

The safety precautions stated below are to be followed to use the product safely and correctly and to safeguard both you and other persons and avoid property damage. The precautions are classified into three categories, DANGER, WARNING and CAUTION, to indicate the degree of hazard, damage and imminence. Strictly observe these important safety precautions in addition to the safety requirements specified in ISO 4414\*1) and JIS B 8370\*2) and other standards.

**⚠ DANGER :** An imminent hazard which, if not avoided, will result in death or serious injury

**⚠ WARNING :** A potentially hazardous situation which can result in death or serious injury if the product is improperly handled

**⚠ CAUTION :** A potentially hazardous situation which may result in personal injury or only property damage if the product is improperly handled

\*1) ISO 4414: Pneumatic fluid power Recommendations for the application of equipment to transmission control systems

\*2) JIS B 8370: General rules of pneumatic system

### ⚠ WARNING

- The suitability of pneumatic equipment shall be judged by the person who designs the pneumatic system or determines the specifications.
- The equipment shall be handled by persons with sufficient knowledge and experience. Incorrect handling of compressed air can cause hazardous situations. Any machine or device using pneumatic equipment shall be assembled, operated and maintained by persons with sufficient knowledge and experience.
- Never handle any machine or device or remove the equipment without ensuring the safety.
  - 1) Before inspecting or servicing any machine or device, make sure that the object to be driven is provided with drop or runaway preventing means.
  - 2) Before removing the equipment, make sure that the above safeguard has been provided, and discharge the compressed air in the system.
  - 3) Before restarting any machine or device, make sure that jumping-out preventing measures have been taken.
- Use the product in an environment appropriate to the specifications. If the product is used in any equipment which may considerably affect persons or properties, such as nuclear, railroad, aircraft, vehicle and medical equipment, equipment in contact with drink or food, entertainment equipment, emergency shutoff devices, safeguards for press, brake circuits and safety equipment, particularly for a purpose requiring safety or in an outdoor area, contact us.

## Notes on Use of Air-oil Unit

### Notes on installation

#### ⚠ CAUTION

- Install the air-oil unit in the vertical direction.
- Install the air-oil unit at a height at which the lower limit of the air-oil unit oil level is higher than the upper limit of the actuator oil unit.
- When the unit is provided with a sensor, avoid using the unit in a place with a powerful magnetic field. (Note) The sensor may malfunction under the influence of the magnetic field.

### Notes on piping

#### ⚠ CAUTION

- Flush the pipes to remove dirt and foreign matter. (For copper pipes, use galvanized copper pipes.)
- The pipe on the oil side must be as short and thick as possible. (Reduce the pressure loss due to the piping as low as possible, and use the unit efficiently.)
- If the piping on the oil side remarkably varies in inner diameter, stable cylinder speed cannot be obtained.
- If jointed portions are reduced in diameter or many 90° elbows are used, the specified speed cannot be obtained.
- After piping, check for leak from the connected parts.
- Discharge air from the piping on the oil side.

### Notes on air pressure source

#### ⚠ CAUTION

- Use clean compressed air. Compressed air containing chemicals or corrosive gas may damage the air-oil unit or cause operation failure.
- To remove foreign particles in compressed air, install an air filter.
- To remove drain from compressed air, install an after-cooler, air dryer or air filter.

### Notes on use environment

#### ⚠ WARNING

- Do not use any air-oil unit in a corrosive environment. For the materials of the air-oil units, see the catalog.
- The air-oil units use oil gauge pipes (acrylic pipes). Avoid using them in an organic solvent atmosphere.

### Notes on lubrication

#### ⚠ CAUTION

#### Adaptable fluid

- Use a mineral hydraulic fluid having a viscosity of  $10 \times 10^{-6}$  to  $100 \times 10^{-6} \text{ m}^2/\text{s}$  in the oil temperature range of  $-5$  to  $+50^\circ\text{C}$ . (No freezing)

### Lubricating procedures

Discharge the main pressure from the cylinder to be lubricated.

① Move the cylinder piston to the stroke end on the side to be lubricated. (Fig. 1)

② Loosen the cylinder air vent plugs 1/4 turn. (Fig. 2)

③ Open the flow control valve and throttle valve.

④ When the unit has a stop valve, open the stop valve, open the valve.

● In the case of normally closed type  
Supply the pilot pressure, and keep the stop valve in the open state manually or by applying power.

● In the case of normally open type  
Supply the pilot pressure, and the valve will be kept open in the non-energized state.

⑤ Open the lubricating plug of the air-oil unit, and lubricate it.

Note) Make sure that pressure has been discharged from the side to be lubricated.

⑥ Make sure that air is not discharged together with oil from the air vent plug of the cylinder, and close the air vent plug.

⑦ Pour oil to the oil level upper limit (red mark) in the air-oil unit.

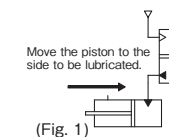
Note) When oil is poured, the oil level indicator rises later than the actual oil level rises. Take care not to pour an excessive amount of oil.

⑧ To lubricate the opposite side of the cylinder, repeat steps ① to ⑦.

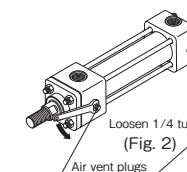
⑨ Discharge air again.

⑩ Check the range in which the oil level in the converter rises and lowers, and pour oil to the upper limit (red mark).

⑪ After moving the cylinder several times, discharge air from the flow controller and throttle valve.



(Fig. 1)



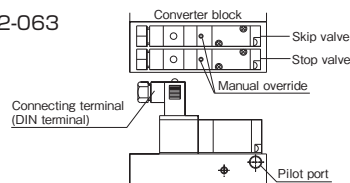
(Fig. 2)

## Notes on adjustment

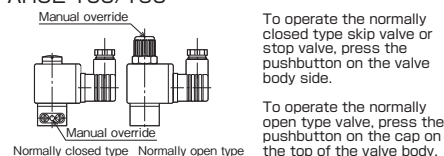
**⚠ CAUTION**

- When starting the device, gradually increase the supply pressure from a low pressure, and make sure that the device operates smoothly.
- For the pilot pressure for operating the control valve, install piping separately from the piping to the air port (main pressure).
- Start supplying pressure to the pilot port at the stage of test run.  
AHU2-063: (Main pressure $\times$ 0.3+0.25 to 0.7 MPa)  
AHU2-100/160: (Main pressure $\times$ 0.4+0.2 to 0.7 MPa)
- Hydraulic pressure control on one side of actuator may cause control failure due to air leakage in the actuator. Hydraulic pressure control on both sides is recommended.
- If the air-oil unit is not used for many hours after the operation is terminated, discharge pressure from the air-oil unit to reduce entry of air to hydraulic fluid as low as possible. Entry of air will degrade the controllability.
- During test run or lubrication, the stop valve and skip valve can be manually operated by pressing the manual override.

## AHU2-063



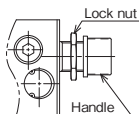
## AHU2-100/160



## Flow rate adjusting procedures

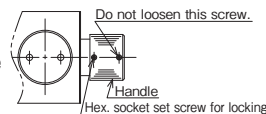
## AHU2-063

- Loosen the lock nut.
- Adjust the handle to set the flow rate to the required value. Turn the handle counterclockwise, and the flow rate will increase. Turn it clockwise, and the flow rate will decrease.
- After the completion of adjustment, loosen the lock nut to lock the handle.



## AHU2-100/160

- Loosen the hex. socket set screw (M5) for locking.
- Adjust the handle to set the flow rate to the required value. Turn the handle counterclockwise, and the flow rate will increase. Turn it clockwise, and the flow rate will decrease.
- After the completion of adjustment, tighten the hex. socket set screw for locking to lock the handle.



## Intermediate stop/2-step speed control

- The stop valve and skip valve are pilot type two-way valves. The pilot valve is turned on and off to open and close the passage for intermediate stop or fast movement of cylinder.
- There are two types of pilot valves of stop valve and skip valve, normally open and normally closed types.

The valves operate as shown in the following table according to the pilot valve type.

	Type	Passage state	
		Non-energized state	Energized state
Skip valve	Normally closed type	Closed	Open
Stop valve	Normally open type	Open	Closed

- When the flow control valve is used, a jumping phenomenon (the flow rate is temporarily high until pressure balance is established) occurs. Pay attention to the phenomenon.
- If the cylinder does not move smoothly (stick-slip, etc.), the fluid may contain air. Discharge air from the fluid.

## Notes on maintenance

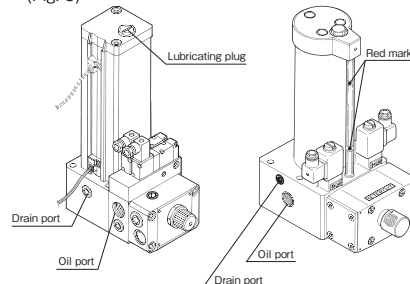
**⚠ WARNING**

- Before removing or disassembling the equipment, take measures for prevention of drop and runaway, discharge compressed air from the system, and ensure the safety.

**⚠ CAUTION**

- Periodically discharge drain from the pneumatic system.
- Periodically inspect the pneumatic equipment, and, if any abnormality is found, do not use them until measures are taken.
- If the hydraulic fluid contain drain and is turbid, deteriorated or discolored, change it with a new fluid. As a new fluid, use the fluid of the same brand as the old one.
- Before discharging the fluid, completely discharge pressure from the air-oil unit. When discharging the fluid from the converter, discharge it through the drain port shown in Fig. 3.
- At the same time, change the fluid in the actuator.

(Fig. 3)



## Notes on Use of Low-pressure Hydraulic Cylinder

## Notes on use environment

**⚠ WARNING**

- Do not use it in a corrosive environment. For the material of the cylinder, see the explanation of the body.

**⚠ CAUTION**

- In a dusty place or in a place exposed to water drops, cover the piston rod.
- Use the cylinder within the working temperature range. If it is used out of the range, the following problems may occur.
  - When used at a temperature lower than the working temperature range
    - Brittle fracture caused by reduction of cylinder material elongation
    - Oil leakage caused by reduction of seal elasticity
  - When used at a temperature higher than the working temperature range
    - Fracture caused by reduction of cylinder material strength
    - Fracture of seal
    - Dragging caused by thermal expansion of sliding parts
- If the cylinder is used or stored in an environment exposed to water, seawater or moisture, it is necessary to consider rust and corrosion prevention.
- Use the cylinder indoors.
- Do not use the cylinder in a place where it is exposed to considerable dust or vibration.

## Notes on installation

**⚠ CAUTION**

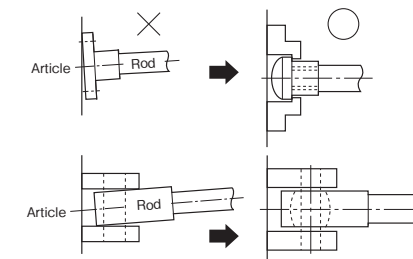
- Connect the cylinder aligning the rod shaft center with the moving direction. If it is not aligned, the bush and rod surfaces, tube inner surfaces and seals may be worn or damaged.
- Take care not to hit any object against the cylinder tube or piston rod to damage it. Flaws in the sliding parts can wear the seals.
- Apply grease to the rotating parts, such as the trunnion and clevis type accessories, to prevent seizing.
- If the cylinder has bellows, install it taking care not to twist the bellows.
- To secure the cylinder accessories, use the bolts of the specified size. For rocking mounting accessories, use the pins of the specified size. Otherwise, the screws may be loosened or damaged by the cylinder thrust force or its reaction force.
- The rigidity of the mounting materials of the stationary cylinder body greatly affects the cylinder performance. If the mounting materials do not have sufficient rigidity, they will be distorted by the cylinder thrust force, the piston rod and bush will be deformed and worn earlier, and the piston rod threads will be damaged. Use rigid mounting materials.

## Mounting of rod end with stationary accessories (LA, LB, FA and FB styles)

The direction of the movement of the article to be moved by the cylinder must be aligned with the center of the axis of motion of the piston rod. If the shaft center is deviated, the bush will be worn earlier, and the cylinder tube will be seized or dragged. To check for misalignment of the shaft center, measure the deviation of the center of the object mounting part when the piston rod is completely extended and retracted. Then, after centering the shaft, connect the cylinder and the object.

Avoid using the cylinder in a place as shown below.

Environment
Sand particles, dust, cuttings, welding spatters, etc.
Water, seawater, oil, chemicals, etc.
Direct sunlight (ozone), moisture, etc.
High temperature, low temperature, freezing, etc.
Strong magnetic field
Vibration

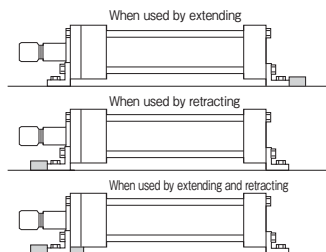


## Installation of cylinder

### 1) Stationary accessories

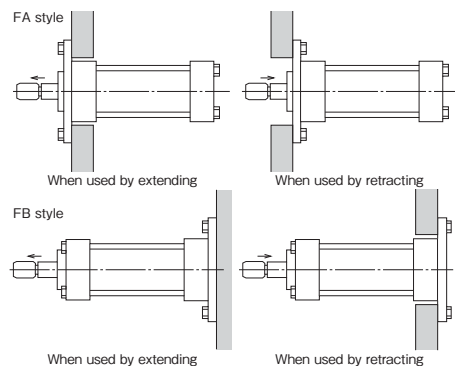
#### 1-1 LA/LB style accessories

When fitting the LA or LB style accessories, secure them with the clamp bolts. However, the accessories secured with the bolts are not resistant to the axial movement when load is applied to them. Therefore, provide a stopper(s) on the installation base as shown below.



#### 1-2 FA/FB style accessories

Secure the cylinder by the method as shown in the following figure.

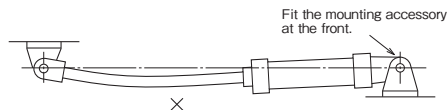


### 2) Rotating mounting accessories

- If the cylinder is installed on a plane and is movable on the plane, connect the connecting accessory at the rod end with a pin or the like, so that the cylinder can move on the plane. Center the cylinder in the perpendicular direction to the plane in the same manner as when centering a stationary type cylinder.
- Apply lubricant to the connecting accessory bearing.
- Never use a floating joint as a rod end attachment.

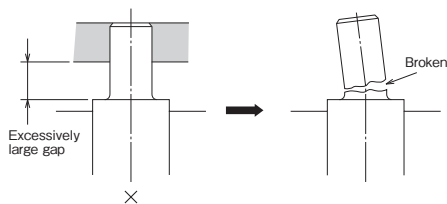
### 2-1 CA/CB/CC/CD style accessories

- Use a pin having a size shown in the catalog.
- Avoid installing a cylinder with a long stroke (1000 mm or more) in the horizontal direction. Lateral load will be applied to the bushes due to the cylinder weight, and, as the result of this, the bushes will wear unevenly, the service life will significantly reduce, and dragging may be caused.

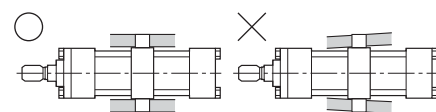


### 2-2 TA/TC style accessories

- Mount the mating fitting perpendicularly to the trunnion boss. If it is installed in an inclined surface, the boss bearing will be unevenly worn, and the service life will be considerably reduced.



- Install the cylinder minimizing the gap between the trunnion and the mating bearing. Install it aligning the shaft center to avoid applying bending moment between the bearing and the pin.



## Notes on piping

### CAUTION

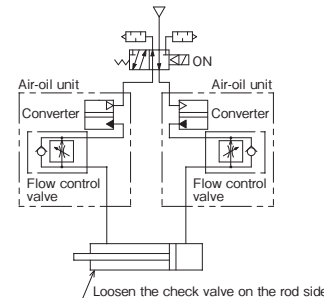
- Before piping, clean the inside of the pipes.
- Take care that sealing tape and sealing materials will not enter the pipes.
- Take care that chips caused by pipe threading and dust will not enter the pipes.

## Notes on adjustment

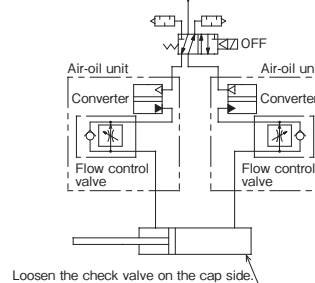
### CAUTION

- When starting the device, gradually increase the supply pressure from a low pressure, and make sure that the device operates smoothly.
- Feed the fluid to the cylinder at a low pressure (at which the cylinder moves at a low speed of about 10 mm/s) to discharge air from the fluid through the air vent check plug.
- If the check plug is excessively loosened, it may be disconnected from the cylinder, and the fluid may spout out, resulting in serious accidents.
- Discharge air repeatedly until the fluid is freed from air.
- Discharge air not only from the cylinder, but also from the piping. If air is left in the piping, the following operation failures may occur.
  - a) The cylinder causes stick-slip.
  - b) Smooth speed control cannot be made.
  - c) Temperature rise caused by adiabatic compression can damage the seals.
  - d) Shock and vibration are given to the outside.
  - e) The set output cannot be obtained.

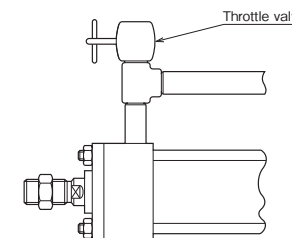
### ● When the cylinder moves forward



### ● When the cylinder moves backward



- After the completion of discharge of air, tighten the check valve (tightening torque of 8 to 10 N·m), and check for oil leak.
- \* For the cylinder (10H-6) without check plugs, install a throttle valve on the piping to discharge air.



## Notes on maintenance

### WARNING

- Before disconnecting or disassembling the equipment, take measures for prevention of drop and runaway, completely discharge compressed air from the system, and ensure the safety.

### CAUTION

- To use the cylinder without trouble for a long time, it is necessary to conduct daily and periodic inspections.

### 1) Daily inspection

In the daily inspection, check that:

- (1) the cylinder mounting bolts and nuts are not loose.
- (2) the cylinder operates normally.
- (3) the fluid does not leak from any part, and
- (4) the cylinder parts do not show any abnormality (tie rod, flange, etc.).

### 2) Periodic inspection (overhauling)

Conduct the periodic inspection according to the operating conditions and necessity. It is recommended to conduct the periodic inspection at least once a year.

- Replace the seals and gaskets with new ones in the periodic inspection.
- Do not use seals which have been stored for two years or more.

## Wiring procedures

- Cables applicable to AHU2-063 (reference) JIS C3306VCTF(Vinyl cabtyre round cord)

Socket type	No. of cores	Finished cord OD	Conductor sectional area
DIN socket	2 cores	φ6.6mm	0.75mm <sup>2</sup> (equivalent to AWG16 to 20)
	3 cores	φ7mm	

- Cables applicable to AHU2-100/160

JIS C3306VCTF(Vinyl cabtyre round cord)

Socket type	Cable OD	Conductor sectional area
DIN socket (without lamp)	φ6 to 12mm	0.5 to 1.5mm <sup>2</sup>
DIN socket (with orange lamp)	φ6 to 10mm	