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Instruction Manual

“ATSUKAN Servo”
PQCS2 Series
(Mechanical)

For Safe Operation

Inappropriate handling of this product may cause failure
in unsatisfactory performance or serious accidents.
To prevent any accident, be sure to read this operation manual carefully,
and fully understand the contents before operation.
If you have any inquiry, contact us.

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CONTENTS

1． For safe operation

Improper handling of this product may result in unsatisfactory performance or serious accidents. In order to prevent an accident from occurring, be sure to read this instruction manual carefully and fully understand the contents before using the product.

The instructions in this manual are classified into “DANGER”, “WARNING”, and “CAUTION” categories depending on the degree of danger and injury.

Pay special attention to instructions described under “DANGER”, “WARNING”, and “CAUTION” categories.

Noncompliance with safety instructions in this manual or improper use of this product may cause damage to the product or surrounding equipment or injuries to operators. We are not liable for such damage or injuries.

DANGER	Imminent dangerous condition; if not avoided, this condition will lead to death or serious personal injuries.
WARNING	Wrong handling of this product can lead to death or serious personal injuries.
CAUTION	Wrong handling of this product may lead to personal injuries or damage to properties.

- This product is designed and manufactured as a general-purpose industrial machine part.
- After reading this instruction manual, be sure to keep it where those using this product have an easy access to it.

⚠ DANGER

Working environment

- Do not use the product in an explosive, flammable, or corrosive atmosphere, in a high-temperature or high-humidity environment, and near combustibles; doing so may lead to personal injuries or a fire.

⚠ WARNING

General

- Those who have sufficient knowledge and experience may handle the product.
- Do not use the product outside its specifications. Using the product outside its specifications may cause it to fail, lose its functions, be damaged, and suffer extremely short service life.
- Never disassemble the product; doing so may cause it to operate abnormally, which in turn leads to personal injuries, electrical shock, or a fire.

Design

- Design a safety circuit or device to prevent personal injuries or property damage arising from the stopping of the product due to system abnormalities such as an emergency stop or power interruption.

Working environment

- When using the product under the following conditions or environments, take safety measures into consideration and contact us at the same time:
  - Use of the product under conditions and environments outside the specifications as well as outdoor use of the product
  - Use of the product in applications affecting the public safety (for example, nuclear, rail road, aviation, vehicle applications, medical equipment, amusement equipment, emergency shutoff circuits, brake circuits, and equipment coming in contact with foods and beverages)
  - Use with safety devices
  - Use in applications in which special attention to safety is required

⚠ CAUTION

General

- Pay special attention to keep the workshop neat, clean, organized and uncluttered. Leaking oil may cause persons to slip and topple; make an effort to detect leaking oil early.

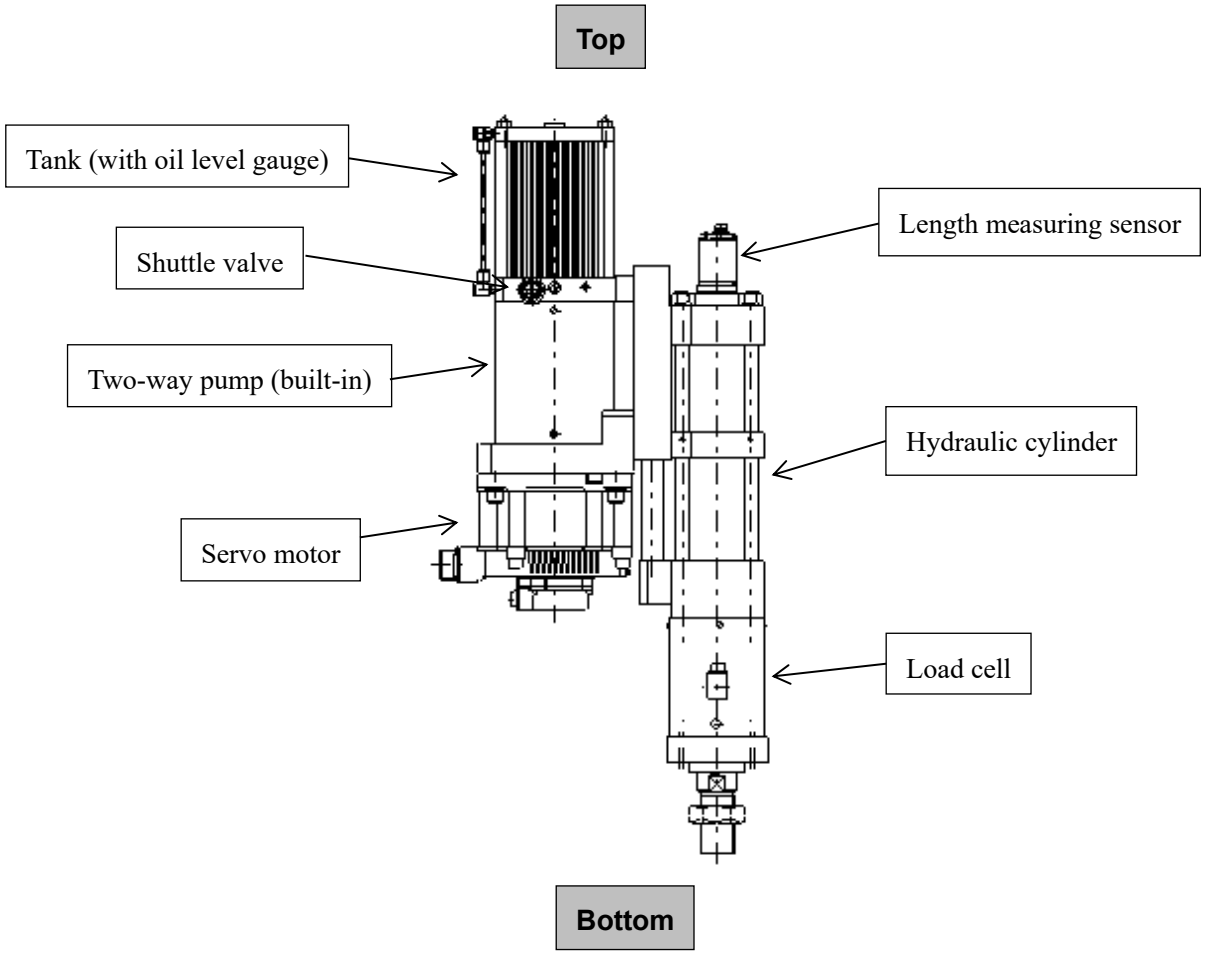
2． Names of parts and outside drawing

- The outside drawing shown below is a representative example. For the detailed appearance and specifications, refer to the product outline drawing.

2－1． Integrated type, for downward rod

⚠ CAUTION

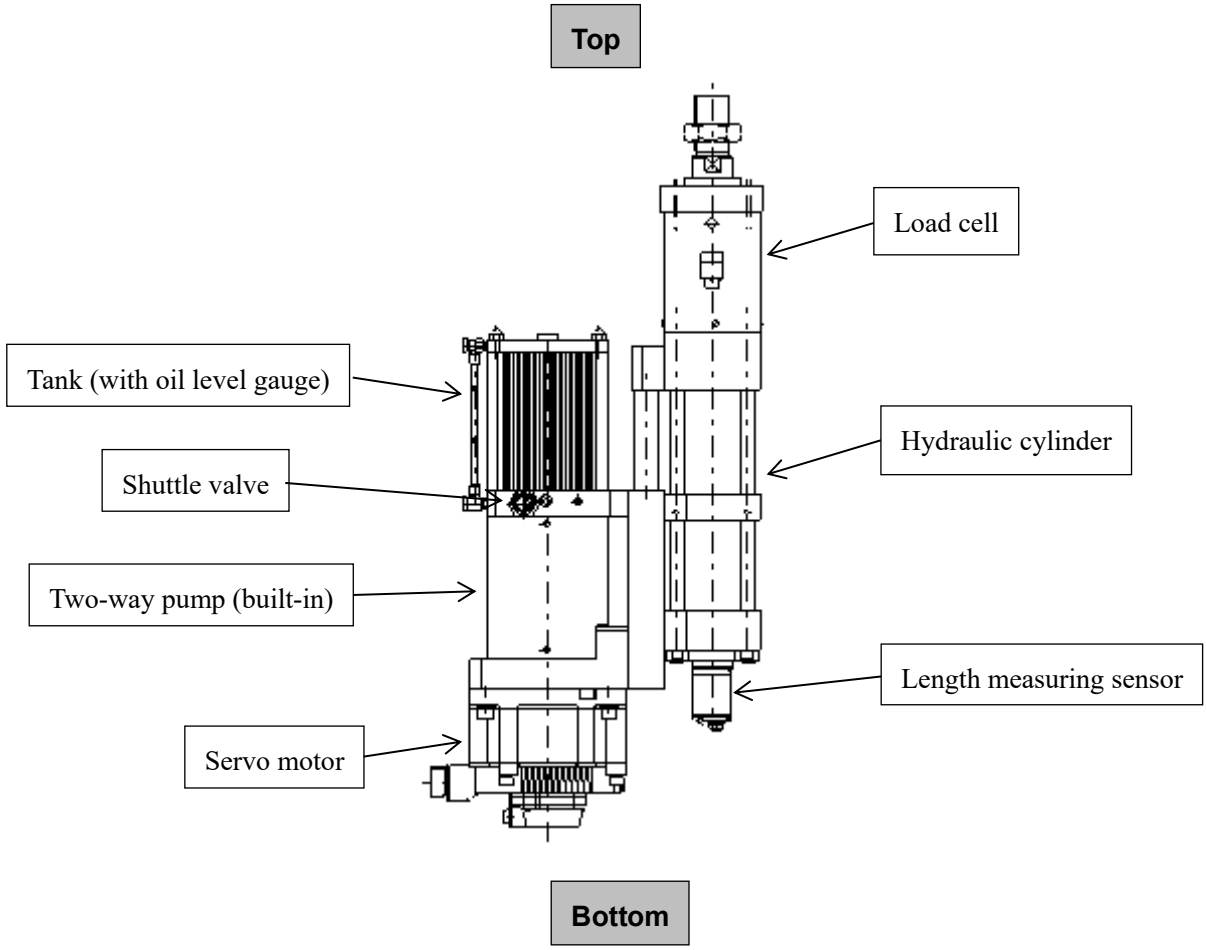
- It cannot be used in any mounting direction for other than downward rod.



2－2．Integrated type, for upward rod

⚠ CAUTION

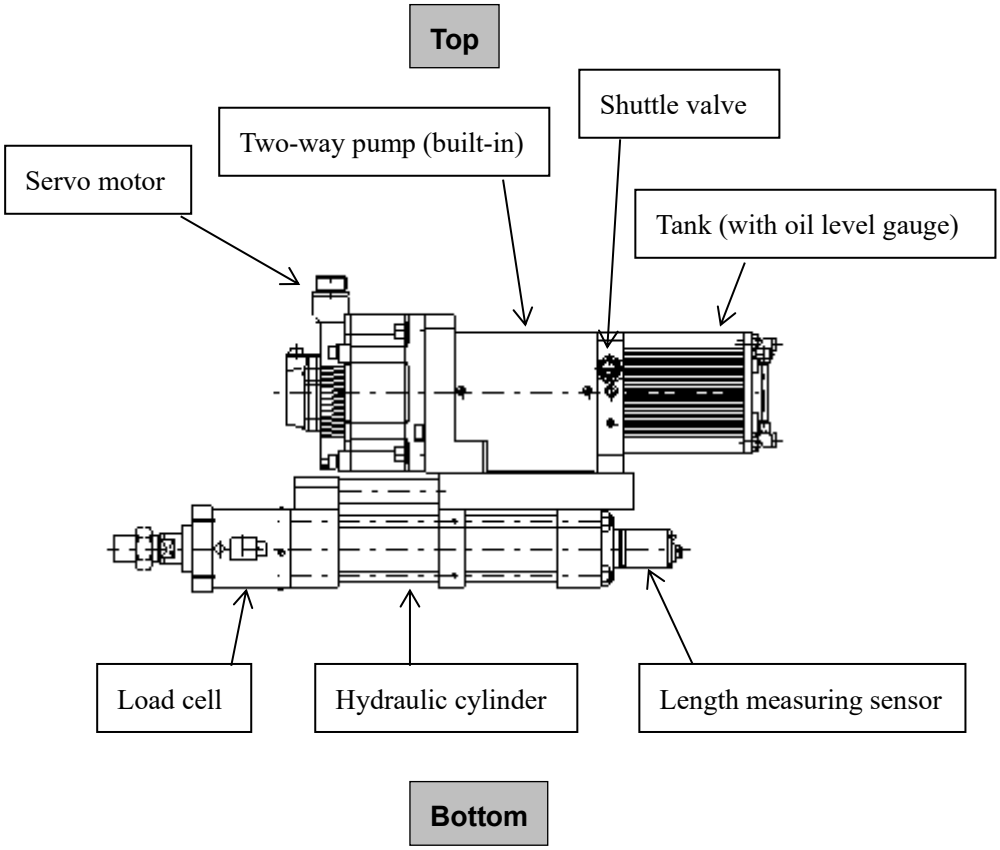
- It cannot be used in any mounting direction for other than upward rod.



2－3．Integrated type, for horizontal rod

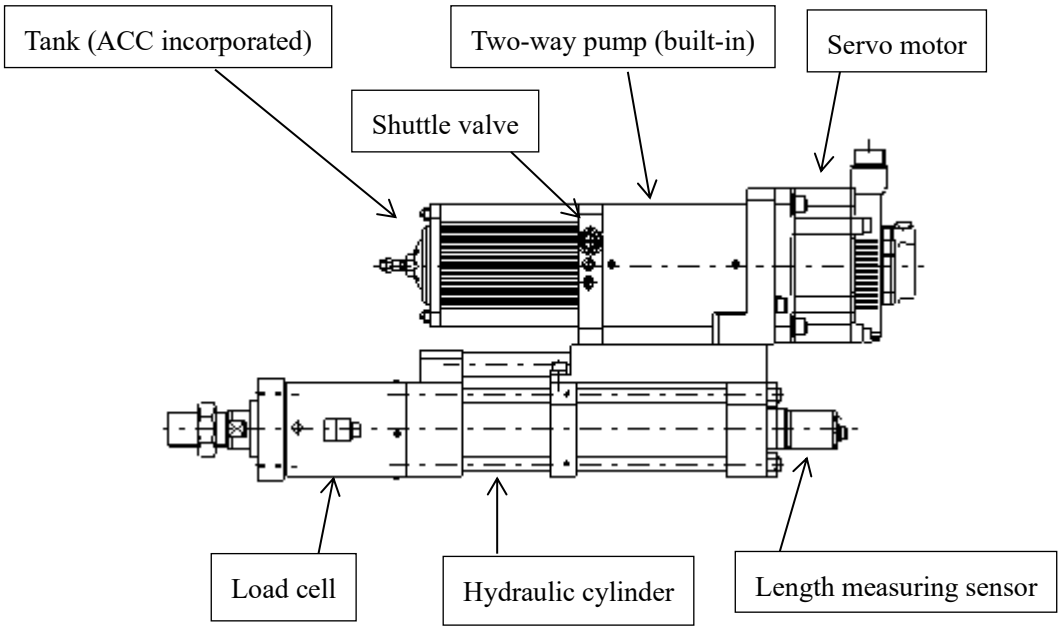
⚠ CAUTION

- It cannot be used in any mounting direction for other than horizontal rod.
- Install it with the cylinder part faced down and the unit part faced up.



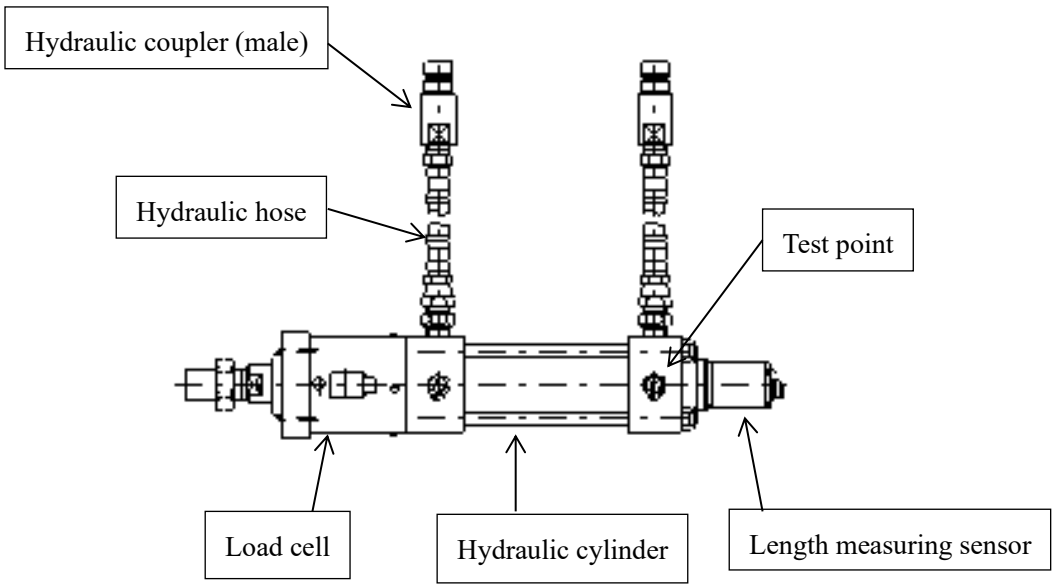
2－4．Integrated type, with ACC

- It can be used in any mounting direction.

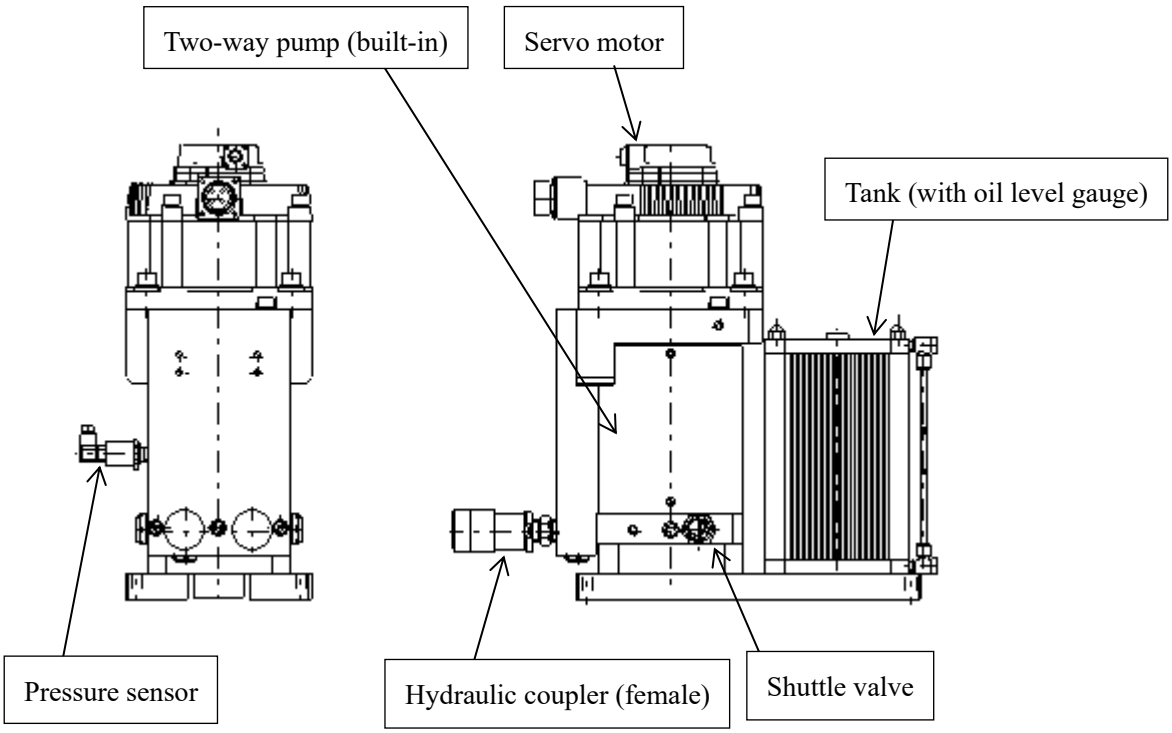


2－5．Separate type, cylinder part

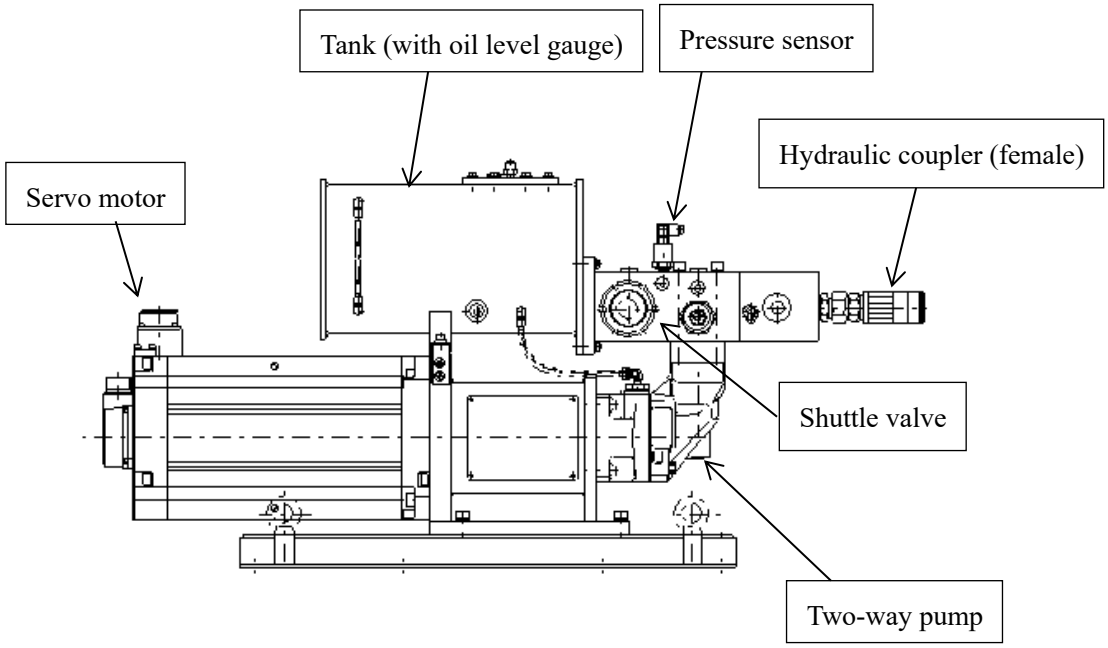
- It can be used in any mounting direction.



2－6．Separate type, unit part (1.1 cc/rev to 11 cc/rev)



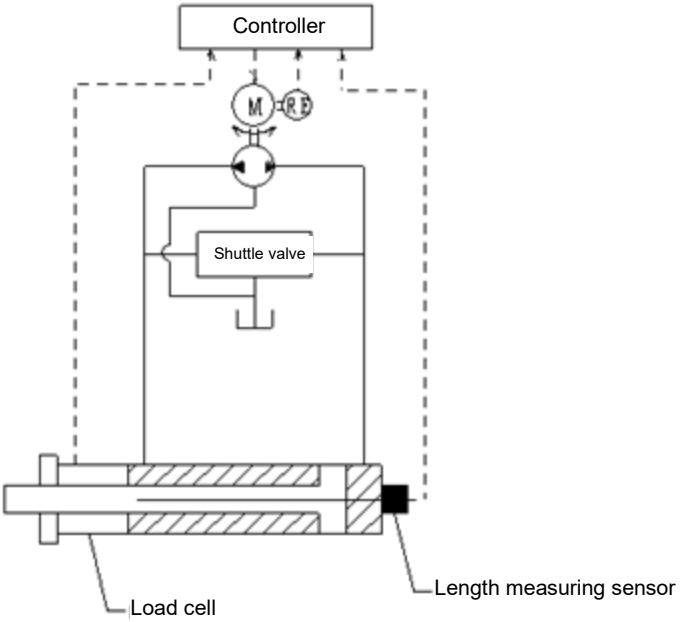
2－7．Separate type, unit part (19 cc/rev to 60 cc/rev)



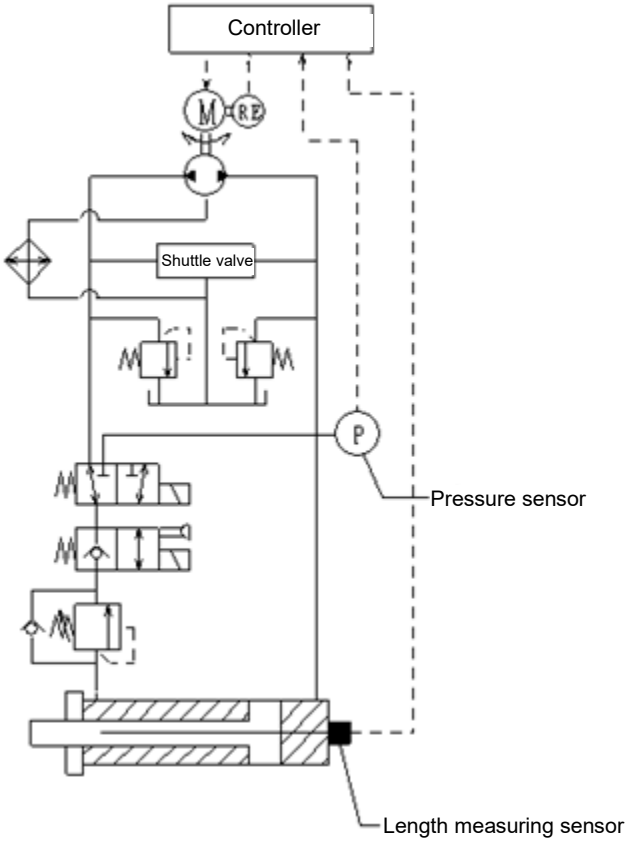
3. Hydraulic circuit

- The hydraulic circuits shown below are representative examples. For the detailed hydraulic circuits, refer to the product outline drawing.

[Basic hydraulic circuit]



[With pressure sensor, abrupt fall prevention valve, differential valve, counter balance valve, relief valve and drain cooler]



４． Check items at the unpacking

- On unpacking the package containing the product, check the following points. If you find problems or have doubts, contact us.
  1) Check if the product you ordered agrees with the contents of the packing list.
  2) Check for parts damaged due to an unexpected accident during transportation.
  3) Check for faulty parts causing fastener loosening, oil leakage, etc.

５． Transportation and storage

- When transporting the product, utilize lifting taps. For the positions of the lifting taps, refer to the product outline drawing.
- If the weight of the product is 15 kg or more, transport it using a crane, forklift, etc.
- When storing the cylinder, retract the piston rod into the cylinder, apply rust-proof oil to the screw at the tip of the rod and to the exposed portion of the piston rod, and protect the threaded parts with vinyl tape, etc.
- For storage, avoid locations where strong magnetic fields occur (near a welder, a motor, or a motor power supply, for example); store the product in a dry, cool location.

⚠ CAUTION

- Never get under the product during transportation. Doing so may result in personal injury or property damage due to falling.
- Do not hook hoisting accessories or carrying means on the tank, two-way pump, servo motor or sensors. Doing so may cause damage to the device.
- Do not subject the product to a shock or vibration during transportation or storage. Doing so may cause the parts to be damaged and broken down.

6. Installation

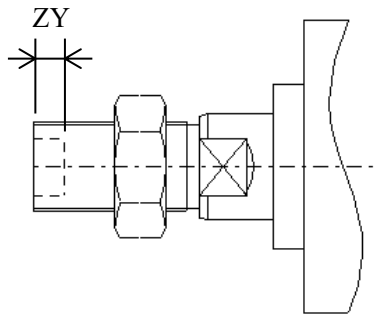
- The integrated type ATSUKAN Servo has restrictions on the mounting direction. Install the product in the direction specified in “Mounting direction” in the delivery specification and product outline drawing. If “Top” and “Bottom” are specified in the product outline drawing, comply with them.
- In the case of the separate type ATSUKAN Servo, it is recommended to install the unit above the cylinder in order to prevent a dead air space from being created in the cylinder.
- Install the separate type unit horizontally.

⚠ CAUTION

- To fasten the cylinder bracket, use bolts of the specified size and strength category and tighten the bolts to the specified tightening torque. If the bolt is unsuitable or not sized as specified, the thrust of the cylinder or its reaction force may cause the bolt to be loosened or damaged.
- For both the cylinder and unit, use mounting members having enough rigidity.
- At the time of installation, disconnect all the cables.
- When fastening the cylinder, be sure to perform alignment. An unaligned cylinder may cause the packing to be worn or damaged or may not allow the rod to move smoothly.

7. Installing the rod tip hardware

- It is recommended to use a lock nut to prevent the tip hardware from being loosened.
- In the case of the model with digital length measuring sensor, the length measuring sensor is built into the rod tip. When using a spring pin, etc. to prevent the tip hardware from being loosened, do so within the ZY dimension from the rod tip.



Cylinder diameter	Rod diameter	ZY
ϕ63 or less	-	10
ϕ80	ϕ45	10
ϕ80	ϕ56	25
ϕ100 or more	-	25

8. Electric wiring

- For details, refer to the ATSUKAN Servo controller instruction manual.

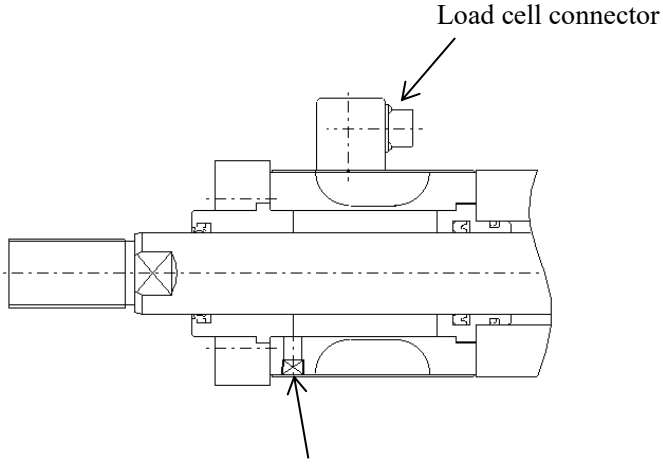
⚠ CAUTION

- When wiring and connecting the electrical components, do so with the power to the equipment shut off. Not doing so may lead to an electric shock accident or damage to the electric equipment.
- When wiring the servo pack and controller, use a round crimping terminal of appropriate size and establish connections securely so as to prevent short-circuiting between phases, electric leakage to the main body, etc. Carry out wiring so that no tension will be applied to the connection parts.
- Based on the current value, select an electric wire of appropriate specifications and having an appropriate nominal cross sectional area.
- Note that, if appropriate measures are not taken in carrying out electric wiring, not only a malfunction or failure of the product but also an accident may be caused.
- Do not fix the wiring of the sensors on the same route as the wiring of the power system. Doing so may cause the sensors to be subject to noise.

9. Load cell

- The load cell is equipped with a drain port. If the load cell output is abnormal, oil may collect inside the load cell. In that case, discharge oil through the drain port.

  <Example of abnormal load cell output>
  - The output does not become zero at time of no load.
  - The output varies.



Note: The drain port is located opposite to the load cell connector.

１０．Shuttle valve

- The method of adjusting the shuttle valve is as shown below. If the cylinder operates unstably, adjust the shuttle valve.

  [1] Loosen the lock nut.

  [2] Turn the shuttle valve clockwise (tightening) and put a mark on the tightening end.

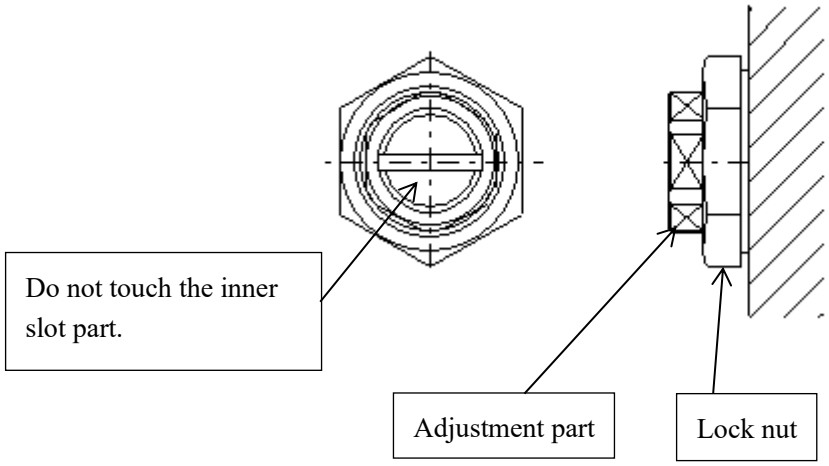
  [3] Make adjustments by turning the shuttle valve counterclockwise (loosening) with reference to the mark put in step [2]. In the case of “adjusting the shuttle valve to 1/2”, for example, turn the shuttle valve counterclockwise 1/2 turn from the mark. The shuttle valve can be adjusted to 3/4 maximum.

  [4] Fix the shuttle valve with the lock nut.

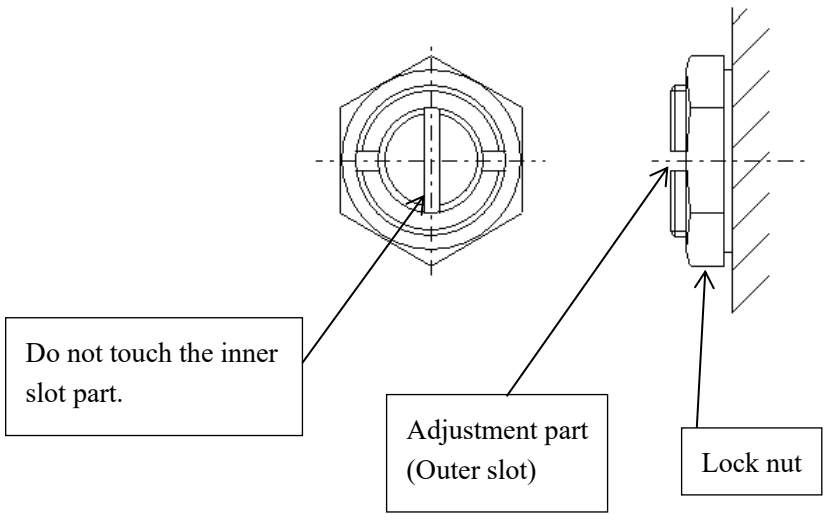
⚠ CAUTION

- The shuttle valve should be adjusted to 3/4 or less. If 3/4 is exceeded, oil leakage or damage to the seal part will result.

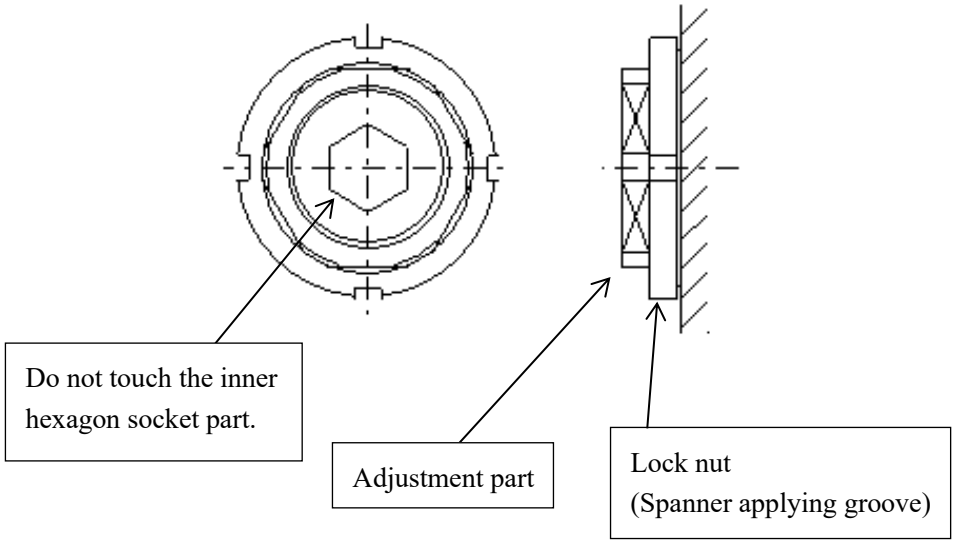
Appearance of shuttle valve for 1.1 cc/rev



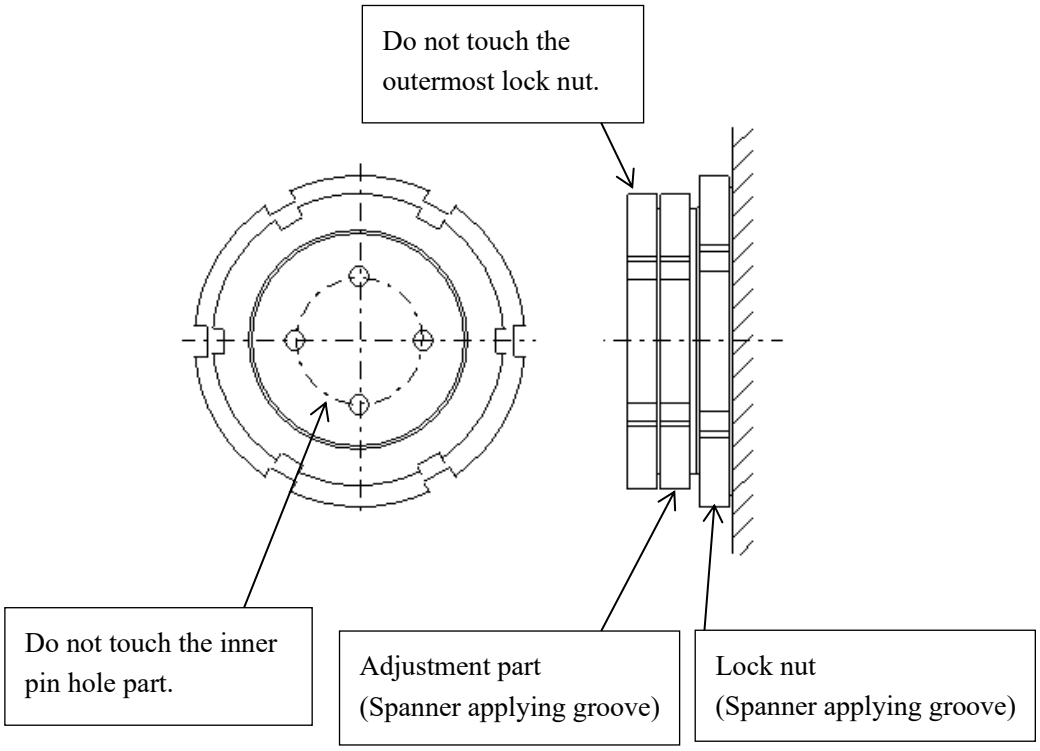
Appearance of shuttle valve for 3.5 cc/rev and 11 cc/rev



Appearance of shuttle valve for 19 cc/rev



Appearance of shuttle valve for 30 cc/rev, 40 cc/rev and 60 cc/rev



１１．Solenoid valve（Two-way valve）

１１－１．Abrupt fall prevention valve（Normal close type one-way check valve）

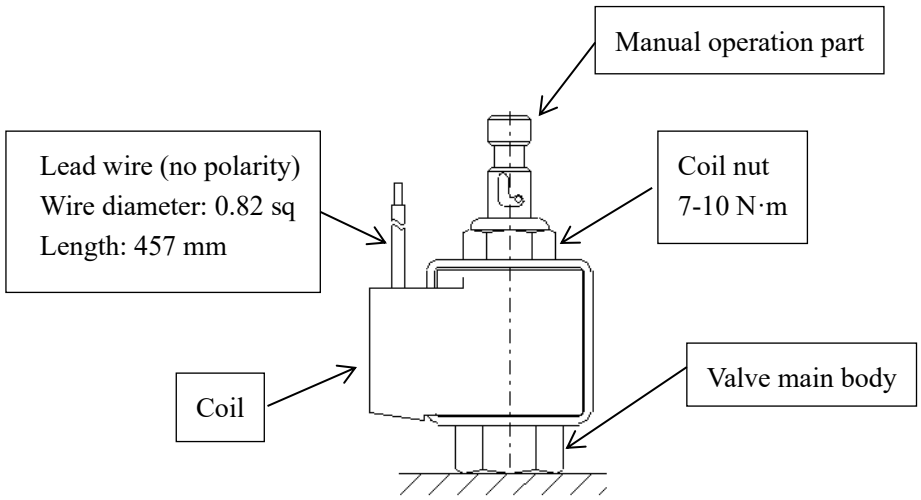
- The abrupt fall prevention valve is a solenoid valve. The one-way check valve is opened/closed by turning ON/OFF the power.

  Power ON: Check valve opened (OPEN)
  Power OFF: Check valve closed (CLOSE)
- When the power is turned OFF, the cylinder rod does not move downward. When moving the cylinder, turn ON the power.
- Because the abrupt fall prevention valve has internal leakage, it cannot be used to hold the position of the cylinder rod. If it is necessary to hold the position of the rod, control the position using the controller.
- The abrupt fall prevention valve is equipped with a manual operation part. When the manual operation part is set to “Switching state”, the check valve is left opened whether the power is turned ON or OFF. Usually set it to “Normal state”.

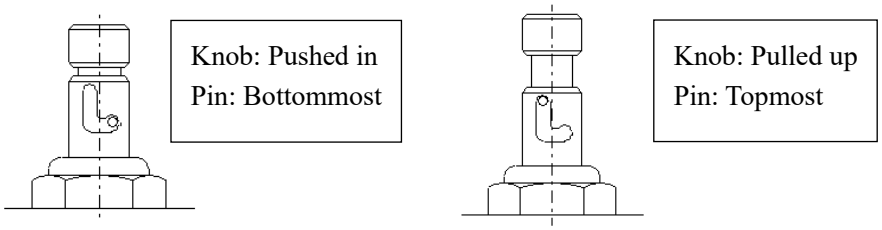
⚠ CAUTION

- When moving the cylinder, turn ON the power to the abrupt fall prevention valve. Moving the cylinder with the power left turned OFF may lead to damage to the device.

Appearance of abrupt fall prevention valve



Manual operation part



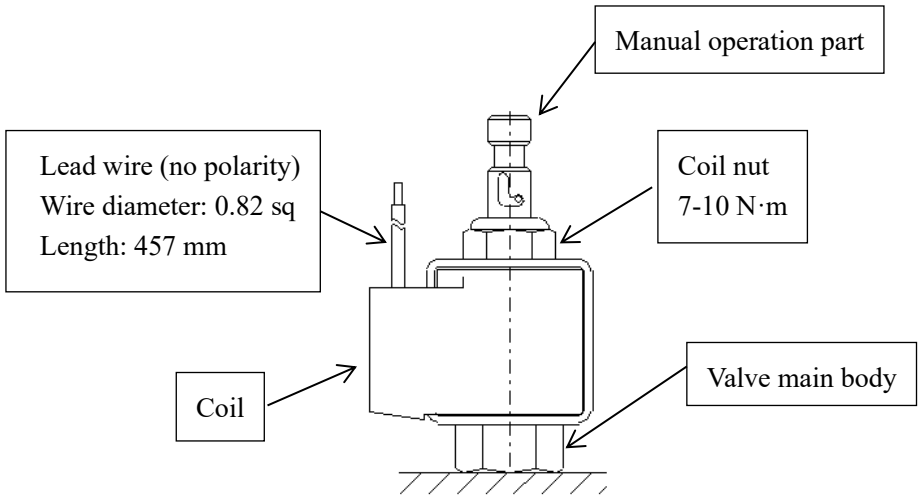
Normal state　　Switching state

１１－２．Bypass valve（Normal open type one-way check valve）

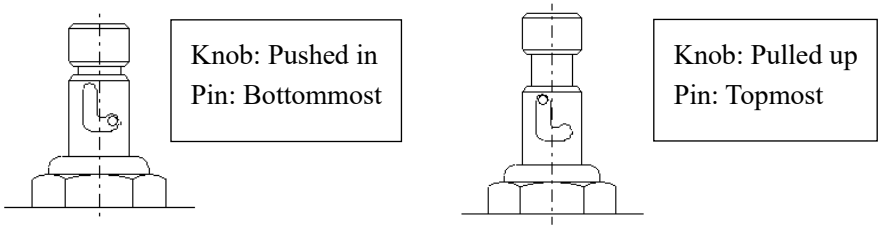
- The bypass valve is a solenoid valve. The one-way check valve is opened/closed by turning ON/OFF the power.

  Power ON: Check valve closed (CLOSE)
  Power OFF: Check valve opened (OPEN)
- When the power is turned OFF, the pump outlet communicates with the tank and the cylinder does not move. When moving the cylinder, turn ON the power.
- The bypass valve is equipped with a manual operation part. When the manual operation part is set to “Switching state”, the check valve is left closed whether the power is turned ON or OFF. Usually set it to “Normal state”.

Appearance of bypass valve



Manual operation part



Swiching state　　Nomal state

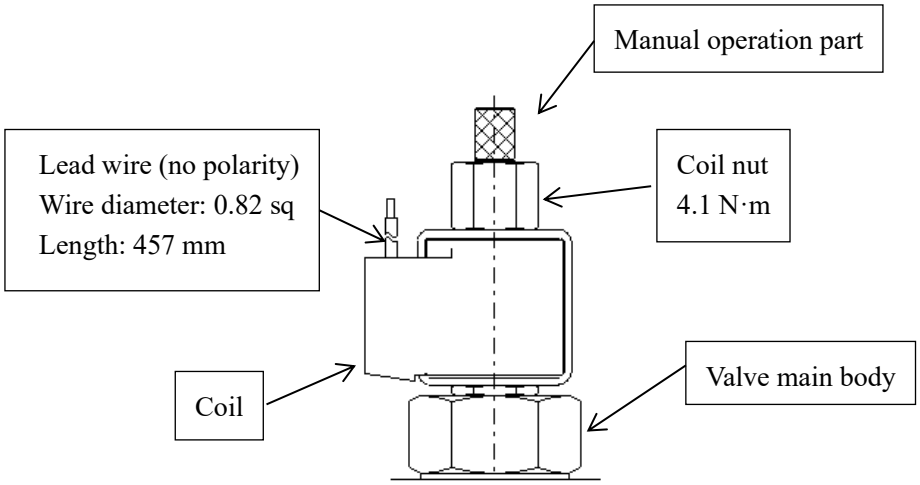
１１－３．Shut off valve（Normal close type bi-directional check valve）

- The shut off valve is a solenoid valve. The bi-directional check valve is opened/closed by turning ON/OFF the power.

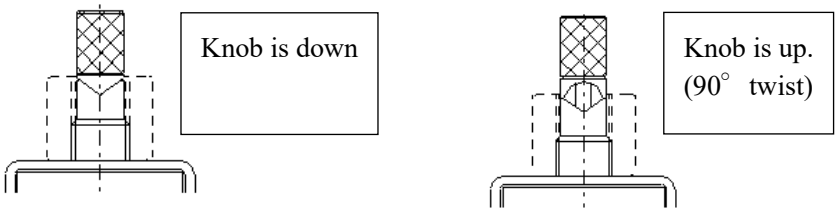
  Power ON: Check valve opened (OPEN)
  Power OFF: Check valve closed (CLOSE)

- The shut off valve is equipped with a manual operation part. When the manual operation part is set to “Switching state”, the check valve is left opened whether the power is turned ON or OFF. Usually set it to “Normal state”.

Appearance of bypass valve



Manual operation part



Nomal state　　Swiching state

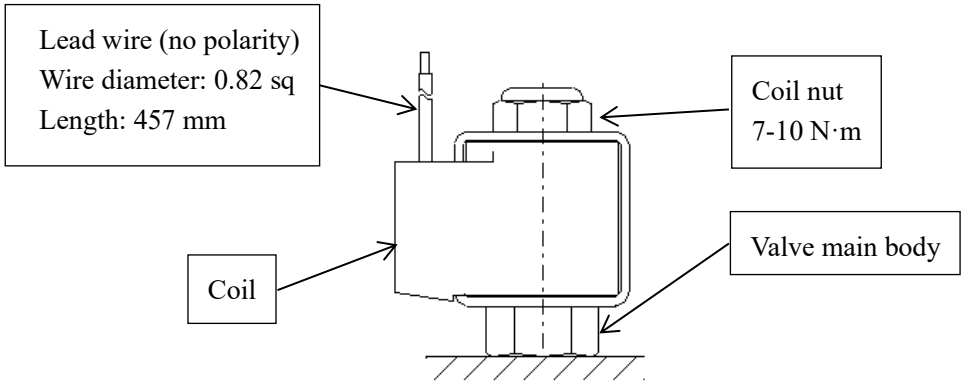
１２．Differential valve

- The differential valve is a solenoid valve. When the power is turned ON, switching from the hydraulic circuit to the differential circuit is performed. Because the differential circuit is intended to operate the cylinder in the advancing direction only, be sure to turn OFF the power when operating the cylinder in the retracting direction.
- The differential valve for 11 cc/rev (DS163BD024L) is equipped with a manual operation part. The manual operation part is of spring return type. When the knob is pushed in, the differential circuit is selected whether the power is turned ON or OFF.

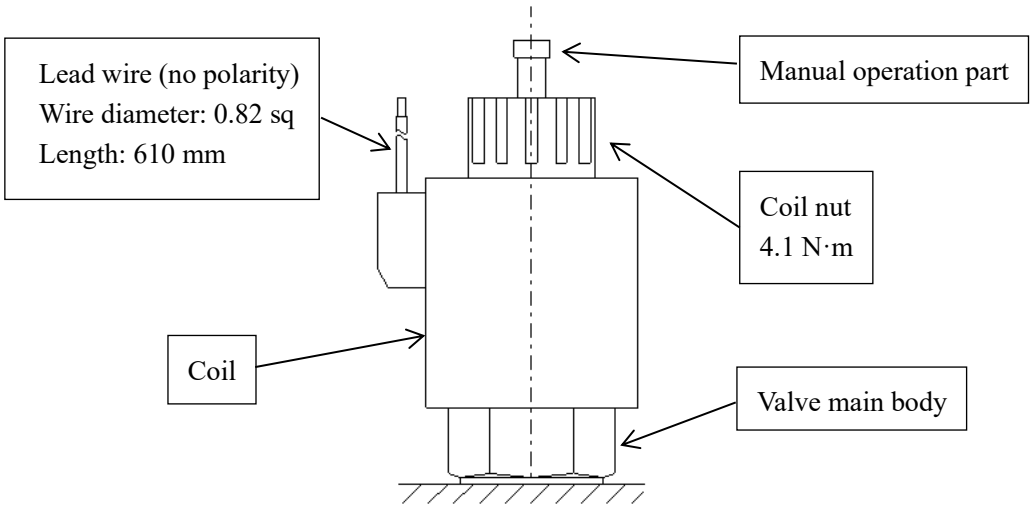
⚠ CAUTION

- Do not operate the cylinder in the retracting direction with the differential valve left ON. Doing so may lead to damage to the device.

Appearance of differential valve for 1.1 cc/rev and 3.5 cc/rev



Appearance of differential valve for 11 cc/rev



Note: Because the differential valve for 19 cc/rev to 60 cc/rev is designed based on an order, refer to the product drawing for the appearance, etc.

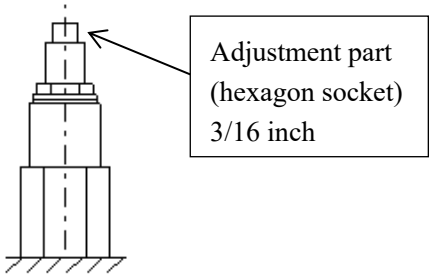
１３．Counter balance valve

- The counter balance valve is used to keep constant the cylinder back pressure. This valve is necessary when, for example, a heavy load (e.g. large mold) is attached to the rod tip.
- Because the counter balance valve is fully opened (not adjusted) when the product is shipped, adjust it on your part.
  Counter balance valve adjusted pressure (MPa) = Weight of tip (kg) / Pressure receiving area (mm^2) × 9.8
  Notes:
  - The pressure receiving area is the area on the side where the counter balance valve is provided. (Example: When the valve is provided on the R side, it is the area on the R side.)
  - Check the pressure by connecting the test hose ASSY (test hose + pressure gauge) between the counter balance valve and cylinder or to the test point provided directly on the cylinder.

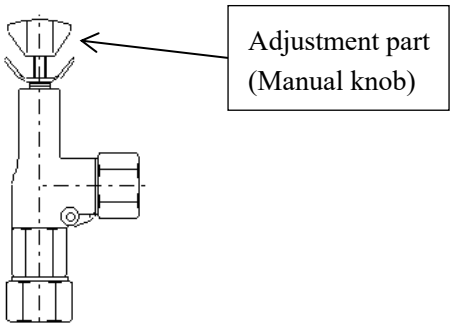
⚠ CAUTION

- If the adjusted pressure is high, the device may heat up.
- Do not adjust the pressure to a value exceeding the adjustment range of the counter balance valve.
- Attach and detach the pressure gauge with the cylinder stopped (with no pressure generated).

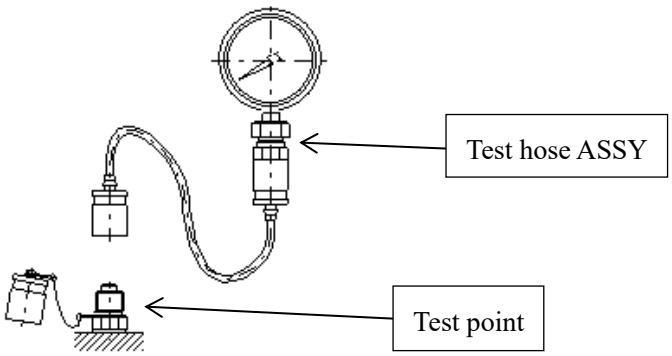
Appearance of integrated type counter balance valve



Appearance of separate type counter balance valve



Appearance of test point and test hose ASSY



Note: Because the counter balance valve for 19 cc/rev to 60 cc/rev is designed based on an order, refer to the product drawing for the appearance, etc.

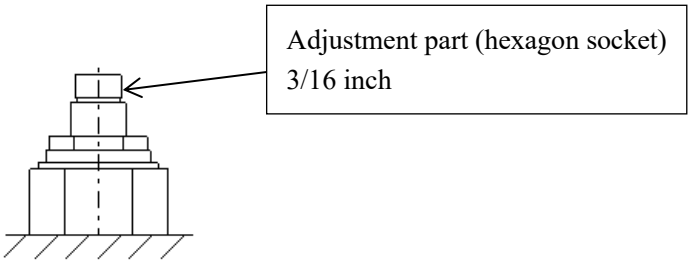
１４． Relief valve

- The relief valve is shipped with the relief pressure adjusted. For the adjusted pressure, refer to the product drawing.

⚠ CAUTION

- If the relief pressure is readjusted and made higher than it was at the time of shipment on your part, damage to the device may result. If the relief pressure is readjusted and made lower than it was at the time of shipment, the specifications may not be met. Therefore do not readjust the relief pressure.

Appearance of relief valve

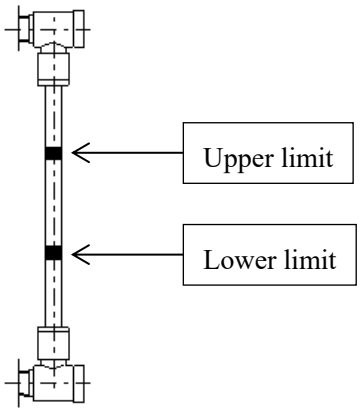


１５． Oil level gauge

- In the case of the separate type unit and integrated type cylinder without ACC, the level gauge is provided on the tank, and the marks (red) indicating the upper and lower limits are shown on the oil level gauge. Take care not to allow the oil level to get out of the range between the upper and lower limits while the cylinder is operating.

Appearance of oil level gauge

Note: The appearance of the joint used for the oil level gauge may vary depending on the model.



⚠ CAUTION

- Keep the oil level in the tank within the range between the upper and lower limits while the cylinder is operating. If the oil level exceeds the upper limit, the pressure in the tank will become excessive. If the oil level falls below the lower limit, air will be mixed. Because both will lead to a malfunction, keep the oil level within this range.

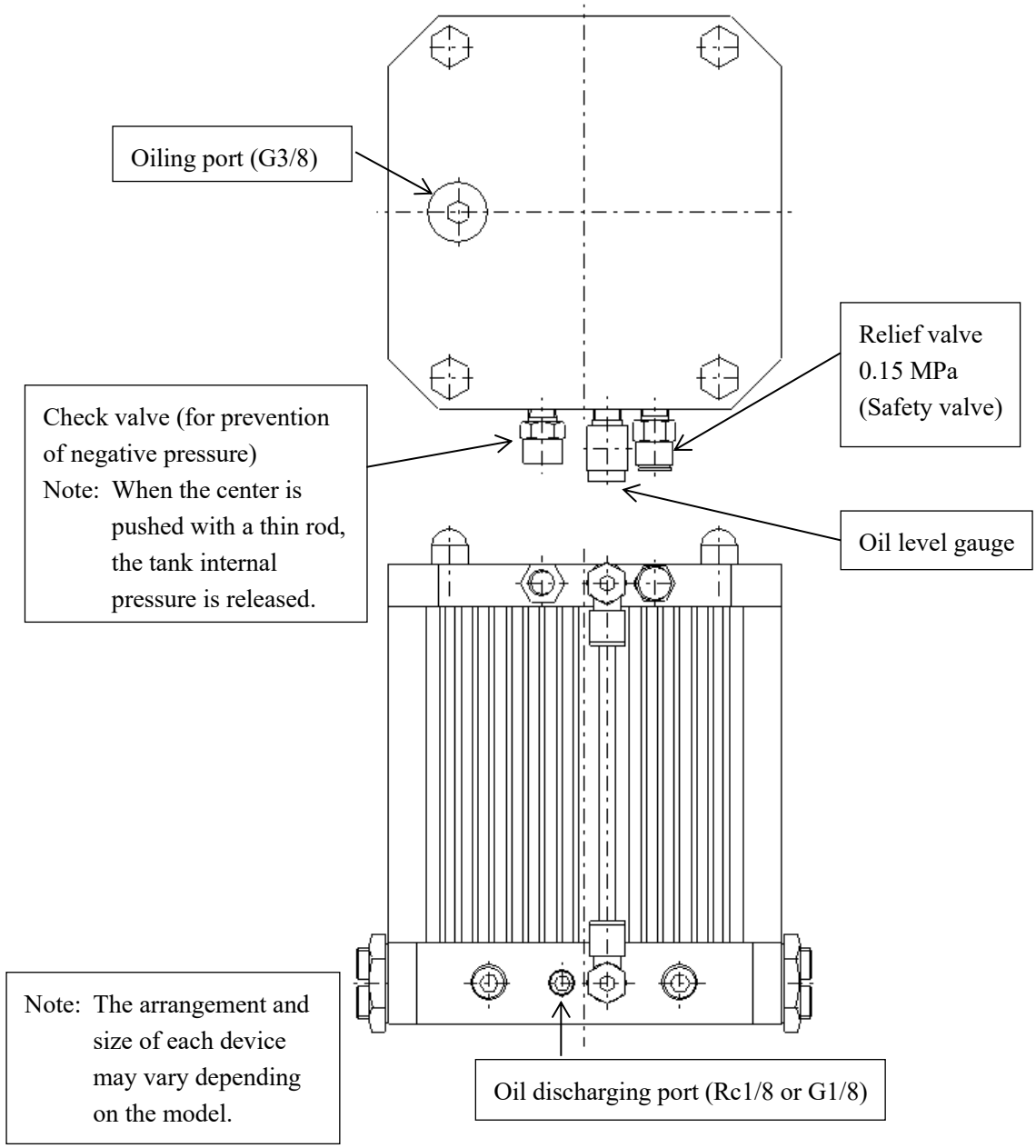
１６．Oiling and oil discharging

- Adjust the oil level by referring to the following as a guideline. The standard hydraulic oil is “Daphne Super Hydro A32”.
  - The oil level should be about 5 mm below the upper limit with the cylinder rod located at the retracting end.
  - The oil level should be about 5 mm above the lower limit with the cylinder rod located at the advancing end.

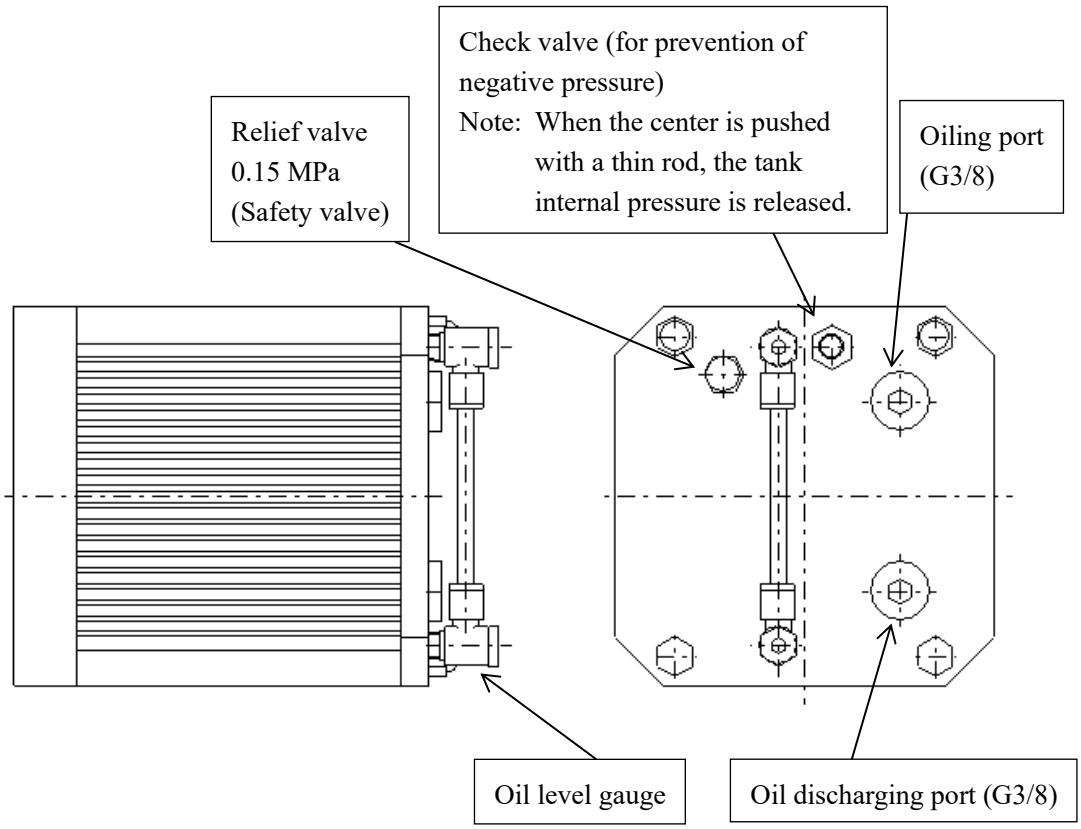
⚠ CAUTION

- When replenishing the tank with oil and when discharging oil from the tank, release the pressure in the tank beforehand. If such operation is performed with the pressure remaining in the tank, the oil etc. will spring out.
- When adjusting the oil level, stop the cylinder and turn OFF the servo. If this operation is performed with the cylinder operating, the oil may spring out.

Details of tank part of integrated type for downward rod and upward rod/separate type unit for 1.1 to 11 cc/rev

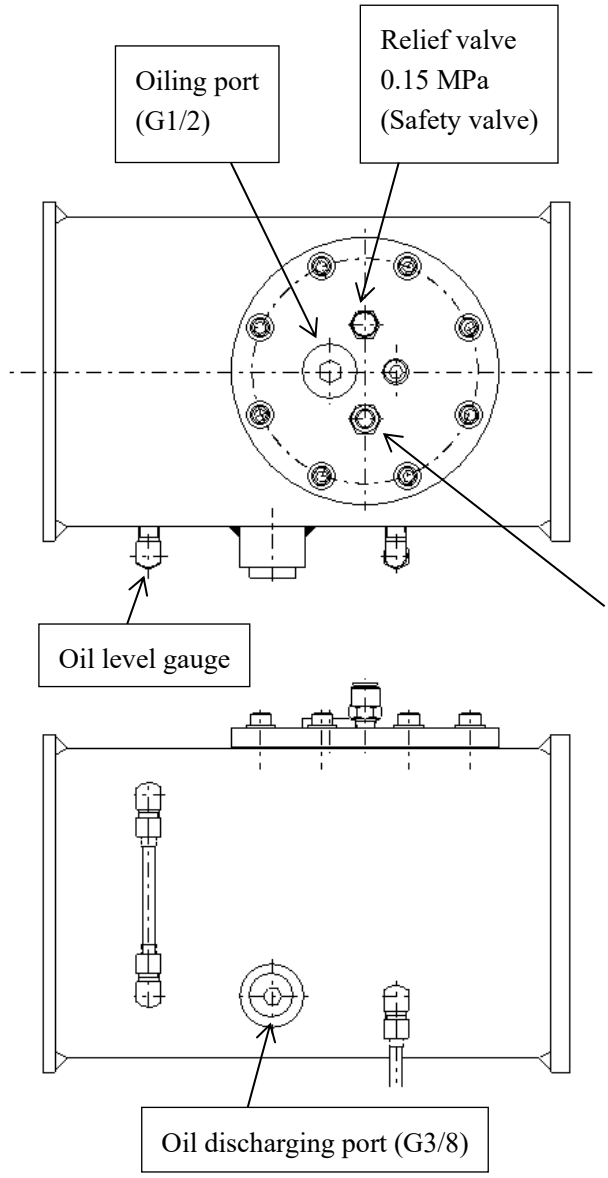


Details of tank part of integrated type for horizontal rod



Note: The arrangement and size of each device may vary depending on the model.

Details of tank part of separate type unit for 19 to 60 cc/rev



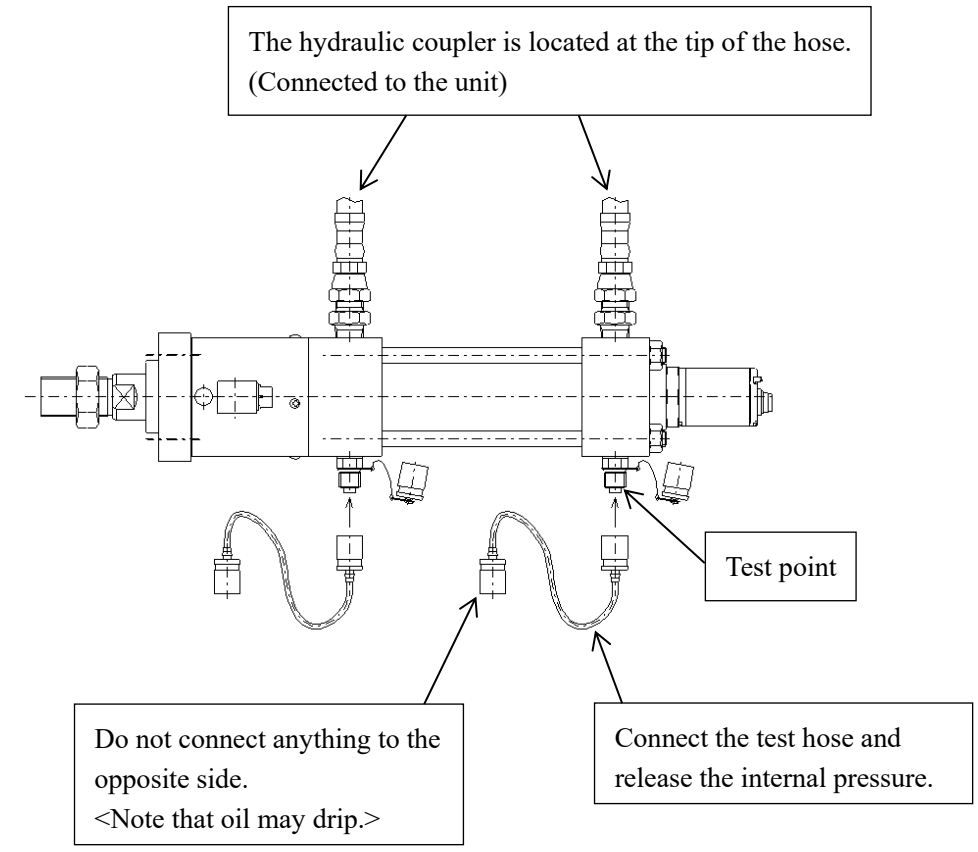
Note: The arrangement and size of each device may vary depending on the model.

１７． Hydraulic coupler

- The hydraulic coupler is included with the separate type. If the hydraulic coupler cannot be connected due to strong resistance, the pressure in the piping is high. In such a case, connect the test hose to the test point on the cylinder and release the internal pressure.

⚠ CAUTION

- Do not connect or disconnect the coupler in a pressurized state or residual pressure existing state. Connecting the coupler in a residual pressure existing state will lead to oil collecting in the coupler or damage to the seal. (In the case of oil collecting in the coupler, pseudo-leakage occurs but it stops in one to two months, which situation should be observed. In the case of damage to the seal, it is necessary to replace the coupler.)



Note: When connecting the coupler on the H side, use the test point on the H side.
When connecting the coupler on the R side, use the test point on the R side.

１８．Air releasing method

⚠ CAUTION

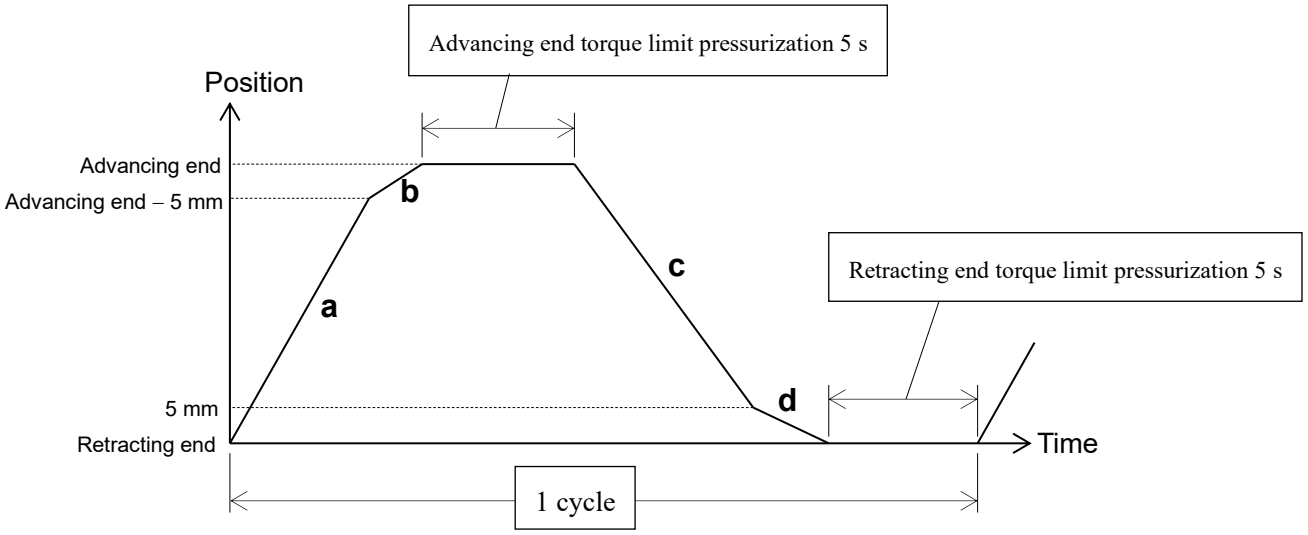
- When performing air releasing, lower the setting of the torque limit of the servo pack according to the following table. Because the cylinder end is used at the time of air releasing, performing air releasing with the torque limit left high will lead to damage to the device.

Maker (Parameter No.)	Cylinder rated pressure	Torque limit
Yaskawa Electric (Pn402, Pn403)	14 MPa or less	50
Yaskawa Electric (Pn402, Pn403)	21 MPa	30
Mitsubishi Electric (PA11, PA12)	14 MPa or less	16
Mitsubishi Electric (PA11, PA12)	21 MPa	10

- In the case of the integrated type with ACC, a dedicated air releasing unit is necessary for performing air releasing. If it is necessary to perform air releasing, contact our company.

１８－１．Air releasing method for other than integrated type with ACC

- In the case of other than the integrated type with ACC, perform the following operation for two hours or more. (For the air releasing methods for the separate type unit single body and cylinder single body, refer to 18-2. and 18-3.)



Speed in each section

Section	Position	Speed
a	Retracting end to Advancing end – 5 mm	Rated speed × 1/3
b	Advancing end – 5 mm to Advancing end	10 mm/s or Rated speed × 1/3, whichever is lower
c	Advancing end to 5 mm	Rated speed × 1/3
d	5 mm to Retracting end	10 mm/s or Rated speed × 1/3, whichever is lower

⚠ CAUTION

- If the oil temperature (the surface temperature of the device) becomes 50°C or more during the air releasing operation, set a pause time after Section a or Section c to lower the temperature.

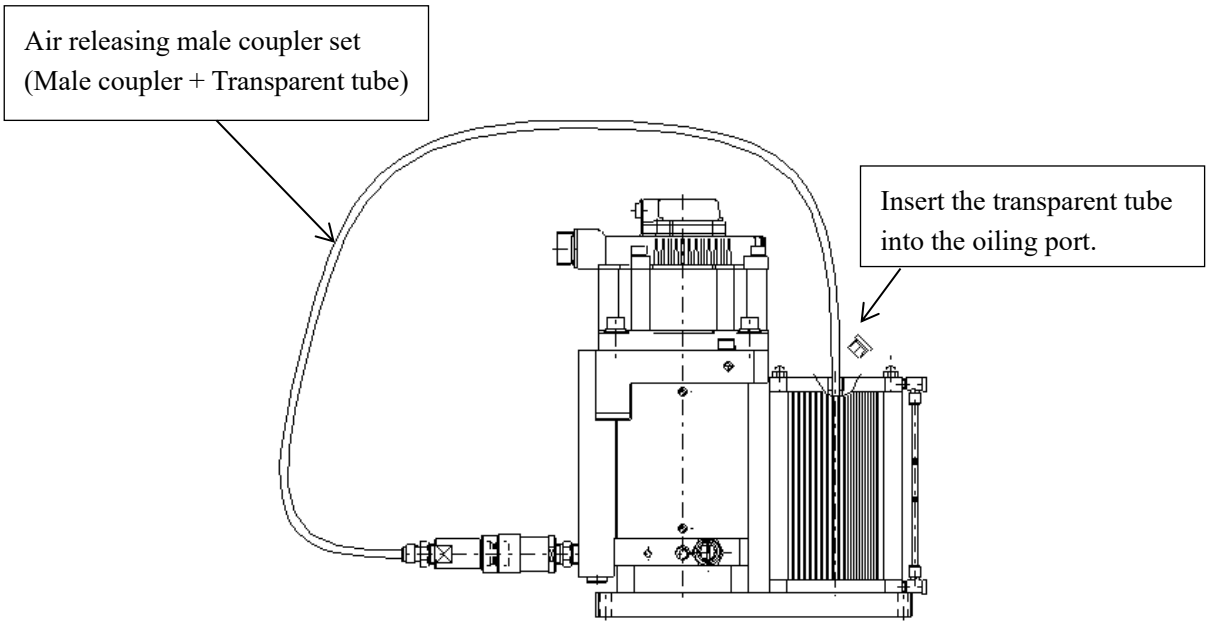
１８－２．Air releasing method for separate type unit

- In the case of the separate type unit, using an air releasing male coupler set, perform air releasing as shown below. (Because the air releasing male coupler set is not included with the product, purchase it separately when necessary.)

Air releasing on unit H side	Connect the air releasing coupler to the coupler on the unit H side, insert the transparent tube into the tank oiling port, and rotate the pump so as to operate the cylinder in the advancing direction. (Rotate the pump for several seconds, stop it and then rotate it for several seconds again. Repeat this several times until no air comes out.) Do not connect anything to the coupler on the unit R side. When performing inching with the controller, do so at 10 mm/s. When performing jogging with the servo pack, do so at 300 rpm.
Air releasing on unit R side	Connect the air releasing coupler to the coupler on the unit R side, insert the transparent tube into the tank oiling port, and rotate the pump so as to operate the cylinder in the retracting direction. (Rotate the pump for several seconds, stop it and then rotate it for several seconds again. Repeat this several times until no air comes out.) Do not connect anything to the coupler on the unit H side. The pump rotation speed is the same as that for the H side.

⚠ CAUTION

- When opening the tank oiling port (disconnecting the plug), release the pressure in the tank beforehand. If operation is performed with the pressure remaining in the tank, the oil etc. will spring out. (For how to release the tank internal pressure, refer to “16. Oiling and oil discharging”.)



１８－３．Air releasing method for separate type cylinder

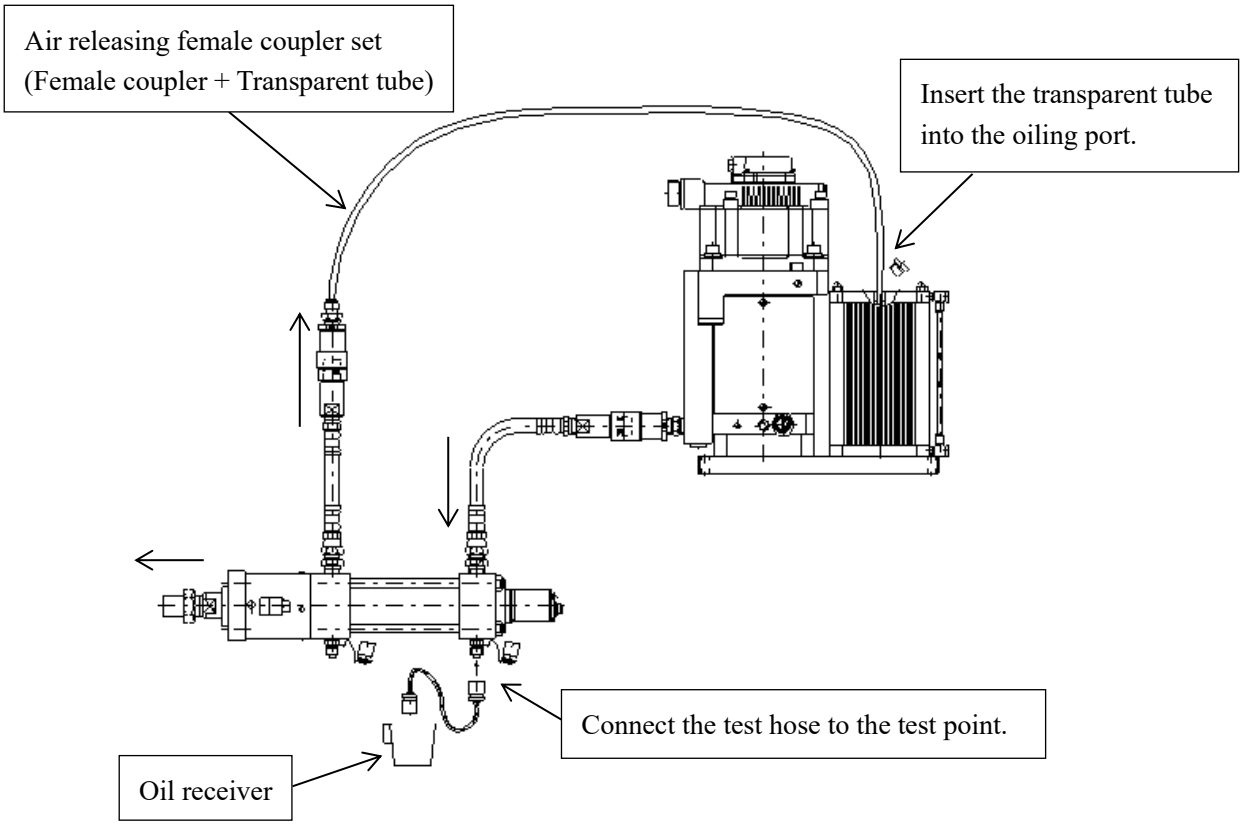
- In the case of the separate type cylinder, using an air releasing female coupler set and a test hose, perform air releasing according to the following procedure. (Because the air releasing female coupler set and test hose are not included with the product, purchase them separately when necessary.)

Step	Description
1	Connect the coupler on the cylinder H side to the coupler on the unit H side, connect the coupler on the cylinder R side to the air releasing coupler, and insert the transparent tube of the air releasing coupler into the tank oiling port.
2	Advance the cylinder rod to the advancing end. [Air releasing on cylinder R side] When performing inching with the controller, do so at 10 mm/s. When performing jogging with the servo pack, do so at 300 rpm.
3	Connect the test hose to the test point on the cylinder H side, and rotate the pump so as to operate the cylinder in the advancing direction. Because oil and air come out of the test hose, receive the oil. When oil only comes out, stop rotating the pump and disconnect the test hose. [Air releasing of hose on H side] The speed (rotation speed) is the same as that shown in step 2.
4	Connect the coupler on the cylinder R side to the coupler on the unit R side, connect the coupler on the cylinder H side to the air releasing coupler, and insert the transparent tube of the air releasing coupler into the tank oiling port.
5	Retract the cylinder rod to the retracting end. [Air releasing on cylinder H side] The speed (rotation speed) is the same as that shown in step 2.
6	Connect the test hose to the test point on the cylinder R side, and rotate the pump so as to operate the cylinder in the retracting direction. Because oil and air come out of the test hose, receive the oil. When oil only comes out, stop rotating the pump and disconnect the test hose. [Air releasing of hose on R side] The speed (rotation speed) is the same as that shown in step 2.
7	Repeat steps 1 to 6 several times.

⚠ CAUTION

- When opening the tank oiling port (disconnecting the plug), release the pressure in the tank beforehand. If operation is performed with the pressure remaining in the tank, the oil etc. will spring out. (For how to release the tank internal pressure, refer to “16. Oiling and oil discharging”.)

Schematic drawing for steps 1 to 3 (For steps 4 to 6, bear in mind that the H side and R side are in opposite relationship.)



１９．Maintenance and checking

- For routine checking, check the following items at intervals of two to three days. If an abnormal condition is found, contact our company.
  (1) Abnormal sound, abnormal vibration, and shock
  (2) Abnormality in the cylinder stroke
  (3) Oil leakage
  (4) Flaws, abnormal stains and adherents in the rod
  (5) Distortion and abnormal bending of the cylinder-mounting frame
  (6) Loosening of cylinder-mounting bolts and nuts
  (7) Quantity of oil

⚠ WARNING

- Make sure that safety measures have been taken before conducting maintenance and checking work on this product.
- To use this product safely, conduct maintenance and checking work on this product.

２０．Maintenance

- In order to use this product safely, it is necessary to perform maintenance periodically.
- Though the maintenance interval depends on the use condition, it is recommended that the interval be two years, cylinder total travel distance of 300 km or 5 million cycles, whichever elapses earlier.
- At the time of maintenance, contact our company without disassembling the product.

２１．Disposal

- To dispose of this product, drain the hydraulic oil thoroughly and separate different materials before disposal.
- Dispose of resin and rubber-based materials as non-combustibles.
- Dispose of used oil in conformity with the relevant laws and regulations.

２２．Warranty

- The warranty period is 12 months dating from the day of delivery. Should (a) malfunction(s) occur due to poor design, workmanship, or defective materials within this period of time, we will repair the product or replace parts thereof at no charge. However, the following cases are outside the warranty even within the warranty period:
  (1) Failures arising from improper handling and use under conditions and environments outside the specifications
  (2) Cases where repair was carried out by those other than us
  (3) Failures arising from modifications/changes made to the product by those other than us
  (4) Failures due to wrong operations or insufficient checking
  (5) Failures due to acts of God or disasters

Revision	Description of revisions	Date
△1	１１． Change	Apr.19.2019
△2		
△3		

Please note that the description is subject to change without notice for improvement.