

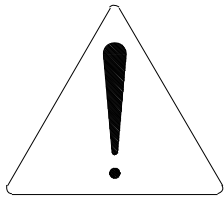


Instruction Manual for Tie Rod Type Cylinder

K Series : 3.5MPa

F Series : 7 · 14MPa

T Series : 21MPa



Safety Precautions

- Thoroughly read the instruction manual before use for correct operation.
Be sure to turn OFF the power switch, completely shut down the hydraulic source and discharge the residual pressure before mounting and maintenance of the cylinder.
- Be sure to apply nominal pressure when using the cylinder.
- When injecting hydraulic fluid into the cylinder, please take great care to prevent physical injury due to the rapid movement of the mounting part.
- Do not attempt to tamper with the cushion plug, air bleeding plug, or check plug during operation.

HORIUCHI MACHINERY

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* Agree with changing the contents in this manual without any permission.

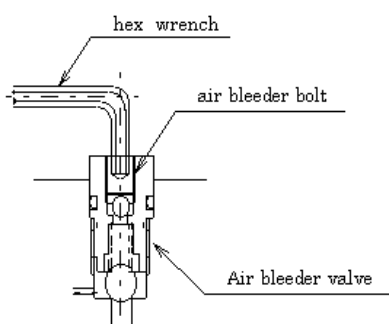
§ 1. CAUTIONS FOR OPERATION

(1-1) Cautions for test run

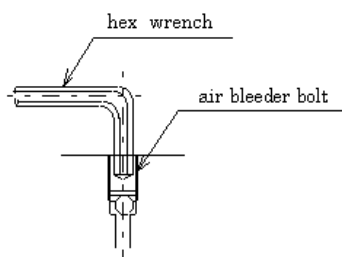
1. When using the cylinder for the first time after installation, apply 0.3-0.5MPa of pressure to check the smooth operation, and open the air-bleeder bolt a half-turn counterclockwise at 20-50mm before the end of the stroke until the oil in the cylinder is bled out free of air, and tighten the air-bleeder bolt again. Under normal conditions, most of the air is removed during the first pass. Be careful not to loosen the air-bleeder bolt too much during this operation and not to apply too much pressure on the cylinder for test run.

(Caution) When air is still remained in the cylinder, white hydraulic oil comes out from the air bleeder bolt. In this case, repeat the air-bleeding procedure until the oil becomes transparent.

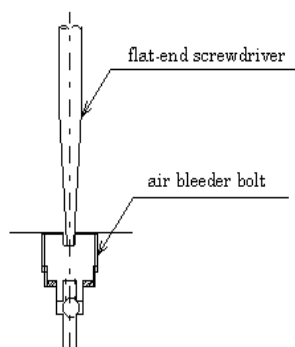
With cushion option(F,T Series)



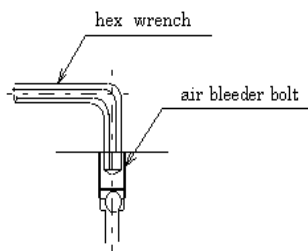
Without cushion option (F,T Series)



With cushion option (K Series)



Without cushion option (K Series)



After completing the air bleeding operation, tighten the air bleeder bolt with the torque shown in the table below to check that there are no oil leakages.

【Tightening Torque for Air Bleeder Bolt】

F Series			T Series			K Series		
	Without Cushion	With Cushion		Without Cushion	With Cushion		Without Cushion	With Cushion
Φ 32	approx. 500~	approx. 400~ 500N · cm	Φ 40	approx. 500~	approx. 400~ 500N · cm	Φ 32	approx. 550~ 750N · cm	approx. 550~
Φ 125	650N · cm		Φ 125	650N · cm		Φ 80		700N · cm
Φ 140	approx. 600~	approx. 400~ 500N · cm	Φ 140	approx. 600~	approx. 400~ 500N · cm	Φ 100	approx. 550~ 750N · cm	approx. 800~
Φ 250	800N · cm		Φ 250	800N · cm		Φ 160		1000N · cm

2. Clean the inside of the supply pipes to the cylinder by pickling or other methods and take extreme care not to flow debris and filings into the cylinder. Debris and/or metallic filings generated from pipe set-up or improper cleaning can later flow into the cylinder and cause damage on the packing, resulting in oil leakage. Air entered into the system during supply line set-up must be bled out. Air remained in the system may cause the following problems:

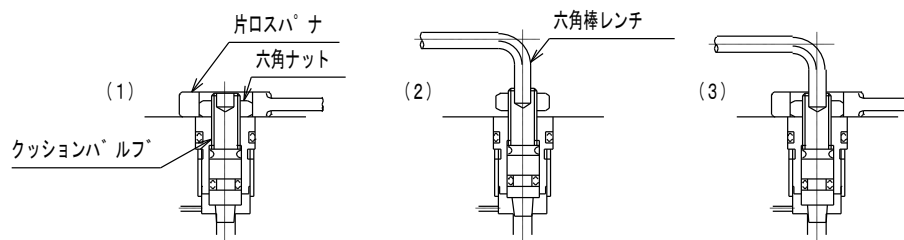
- 1) Air contamination with oil
- 2) Inability to control speed.
- 3) Damage on the packing due to increase in temperature caused by adiabatic compression.
- 4) Transmission of vibration and shock to external parts.

3. After completing the air bleeding procedure, under a low hydraulic pressure, operate the cylinder by gradually increasing the pressure to the specified level. Keep the cylinder speed at about 50mm/sec during this operation.

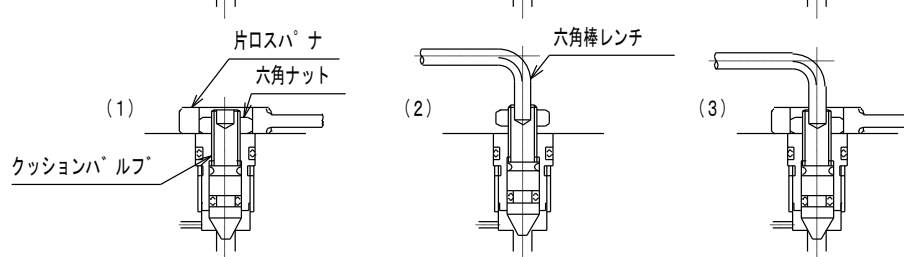
4. In case of models with the cushion attached, the cushion is not factory adjusted. In these models, increase piston speed gradually and adjust the cushion option. Increasing piston speed from the start or too rapidly may generate abnormal surge pressures which can damage the cylinder and/or attached devices.

5. Adjust the cushion valve as shown in the illustration below.

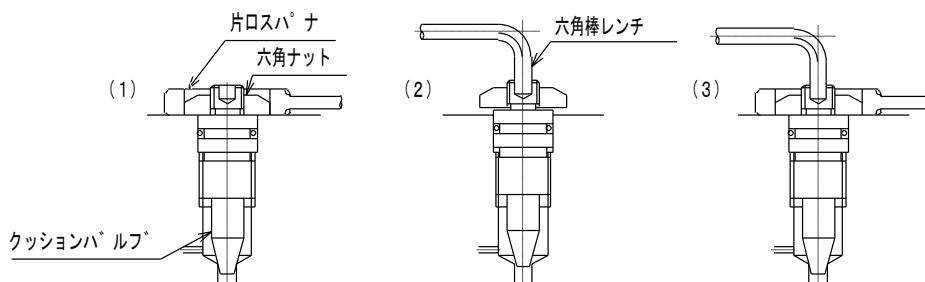
Bore
F series
$\phi 32 \sim \phi 125$



Bore
T series
$\phi 40 \sim \phi 125$



Bore
F series
$\phi 140 \sim \phi 250$
T series
$\phi 140 \sim \phi 160$



- (1) Loosen the hex nut 1/4 turn counterclockwise (turning it to the left).
- (2) Turning the cushion valve clockwise (to the right) will result in a decrease in cushion speed: Turning it counterclockwise (to the left) will result in an increase in speed. However, turning it too far clockwise to the right can result in abnormal hydraulic pressure surges. In contrast, turning it too far to the left can cause a loss of the cushion's function.
- (3) After the adjustment of the cushion valve, use the hex wrench to lock the cushion valve's position. Tighten the hex nut with the torque shown in the specifications in the table below.

(Caution 1) Excessive loosening the hex nut may cause fall-off.

(Caution 2) The cushion mechanism in the cylinder prevents damage on the cylinder; however, its ability to absorb inertia forces is limited, so it is necessary to exercise caution in adjustment.

【Cushion Valve Tightening Torque Specifications】

	F Series		T Series		K Series
Φ 32 Φ 125	approx. 400-500N · cm	Φ 40 Φ 100	approx. 400-500N · cm	Φ 32 Φ 80	approx. 120-150N · cm
Φ 140 Φ 250	approx. 900-1000N · cm	Φ 125 Φ 180	approx. 900-1000N · cm	Φ 100 Φ 160	approx. 800-1000N · cm
		Φ 200 Φ 250	approx. 4200-4600N · cm		

6. The operation environment temperature and the oil temperature should not exceed 80°C for the normal specification or 120°C for the high temperature specification. The heat resistance limits of the packing gaskets used in the assembly are 80°C for standard rated oil and 120°C for high temperature rated oil. Care should be taken to monitor and avoid radiated and transmitted heat.

7. Oil used in operation should be that recommended by the manufacturer or that equivalent to the standard high-grade hydraulic oil.

8. Troubleshooting

When the cylinder does not operate, check the following:

- (1) Failure to operate due to a lack of hydraulic pressure.

With the cylinder attached in place in the hydraulic line system, mount an oil pressure gauge close to the cylinder to make sure that pressure is applied. If not, remove the line connected to the cylinder and check that oil is reaching the cylinder. If oil is not reaching the cylinder, check the lines back toward the hydraulic pump to make sure that there are no oil leaks.

- (2) The cylinder is overloaded beyond its output capacity.

Even if the cylinder is attached correctly, the cylinder is bound by overload. To check if this is the case, remove the load from the cylinder, and try to operate the cylinder only at low pressure.

9. When the cylinder will not operate at specified speed, check the following.
 - (1) Check that the load on the cylinder is not beyond its capacity.
 - (2) Check that foreign matter has not caught in the system and caused destruction of the seal.

10. The cushion option will not operate under the following conditions:
 - (1) When cylinder speed is extremely slow.
 - (2) When cylinder speed is extremely high and the load is beyond cylinder capacity.
 - (3) When the cushion valve is open.
 - (4) When the check ball is not effective.

(1-2) Precautions for normal use

1. Check the following items periodically after the cylinder has been placed in operation.
 - (1) Check oil leakage from the cylinder and lines.
 - (2) Check the hydraulic tank to make sure that the fluid is free of water and debris.
 - (3) Check that the oil is not burned or contaminated.
 - (4) Make sure that supply lines are not loose.
 - (5) Check the cylinder mountings to make sure that there is no distortion or stretching.
 - (6) Check the cylinder mounting bolts to make sure they are tightened in accordance with specifications.
 - (7) Check noises coming from the cylinder. It could be indications of trouble.

2. The packing components are consumables and have to be replaced periodically. Make sure that spare parts are always available. The shelf life of the packing is normally one year. Store the spare part in a dry, cool, and dark place. Ultraviolet light and humidity cause deterioration of the rubber materials used in the packing as well as the distortion of the resin, so it is important to avoid storage in areas with these factors.

§ 2. Cylinder Disassembly

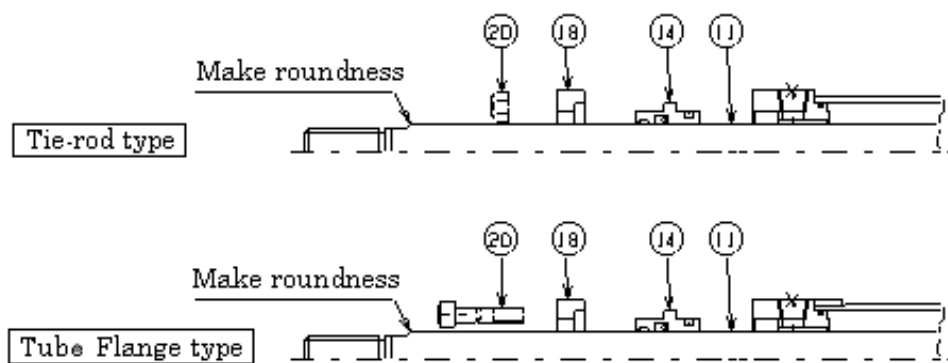
(2-1) Cautions for Cylinder Disassembly

- (1) Before attempting to remove the cylinder, make sure that line pressure is zero and that the electrical power supply has been turned off.

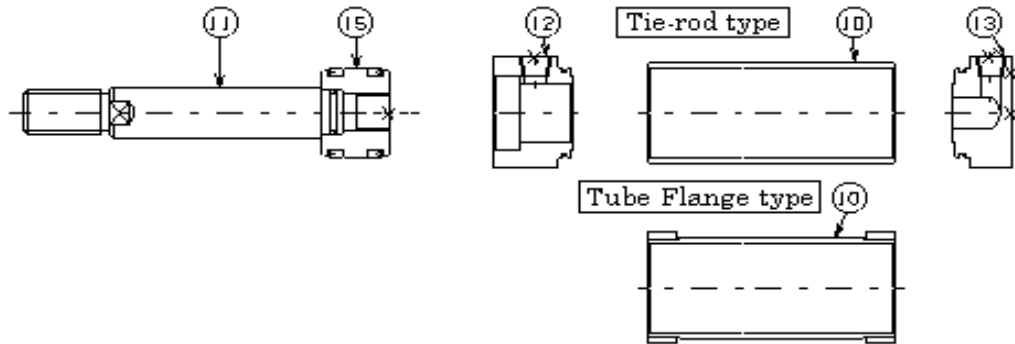
- (2) During disassembly, care must be taken to protect the rod front threads, port threads, and rod surface from damage. For example, dropping banging on the parts may cause damage to the thread surfaces that makes them unfit for further use.
- (3) Be careful not to allow the parts to contact with oils other than those used in the system. Contact with dissimilar oils may cause chemical changes, resulting in seal swelling.

(2-2) Cylinder Disassembly

- (1) Loosen hex nut (20), and remove retainer (18), and rod bushing (14). During this operation, be careful not to damage the piston rod (11) with the wrench during removal or by banging it against other parts. When removing the rod bushing, pay attention so as not to damage the rod bushing or packing.



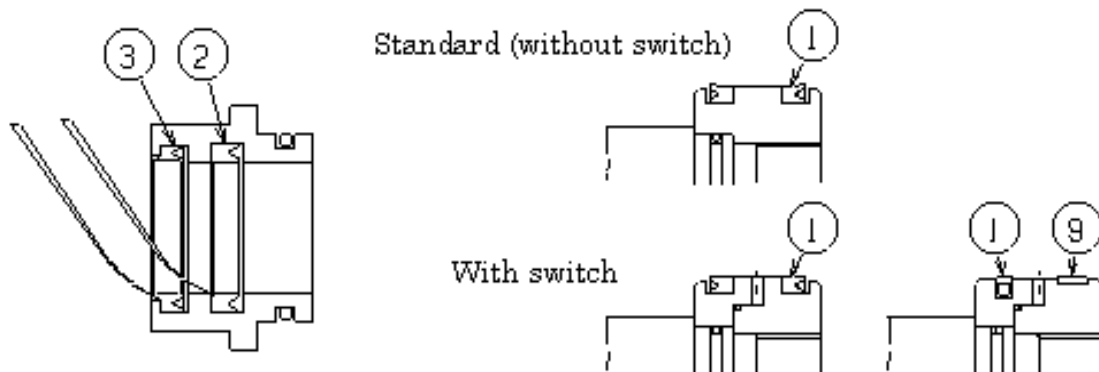
(2) Remove the head cover (13) and rod cover (12) from the cylinder tube (10),



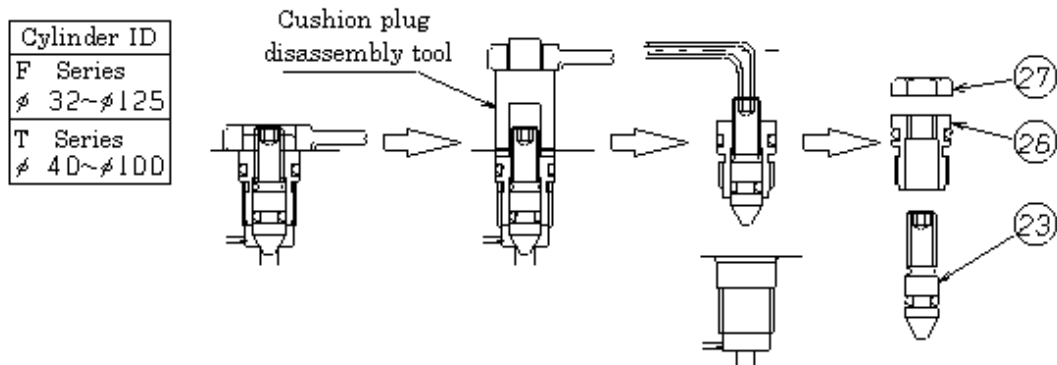
and then the piston/piston rod (15/11) assembly.

(3) Under normal conditions, Loctite is applied on the piston, so the piston cannot be disassembled.

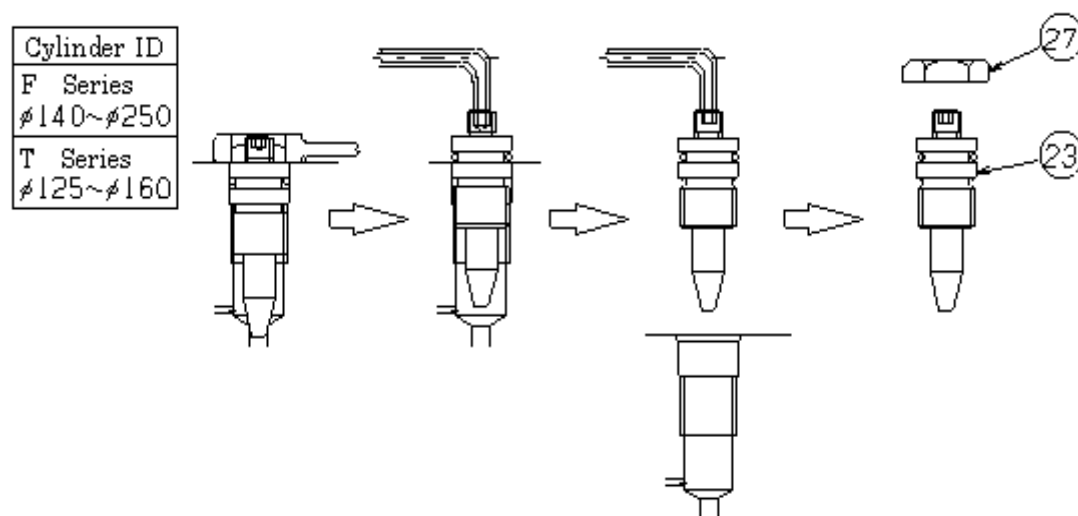
(4) As the front surface is flat copper, follow the illustrations when removing the dust packing (3), rod packing (2), and piston packing (1).



(5) Cushion valve disassembly

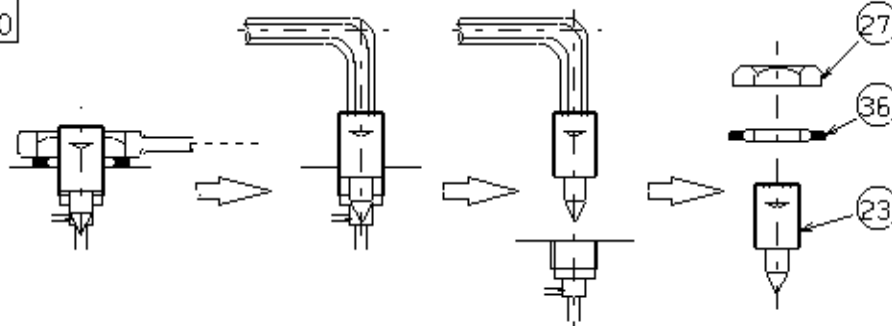


- 1) Remove hex nut (27).
- 2) Use the cushion plug disassembly tool (Horiuchi Machinery Mfg., sold separately) to remove the cushion plug (26) and cushion valve assembly (23).
- 3) Use a hex wrench to remove the cushion valve lower than the cushion plug.



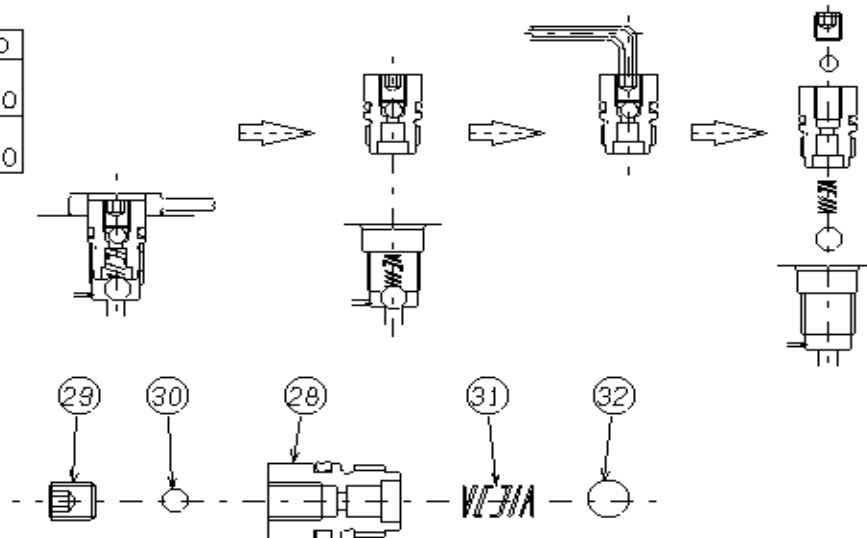
- 1) Remove the hex nut (27).
- 2) Use a hex wrench to remove the cushion valve upper than the cover.

Cylinder ID
K Series
φ 32~φ160



- 1) Remove hex nut (27).
- 2) Remove the needle gasket (36).
- 3) Remove the cushion valve from the cover using a hex wrench.

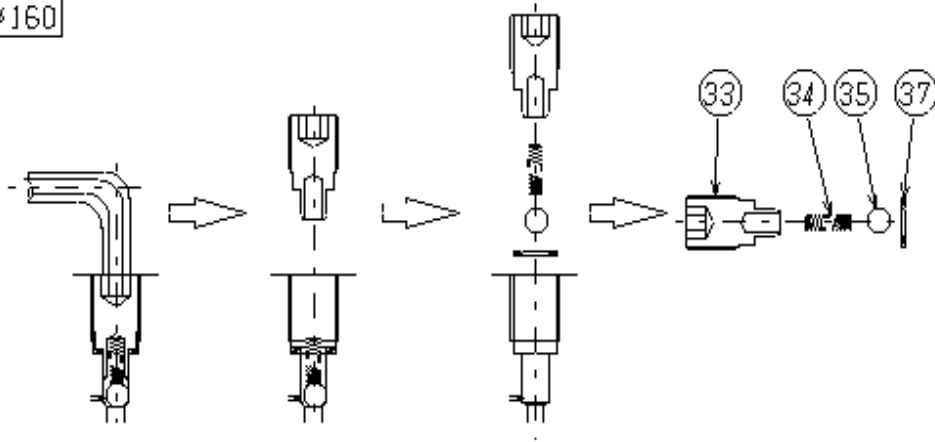
Cylinder ID
F Series
φ 32~φ250
T Series
φ 40~φ160



(6) Air-bleed valve disassembly (with cushion)

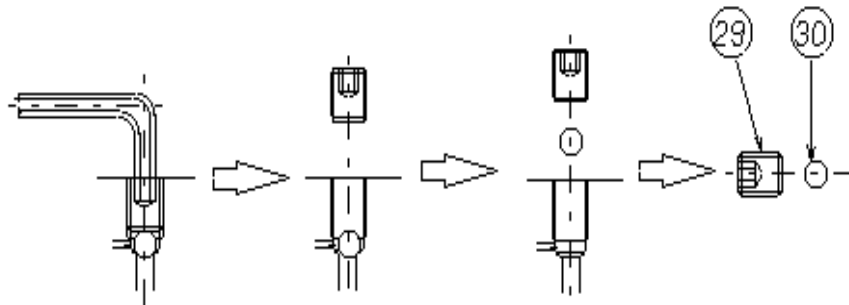
- 1) Loosen the air-bleed valve (28), and remove the air-bleed plug and spring (31), and metal check-ball (32).
- 2) Remove the air-bleed bolt (29) and the metal checkball (30) from the air-bleed cover side.

Cylinder ID
K Series
φ 32~φ160

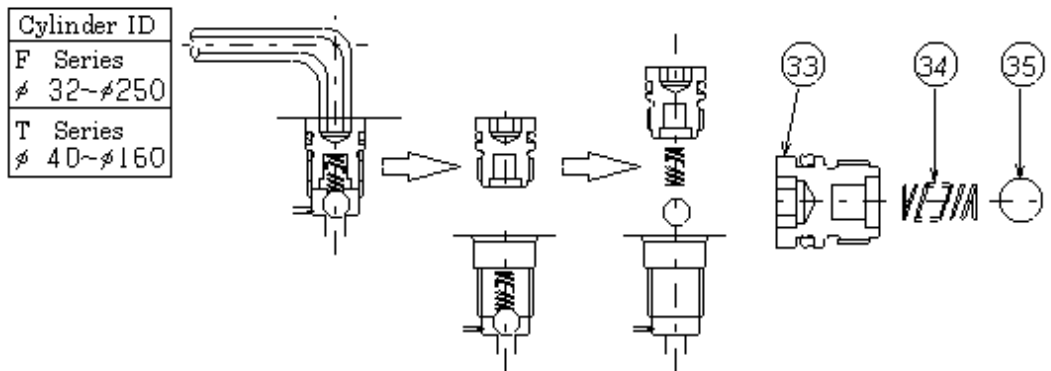


- 1) Loosen check plug (33) and remove from cover.
- 2) Remove the check spring (34), metal check ball (35), and valve gasket (37) as shown in the illustration.

Cylinder ID
F Series
φ 32~φ250
T Series
φ 40~φ160
K Series
φ 32~φ160

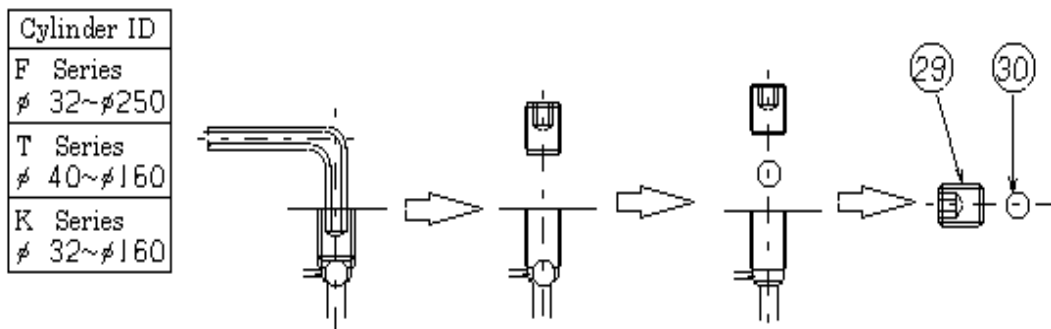


- 1) Remove the air bleed bolt (29) from cover.
- 2) Remove the metal check ball (30).



(7) Check valve disassembly

- 1) Loosen check plug (33) and remove from cover.
- 2) Remove the check spring (34) and metal check ball (35).



- 1) Loosen check plug (33) and remove from cover.
- 2) Remove the check spring (34), metal check ball (35), and valve gasket (37) from the cover.

§3. Guide for cylinder assembly.

(3-1) Cautions for cylinder assembly

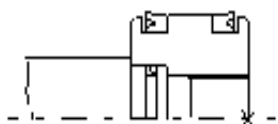
1. Wash parts carefully before assembling.
2. Inspect all parts for damage or abnormalities before attempting assembly.
Fix or replace all damaged parts.
3. Inspect the U-packing and O-rings, etc. for irregularities or deformities.
If irregularities and/or deformities are found, replace them with new parts.

(3-2) Cylinder assembly

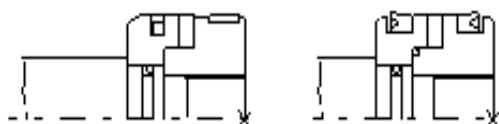
1. Inserting the piston packing.

Insert the packing as shown in the illustration with paying attention not

Standard (without switch)



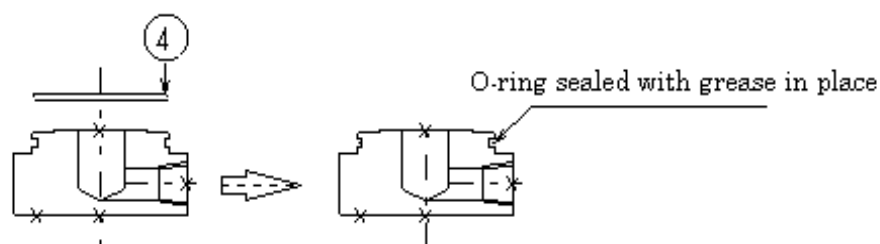
(with switch)



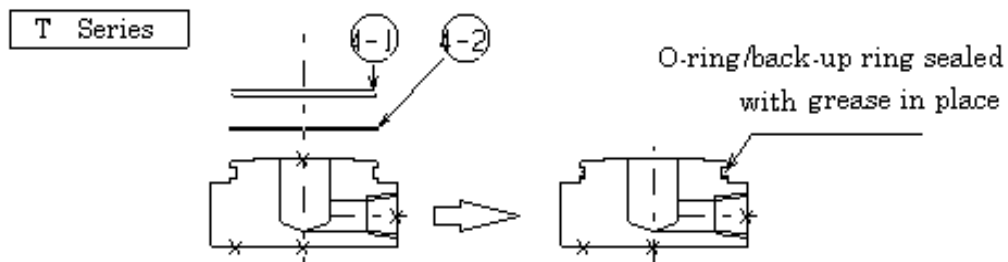
to wear in the wrong direction.

2. Inserting tube gasket

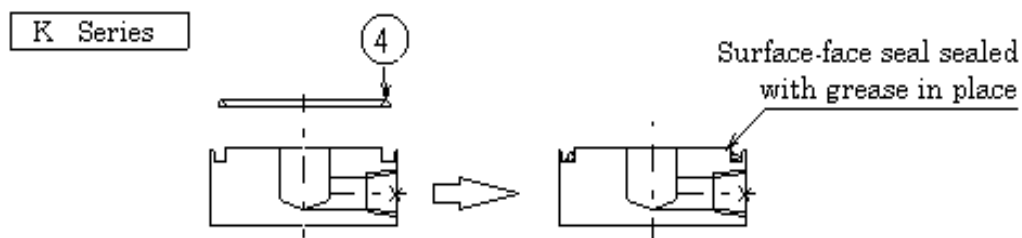
F Series



- (1) Insert the O-ring ④ as shown in the illustration in the head cover section.
- (2) Insert the O-ring (4-1) and back-up ring (4-2) as shown in the illustration in the head cover section.

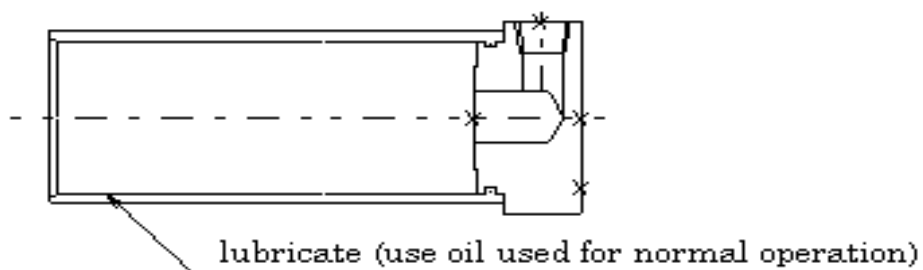


(3) Insert the surface-face seal (4) as shown in the illustration in the head

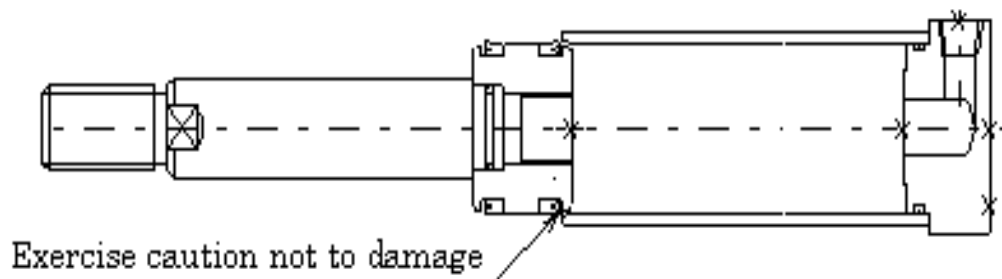


cover section.

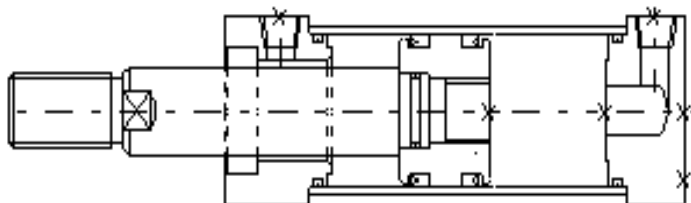
3. Lubricate the cylinder tube using the same kind of oil used in operation and insert it into the head cover. Take care so that debris does not enter during this operation.



4. Insert the piston/piston rod assembly into the cylinder tube with paying attention not to damage the packing during insertion.

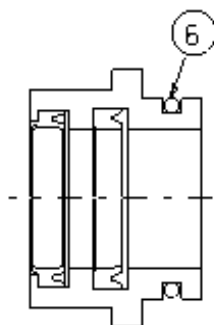


5. After inserting the piston/piston rod assembly, attach the rod cover. Take care so that the cylinder tube does not remove from the head cover during this operation.



(Caution) Before attaching the rod cover, grease the O-ring in the rod cover as well as the head cover assembly.

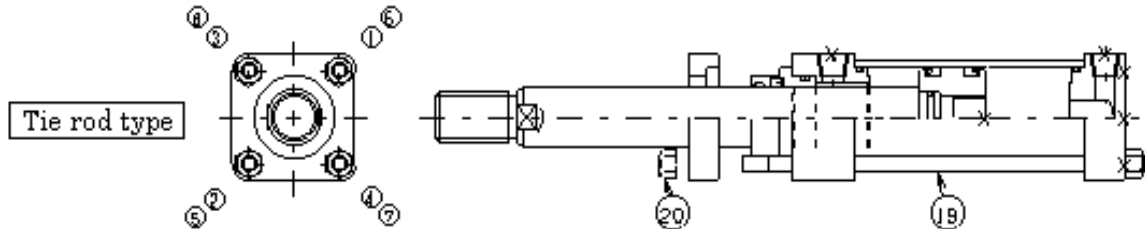
6. Attach the O-ring (6), rod packing, and dust packing to the rod bushing. Take care not to seal in the wrong direction.



7. After attaching the rod bushing, grease the seal. After greasing the seal, attach to rod cover. Wrap the piston rod bolt threads with protective tape to prevent damaging inside surfaces and/or seal of the rod bushing. Also pay attention so as not to damage surfaces by banging with the wrench being used.

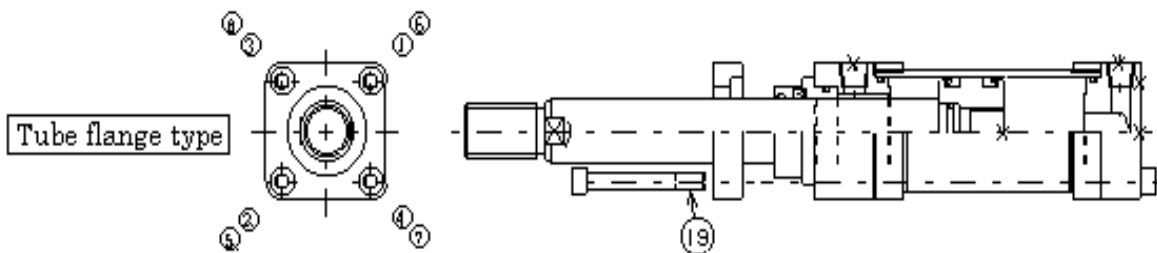


8-1. Affix the retainer, insert tie-rod (19), and tighten hex nut (20).



(Tighten bolts in order from 1-8)

8-2. Affix retainer, and tighten hex bolt (19).



(Tighten bolts in order from 1-8)

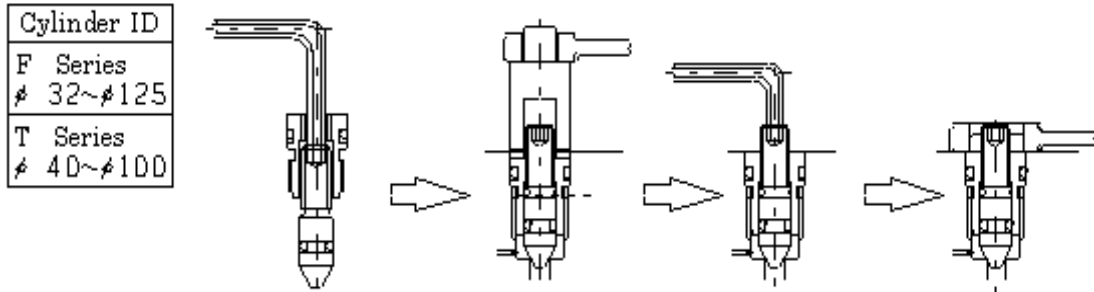
9. Tightening of tie-rod (hex bolts)

After loosely attaching tie-rod hex bolts, run in the 4 bolts evenly, checking the rod cover and head cover alignment to make sure that they are not canted. Finally tighten in accordance with the tightening sequence shown in the illustration and to the torque specifications shown in the table*. Uneven tightening of tie-rod (hex bolts) can cause improper operation as well as shimmy later.

* Refer to page 19 for torque specifications for tie-rod hex bolts

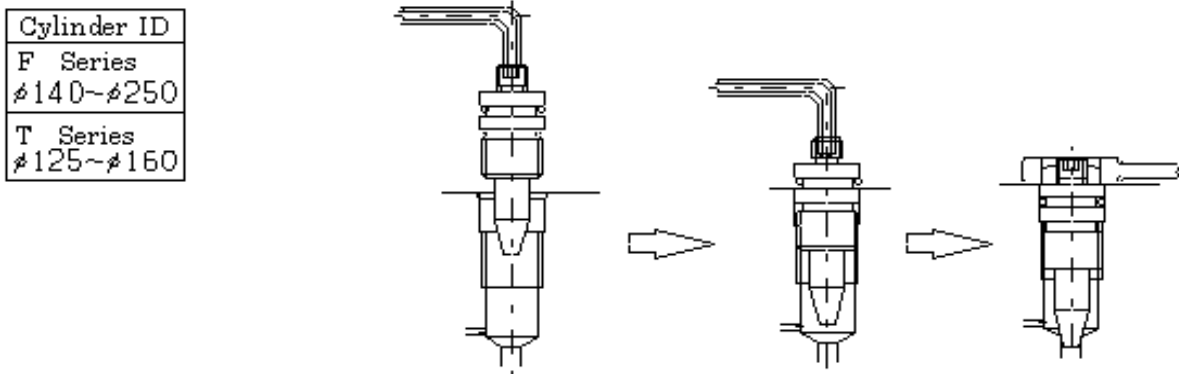
10. Cushion valve assembly

Assemble the cushion valve as illustrated below.

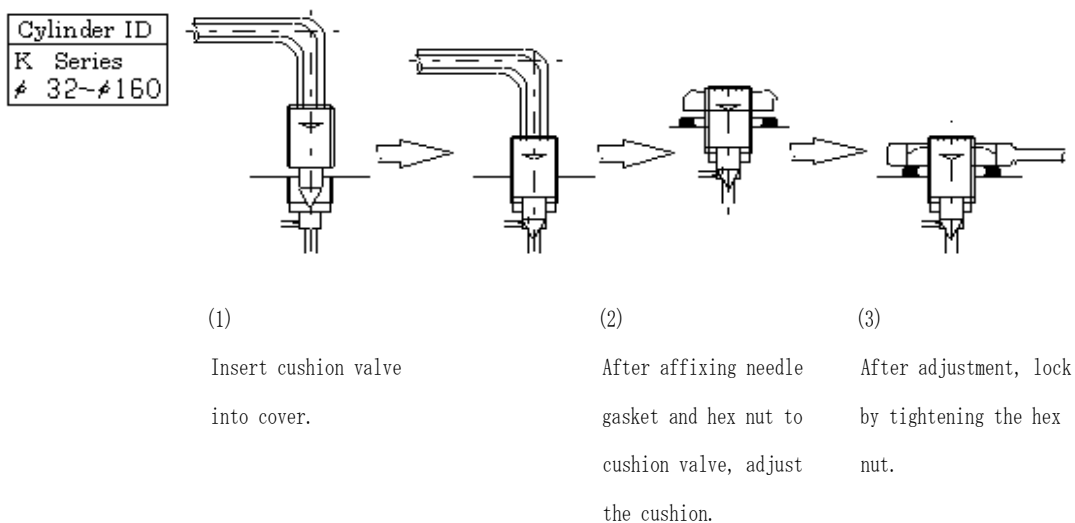


Inspect the damage of the needle gasket and O-ring and replace them, if necessary.

- | | | | |
|---|---|--|---|
| (1) | (2) | (3) | (4) |
| Run in until cushion valve seats into cushion plug. | Use the disassembly tool to insert plug into cover. | Adjust cushion by turning cushion valve. | After adjustment, lock by tightening the hex nut. |



- | | | |
|----------------------------------|--|---|
| (1) | (2) | (3) |
| Insert cushion valve into cover. | Adjust cushion by turning cushion valve. | After adjustment, lock by tightening the hex nut. |

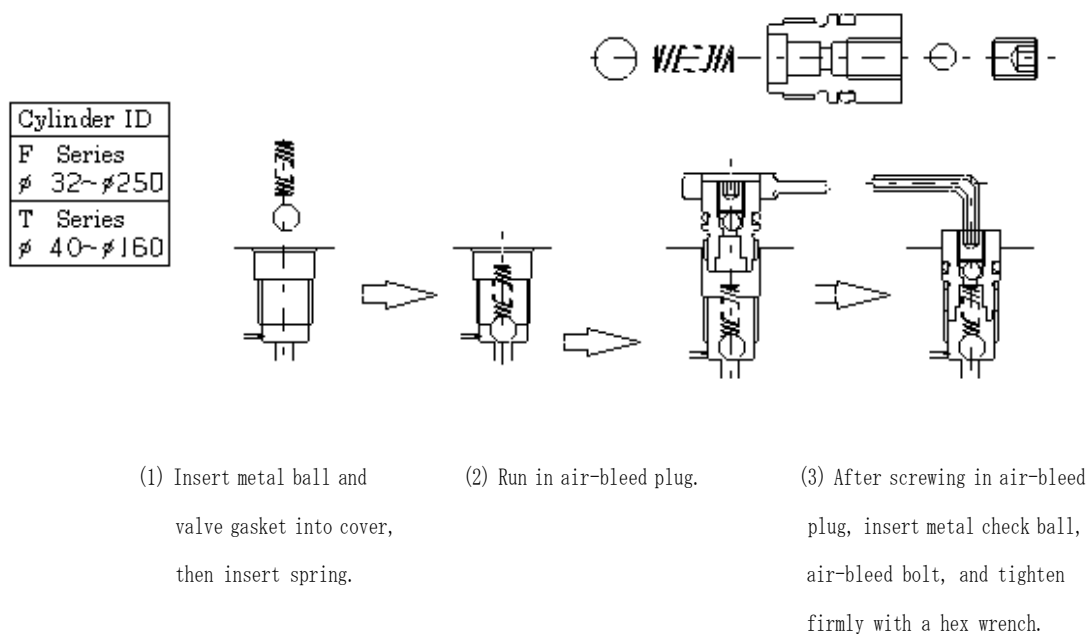


11. Air-bleed valve assembly

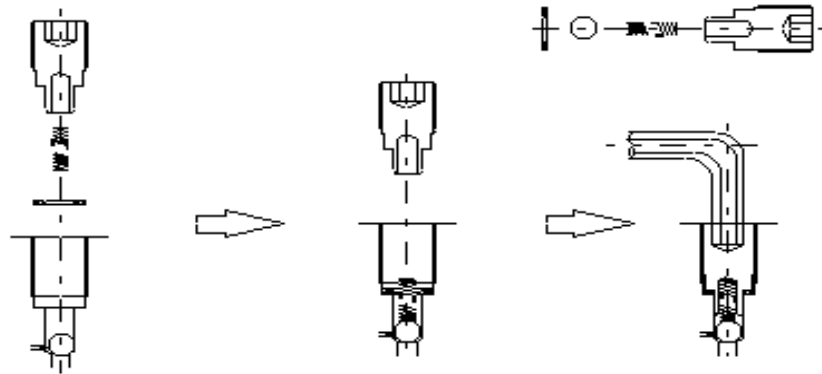
Assemble the cushion valve as illustrated below.

Inspect the damage of the O-ring and replace it, if necessary.

(1) Air-bleed valve assembly (with cushion)



Cylinder ID
K Series
φ 32~φ160



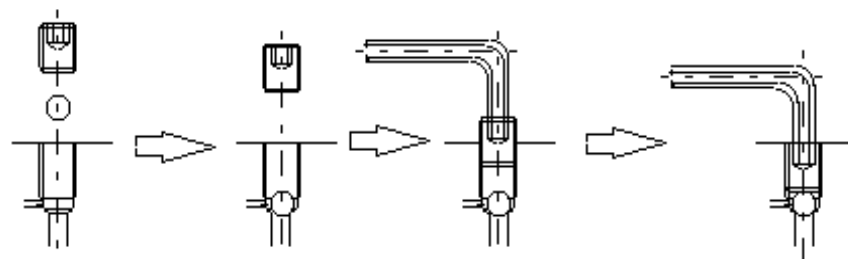
(1) Insert metal ball and valve gasket, then insert spring into cover.

(2) Run in check plug.

(3) Tighten the check plug firmly using a hex wrench.

(2) Air-bleed valve assembly (without cushion)

Cylinder ID
F Series
φ 32~φ250
T Series
φ 40~φ160
K Series
φ 32~φ160



(1) Insert metal ball into cover.

(2) Run in air-bleed bolt.

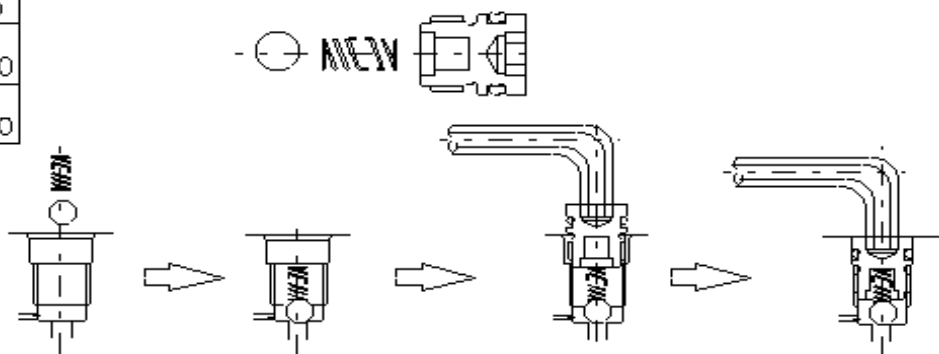
(3) Use a hex wrench to firmly tighten the air-bleed bolt.

12. Check valve assembly

(1) Assembly of check valve

Assemble the check valve as illustrated below.

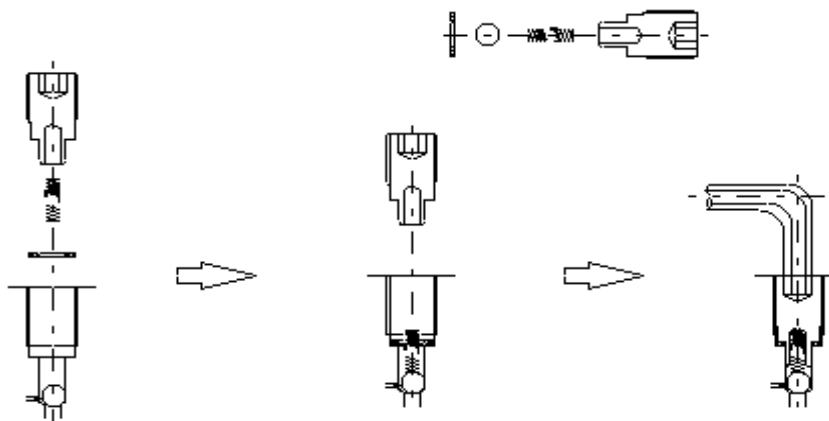
Cylinder ID	
F Series	φ 32~φ250
T Series	φ 40~φ160



Inspect the damage of the O-ring and replace it if necessary.

- (1) Insert metal ball, then insert spring into cover.
- (2) Screw in check plug.
- (3) Use a hex wrench to firmly tighten the check plug.

Cylinder ID	
K Series	φ 32~φ160



- (1) Insert metal ball and valve gasket, then inset spring.
- (2) Screw in check plug.
- (3) Use a hex wrench to firmly tighten the check plug.

§ 4. Caution for maintenance inspection

1. Pay full attention to the following cases to avoid the damage of the cylinder.
 - 1) When the piston given a greater inertia force (due to excessive force or high speed) is rapidly stopped, the following disorders are caused by accidental excessive pressure or force.
 - a) An inflation of the cylinder tube
 - b) Damage on or deformation of the mounting tools or bolts
 - c) Damage on the thread of the piston rod
 - d) Damage on or deformation of the cylinder mounting foundation and frame
2. Pay full attention to the following cases to prevent dusts from getting into the cylinder.
 - 1) When the cylinder port is kept open for a long time without plugging
Be sure to apply the rust-proof fluid or applied fluid and plug it when leaving the cylinder for a long time.
 - 2) Water may be generated due to condensation in the cylinder chamber during storage, and rust may occur.
Avoid storage in hot humid place. Please make it environment free from temperature difference. Further, Volatile rust preventive is effective for dew condensation prevention.
 - 3) When the ambient air is strongly acidic or alkaline, the hard chrome plating on the rod is gradually peeled off as time goes by. The pieces of the plating may get into the cylinder.
 - 4) Careless flushing
In the case of flushing after the piping, perform it after making a bypass circuit to prevent dust from getting into the cylinder.
3. It is necessary to perform periodical check (disassembly and inspection) every year.
 - 1) Disassemble the cylinder in accordance with the user's manual. Then reassemble it after cleaning and inspection of the cylinder, and replacement of parts.
 - 2) Inspect the leakage and the operation before reinstallation.
 - 3) Replace packing and gaskets with new ones at the periodical inspection.

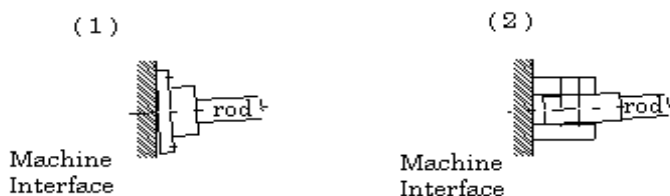
Item to be inspected	Judgment Criterion	Action to be taken
Inner surface of cylinder tube	1) A shallow scratch on a sliding surface where a nail is slightly caught. 2) A lengthwise deep scratch on a sliding surface	1) Repair using sandpaper (#320 or similar). 2) Replace with a new one if not repairable using sandpaper (#320 or similar).
Sliding surface of piston rod	1) A shallow scratch where a nail is slightly caught or a dent on a sliding surface 2) Flaking of plated surface due to a large dent	1) Repair using a grind stone for plating (#600 or similar). 2) Replace with a new one.
Sliding surface of piston	1) A minor sliding scratch on a sliding surface 2) A deep scratch or a dent on a sliding surface	1) Repair using sandpaper (#320 or similar). 2) Replace with a new one.
Inner surface of Rod bush	1) A minor sliding scratch on a sliding surface 2) Uneven wear exceeding about 0.3mm in diameter 3) A crack or a tear on a rod bush	1) Repair using sandpaper (#320 or similar). 2) Replace with a new one. 3) Replace with a new one.
Wearing surface	1) A minor sliding scratch on a surface 2) A lengthwise deep flaw or a scratch 3) Uneven wear is found. 4) Wearing crack	1) Practically no trouble 2) Replace with a new one. 3) Replace with a new one. 4) Replace with a new one.
Seal related	1) Wear or a flaw is visually found. 2) A tear due to a protrusion of a gasket is found.	1) Replace with a new one. 2) Replace with a new one.
Others	Although the details vary by the application of a cylinder, it is necessary to carefully check a cover and a mounting part for a crack and inspect all others including end screws and port screws so as to confirm the absence of inappropriate conditions.	

§5. Precautions for cylinder mounting

To ensure the full performance of the cylinder and promote long service life, follow the instructions below. It is important to keep the load at levels below the upper limits.

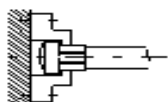
1. Mounting attachment

The cylinder load and mounting attachment should not be set up as shown in illustration



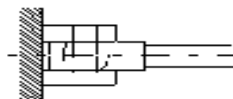
In addition, when the stroke is long, a crevice, knuckle joint, or a ball joint

(3)



knuckle joint

(4)

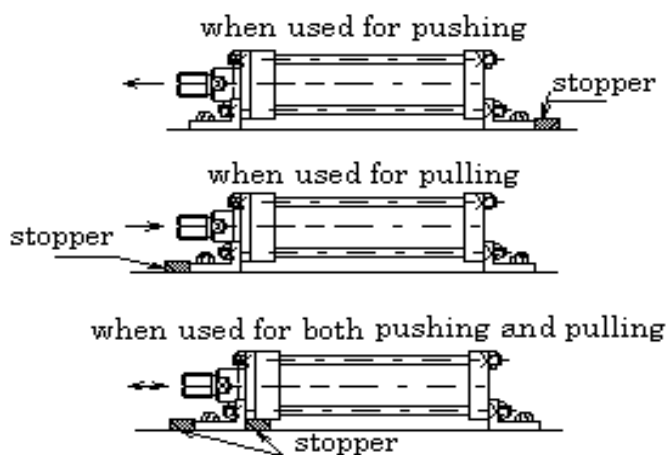


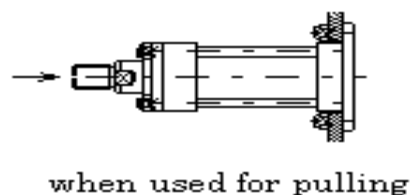
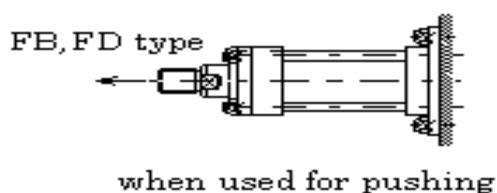
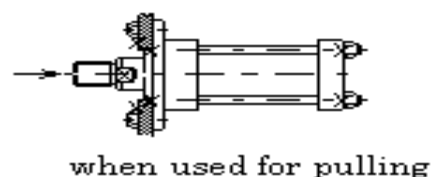
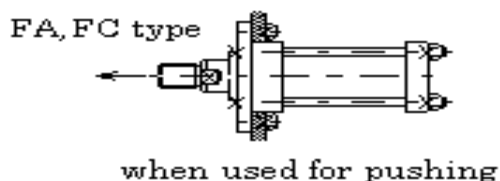
ball joint

should be used.

2. Foot-type cylinder (LA, LB, LC)

The foot-type cylinder is normally attached with bolts; however, this may not be the best mounting practice because of the possibility of horizontal movement by load. In order to prevent this, affix a stopper to the mounting base.

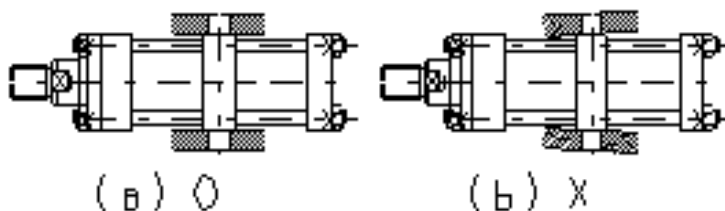




3. Flange type (FA, FB, FC, FD)

4. Trunnion type cylinder (TC, TA)

In case of (b), the trunnion axis is bent and stress on the trunnion can cause failure.



5. Crevice-type cylinder (CA, CB)

When the crevice-type cylinder with a long stroke is used and mounted in a level plane, the weight of the cylinder is absorbed by the piston rod with corresponding binding of the bushing. It causes fast wearing and burning of the tube and piston surfaces. This angular rod binding can lead to loss of buckling strength which is another reason to avoid mounting in a level plane.

(Caution) In case where long stroke level-plane mounting is necessary, please consult with Horiuchi Machinery.

6. Assembled Cylinder

- (1) Take care that the piston rod unit does not contact with noxious fluids which can damage it or gases which contain chlorine.
- (2) Do not paint the piston rod unit.

§6. Torque specifications for tie-rod, hex bolt

F Series		[Tie rod tightening torque]												
Cylinder ID	32	40	50	63	80	100	125	140	150	160	180	200	224	250
Tie rod threads	M8 P1.25	M10 P1.25	M10 P1.25	M12 P1.5	M16 P1.5	M18 P1.5	M22 P1.5	M24 P1.5	M27 P1.5	M27 P1.5	M30 P1.5	M33 P1.5	M39 P1.5	M42 P1.5
Torque N·m	8.0	23.0	23.0	44.0	100.0	165.0	340.0	460.0	690.0	690.0	970.0	1320.0	1970.0	2650.0

* Use JIS B1181 (S45C-H quality) nuts and tighten according to specification table torque

T Series		[Tie rod torque specifications]										
Cylinder ID	40	50	63	80	100	125	140	160	180	200	224	250
Tie-rod threads	M12 P1.5	M14 P1.5	M16 P1.5	M18 P1.5	M22 P1.5	M27 P1.5	M30 P1.5	M33 P1.5	M39 P1.5	M45 P1.5	M33 P1.5	M39 P1.5
Torque N·m	44.0	50.0	100.0	165.0	340.0	690.0	970.0	1320.0	1970.0	2750.0	1320.0	1970.0

* Use JIS B1181 (S45C-H quality) nuts and tighten in accordance with the specification table torque.

K Series		[Tie rod torque specifications]						
Cylinder ID	32	40	50	63	80	100	125	160
Tie-rod threads	M6 P1.0	M6 P1.0	M6 P1.0	M8 P1.0	M10 P1.25	M12 P1.25	M16 P1.5	M20 P1.5
Torque N·m	2.0	3.0	4.0	8.0	9.0	17.0	35.0	76.0

F Series		[Hex bolt torque specifications]												
Cylinder ID	32	40	50	63	80	100	125	140	150	160	180	200	224	250
Tie-rod thread	—	—	—	M12 P1.75	M16 P2.0	M18 P2.5	M22 P2.5	M24 P3.0	M27 P3.0	M27 P3.0	M30 P3.5	M33 P3.5	M39 P4.0	M42 P4.5
Torque N·m	—	—	—	75.0	190.0	260.0	430.0	540.0	800.0	800.0	1080.0	1490.0	2480.0	3050.0

T Series		[Hex bolt torque specifications]										
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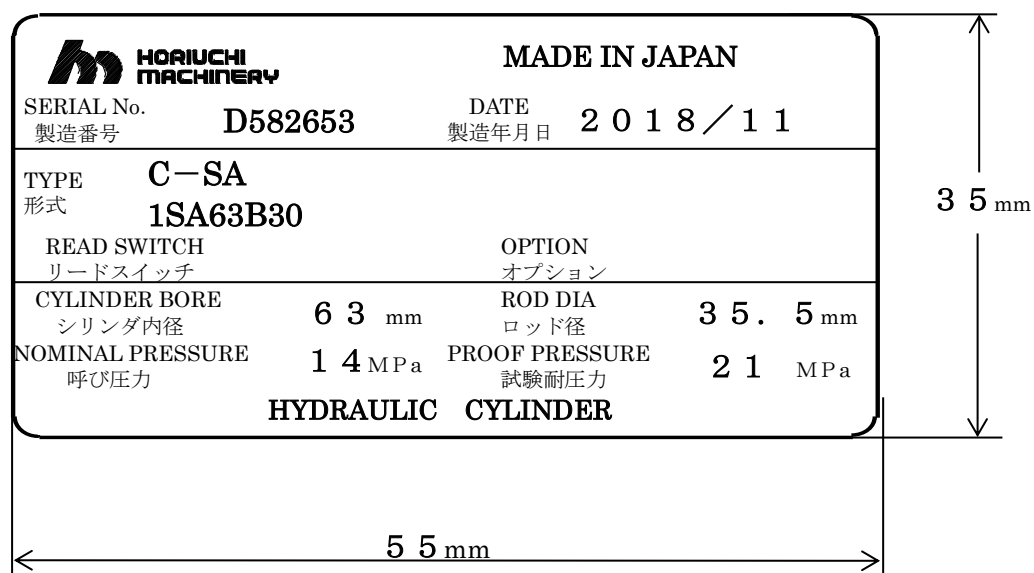
Cylinder ID	40	50	63	80	100	125	140	160	180	200	224	250
Tie-rod thread	—	—	M16 P2.0	M18 P2.5	M22 P2.5	M27 P3.0	M30 P3.5	M33 P3.5	M39 P4.0	M45 P4.5	M33 P3.5	M39 P4.0
Torque N·m	—	—	190.0	260.0	430.0	800.0	1080.0	1490.0	2480.0	3840.0	1490.0	2480.0

§7 Indication of cylinder label

1. What the label shows

Information pertaining to the cylinders is shown on the label.

Please indicate the serial no. shown here when inquiring about this product.



2. Label position

- 1) The label is attached to the surface of the tube nearest to the head port.
- 2) The label is always attached to the top side regardless of the port position and foot mounting.

