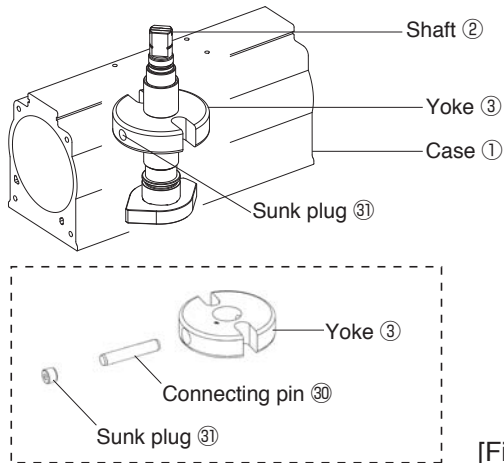
[Fig. 19]

- (4) Loosen the hexagon socket head cap screws (49), and take out the spring washers (50), the base plate (8), and the thrust plate (19). [Fig. 19]

The quantity of the hexagon socket head cap screws (49) and the spring washer (50) depend on the type. Please refer to [Table 6] for details.

Table 6 Quantity of hexagon socket head cap screws and spring washers

Type	Qty
T 35	2 pcs for each
T85~T750 T85S~T750S	4 pcs for each



[Fig. 20]

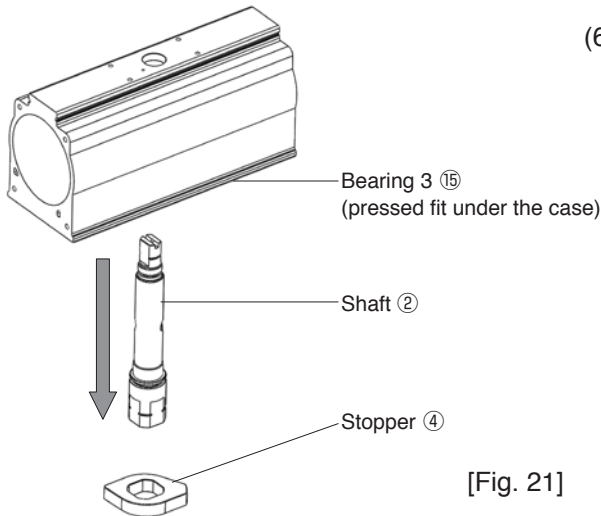
- (5) Turn the shaft (2) until the sunk plug (31) mounted at the side of the yoke (3) can be seen, then loosen the sunk plug (31) and take out the connecting pin (30). [Fig. 20]



CAUTION

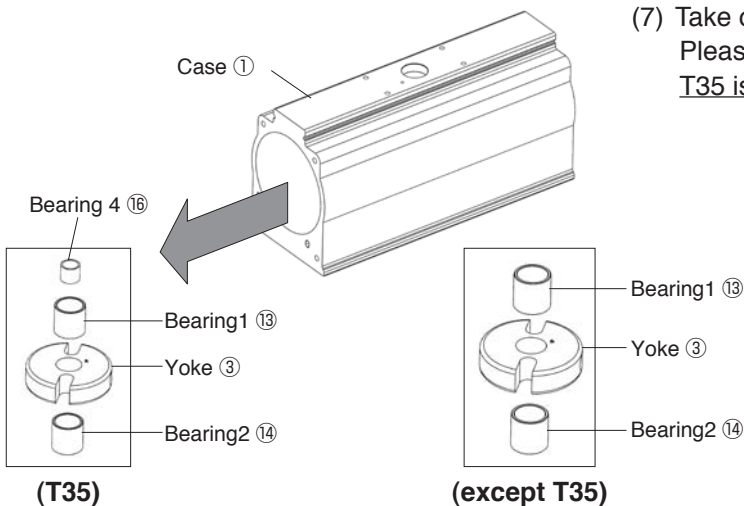
Do not hit the shaft (2) when taking out the shaft (2). Otherwise the yoke (3) may hit and break the case (1). Take out the shaft (2) slowly while rotating it. [Fig. 21]

- (6) Take out the shaft (2) and the stopper (4) in the direction of the arrow. When taking it out, be careful not to damage the bearing 3 (15). [Fig. 21]



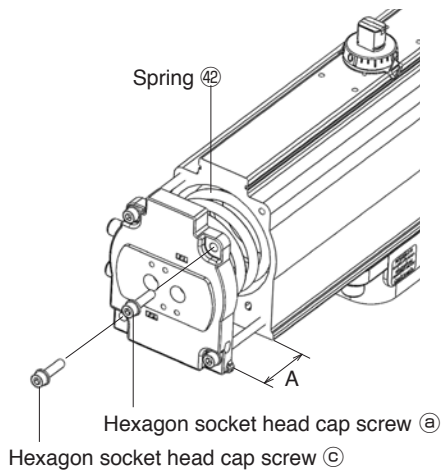
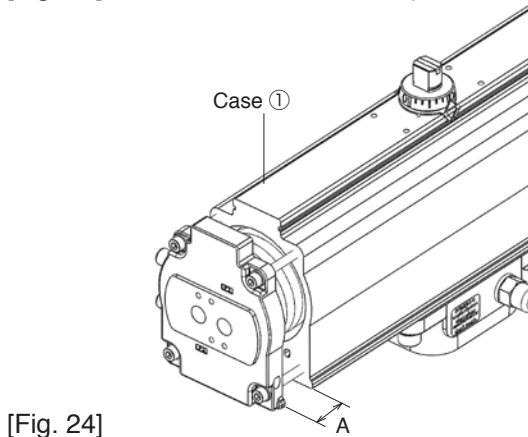
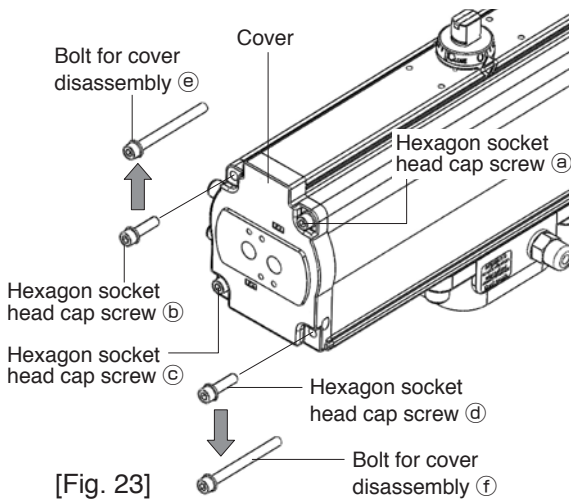
[Fig. 21]

- (7) Take out the yoke (3) and the bearing from the case (1). Please note that the type and quantity of the bearing of T35 is different from those of the other types. [Fig. 22]



[Fig. 22]

5-2 Single-acting type cylinder side cover disassembly procedure



[Fig. 25]

When taking out the side covers of single-acting type cylinders for disassembly, the internal spring may fly out, resulting in a dangerous situation. When disassembly is required, follow the instructions given below for safe work. For the actuator type T750S, the spring length has been returned to the free length when taking out the standard bolts.

- 1) Take out pneumatic pipelines from this product, and check that internal compressed air, etc. is discharged completely from this product.
- 2) Make sure that no damage, such as cracks, deformation and chipping, is noticed on the covers (Cover 1 ⑥, Cover 2 ⑦). If any damage is noticed, stop work and replace the whole actuator because the actuator is dangerous.
- 3) During work, be careful to avoid workers standing on the extension of the longitudinal direction line of the cylinder until the spring is taken out as a precaution.
- 4) Please prepare two bolts for disassembly with the size shown in [Table 7] (Not required for T750S.)
- 5) Take out two diagonally-mounted the "hexagon socket head cap screws ⑥ and ④" [Fig. 23] (Not required for T750S.)
- 6) Apply grease to the thread part of the prepared "bolts for disassembly", insert them to the holes where the "hexagon socket head cap screws ⑥ and ④" have been taken out. Then screw in the bolts to the length shown in [Table 8] and tighten them. [Fig. 23] (Not required for T750S.)
- 7) Loosen the "hexagon socket head cap screws ① and ③" alternately. When the cover and the "bolts for disassembly ⑥ and ④" make contact, loosen all the bolts in diagonal sequence evenly and alternately. [Fig. 24]
- 8) When the dimension A in the figure is the length of [Table 9], the "hexagon socket head cap screws ① and ③" which are not replaced will come out. [Fig. 25] (Not required for T750S.)
- 9) Loosen the rest two "bolts for disassembly ⑥, ④" evenly and alternately. (Not required for T750S.)
- 10) When the bolts for disassembly (standard bolts in the case of T750S) come off, the spring is stretched fully. Thus the side cover can be taken out safely.
- 11) Take out the side cover and the spring ④ straight away.
- 12) Take out the side cover at the opposite side in the same way.

Table 7 Sizes of bolts for disassembly [Fig. 26]

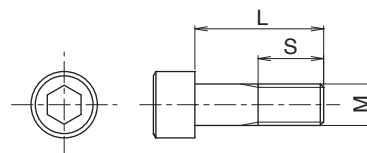
Item	Actuator type				
	Symbol	T85S	T200S	T380S	T750S
Screw length	M	M5	M6	M8	Not required
Bolt length	L	70mm	100mm	120mm	Not required
Screw length	S	61mm or more	91mm or more	112mm or more	Not required

Table 8 Thread engagement length of bolts for disassembly

	Length [mm]
T85S	40
T200S	60
T380S	80
T750S	—

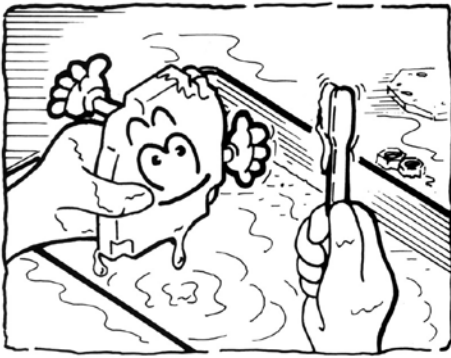
Table 9 Dimension A

	Dimension A [mm]
T85S	40
T200S	60
T380S	80
T750S	105

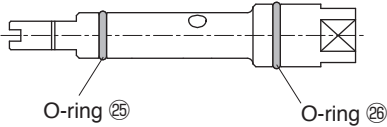


[Fig. 26]

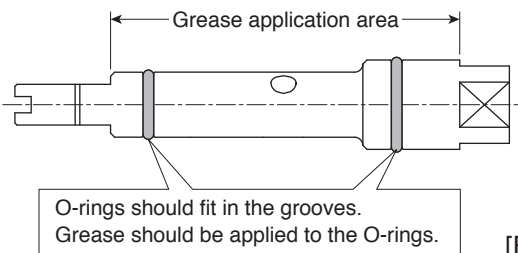
5-3 Assembly procedure



[Fig. 27]



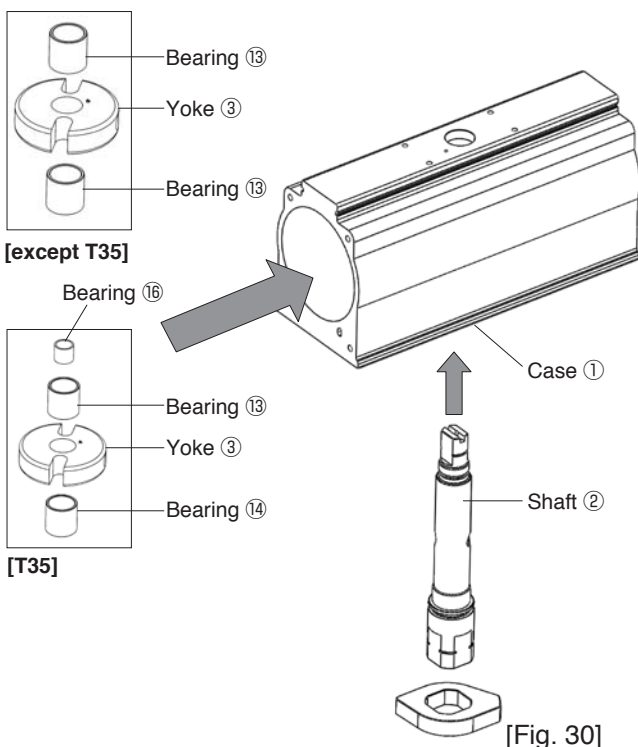
[Fig. 28]



[Fig. 29]

Table 10 Grease application amount (Bearing, Shaft)

Application area	Part number	Application amount				
		T35	T85 T85S	T200 T200S	T380 T380S	T750 T750S
Shaft O-ring groove	2	0.5g	1g	1g	2g	2g
Bearing inner surface	13,14,16	Total 2g	—	—	—	—
Bearing inner surface	13	—	Total 2g	Total 2g	Total 3g	Total 5g
Shaft	2	3g	4g	5g	7.5g	15g
Bearing inner surface	15	0.5g	0.5g	0.5g	1g	1g



[Fig. 30]

- (1) Prior to the reassembly, each element should be thoroughly cleaned and checked to make sure that no dirt or damage is noticed. [Fig. 27]
- (2) Replace all the consumables (O-rings, packings, bearings, etc.) even if they appear intact.
- (3) The sliding parts of the O-rings, packings, bearings, etc. should be applied with grease.
- (4) For assembly of single-acting type cylinders, refer to **5-4 Single-acting type cylinder side cover assembly procedure**.
- (5) Remove liquid gasket adhered to the base plate and the case completely.

Assembly procedure



CAUTION

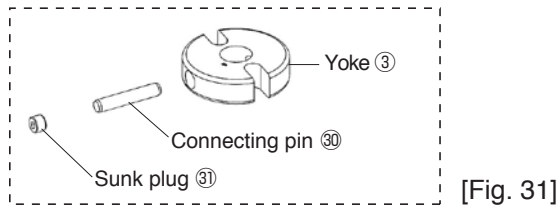
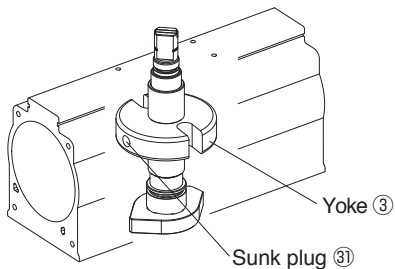
There is a mounting direction for the yoke ③. Assembly of the unit the yoke whose direction is wrong will cause defective operation due to insufficient output torque.



CAUTION

Do not hit the shaft when inserting the shaft. Otherwise the case may be damaged. If the shaft is not inserted smoothly, any part may interfere. If the shaft is inserted forcibly, the O-rings may be broken, resulting in air leakage or defective operation.

- (1) Replace all the O-rings mounted on the shaft ②. [Fig. 28]
When replacing the O-rings, apply grease (lithium soap-base, consistency No.2) to two O-ring grooves on the shaft ②. Please use the application amount shown in [Table 10].
- (2) Apply grease (lithium soap-base, consistency No.2) to O-rings ②⑤ and ②⑥, the shaft ② and the inner and outer surfaces of the bearings. Please use the application amount shown in [Table 10]. [Fig. 29]
- (3) Insert the shaft ② in the direction of the arrow while holding the yoke ③ and the bearings in the case. Rotate and insert the shaft slowly. [Fig. 30]
There is a mounting direction for the yoke ③. Assemble the unit so that the face stamped with "UP" mark of the yoke faces to the upper side of the cylinder.
Note) If "F" mark is stamped on the yoke instead of "UP" mark, assemble the unit so that the face stamped with "F" mark faces to the bottom of the cylinder.



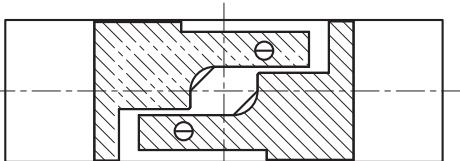
- Insert the connecting pin (30) after making sure that the pin hole of the yoke (3) and the pin hole of the shaft (2) are aligned.
- Insert the connecting pin (30) into the tapped hole of the yoke (3). [Fig. 31]

- Insert the connecting pin (30) into the yoke (3) and fix with the sunk plug (31). Apply Loctite to the sunk plug. [Fig. 31]
Loctite:Henkel Corporation Loctite 242 or 243
- Replace all the O-rings mounted on the piston (5). [Fig. 33]
- Apply grease (lithium soap-base, consistency No.2) to the groove of the piston (5) and the piston packing (24). Please use the application amount shown in [Table 10].
- Install the piston packing (24) and the wear ring (17) to the piston (5).
- Before inserting the piston (5) ASSY into the case, apply grease (lithium soap-base, consistency No.2) to the sliding area of the piston (5), the inner surface of the case (1), and the bearing outer surface.
Apply grease (MOLYKOTE G paste grease) to the yoke U groove. Please use the application amount shown in [Table 11].

Table 11 Grease application amount (Piston, Yoke, Case, Bearing)

Application area	Part number	Application amount				
		T35	T85 T85S	T200 T200S	T380 T380S	T750 T750S
Piston	5	2g x 2 pcs	2g x 2 pcs	3g x 2 pcs	5g x 2 pcs	7.5g x 2 pcs
Yoke U groove	3	1g x 2 pcs	2g x 2 pcs	2g x 2 pcs	3g x 2 pcs	5g x 2 pcs
Case inner surface	1	Double 5g	Double 10g Single 15g	Double 15g Single 20g	Double 20g Single 35g	Double 30g Single 45g
Bearing outer surface	13,14	1g x 2 pcs	2g x 2 pcs	2g x 2 pcs	3g x 2 pcs	3g x 2 pcs

Piston installation orientation of double-acting type cylinder and pressure-opening single-acting type cylinder (7G)



Piston installation orientation of pressure-closing single-acting type cylinder (7F)

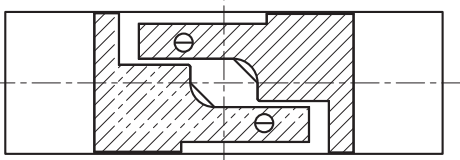
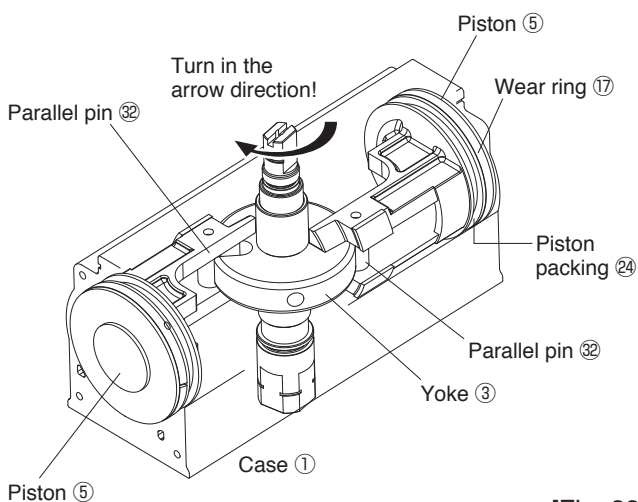


Fig. 32 shows the figure when this product is seen from the top

[Fig. 32]



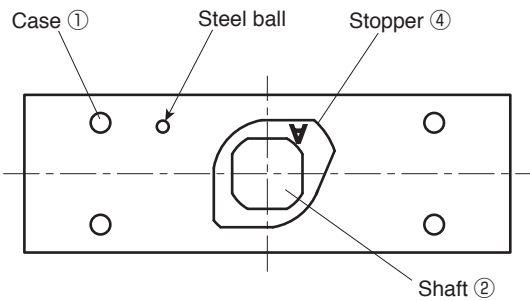
[Fig. 33]



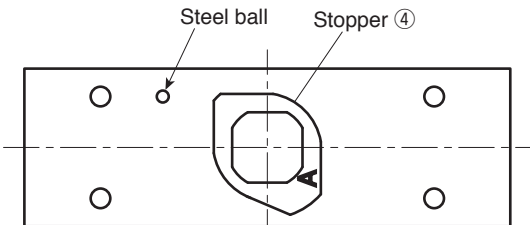
Assembly direction of the piston (5) ASSY for pressure-opening single-acting type cylinder is different from that of pressure-closing. Assembly with wrong direction causes defective operation, such as reverse opening/closing operation of the valve.

- Place the case (1) and the piston (5) in the direction shown in [Fig. 33]. Be careful of the direction because assembly direction of the piston is different between pressure-opening (7G) and pressure-closing (7F) of single-acting type cylinders. Make sure that parts are installed in the direction shown in [Fig. 33] when the cylinder is seen from the top. [Fig. 32][Fig. 33]
- Insert the pistons (5) into the right and left sides of the case (1).
Align the parallel pins (32) right and left on the pistons (5) with the U grooves on the yoke (3). Then insert the shaft while turning the shaft in the direction of the arrow.
After assembly, turn the shaft to ensure the free movement of the piston. [Fig. 33]

Align the parallel pin (32) that is the part of the piston with the U-shaped notch on the yoke. Match with the shaft rotation and push it in.



Stopper installation orientation for double-acting type (7E)/pressure-opening single-acting type (7G) [Fig. 34]



Stopper installation orientation for pressure-closing single-acting type (7F) [Fig. 35]

[Fig. 34] and [Fig. 35] show the figures when this product is seen from the bottom of this product.



CAUTION

Assembly direction of the stopper ④ for pressure-opening single-acting type cylinder is different from that of pressure-closing.
Assembly with wrong direction causes defective operation, such as reverse opening/closing operation of the valve.

(11) Install the stopper ④ to the underside of the shaft ② so that the stamp "A" can be seen when the cylinder is seen from the bottom.

Stopper assembly direction for pressure-closing single-acting type (7F) is different from that of double-acting type (7E) and pressure-opening single-acting type (7G). [Fig. 34][Fig. 35]

(12) Apply grease (lithium soap-base, consistency No.2) to both sides of the thrust plate ⑱. Please use the application amount shown in [Table 12]. After applying grease, install the thrust plate ⑱ to fit the groove of the base plate ⑧. [Fig. 36]

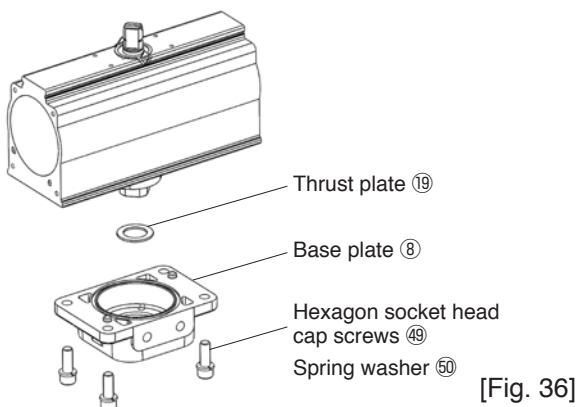


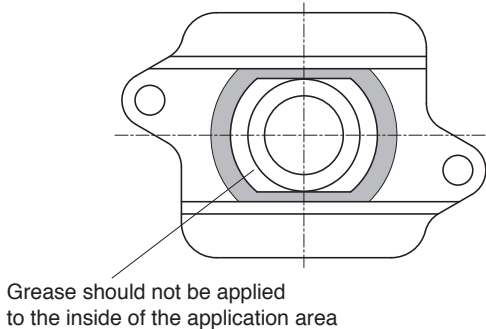
Table 12 Grease application amount (Thrust plate)

Application area	Part number	Application amount				
		T35	T85 T85S	T200 T200S	T380 T380S	T750 T750S
Thrust plate	19	0.5g	0.5g	0.5g	1g	1g

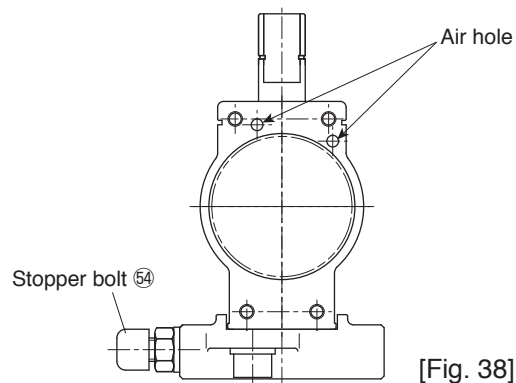
For T35

- Apply liquid gasket to the designated area on the base plate ⑧ completely. [Fig. 37]
Liquid gasket: ThreeBond 1207D or an equivalent
- Assemble the unit so that the air holes are in the positions shown in the figure to the direction of the stopper bolt ⑤④. [Fig. 38]

■ : Liquid gasket application area



[Fig. 37]



[Fig. 38]

(13) Make sure to remove water, oil, other dust from the application area, and apply liquid gasket to the designated area on the base plate completely. Be careful to avoid applying liquid gasket to the thrust plate ⑱. Otherwise, defective operation is caused.

Liquid gasket: ThreeBond 1207D or an equivalent [Fig. 36]

Table 13 Bolt tightening torque (Base plate)

Type	Bolt	Torque
T35 · T85 · T85S	M8	22.5 Nm
T200 · T200S	M10	43 Nm
T380 · T380S	M10	43 Nm
T750 · T750S	M12	68 Nm



Please note that insufficient clamping force of the bolts causes looseness of the bolts, resulting in defective operation or falling of the cylinder.

- (14) Apply LOCTITE to the hexagon socket head cap screws. Tighten the screws with a torque wrench to fasten the base plate securely with the torque shown in [Table 13]. Tighten the screws diagonally and evenly. LOCTITE: Henkel Corporation Loctite 242 or 243



Install the cover 1 ⑥ and the cover 2 ⑦ to the left side and the right side respectively while facing the full-close stopper bolt. Please note that wrong cover installation causes defective operation, such as air leakage.

- (15) Replace all cover packings ⑳.
- (16) Apply grease (lithium soap-base, consistency No.2) to the cover packing ⑳. Grease application amount for each type is show in [Table 14].
- (17) Install the cover 1 ⑥ and the cover 2 ⑦ so that the bosses of the covers face the side opposite to the full-close stopper bolt side. Install the cover 1 ⑥ and the cover 2 ⑦ with the hexagon socket head cap screws ④⑦ and the spring washers ④⑥ to the case. At this time, do not forget to assemble the cover packing ⑳ in advance. [Fig. 39]

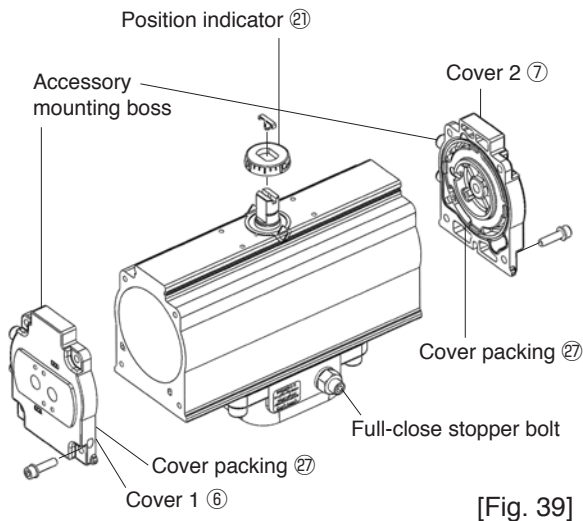


Table 14 Grease application amount (Cover packing)

Application area	Part number	Application amount				
		T35	T85 T85S	T200 T200S	T380 T380S	T750 T750S
Cover packing	27	0.5g	1g	1g	2g	2g

Table 15 Bolt tightening torque (Cover)

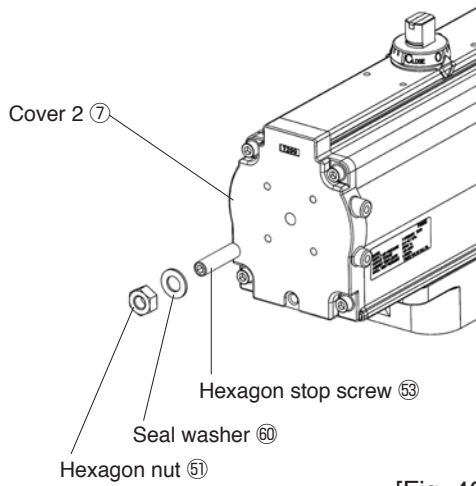
Type	Bolt	Torque
T35 · T85	M5	4.5 Nm
T85S	M5	4.5 Nm
T200	M6	8 Nm
T200S	M6	8 Nm
T380	M8	20 Nm
T380S	M8	20 Nm
T750	M10	35 Nm
T750S	M10	35 Nm



Forcible assembly of single-acting type cylinders, such as uneven tightening of the hexagon socket head cap screw to mount the cover, may cause flying out of the spring, which would result in a dangerous situation. Install the covers of single-acting type cylinders according to **5-4 Single-acting type cylinder side cover assembly procedure**.

- (18) Tighten the hexagon socket head cap screws ④⑦ to mount cover1 ⑥ and the cover2 ⑦ securely with the torque shown in [Table 15].
- (19) Fit the position indicator ㉑ onto the top of the shaft. [Fig. 39]

Assembly of Closing Side Stopper Bolt



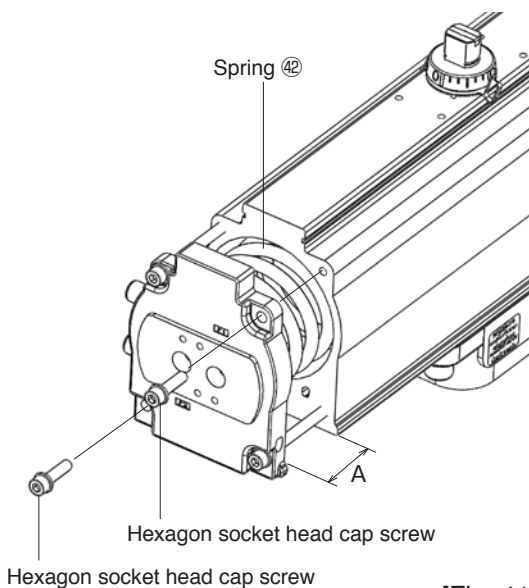
[Fig. 40]

- (1) Replace the seal washer ⑥⑩ with a new one.
- (2) Screw in the seal washer ⑥⑩ while turning it along the thread of the hexagon stop screw ⑤③ to the 1/3th length of the screw. [Fig. 40]
- (3) Install the hexagon stop screw ⑤③ to the cover 2 ⑦.
- (4) Fix the hexagon stop screw ⑤③ with a hexagonal wrench and then tighten the hexagon nut ⑤① with a wrench.
- (5) Tighten the hexagon nut ⑤① using the torque shown in [Table 16]. Please refer to **4-3 Adjustment of valve position** for adjustment of the stopper bolt.

Table 16 Opening side stopper bolt fixing nut tightening torque

Type	Bolt	Torque
T35 · T85 · T85S	M8	20 Nm
T200 · T200S	M10	35 Nm
T380 · T380S	M12	38 Nm
T750 · T750S	M16	115 Nm

5-4 Single-acting type cylinder side cover assembly procedure



[Fig. 41]

- (1) Put the spring ④② in the case ①, and install the side cover using two "bolts for disassembly" where grease has been applied [Fig. 41]
For T750S, do not use the "bolts for disassembly". Instead, install the cover 1 and 2 using eight "hexagon socket head cap screws" (four for each) mounted on the product.
- (2) Tighten the "bolts for disassembly" until the dimension A in the figure becomes the distance where the "hexagon socket head cap screws" which had been mounted to the product can engage the case. And then install the two "hexagon bolts" to the rest holes on the cover. (This process is not required for T750S.)
- (3) Tighten the four screws by turns. When "hexagon socket head cap screws" mounted to the product are fitted into 3 or 4 threads, replace the "bolts for disassembly" with the "hexagon socket head cap screws" which had been mounted to the product (This process is not required for T750S.)
- (4) Tighten the four "hexagon socket head cap screws" diagonally and evenly. When the side cover is in perfect contact with the case, tighten the screws using the torque shown in [Table 13].

5-5 Troubleshooting

Trouble	Cause of trouble	Remedy
The cylinder unit does not open/close valve.	• Supply pressure of compressed air, etc. is low.	• Increase the air supply pressure within the range of the specifications of this product.
	• Air pipes clogged.	• Remove foreign substances from the air pipes.
	• Speed controller is shut or throttled too much.	• Open the speed controller.
	• Air leaks inside the cylinder case.	• Replace O-rings of the piston.
	• Torque required by a valve is too high.	• Check the valve.
The valve is not fully opened or shut.	• Position is wrong.	• Adjust the stopper bolt positioning.
	• Torque required by a valve is too high.	• Check the valve.
The valve opens/closes too quickly.	• Speed controller is opened too much.	• Close the knob of the speed controller.
	• Supply pressure of compressed air, etc. is high.	• Decrease the air supply pressure within the range of the specifications of this product.
The valve opens/closes too slowly.	• Speed controller is closed too much.	• Open the knob of the speed controller.
	• Supply pressure of compressed air, etc. is low.	• Increase the air supply pressure within the range of the specifications of this product.
	• Air pipe from compressor to this product is too long.	• Increase the diameter of the air pipe
Air leaks.	• Deterioration of cover packing of output shaft or cover case.	• Replace the consumables.
	• Loosened bolts of side cover	• Retighten the bolts.

Before placing an order

Warranty Period

The warranty period of the delivered product should be eighteen (18) months after shipment from our factory or one (1) year after the date of starting trial runs, whichever comes first.

Scope of Warranty and Indemnity

If any damage or problem should occur during the foregoing warranty period due to our fault, Tomoe Valve will replace or repair any defective part of the product free of charge at the place where the product was purchased or where it was delivered (limited to Japan).

However, warranty is not applicable if the causes of defect should result from the following:

- (1) The failure was caused by inappropriate conditions, environment, handling or use methods, etc. which are not specified in the catalog, specifications or other relevant documents that had been made and entered into between the customer and Tomoe Valve.
- (2) The failure was caused by the product other than the delivered Tomoe's product.
- (3) The failure was caused by modifications or repairs by a party other than Tomoe Valve.
- (4) The failure was caused by use under the condition that had not been given as required specifications of valves, etc., or by a problem that was not foreseen from the specified conditions.
- (5) The failure was caused by significant wear and tear of the seat ring, the gland packing, etc.
- (6) The failure was caused by poor application of consumables, such as lubricant.
- (7) The failure was caused by inappropriate maintenance or inspection under highly frequent valve operation.
- (8) The failure was caused by power source or air supply.
- (9) The failure was caused by foreign substances, such as dust, that entered and clogged in the product.
- (10) The failure was caused by inappropriate storage of the product, such as open air storage.
- (11) The failure was caused by fire, flood, earthquakes, fall of rocks, and other acts of God.
- (12) The failure was caused by other reasons which are not our responsibility.

In addition, the forgoing warranty is only applicable to the product itself and excludes compensation of any other indirect or consequential damage.

Charged Repair Service and Supply of Discontinued Parts

Products are subject to discontinuation or modification without notice. For products that are no longer manufactured or sold, repair or overhaul of the products may not be available after 5 years since discontinuation. In addition, supply of the parts or spare parts of the products may not be available.

* "Before placing an order" has been described since 25 May, 2005.

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