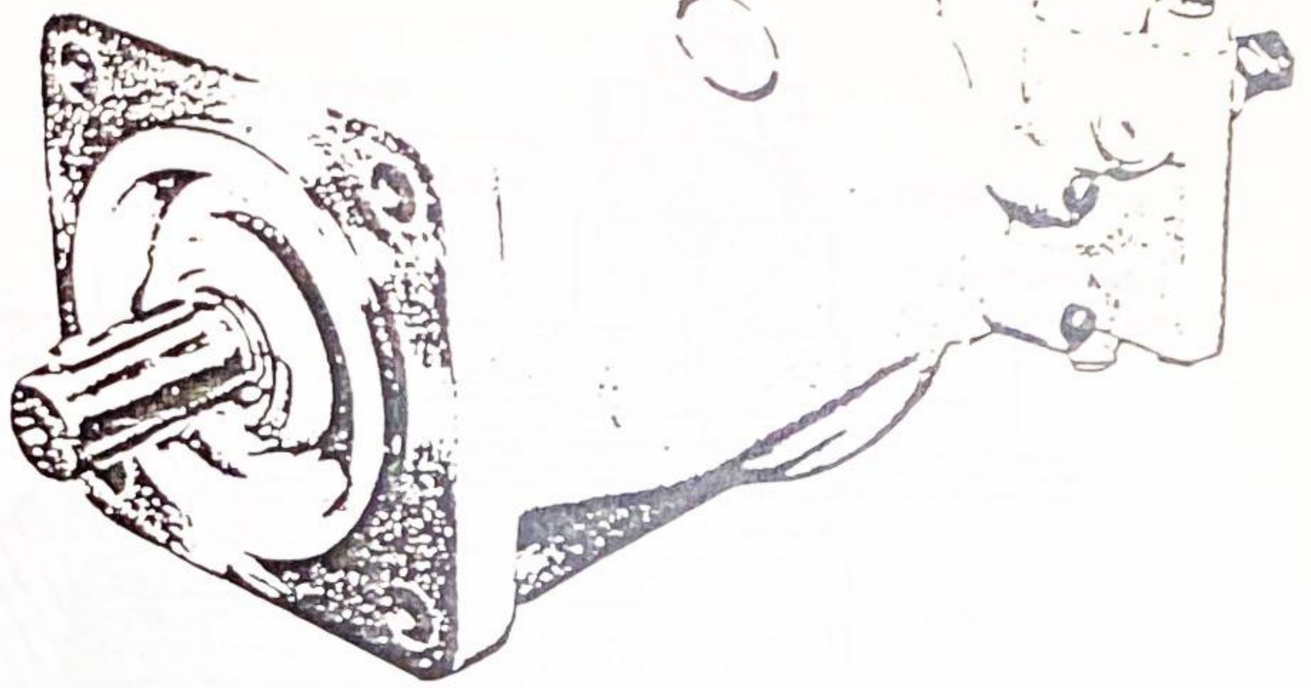


C600M E/85.01

Operating instructions

Variable displacement piston pump

A10V

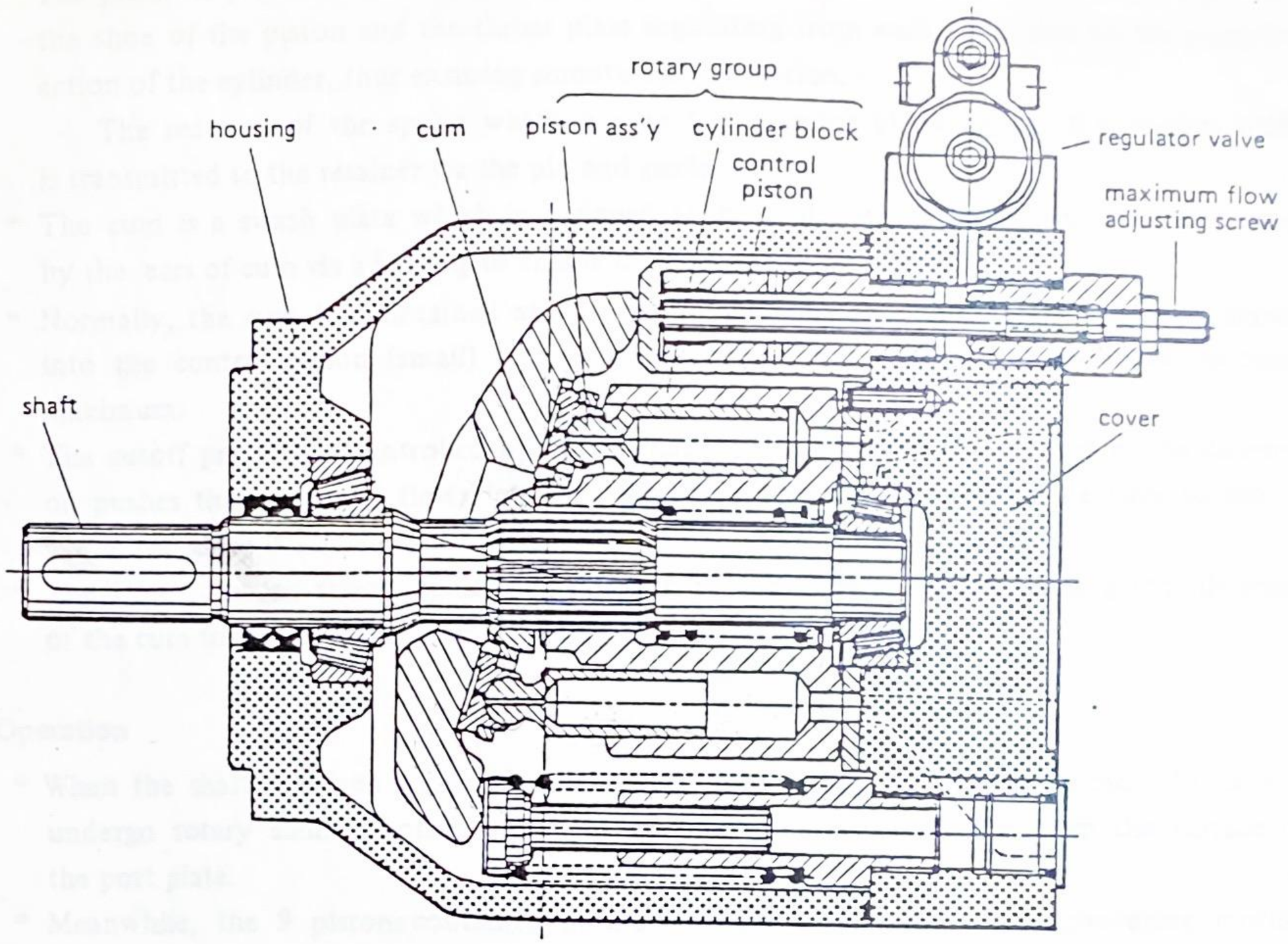
Series : 1

Pressure:up to 210kgf/cm²

Size : 16~63cc/rev

A member of the REXROTH group

UCHIDA OIL HYDRAULICS



• Construction

The parts configuration of the A10V piston pump is the same for all sizes. The parts of this pump are divided into a housing, cover, shaft, rotary group, cum, control piston, regulator valve, and so on.

The rotary group which performs pumping action consists of a cylinder block, piston ass'y, retainer, guide and spring.

* The cylinder block is installed in the housing via spline on shaft which is supported front and rear by bearings.
* Between the cylinder block and the cover is the control plate which constitutes the sliding face of the cylinder block.
* The cylinder block is continually pressed against the control plate at a constant force by a spring inside the cylinder block, ensuring a stable sliding motion.

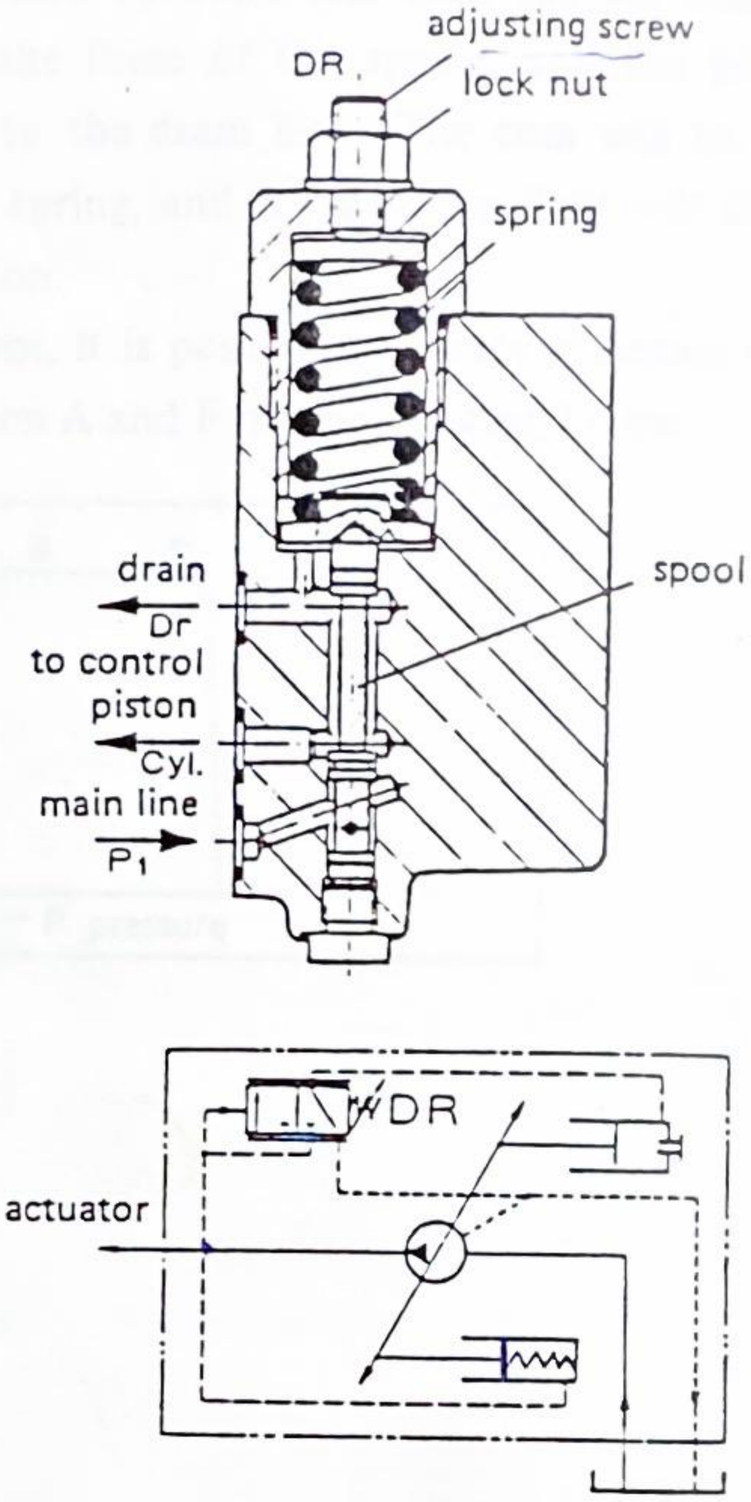
FUNCTION

* The piston is pressed against the thrust plate installed in the cum by the retainer, to prevent the shoe of the piston and the thrust plate separating from each other due to the pumping action of the cylinder, thus ensuring smooth sliding motion.

  The reaction of the spring which presses the cylinder block against the control plate is transmitted to the retainer via the pin and guide.
* The cum is a swash plate which is designed to control the piston stroke. It is supported by the ears of cum via a bearing to enable its tilt angle to be varied.
* Normally, the cum is maintained at the maximum angle by the pressure of the oil drawn into the control piston (small) and also the spring force, so that piston stroke becomes maximum.
* The cutoff pressure is controlled by the regulator valve. During cutoff, part of the delivery oil pushes the spool and flows into the control piston (large), causing the cum to return to the tilt angle 0°.
* The flow adjusting screw regulates the stroke of the control piston, causing the tilt angle of the cum to vary arbitrarily, and thereby sets the delivery rate.

- Operation
  * When the shaft is driven by an electric motor, engine, and so on, the cylinder block will undergo rotary sliding motion while maintaining a certain clearance from the surface of the port plate.
  * Meanwhile, the 9 pistons contained in the cylinder block undergo reciprocating motion following the thrust plate on the cum. This results in a volumetric change, causing suction and delivery pumping action to take place.
  * During the suction stroke when the pistons are moving from the bottom dead point to the top dead point, an amount of oil equal to the stroke volume flows from the suction port on the cover, via the port plate, into the cylinder block.
  * While the pistons are moving from the top dead point to the bottom dead point, the oil is forcibly discharged, via the port plate, to the delivery port in the cover.
  * Each time the cylinder block makes one revolution, each piston will undergo a suction and delivery stroke, hence if the shaft is rotated by a prime mover, suction and delivery will take place continuously.

• DR regulator (constant pressure control)



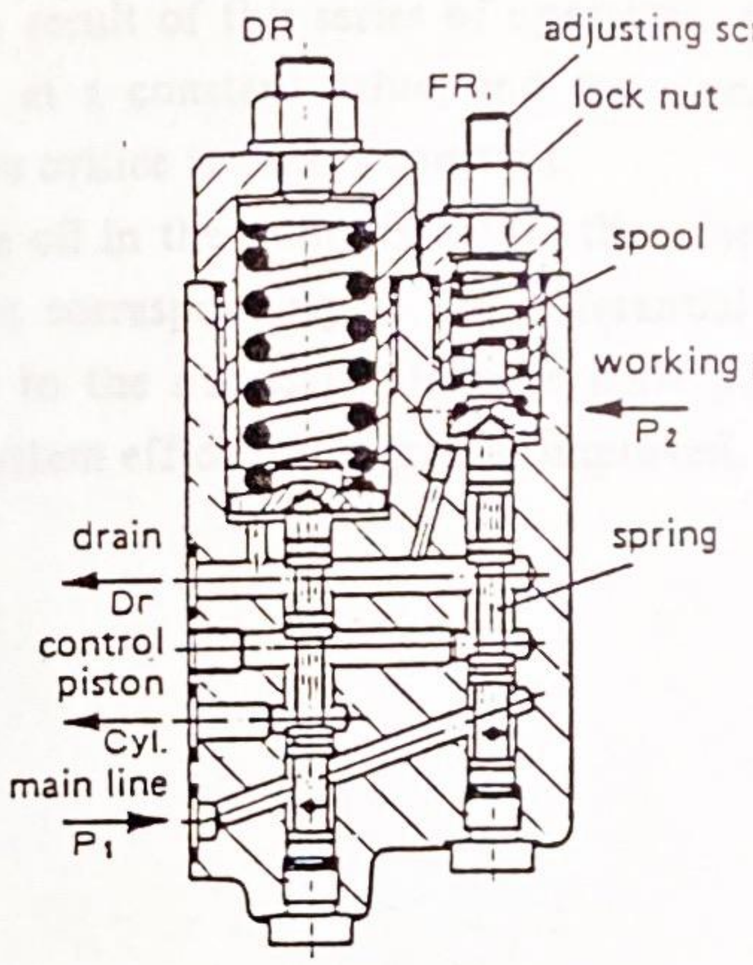
The delivery pressure is controlled by the spool and spring. When the line pressure rises to the set value of the DR regulator, the tilt angle of the cum will automatically become 0°, and the delivery will become zero.

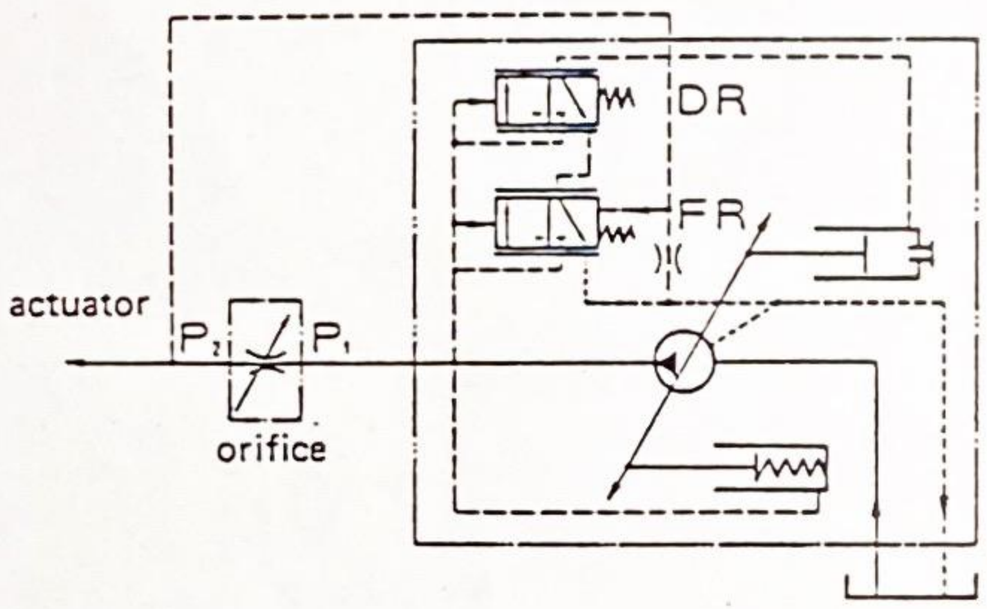
This condition is known as a dead head.

* Part of the pressurized oil is fed to the end of the spool, and when the pressure load from the spool exceeds the set load of the spring, the spool will move, causing the oil pressure to fall off. The oil will flow into the control piston (large), causing the tilt angle of the cum to be gradually returned to 0°, hence the suction and delivery stroke of the piston will decrease, and the delivery from the pump will fall off.
* The magnitude of the reduced pressure of the oil which flows into the control piston (large) will be automatically regulated so that it is equal to the sum of (1) the moment force tending to tilt the cum and (2) the compression force of the cum spring, acting on the difference in area between the large and small control pistons.

FUNCTION

• DFR regulator (constant pressure/constant flow control)





A variable or fixed orifice is installed in the main line, and the pressure difference across the orifice mainteined constant, that is, the delivery flow is maintained constant.

* Like the DR valve, the pump pressure is applied to the end of the spool of the FR valve, and also the working pressure is applied to the inside of the spring chamber. The difference between these pressures is set by the spring.
* If the pump flow is excessive with respect to the flowrate setting of the orifice, the difference between the delivery pressure and the working pressure will become larger than the set pressure difference. As a result, the spool will move and part of the delivery pressure will flow to the control piston (large), causing the cum to move and reduce the delivery flow.
* Conversely, if the discharge from the pump is low with respect to the setting of the orifice, the difference between the delivery pressure and the working pressure will become less

than the set pressure, hence the spool will be pushed back by the spring, the pressurized oil in the control piston will be released to drain, and the delivery from the pump will increase once again. As a result of this series of operation, the FR valve will automatically maintain $P_1 - P_2 = \Delta P$ at a constant value, and the pump will deliver oil so that the pressure difference across the orifice is always constant.

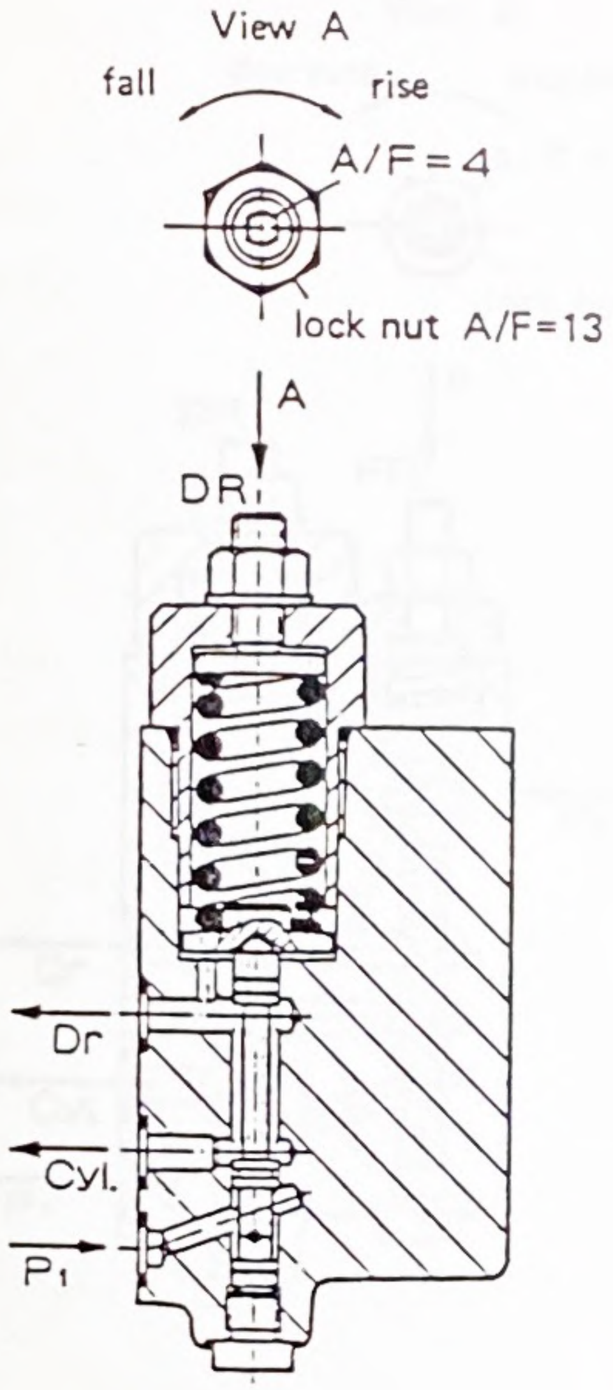
* The pressure of the oil in the pump is higher than the pressure required to operate the actuator by an amount corresponding to the differential pressure setting spring, and also the delivery is limited to the necessary flowrate corresponding to the opening of the orifice, hence the overall system efficiency is greatly improved.

ADJUSTING PRESSURE AND FLOW

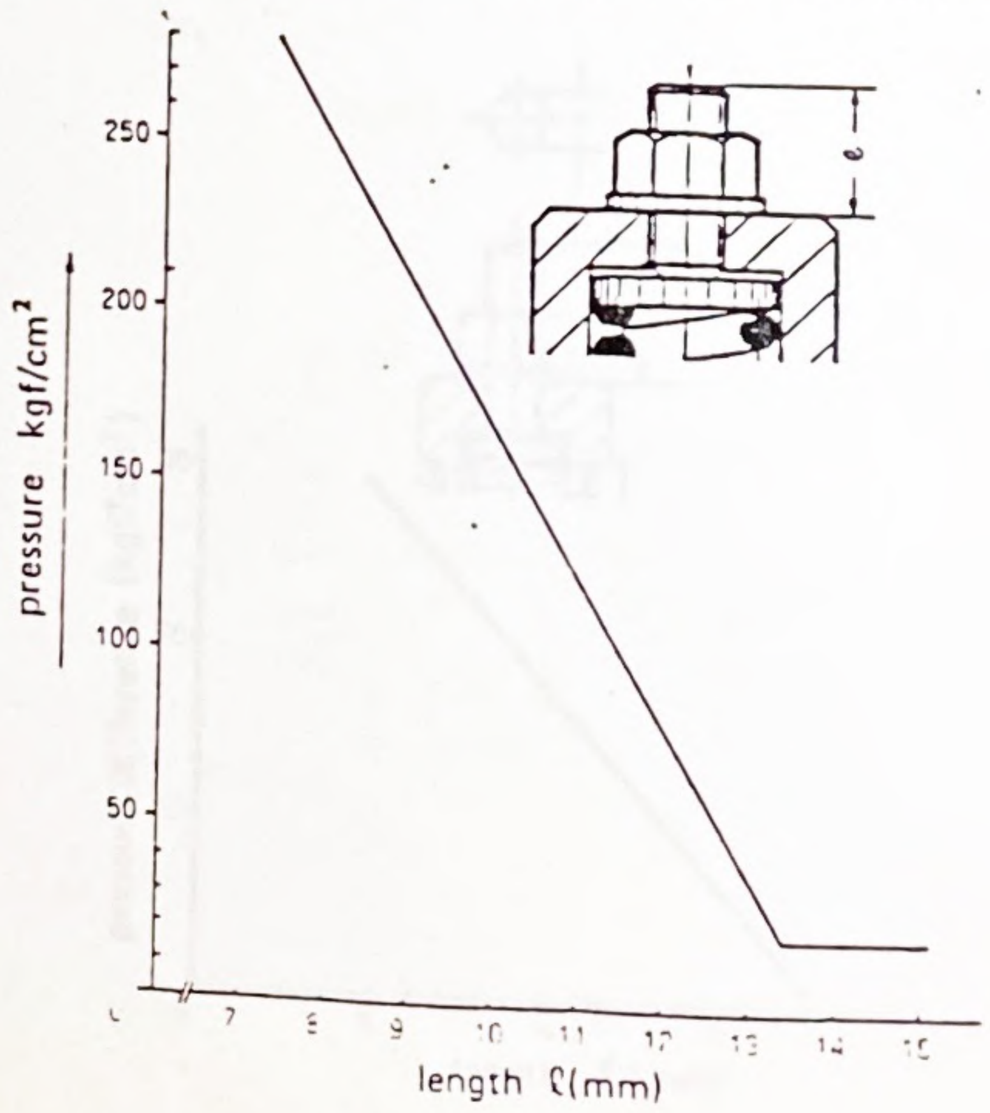
- Method of adjusting pressure

It is possible to set the pressure arbitrarily by rotating the adjusting screw of the DR valve.

* Turning it to the right (clockwise), will cause the pressure to rise.
* Turning it to the left (counter-clockwise), will cause the pressure to fall.



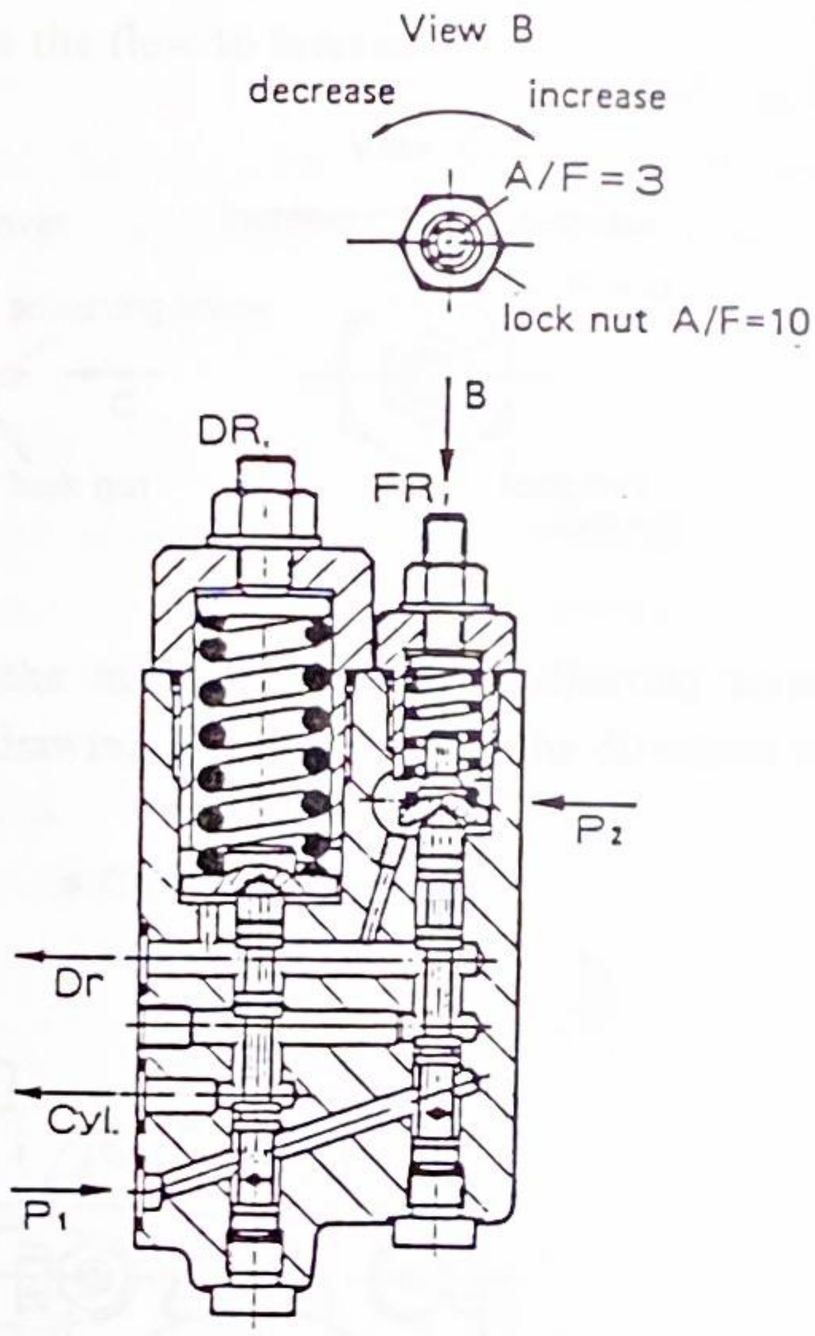
* It is possible to adjust the pressure within the range 20 to 250 kgf/cm² .



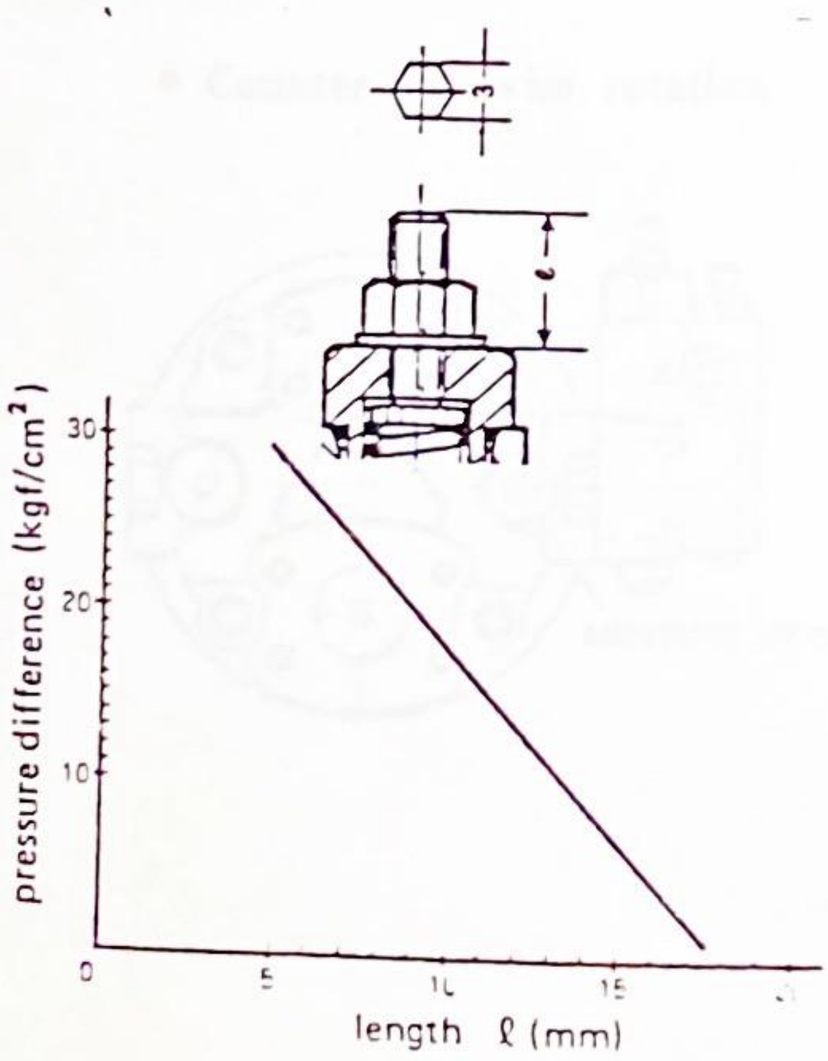
ADJUSTING PRESSURE AND FLOW

It is possible to arbitrarily set the pressure difference by turning the adjusting screw on the FR valve.

* Turning it to the right will cause the pressure difference to increase.
* Turning it to the left will cause the pressure difference to decrease.



* It is possible to regulate the pressure within the range 4 to 35 kgf/cm².

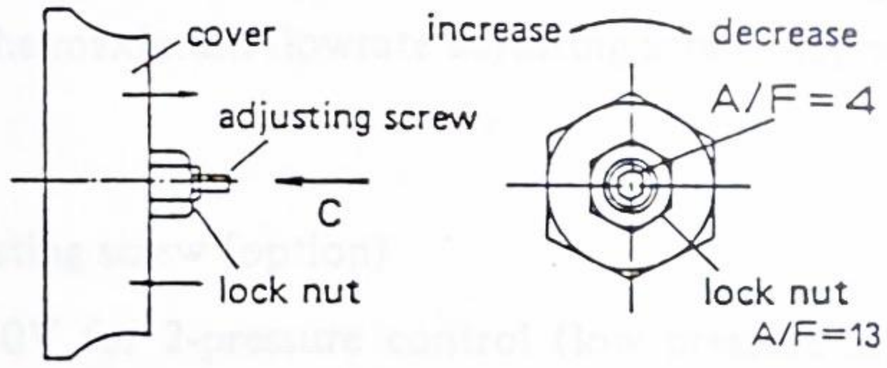


• Method of adjusting delivery flow

Adjusting maximum flowrate

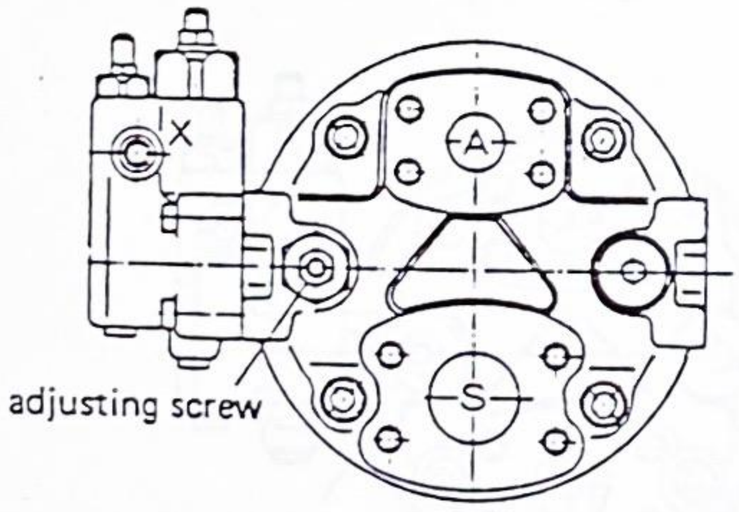
It is possible to arbitrarily set the maximum flow by turning the adjusting screw installed on the cover.

* Turning it to the right will cause the flow to decrease.
* Turning it to the left will cause the flow to increase.

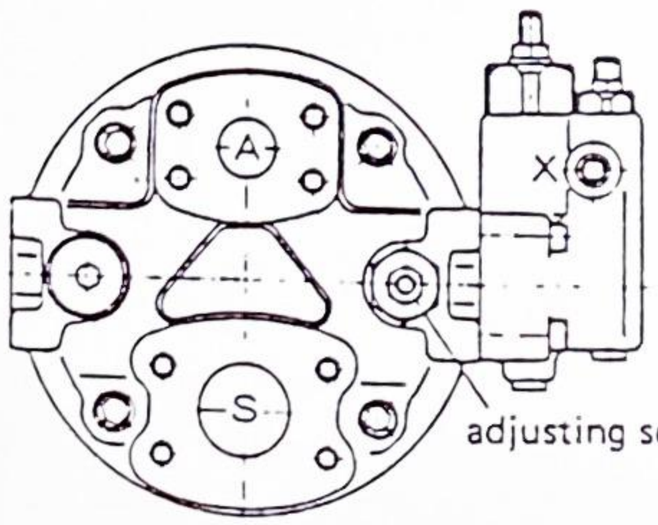


* The installation position of the maximum flowrate adjusting screw and the DR (DFR) valve differ, as shown in the drawing, depending upon the direction of rotation of the pump.

• Clockwise rotation



• Counter-clockwise rotation



* Adjusting range of displacement

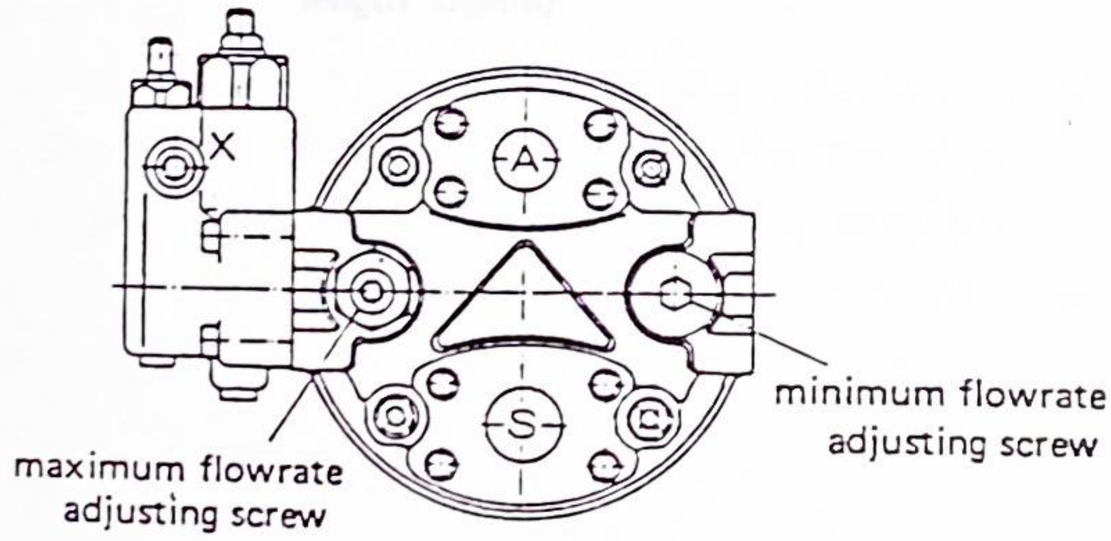
Size	Displacement (cc/rev)
A10V 16	16 ~ 0
25	25 ~ 4.1
40	40 ~ 10.4
63	63 ~ 20.8

* The relationship between the length (ℓ)of the adjusting screw and the flow is shown in the diagram on page 11. Use this diagram as a guide when setting the delivery pressure.
* In special cases, the maximum flowrate adjusting screw may sometimes be omitted.

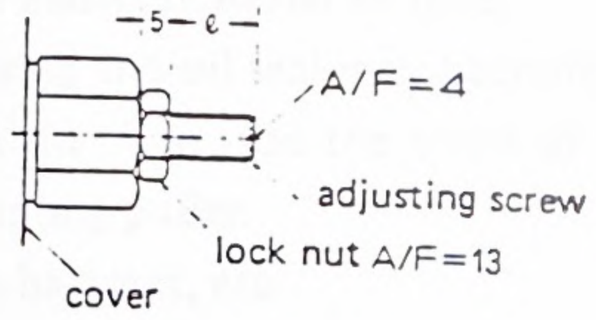
Minimum flowrate adjusting screw (option)

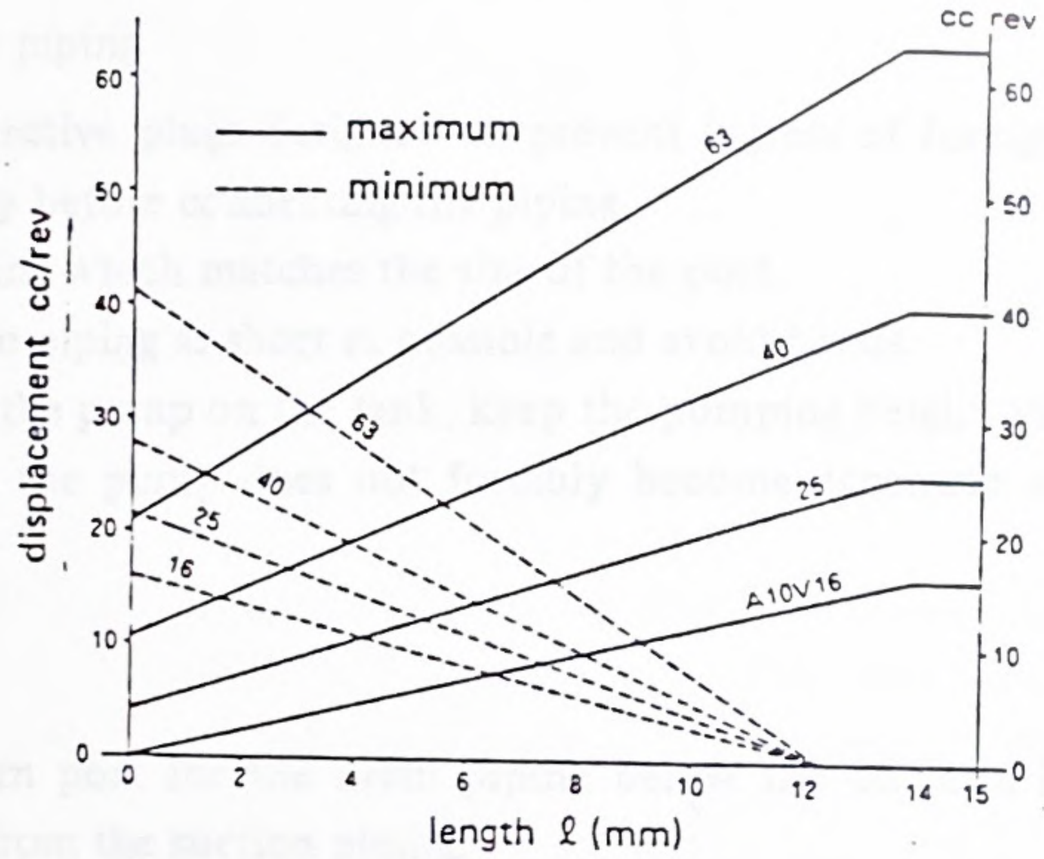
When using the A10V for 2-pressure control (low pressure high flow and high pressure small flow, a minimum flowrate adjusting screw may sometimes be installed as an option.

* The construction of this screw is the same as the maximum flowrate adjusting screw.
* Turning it to the right will cause the flow to increase.
* Turning it to the left will cause the flow to decrease.
* The minimum flowrate adjusting screw is installed on the opposite side of the DR (DFR) valve, between the suction and delivery ports.



* The relationship between the length (ℓ) of the screw and the flowrate is as shown in the diagram below. Use the dotted lines in this diagram as a guide when adjusting the flowrate.





- Installing and centering pump
  - * The pump may be installed in any position.
  - * Connect the pump to the shaft using flexible coupling.
  - * Sometimes, the coupling constitutes a source of noise. It is therefore recommended that a coupling made of rubber or other elastic material be used.
  - * If the shaft is out of line, the bearing and oil seal may become damaged.
  - * When installing the coupling on the shaft, use the screw at the end of the shaft. When removing the coupling, use the coupling puller.
    Do not strike the coupling with a hammer, etc.

- Suction and delivery piping

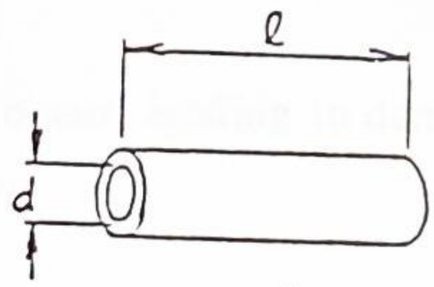
Remove the protective plugs designed to prevent ingress of foreign matter when transporting the pipes, immediately before connecting the piping.

  - * Use suction piping which matches the size of the port.
  - * Keep the suction piping as short as possible and avoid bends.
  - * When installing the pump on the tank, keep the pumping height within 1 m.
  - * Be careful that the pump does not forcibly become eccentric as a result of installing the piping.

- Drain piping
  - * Install the return port for the drain piping below the oil level in the tank, and at a point which is so far from the suction piping.
  - * Because the amount of drain during normal operation (before DR valve operates) is no greater than 1.2 ℓ/min, there is no risk of the pressure in the case rising above the permissible value (0.5 kgf/cm²). After cutoff, when the pump is in a dead head condition, however, the quantity of drain will rise abruptly, hence the pressure in the case will increase. Because this pressure can cause damage to the piston shoe and oil seal, be sure to perform piping so that the following conditions are satisfied.
  - * Recommended drain piping size

Pump size	Piping size
A10V16, 25	>ϕ10
A10V40, 63	>ϕ10

d × ℓ



  - * When installing the pump so that the pump drain port is below the drive shaft, run the drain piping vertically upwards from an intermediate point until it reaches the top of the pump, in order to prevent air getting into the pump housing.