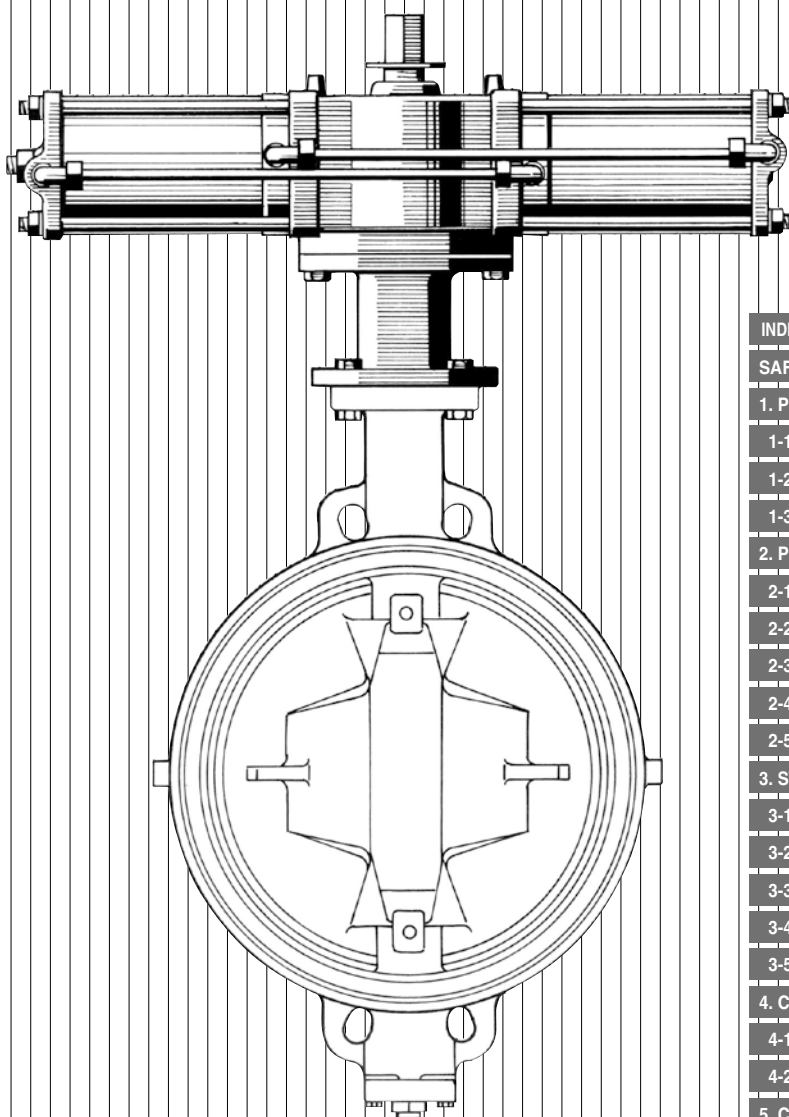


Pneumatic Actuator

INSTRUCTION MANUAL

TGA Fig.No.3A



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Please Observe the Following Safety Precautions

Note that the items listed here are to promote the correct usage of TGA actuator (hereinafter "this product") and to help prevent injury or damage. Carefully read this instruction manual in its entirety then proceed to use the product correctly while adhering to the safety precautions. Furthermore, please be sure to also read the safety precautions for handling valves.

■ The degrees of danger and damage that may occur when displayed advisories are ignored and the product is used incorrectly are classified and described below.



WARNING!

This display denotes that death or serious injury may occur.



CAUTION!

This display denotes that injury or only property damage may occur.

■ What types of advisories are to be observed are classified and indicated below. (Below are examples of symbols.)



This symbol indicates that the following content is "Prohibited".



This symbol indicates that the following content is "Compulsory".

■ Request

- Carefully read this instruction manual before transporting, storing, attaching pipes, operating, or performing maintenance.
- This instruction manual was not written with the assumption of all situations with regard to transportation, storage, piping attachment, operation, and maintenance of this product; if there are any unclear points, please do not hesitate to contact our sales representative.
- Standard and limit values of operations, maintenance, and inspection specified in this instruction manual were set with consideration for maintenance management of this product. Please operate in compliance with the reference value (standard value) and limit value.
- Use this product by connecting only to a valve with open-close angle of 90 degrees or below.
- Be sure to store this instruction manual in a readily accessible place for future reference after installation and operation start. If staff in charge is changed, information on the storage place of the instruction manual and operation should be transferred to the next staff.
- If dents or scratches are made due to shock, stop using the product for safety and replace the product.

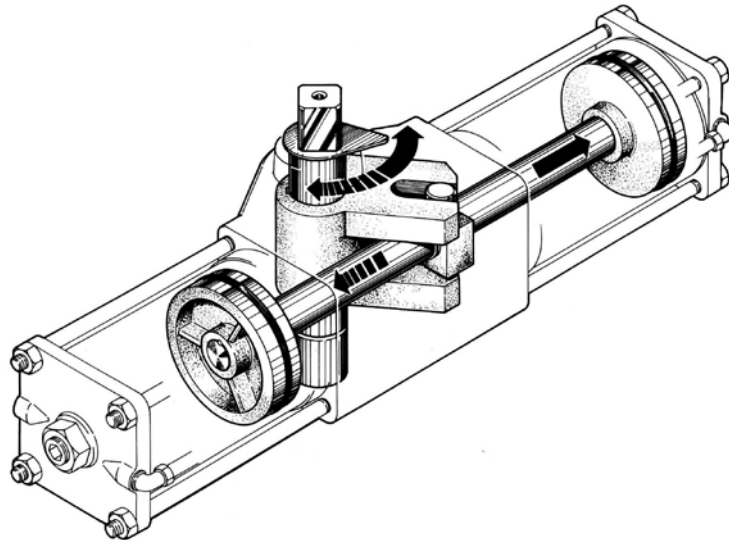
*The contents of this instruction manual are subject to change without notice.

1. PRODUCT FEATURES

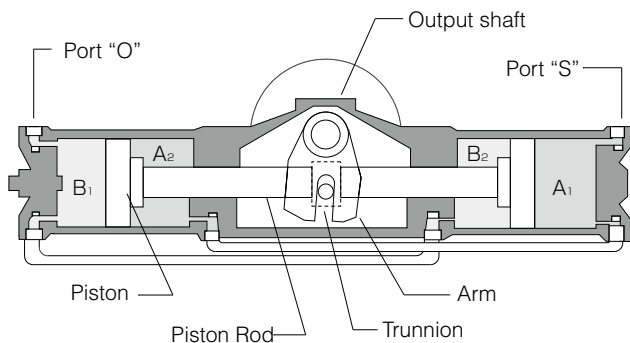
1-1 Product Features

This product is a double-acting pneumatic actuator suitable for ON-OFF control of various butterfly valves, and can be used to control valves with a medium/large bore diameter of large of 350 mm or more. Also, the TGA cylinder can optionally be applied to flow rate control in combination with positioner.

The product permits the piston to be put in linear reciprocating motion using air pressure, causing the trunnion coupled with the rod to rotate the output shaft repeatedly through the arm.



1-2 Operation Principle



As chambers A1 and A2 or B1 and B2 are connected through copper tubes as shown in the figure at left (single-acting cylinder is provided only with chambers A2 and B1), feeding air to port "S" moves the piston to left, in which thrust is transmitted to the trunnion on the piston rod to give the output shaft a force to produce clockwise rotation through the arm, rotating the shaft clockwise. Residual air in chamber B is exhausted through port "O". Feeding air to port "O" causes the reverse of the above-mentioned action, rotating the output shaft counterclockwise.

1-3 Standard Specifications





	TGA-100	TGA-125	TGA-140	TGA-160	TGA-180	TGA-200	TGA-220	TGA-250
Torque (N·m) (0.4MPa)	585	1069	1510	2274	3194	4339	5977	8620
Supply pressure (MPa)	0.4~0.7 ※1							
Body shell max (MPa)	1.0							
Port size	Rc1/4	Rc3/8				Rc1/2		
Rotating angle	0° ~ +90°							
Operating fluid	Dry air							
Working temperature range/ Supplied Air Temperature Range	0 to 80 degrees C / 0 to 60 degrees C (Without Frost Air) ※2							
Rotating speed range (sec.)	5 to 15							
Coating	Epoxy primer finish (Munsell N7)							

※1 If used for the TRITEC with over 0.5MPa supply pressure, please ask us about cylinder specifications.




※2 Please consult with our sales department when used at working temperature of more than 60 degrees C as the cylinder can be changed.

2. PRECAUTIONS FOR USE

2-1 Safety Measures

 WARNING!	2.1.1 Handling This Product Ensure that only personnel with sufficient knowledge and experience handle this product. Compressed air can be dangerous if dealt with improperly. Ensure that only personnel who have carefully read the instruction manual (hereinafter "this document") and understand the contents well, assemble, operate, maintain, etc. machines and equipment that utilize pneumatic equipment.
	2.1.2 Confirming Safe Conditions Never attempt to handle machines or equipment, or remove machinery before safety is ensured. When removing machinery, confirm the following items and ensure safety. <ol style="list-style-type: none">(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 is the energy source 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. Confirm the following items before restarting the equipment. <ol style="list-style-type: none">(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 using the unit 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 cylinder (spring back cylinder), a lock-up valve, etc. in the event 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 open-close time in the range of the product specifications, depending on the pipeline conditions or valve operating conditions.

2-2 Transportation and Storage

 CAUTION!	2.2.1 Mass Products with greater weight (approx. 20 kg) cannot be moved by human power alone, and will require tools and machines to transport. Please confirm a product's mass in our catalog or by checking a product drawing. Forklifts, cranes and slinging must be operated and performed by certified workers, and please be sure follow laws and regulations, as well as your business' safety codes.
 CAUTION!	2.2.2 Dropping Handle the product properly when loading/unloading and double handling to prevent damage from dropping.
	2.2.3 Dust Prevention, Water-proofing Do not remove the plug (tentative seal plug) connected to the piping connection until air piping work is to commence. If dust-prevention and water-proofing measures are not taken, rubbish, particles, rainwater, etc. enter this product, which causes malfunction. If the plug is lost, please cover the connection, use protection tape, or perform any similar protective measures. For single-acting cylinders, orient the exhaust port's elbow downwards to prevent rubbish, particles, rainwater, etc. from penetrating it.



2.2.4 Storage

Please follow the storage guidelines below to avoid contamination, discoloration, and material degradation of this product.

- (1) Do not store in high heat, high humidity places. Store in places without dust particles and moisture away from direct sunlight.
- (2) Keep this product in the factory packaging, or utilize similar protective measures.
- (3) After one year in storage, it is necessary to inspect the product's operating condition, and if any abnormalities are discovered it will be necessary to disassemble and inspect, then exchange any warped or degraded parts.

2-3 Installation and Working Environment



WARNING!

2.3.1 Obtaining Space for Installation Site

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

2.3.2 Installation Sites and Working Environment

If installing at a site or working environment that requires special support for functional specification compliance, regulatory compliance, etc. – as noted in the following – please contact our sales representative before adopting usage of this product on any unclear points.

- (1) When there is a unique working environment that is not listed in the specifications.
- (2) When great risk to personnel, property, or the environment are predicted in the event of product failure. 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.



CAUTION!

2.3.3 Atmosphere of Installation Site

Take following measures depending on the atmosphere of the site where this product will be installed.

- (1) Avoid installation at sites that may expose this product to gas containing salt, corrosive gas, chemical fluids, organic solvents and vapor. However, there are certain environmental conditions where corrosion prevention is possible; if this case applies, please contact our sales representative.
- (2) If there is a possibility of direct exposure to radiant heat or chemicals, ensure protection of the product and ancillary devices by covering it.
- (3) When installing a single-acting cylinder outdoors or at a site where it may be exposed to water, ensure that the exhaust port's elbow is facing down to prevent rubbish, particles, rainwater, etc. from penetrating it.
- (4) This product should not be submerged.



2.3.4 Temperature of Installation Site

Take the following measures depending on the temperature of the site where this product is installed. Using the product out of the specified temperature range causes thermal degradation or hardening of the O-ring, as well as cause malfunction by difference of thermal expansion or thermal shrinkage of components.

- (1) The ambient temperature of the installation site 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 ancillary devices should not exceed the upper limit.
- (4) Keep this product away from heat sources, and install in a site 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) Use the ancillary devices within the appropriate temperature range of the ancillary devices.



2.3.5 Vibration and Shock at Installation Site

Take the following measures if there is vibration or shock at the site where this product is installed.

- (1) If this product is to be used under the following conditions, confirm vibration and shock conditions (particularly the acceleration value) then contact our sales representative for consultation.
 - 1) In sites where excessive vibration or shock is exerted
 - 2) In sites where vibration or shock is exerted continuously
- (2) Ensure that locks are applied to the product's attachments and connectors, and are securely fastened. This is important especially when opening/closing in high-frequency, and to consider fatigue resistance and fasten accordingly.
- (3) Take vibration isolation measures to reduce vibration or shock on the machine. Pipelines should be fixed with supports, or vibration isolation material should be installed.
- (4) It is important to conduct periodic inspections of fasteners to ensure that no loosening or warping has occurred, and make sure to tighten bolts or replace parts in the event of abnormal conditions. If the fastening bolts are removed, this product may drop off or actuate in an unexpected direction.



2.3.6 This Product and Valve Attachments Design

Confirm the following items when attachments between a valve and this product are designed.

- (1) No thrust load and lateral load has jointed to the product's output shaft.
- (2) To prevent axial movement of the valve stem on the valve from occurring, install an independent stopper. If the output shaft of this product is used as a stopper for the valve stem of the valve, the valve stem may eject out due to fluid pressure when this product is removed.
- (3) Secure adequate dimension to fit the output shaft of this product and the valve stem of the valve. Please refer to separate dimensional outline drawings for appropriate fit dimension. If the fit dimension is inadequate, strength at fitting section may become insufficient, resulting in damage.



2.3.7 Precautions at Air Piping

Connect air pipes to this product while paying attention to the following items. If dents or scratches are made due to shock, stop using the product for safety and replace the product.

- (1) Make sure that strong force, impact from objects, or any sort of shock is not applied to the cylinder, ancillary devices, or air pipes. Rough handling may result in warping of the output shaft or damage to the O-ring, which in turn causes air leaks.
- (2) Avoid standing on this product at connecting pipelines. Do not insert this product by hitting it.
- (3) Prior to piping, air blow (flushing) or sufficiently clean pipes and joints; purge shavings, cutting oil, rubbish, etc. within the pipes. It is especially important to ensure there are no accumulated piping screw shavings, cutting oil, rubbish, etc. in the secondary side of the air filter for compressed air, etc.
- (4) When screwing pipes or joints, make sure shavings and sealant do not enter the interior of the product.
- (5) When the joints are screwed into the unit, excessive force may cause damage. After screwing in the joints lightly, tighten the joints 1/4 turn as a guide. The reference value of the tightening torque is approx. 10 - 14 Nm.
- (6) A plug (tentative seal plug) has been attached to the pipe connection and/or intake/exhaust at the factory to prevent foreign substances from entering. Please remove before using the product.



2.3.8 Precautions for Ancillary Devices

Confirm the following items on ancillary devices of this product.

- (1) In the factory state, the speed controller, which is a standard feature of the product, is set to full open. Please rotate towards "close" (clockwise), and adjust the open-close time before using.
- (2) Rotation speed can be adjusted with the speed controller; do not adjust speed on the decompression valve. Furthermore, please take caution when adjusting the speed, as high-speed switching of the valve may cause the water hammer phenomenon of the valve to occur.
- (3) If the open-close time of this product influences system operation timing, please ensure there is ample open-close time. There may be variations in open-close time due to conditions, such as fluid pressure and temperature.
- (4) Resin silencers and other parts are shipped in the same packaging, but not attached to prevent damage that may occur in transit. Please ensure that these are attached after the valves have been installed and before operation.

2-4 Use and Adjustment



2.4.1 Operating Air

Confirm the following items on operating air of this product.

- 1) Only use clean operating air.
- 2) Ensure that the pressure of compressed air, etc. supplied to this product is within the range between 0.4MPa and 0.7MPa. If this product is used for the TRITEC with over 0.5MPa supply pressure, please ask us about cylinder specifications.
- 3) Ensure that foreign substances in operating air are removed with an air filter. A filtration accuracy of 40 μm or below should be selected.
- 4) Ensure that supply air is dehumidified with an air dryer (atmospheric pressure converted to dew point/temperature of at or below -15°C), and water in the air is removed.
- 5) Do not use compressed air, etc. which contains chemicals listed below; doing so may result in damage and malfunction.
 - Chemical/organic solvent-based synthetic fluid, corrosive gases, degraded compressor oil
- 6) As for pneumatic pressure, select an ancillary device (solenoid valve, regulator, filter, air pipe diameter, joints, etc.) with the expectation of pressure loss, so that the specified pressure is maintained at the product's air feed port. There may be instances of slower open-close time.
- 7) Due to lack of supply of compressed air, etc. to the product, intermittent operation of the piston may occur or the valve may jam. Pay close attention to supply amount and supply pressure.
If the air piping is 5 m or longer, it will be necessary to take measures, such as increasing the piping's diameter.
- 8) As cylinder capacity will vary greatly depending on model of the pneumatic actuator, it is important to pay close attention to 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. Inadequate air supply amount or air supply pressure may affect opening/closing operation of the valve.

Sometimes necessary amount and pressure cannot be supplied to this product due to pressure loss within pneumatic systems with long piping at the end of a plant's piping or at the opening of this product's air piping. In the event of absolute necessity, take measures, such as installing auxiliary air tanks.



2.4.3 Operation Confirmation

When this product is purchased separately, confirm operation according to the following procedure.

- (1) Confirm that there is no flaw in the appearance, failure or loss of parts.
- (2) Verify that the product itself is not malfunctioning.
- (3) After connecting to the valve, adjust the valve opening.
- (4) Confirm valve opening/closing operation.

When this product integrated with a valve (hereinafter "finished product") is purchased, confirm operation according to the following procedure.

- (1) Confirm that there is no flaw in the appearance, failure or loss of parts.
- (2) Confirm that pipelines for compressed air and electric signals are connected.
- (3) Confirm that there is no air leak in piping connections and this product.
- (4) Confirm valve opening/closing operation.



CAUTION!

2.4.4 Valve Opening Adjustment

Adjust the valve opening while paying attention to the following points.

- (1) When purchasing finished products, do not loosen the stopper bolts at the closing side. 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, discharge compressed air from this product. If there is any residual pressure due to compressed air, the stopper bolts may fly out.
- (3) After adjustment, confirm that there is no air leak from the stopper bolts.



CAUTION!

2.4.5 Open-Close Time

If the open-close time is shorter than the minimum time of the product specifications, durability of this product may be reduced.



2.4.6 Modifications

Never modify this product as reduction in durability or breakage of this product may pose a danger to the environment.



CAUTION!

2.4.7 External Manual Operation

Pay attention to the following items at external manual operation.

(1) For double-acting cylinders only: it is possible to manually open/close by using a spanner wrench on the output shaft of the actuator after obtaining pressure equalization of supply and exhaust pressure in the bypass valve.

Please note that, when the bypass valve is opened, the valve opening changes due to fluid pressure.

(2) There is a danger of sudden change in manual operation torque at change of valve opening. The change may make you lose balance, resulting in falling. Please ensure that the scaffold and work space is safe before processing.

2.4.8 Others

(1) After supplying this product with compressed air, etc. and then shutting off the supply for a long time, it may not maintain the valve opening position.

(2) When resuming operation after a long rest period (5 or more days), it may take longer than usual to operate due to increased grease viscosity and increased valve resistance.

2-5 Maintenance



WARNING!

2.5.1 Residual Pressure

A jet of compressed air or unexpected movements may occur due to residual pressure in the cylinder even after supply of compressed air, etc. to this product is stopped. Perform installation work and maintenance after removing residual pressure from the cylinder.



CAUTION!

2.5.2 Maintenance and Inspection of This Product

Please follow the procedures in 5-1 Procedure for Disassembly and 5-2 Procedure for Reassembly in this document for maintenance and inspection. Perform maintenance and inspection of this product while paying attention to the following item.

(1) Never loosen the bolts in circumstances where compressed air is supplied or this product or valve may start moving. Otherwise, a jet of compressed air or unexpected movements may occur.



2.5.3 Daily Inspection

Perform daily inspection of this product on the following items.

(1) Drain water in the filter regulator from the drain exhaust port.

(2) While this product is running, inspect the product visually from a safe distance, check to see if there are any loose bolts or anything unusual about its appearance as well as exterior air leak and any air leak in the pipe joints or exhaust port, and be sure to listen for any abnormal noises or rattling.

(3) Inspect the product to see if there are any loose bolts, exterior air leaks, or any air leaks in the exhaust port or pipe joints when this product is in a state of rest, but with compressed air supplied.



2.5.4 Periodic Inspection

Perform periodic inspection of this product on the following items

- (1) Check for loose bolts and air leaks after opening/closing 50,000 times or once a year, whichever comes first; tighten bolts and exchange consumable parts as needed.
- (2) From the second year, the above-mentioned inspection should be made every year.



2.5.5 Removal and Installation

- (1) If this product is to be removed from the valve, it is necessary to shut off the power and compressed air, and ensure that all residual pressure has been exhausted from the machinery and piping before commencing. Otherwise a jet of compressed air or unexpected operation may occur.
- (2) When two or more valves and this product are removed, put numbers or marks on the valves and the product to identify the valve and the product which have been connected before the removal. Wrong installation may cause failure or malfunction of the equipment.
- (3) Make match marks on the top plates of this product and the valve to indicate the installation orientation of this product. Wrong installation orientation may cause malfunction.
- (4) Please 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 them may cause malfunction.
- (5) When this product is removed, the valve full closing position may be changed. Check valve seat leak. In the event of leak, adjust the full closing position.
- (6) At installation, confirm 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 Replacing Consumable Parts

Be sure to disassemble or assemble in a clean area that has no particles, rubbish, debris or dust.

Replace consumable parts according to procedures in 5-1 Procedure for Disassembly and 5-2 Procedure for Reassembly.

2.5.7 Lubricating

As the sliding parts of the inside of this product are lubricated, supply air lubrication is not needed.

However, it is recommended that a grease up is performed every opening/closing 50,000 times or once a year, whichever comes first.

2.5.8 Confirming Safe Conditions

When performing maintenance or inspections, be sure to keep all workers well informed about the shut off of power and compressed air, complete exhaust of all residual pressure, and turning on the power and compressed air again.

2.5.9 Disposal

Dispose of this product while paying attention to the following items.

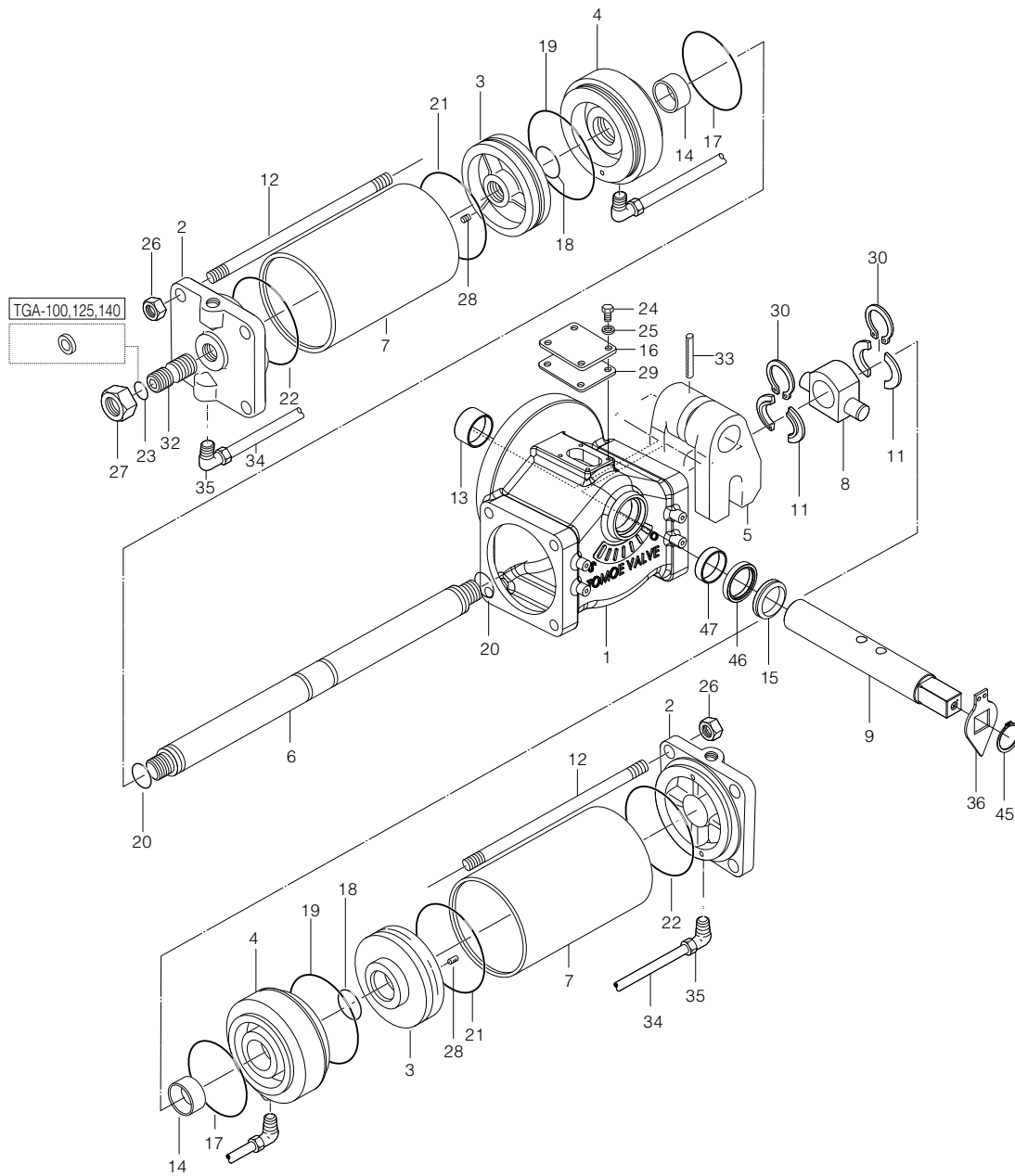
- (1) Do not dispose of this product by incineration. There are possibility of generation of toxic gas and burst. Therefore please dispose of it as general industrial waste. This product does not contain materials which cannot be disposed of as general industrial waste.
- (2) When disposing of this product after separation, classify materials according to the materials specified on drawings.
- (3) Dispose of this product according to laws and regulations.



CAUTION!

3. STRUCTURE

3-1 Expand View (TGA-100 to 160: Double-acting)

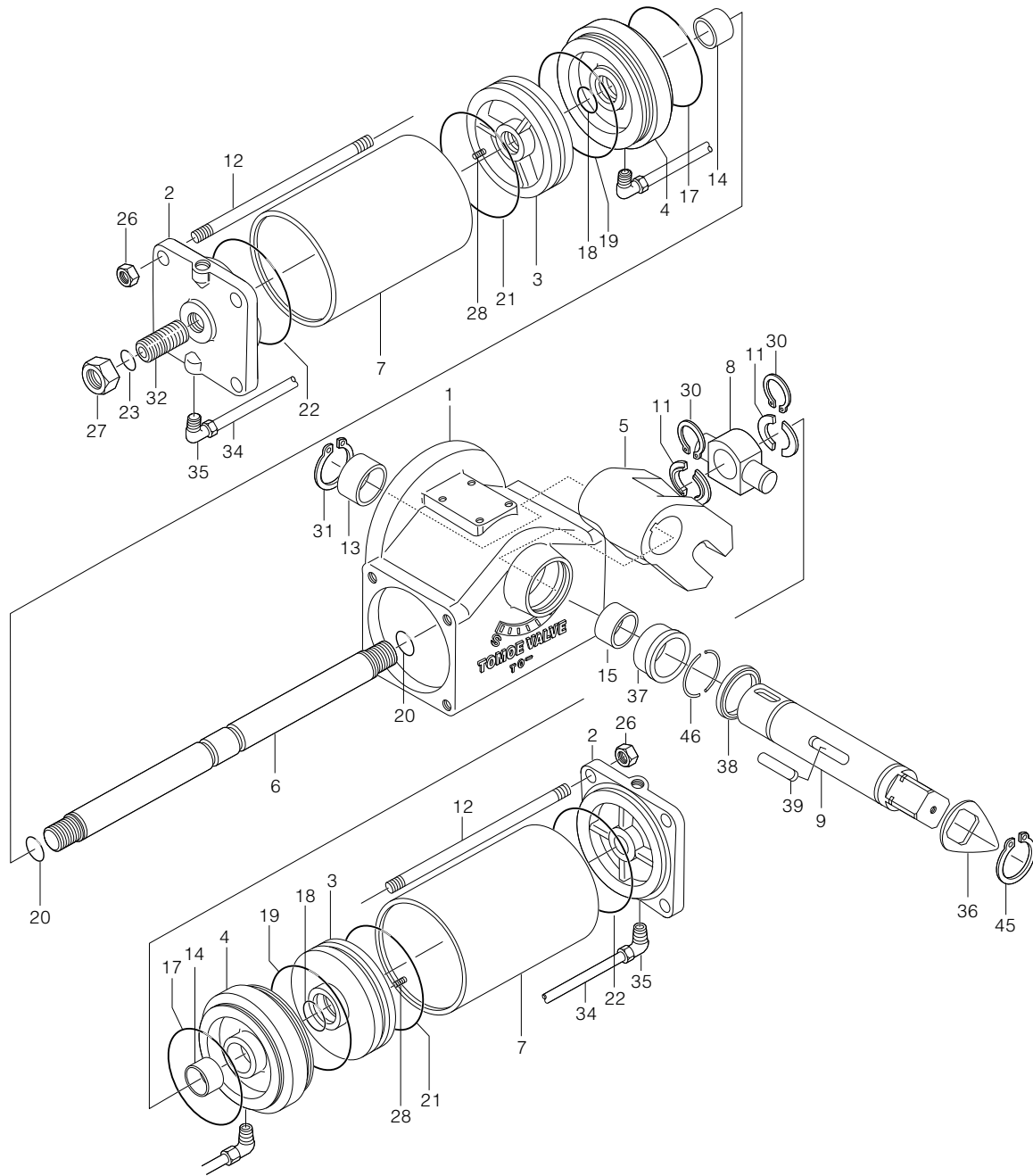


Remark: Parts with a "star ★" in Remarks are included in "O-ring set". To order the parts, please specify "O-ring set". When replacing consumable parts, please replace all the parts with a "star ★".

No.	Description	Q'ty	Remarks
1	Body	1	
2	Head cover	2	
3	Piston	2	
4	Rod cover	2	
5	Arm	1	
6	Piston rod	1	
7	Case	2	
8	Trunnion	1	
9	Shaft	1	
11	Rings	2 sets	
12	Tie bolt	8	
13	Bush	1	
14	Bush	2	
15	"V" ring	1	★
16	Cover	1	
17	"O" ring	2	★
18	"O" ring	2	★
19	"O" ring	2	★
20	"O" ring	2	★

No.	Description	Q'ty	Remarks
21	"O" ring	2	★
22	"O" ring	2	★
23	Seal washer	1	TGA-100,125,140 ★
	"O" ring		TGA-160 ★
24	Hexagon bolt	4	
25	Spring washer	4	
26	Hexagon nut	8	
27	Hexagon nut	1	
28	Lock nut	2	
29	Seat packing	1	
30	C-retainer	2	
32	Stopper bolt	1	
33	Spring pin	4	2 for TGA-125
34	Copper pipe	2	
35	Pipe coupler	4	
36	Indicator	1	
45	C-retainer	1	
46	Oil seal	1	★
47	Bush	1	

3-2 Expand View (TGA-180 to 250: Double-acting)

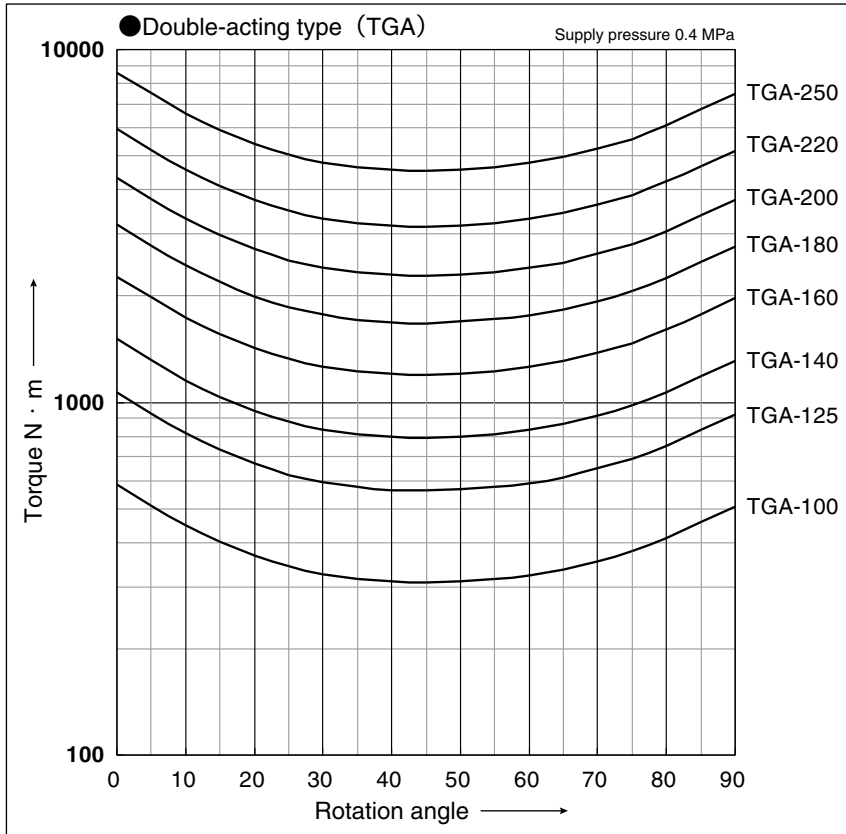


Remark: Parts with a "star ★" in Remarks are included in "O-ring set". To order the parts, please specify "O-ring set". When replacing consumable parts, please replace all the parts with a "star ★".

No.	Description	Q'ty	Remarks
1	Body	1	
2	Head cover	2	
3	Piston	2	
4	Rod cover	2	
5	Arm	1	
6	Piston rod	1	
7	Case	2	
8	Trunnion	1	
9	Shaft	1	
11	Rings	2 sets	
12	Tie bolt	8	
13	Bush	1	
14	Bush	2	
15	Bush	1	
17	"O" ring	2	★
18	"O" ring	2	★
19	"O" ring	2	★
20	"O" ring	2	★

No.	Description	Q'ty	Remarks
21	"O" ring	2	★
22	"O" ring	2	★
23	"O" ring	1	★
26	Hexagon nut	8	
27	Hexagon nut	1	
28	Lock nut	2	
30	C-retainer	2	
31	C-retainer	2	
32	Stopper bolt	1	
34	Copper pipe	2	
35	Pipe coupler	4	
36	Indicator	1	
37	Bush	1	
38	Oil seal	1	★
39	Key	1	
45	C-retainer	1	
46	Stop ring	1 set	

3-3 Output Torque Curve

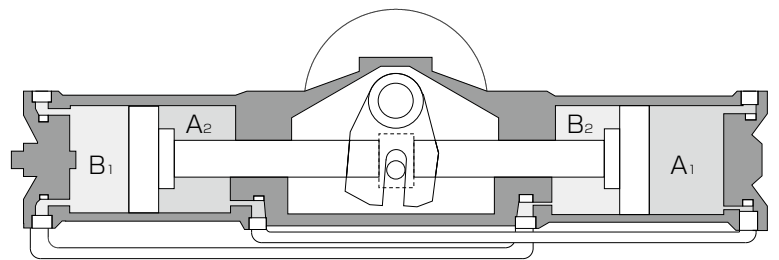


(CAUTION!)

- — Lines show output torque curve by actuator.
- The table shows the torque at an operating air pressure of 0.4 MPa.

3-4 Air Consumption

Type	Cylinder capacity (ℓ)	
	A (O→S)	B (S→O)
TGA-100	1.980	1.980
TGA-125	3.629	3.629
TGA-140	5.113	5.113
TGA-160	7.713	7.713
TGA-180	10.847	10.847
TGA-200	14.730	14.730
TGA-220	20.229	20.229
TGA-250	29.278	29.278



$$A = A_1 + A_2$$

$$B = B_1 + B_2$$

(1) Required air consumption

Double-acting type

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

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

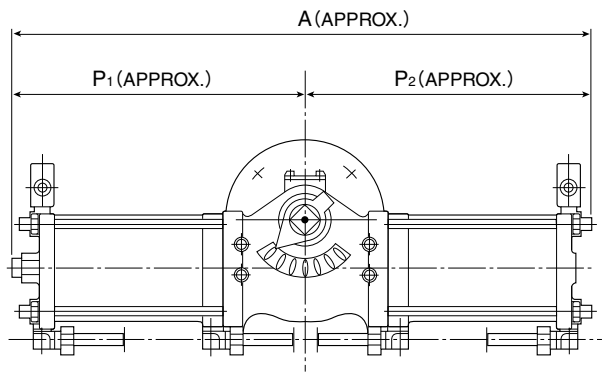
(2) Air consumption within a unit time

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

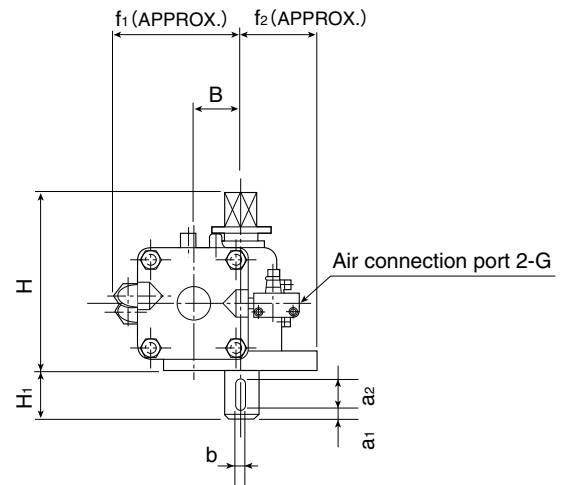
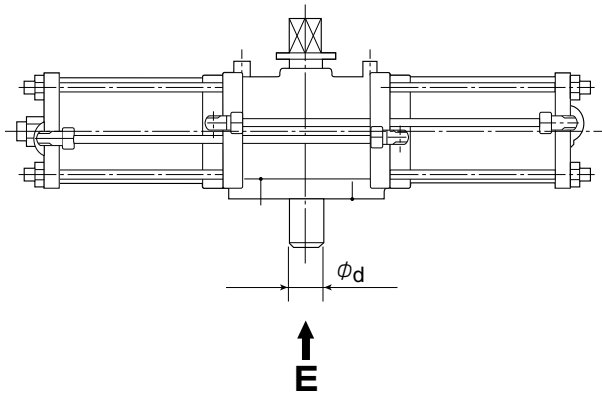
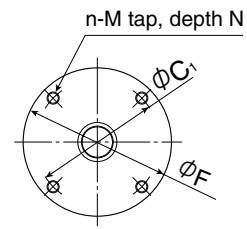
CD : Double-acting type cylinder air consumption (Nℓ/sec)
 t : Unit time (sec)

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

3-5 Major Dimensions



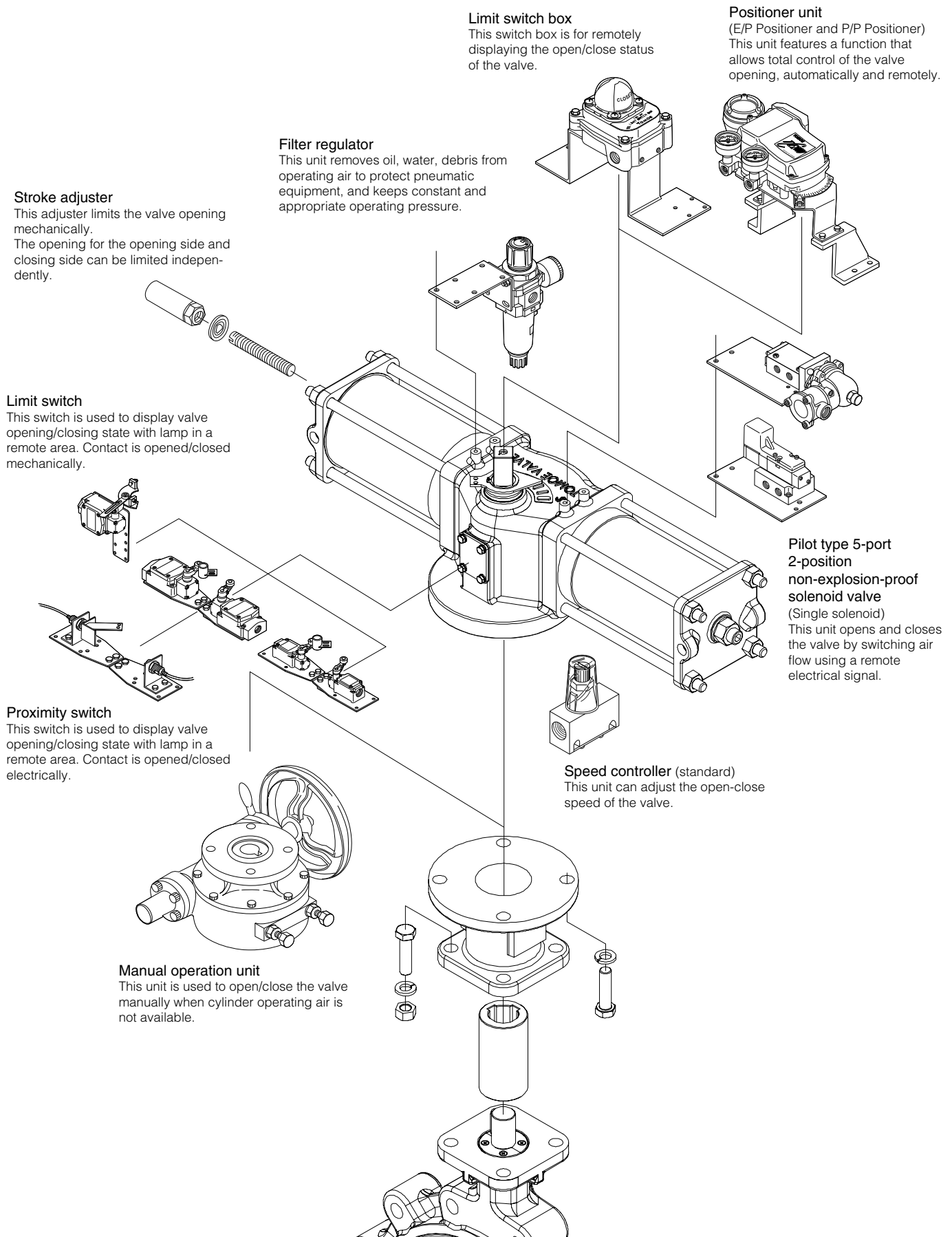
VIEW "E"



Type	Dimension (mm)																		Approx. weight (kg)
	A	P ₁	P ₂	f ₁	f ₂	B	H	H ₁	ϕd	b	a ₁	a ₂	ϕF	C ₁	n	M	N	G	
TGA-100	682	350	332	133	77.5	50	189	45	30	10	2	40	155	125	4	M12	15	Rc1/4	18
TGA-125	754	381	373	164	100	62	234	45	30	12	2	40	200	170	4	M16	20	Rc3/8	31
TGA-140	840	432	408	180	100	70	282	60	45	12	2	55	200	170	4	M16	20	Rc3/8	40
TGA-160	954	483	471	203	130	80	310	61	60	15	2	55	260	220	4	M20	25	Rc3/8	84
TGA-180	1069	543	526	221	130	90	323	65	65	18	2	60	260	220	4	M20	25	Rc3/8	115
TGA-200	1175	599	576	254	160	100	370	70	75	20	2	65	320	280	8	M20	25	Rc1/2	163
TGA-220	1263	642	621	271	160	110	400	85	75	20	2	80	320	280	8	M20	25	Rc1/2	188
TGA-250	1393	707	687	302	160	125	433	100	75	20	2	95	320	280	8	M20	25	Rc1/2	254

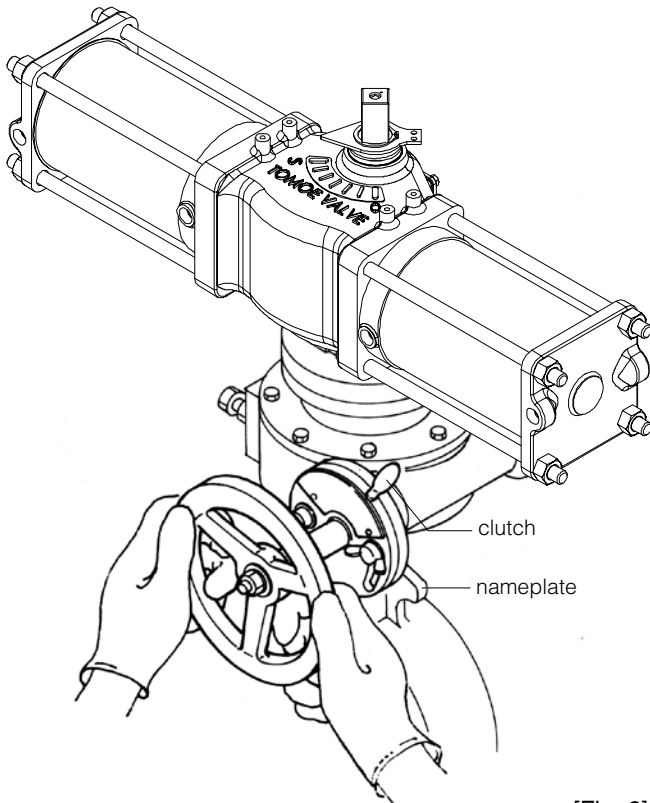
4. CYLINDER SYSTEM CONFIGURATION

4-1 System Configuration



[Fig.-1]

4-2 Manual Operation Procedure



[Fig.-2]

(1) Manual Operation Procedure

1) Operate the clutch according to the operation instructions on the nameplate on the gear, and turn the handwheel to open and close the valve.
[Fig. -2]

2) After operation, always return the clutch to its automatic position.

(2) Recovery after completion of manual operation

1) After operation, always return the clutch to its automatic position.

2) Reconnect the solenoid valve or the air pipes.

5. CYLINDER MAINTENANCE

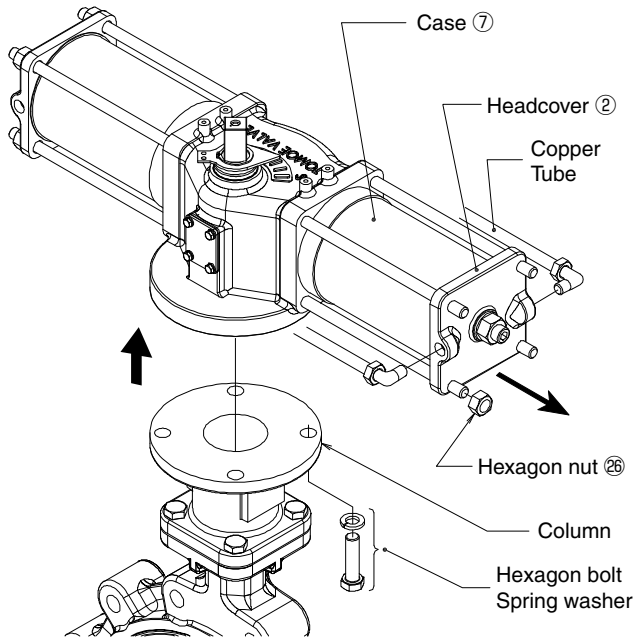
5-1 Procedure For Disassembly



Caution

Before disassembly, be sure to read "SAFETY PRECAUTIONS" of this document once again.

In periodic checking or when trouble is caused by abrasion or damage of packings or sliding parts, disassemble the machine in the following sequence referring to the figure of internal design.



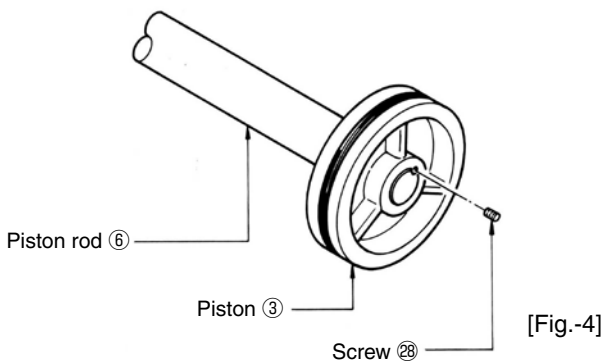
[Fig.-3]

Removal from Valve

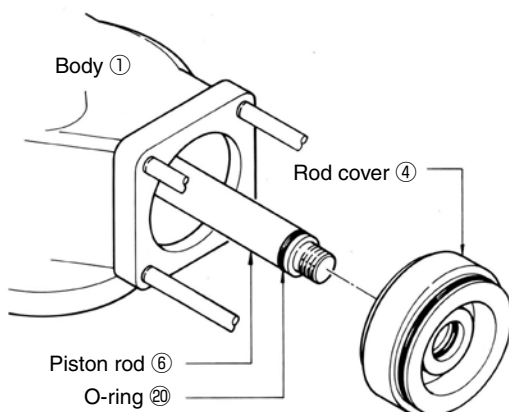
- (1) Remove air pipes and electric wiring from this product.
- (2) Remove bolts and spring washers that fasten this product to column, and then remove this product from column. [Fig.-3]

Procedures for Disassembly

- (1) Remove hexagon nut ⑳. [Fig.-3]
- (2) Draw out head cover ② to remove cylinder case ⑦. [Fig.-3]
- (3) Remove piston ③ by loosening screw ㉘. (It must be noted that the screw is "crimped".) [Fig.-4]
- (4) Loosen piston ③ and remove it from piston rod ⑥. [Fig.-4]
- (5) Draw out rod cover ④ from piston rod ⑥ on which O-ring ㉚ kept fitted. [Fig.-5]

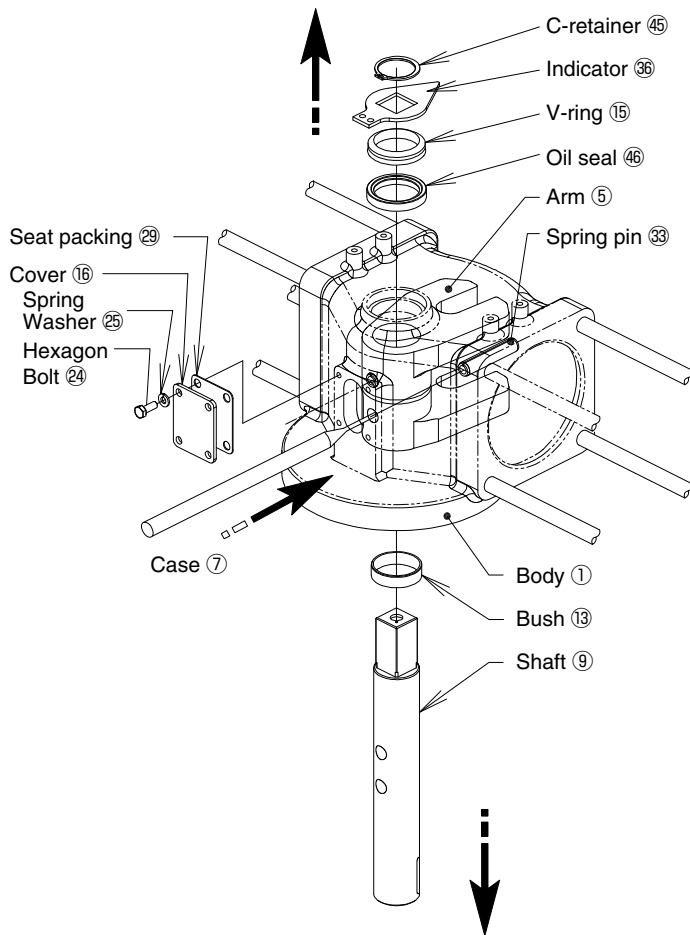


[Fig.-4]

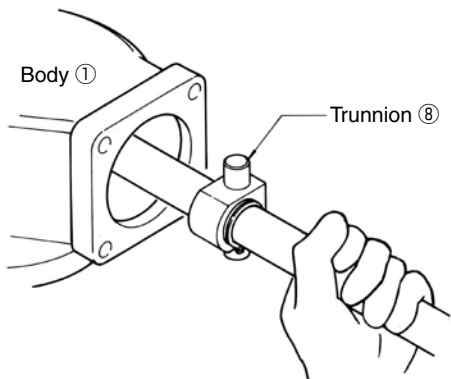


[Fig.-5]

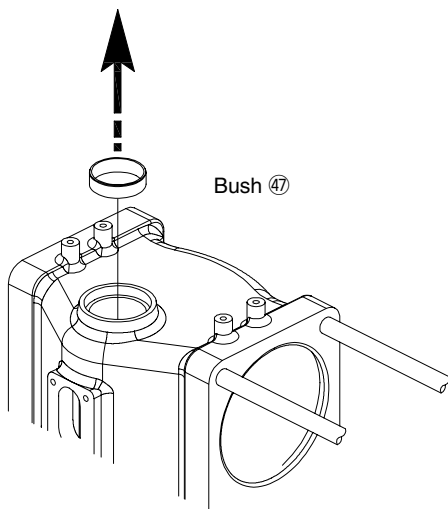
Type TGA-100 to 160



[Fig.-6]



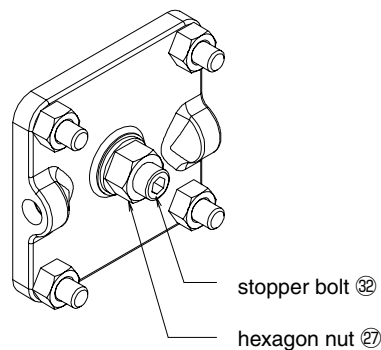
[Fig.-7]



[Fig.-8]

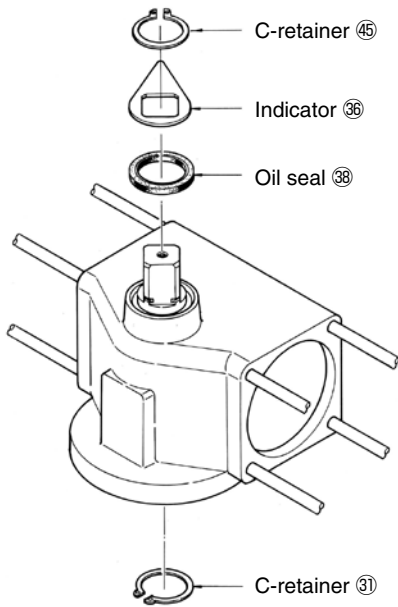
- (1) Remove hexagon bolt (24) and spring washer (25). [Fig.-6]
- (2) Remove seat packing (29) between cover (16) and body (1), and a front hole is found. Rotate arm (5) to the position where spring pin (33) is visible through the hole. (Indicator intermediate position) [Fig.-6]
- (3) Separate arm (5) from trunnion (8), and take out piston rod (6) on which trunnion (8) is attached from body (1). [Fig.-7]
- (4) Remove spring pin (33) by striking it with a flat point punch or a slightly thinner bar. If spring pin (33) is drawn out completely, shaft (9) and arm (5) can be separated from each other. [Fig.-6]
- (5) Remove C-retainer (45), indicator (36), V-ring (15), and oil seal (46), then shaft (9) and bush (13) can be pulled out downward. [Fig.-6]
- (6) As bush (47) is left in the body (1), pull it out from above. [Fig.-8]

Remark: Never loosen hexagon nut (27) and stopper bolt (32). [Fig.-9]



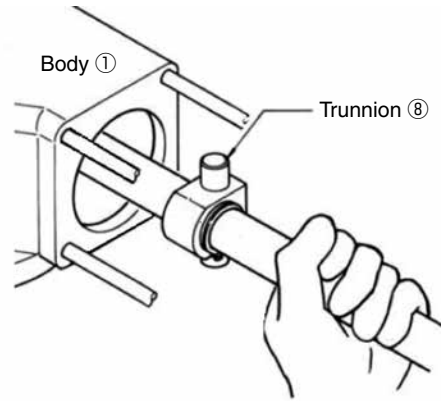
[Fig.-9]

Type TGA-180 to 250

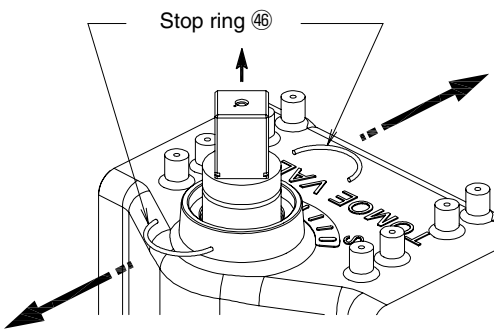


[Fig.-10]

- (1) Remove C-retainer ④⑤, indicator ③⑥, oil seal ③⑧ and C-retainer ③①. [Fig.-10]
- (2) Separate arm ⑤ from trunnion ⑧, and take out piston rod ⑥ on which trunnion ⑧ is attached from body ①. [Fig.-11]

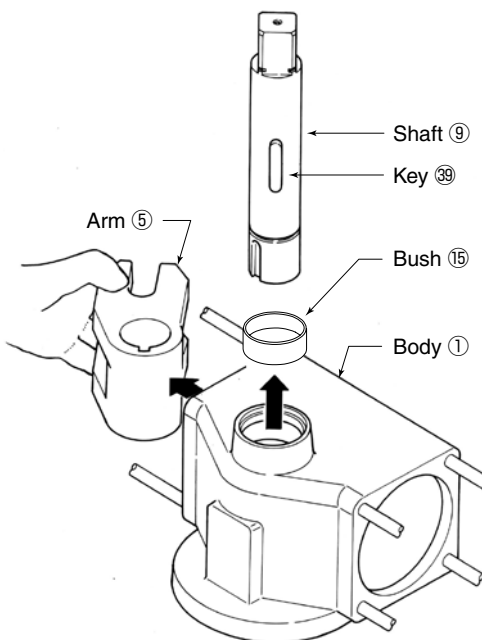


[Fig.-11]

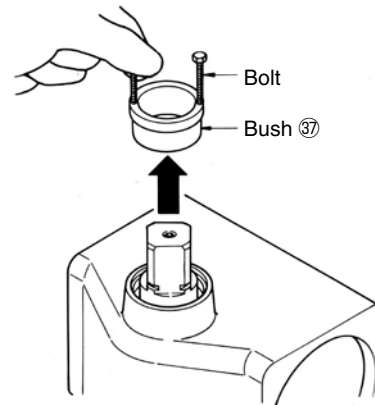


[Fig.-12]

- (3) Lift shaft ⑨ upward a little and remove stop ring ④⑥. [Fig.-12]
- (4) Thrust a bolt into tapped hole of M5 located on the top of bush ③⑦ and pull bush ③⑦ out.

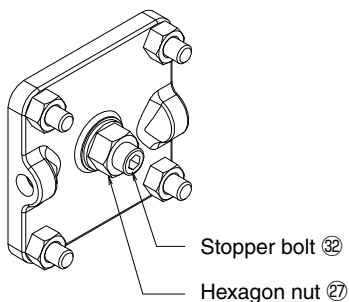


[Fig.-14]



[Fig.-13]

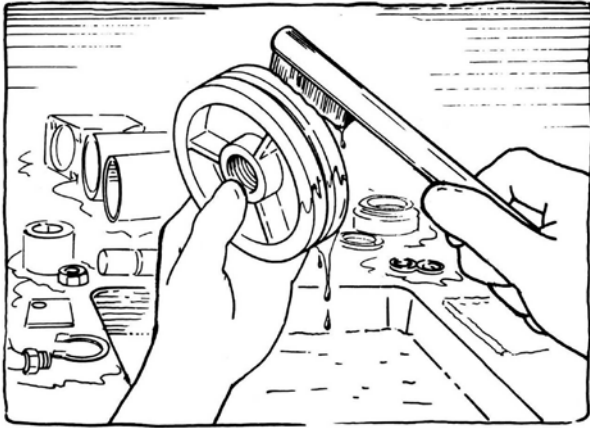
- (5) Draw out shaft ⑨ from bush ③⑤ by pulling it upward. Shaft ⑨ is drawn with attached key ③⑨. [Fig.-14]
- (6) Arm ⑤ can be removed from body ①. [Fig.-14]



[Fig.-15]

Remark: Never loosen hexagon nut ②⑦ and stopper bolt ③②. [Fig.-15]

5-2 Procedure for Reassembly



[Fig.-16]

(1) Wash parts well and make certain of no scratch and no dust on them before beginning the reassembly. [Fig.-16]

(2) Consumable parts (O-rings, packings, bearings, etc.) deteriorate over time even if not abraded. Replace all the consumable parts.

(3) Be sure to apply grease to sliding parts such as O-rings, packings and bearings.

(4) Check sliding parts such as bushes and pistons well for partial abrasion or scratch, and if any damage is found, replace them with new ones.

(5) Check the inner hard chromium plated surface of piston rod ⑥ or cylinder case ⑦ carefully for scratch or hitmark. Deep scratches or burrs cause damage to O-rings and packings, reducing the life of seal.

(6) Be sure to apply grease before reassembly. Refer to <Table-1> for the types of grease used. Refer to [Fig.-17], [Fig.-18] and [Fig.-20] for the parts to be applied and the application areas. Refer to <Table-2>, <Table-3>, <Table-4> and <Table-5> for the application amount and the application area dimension.

(7) The order of reassembly is the reverse of disassembly, but arm ⑤ must be reassembled so that the parallel part of the side of arm ⑤ is positioned right under "S" (CLOSE) of indicator on the top of body ①. [Fig.-19]

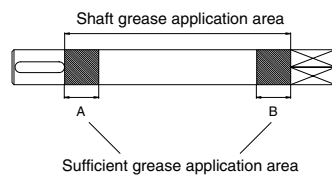
<Table-1> Grease Specifications

Type	(1) Manufactured by Idemitsu: Daphne Eponex Grease No.2 (2) Manufactured by SUMICO LUBRICANT CO., LTD.: Moly Powder PC Mix the above-mentioned two kinds of grease.
Mixing ratio	Daphne Eponex Grease : Moly Powder 97:3
Precautions at mixing	Mix Moly Powder, being careful not to solidify the powder, until uniform powder is obtained.

<Table-2>

Table of Sufficient Shaft Grease Application Area Dimensions

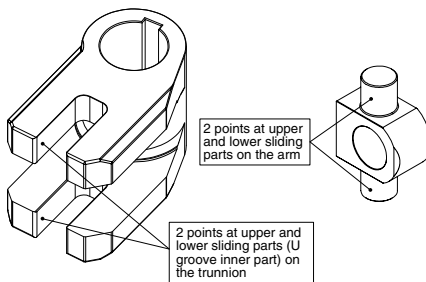
Type	A	B
TGA100	20	30
TGA125	20	30
TGA140	30	40
TGA160	30	40
TGA180	30	30
TGA200	40	40
TGA220	40	40
TGA250	40	40



[Fig.-17]

<Table-3> Grease Application Amount (Shaft)

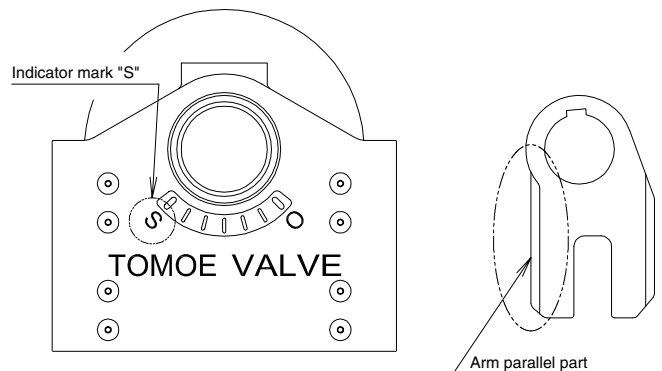
Application area	Part No	Application amount (g)							
		TGA-100	TGA-125	TGA-140	TGA-160	TGA-180	TGA-200	TGA-220	TGA-250
Shaft (Whole)	9	10	15	25	30	35	45	45	50
Shaft (Sliding part)	9	3 x 2 points	3 x 2 points	5 x 2 points	7.5 x 2 points	10 x 2 points	15 x 2 points	15 x 2 points	15 x 2 points



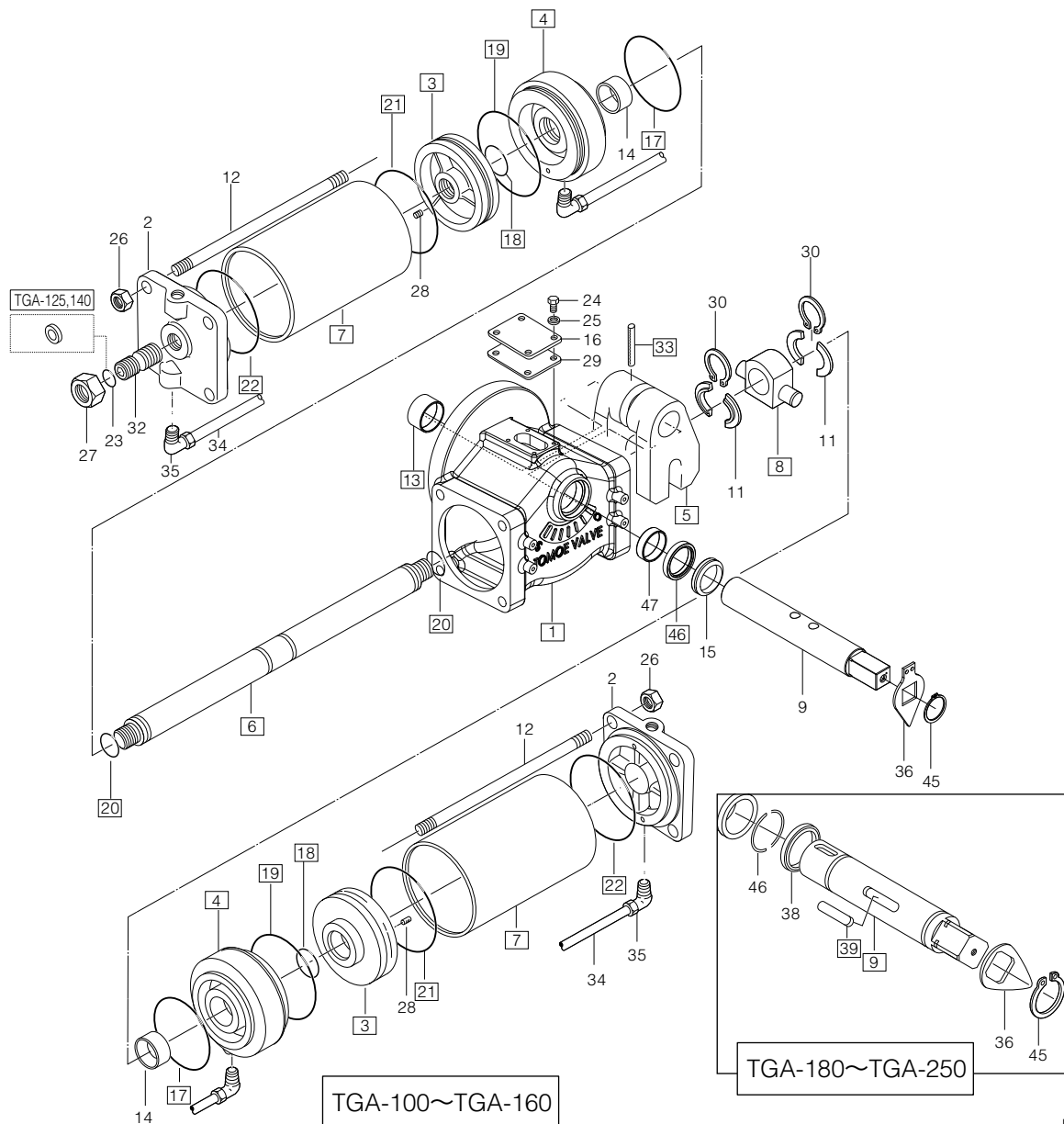
[Fig.-18]

<Table-4> Grease Application Amount (Arm, Trunnion)

Application area	Part No	Application amount (g)							
		TGA-100	TGA-125	TGA-140	TGA-160	TGA-180	TGA-200	TGA-220	TGA-250
Arm sliding part	5	2 x 2 points	3 x 2 points	3 x 2 points	5 x 2 points	5 x 2 points	7.5 x 2 points	7.5 x 2 points	7.5 x 2 points
Trunnion	8	1 x 2 points	1 x 2 points	2 x 2 points	3 x 2 points	3 x 2 points	3 x 2 points	4.5 x 2 points	5 x 2 points



[Fig.-19]

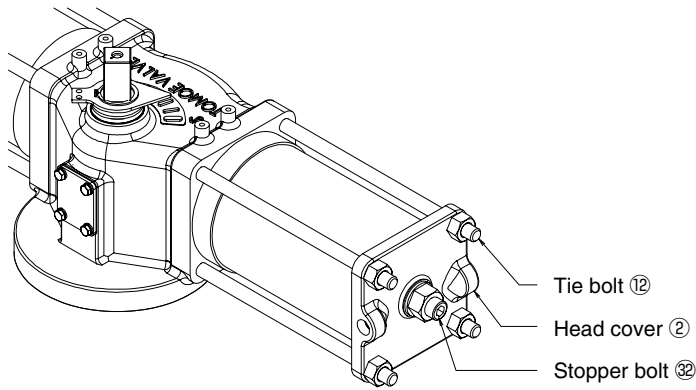


[Fig.20]

<Table-5> Grease Application Amount for Each Part

Application area		Application amount (g)							
		TGA-100	TGA-125	TGA-140	TGA-160	TGA-180	TGA-200	TGA-220	TGA-250
Oil seal	46	2	2	3	4	7.5	7.5	7.5	7.5
Oil seal inner surface	46	0.5	1	1	1.5	2	2	2	2
Key	9	—	—	—	—	1.5	2	2	2
	39	—	—	—	—	1.5	2	2	2
Spring pin	33	0.5	0.5	0.5	0.5	—	—	—	—
Piston rod O-ring O-ring groove	6	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points
	20	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points
Piston rod O-ring	6	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points
	20	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points
Rod cover inner diameter O-ring	18	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	0.5 x 2 points	1 x 2 points	1 x 2 points
Rod cover outside diameter O-ring	17	1 x 2 points	1 x 2 points	1 x 2 points	1 x 2 points	2 x 2 points	3 x 2 points	3 x 2 points	3 x 2 points
	19	1 x 2 points	1 x 2 points	1 x 2 points	1 x 2 points	2 x 2 points	3 x 2 points	3 x 2 points	3 x 2 points
Contact surface between body and rod cover	1	3 x 2 points	3 x 2 points	3 x 2 points	3 x 2 points	7.5 x 2 points	7.5 x 2 points	7.5 x 2 points	10 x 2 points
	4	3 x 2 points	3 x 2 points	3 x 2 points	3 x 2 points	7.5 x 2 points	7.5 x 2 points	7.5 x 2 points	10 x 2 points
Inside of the case	7	30 x 2 points	45 x 2 points	60 x 2 points	75 x 2 points	100 x 2 points	125 x 2 points	150 x 2 points	200 x 2 points
Piston	3	2 x 2 points	2 x 2 points	2 x 2 points	3 x 2 points	3 x 2 points	4.5 x 2 points	4.5 x 2 points	4.5 x 2 points
	21	2 x 2 points	2 x 2 points	2 x 2 points	3 x 2 points	3 x 2 points	4.5 x 2 points	4.5 x 2 points	4.5 x 2 points
Side cover O-ring	22	2	2	3	3	3	3	3	3

(8) Tighten head cover ②, tie bolt ⑫ and stopper bolt ⑬ securely according to torque values in <Table-6>. [Fig.-21]



[Fig.-21]

<Table-6> Bolt Tightening Torque

Part No	Area	TGA-100	TGA-125	TGA-140	TGA-160	TGA-180	TGA-200	TGA-220	TGA-250	Tightening torque tolerance	Tightening tool
②	Cover mounting bolt	M6x15 5.07Nm	M6x15 5.07Nm	M6x15 5.07Nm	M6x15 5.07Nm	M6x15 5.07Nm	M6x15 5.07Nm	M6x15 5.07Nm	M6x15 5.07Nm	±10%	Impact tool
⑬	Stopper bolt	M20 206Nm	M20 206Nm	M24 356Nm	M30 707Nm	M33 962Nm	M33 962Nm	M33 962Nm	M33 962Nm	±10%	Tightening tool
⑫	Tie bolt	M14 67.6Nm	M14 67.6Nm	M16 106Nm	M16 106Nm	M18 145Nm	M20 206Nm	M20 206Nm	M22 280Nm	±10%	Impact tool

5-3 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.	- Open the speed controller.
	- Air leaks inside the cylinder case.	- Check O-rings of the piston.
	- Torque required by a valve is too high.	- Check the valve.
The valve is not fully opened or shut.	- Wrong positioning of the stoppers.	- Adjust the stopper positioning.
	- Torque required by a valve is too high. - Check the valve.	- 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.	- Cover packing of output shaft or case cover is worn out.	- Replace the consumable parts.
	- Loosened bolts of side cover	- Retighten the bolts.

- ◎ The specifications are subject to change without notice. Please consult us for the latest specifications.
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