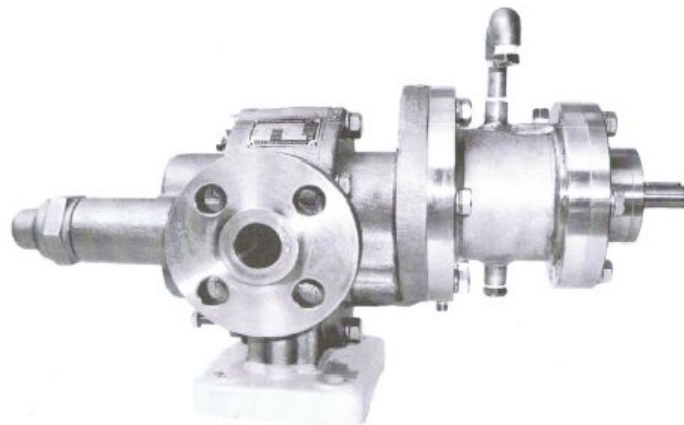


Instruction Manual for Gear Pump



NOTE:

Please read this manual carefully before using the pump in order to obtain maximum performance.

Please keep this manual handy for reference.

Daito Kogyo Co., Ltd.

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Safety Precautions

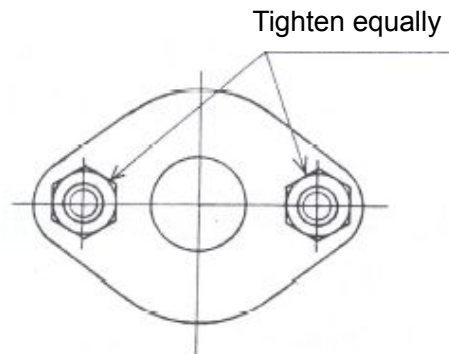
Note the following when handling the pump:

- 1) Do not remove the safety cover of the rotating object while the pump is in operation.
- 2) In principle, replenish the lubricating oil only while the pump is stopped.
If you must replenish the oil while the pump is in operation for reasons such as you cannot stop the pump, take great care to ensure safety although there is no structural risk.

- 3) Tighten the gland packing while the pump is stopped.

The gland packing on both sides should be tightened equally and a little at a time. Observe the operation condition, and tighten further if necessary.

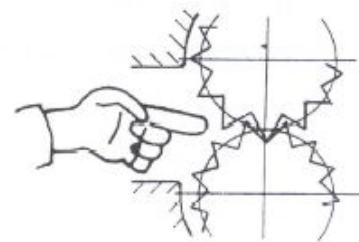
Over-tightening shortens the life due to the development of heat in the packing or abrasion of the shaft.



- 4) Reinstall the V-belt while the pump is stopped.

Reinstall to the reference 4) "tension" stated in section 6 "Maintenance" below, and check the degree of parallelism referring to **section 2, "Installation."**

- 5) If there is leakage from the shaft seal part or other parts, stop the pump before repairing it or taking countermeasures.
- 6) If inspections or maintenance operations are done manually while the safety cover is removed, turn off the power such that it cannot be turned on by mistake.
- 7) When removing the pump from the line, the fluid may spout from the flange as the flange bolt is loosened, so first drain the fluid completely through, for instance, the drainage of the pipeline.
- 8) When removing the pump from the line for inspections or repairs, note it is dangerous to insert your finger into the pump through the aperture.
- 9) In case of the circuit of a pipe which automatically opens/closes, a partial impact pressure occurs due to a small time lag generated upon opening/closing the valve or starting/stopping the pump, which could damage parts. Consider this carefully in the planning stage.



- 10) Do not operate the pump outside of its specifications.

This could cause a serious accident such as damage to the piping, pump parts, or equipment such as the motor.

Handling of MC-Type Seal-Less Gear Pump

- 1) Precautions for handling the magnet (permanent magnet) parts
 - a) Handle the magnet parts carefully during transport or assembly, otherwise an unexpected injury could occur such as your hand becoming trapped between attracting magnets (if the north and south pole face each other) or other magnetic objects such as metal.
 - b) Do not leave multiple magnets on the workbench at the same time or leave a magnetic object near a magnet. This could generate a strong attractive force, which could trap the hand between magnets or other magnetic object, or damage the magnet. In unavoidable circumstances, take safety measures such as keeping magnets and objects sufficiently far away from each other or interspersing a spacer.
 - c) Placing a magnetic product such as a magnetic tape, floppy disk, prepaid card, cash card, or electronic clock near the magnet could destroy or magnetize the magnetic data, making it unreadable.
 - d) If the product is handled by a person who uses an electronic medical device such as a pacemaker, it could hinder the normal functioning of the medical device and is very dangerous. Never allow such a person to handle the product for any reason. Similarly, do not place the product near a person who uses an electronic medical device.

- 2) Storage
 - a) Store the product in the designated packing condition such as attaching a cover for safety and to prevent breakage and contamination.
 - b) Clearly specify by using a warning mark during storage that the product is magnetic.
 - c) Do not place the magnet near an electronic device because this could affect the instrument or control panel, resulting in a failure or accident.

- 3) Disassembly of the Seal-Less Gear Pump
 - a) As stated in 1) and 2), assembly and disassembly of the pump involve risks such as the difficulty of handling the magnet parts or generation of a large thrust force. In addition, assembly and disassembly of the pump requires skill. For these reasons, when it is necessary to disassemble the pump for a regular inspection, for example, send the pump body to our factory or request our service engineer to visit you.

- 4) Use of the Seal-Less Gear Pump

Install a magnet filter in the piping on the pump suction side.

Preface

Thank you very much for purchasing the gear pump(s) of the Daito Kogyo Co., Ltd.

All pumps are inspected and shipped ready for immediate operation. Upon receiving the pump(s), carefully open the packaging so as not to damage the equipment and check the following:

- 1) Whether any damage or failure is visible
- 2) Whether all the ordered items and spare parts and accessories are present
- 3) Whether the pump rotates smoothly by manually revolving the coupling or V pulley (If it rotates smoothly when you turn it by hand, it is normal even if it feels a little heavy.)

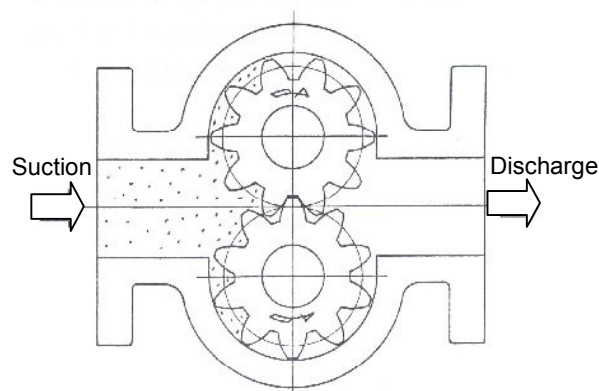
1. Outline of the Gear Pump

A gear pump is a kind of rotary pump and is defined as a positive displacement pump. Gear pumps are roughly classified into external and internal gear types.

The pump which you are now using is of the external gear type. Its operating principle is, as shown in the figure, that the fluid in the space between the valleys of the gears and the casing is forced out to the opposite side when the two gears rotate.

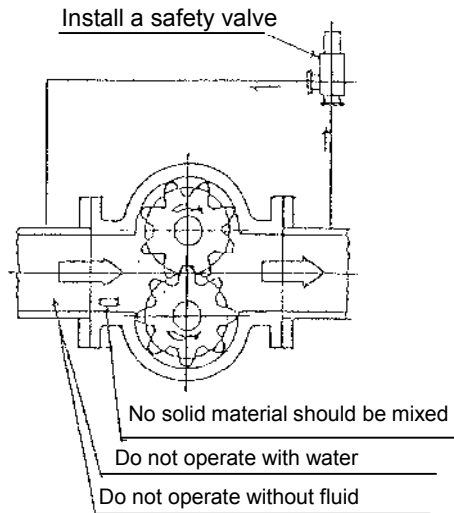
The pump has unique structural characteristics:

- 1) Simple structure and handling.
- 2) The discharge is almost constant, regardless of variations in supply pressure.
- 3) The desired discharge can be obtained by changing the rotating speed.
- 4) Any fluid, from low to high viscosity, can be used.
- 5) With a strong self-suction power, it can suction fluid from an underground tank or extract from a high vacuum tank. It can be used widely for the supply of chemical liquids, hazardous liquids, and low- and high-temperature liquids.
- 6) A high pressure can be obtained regardless of capacity and rotating speed.



Basic Precautions on Using the Gear Pump

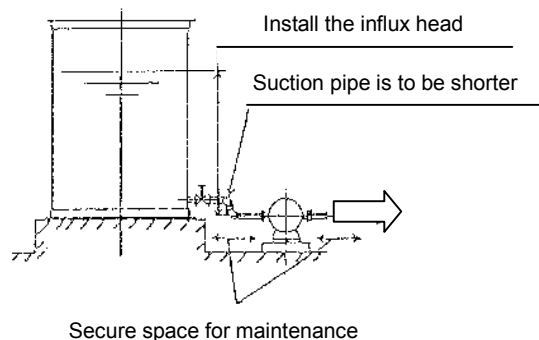
- 1) Be sure to install a strainer. If solid material is drawn in, it may become trapped in the gear and prevent rotation.
- 2) Do not use fluids other than the specified one or similar. Especially, using water for the oil pump could damage it.
- 3) Do not operate the pump with no fluid.
- 4) Install a safety valve. If the pipe on the discharge side is closed the pump pressure may damage the pump or could rise high enough to overload the motor. Therefore a safety valve, integrated or separately installed, is necessary.
- 5) The pump contains rust-preventive oil. If this could cause a problem, clean the pump interior before performing piping.
- 6) All the disassembled and cleansed pumps are degreased and dehydrated. Therefore, do not operate them without fluid for any reason.
- 7) In principle, the directions of rotation cannot be reversed. Contact us if reverse rotation is used.



2. Installation

Improper installation could affect the capacity or life of the pump, so note the following:

- 1) The pump should be installed near the tank of the suction side.
- 2) Install the pump at the position where the influx head is acquired. Especially when a high viscosity fluid is supplied, or extraction from a vacuum tank, etc. in which a high negative pressure arises on the suction side, the influx head is necessary.
- 3) Allow sufficient space around the pump for maintenance.
- 4) The surface of the foundation concrete should be level. If the pump is installed on a steel plate, resonance could occur, so sufficient rigidity with the frame of the pump is required.



- Although the pump is centered prior to shipping, thereafter transportation, installation, etc. may cause the shaft center to deviate. Therefore, after installation and piping, confirm or adjust the center of the couplings or the degree of parallelism of the V pulleys.

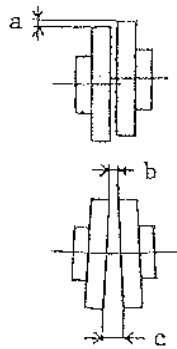
- In case of direct coupling

Measuring should be done at the four points.

(* If the temperature of the pump could become high (higher than 100°C), please contact us for safety.)

a = not more than 0.05 mm

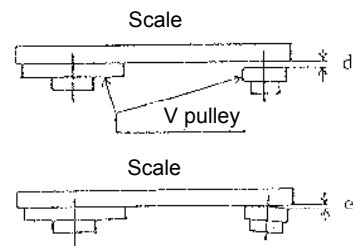
c – b = not more than 0.1 mm



- In case of V-belt driven

d = not more than 0.3 mm

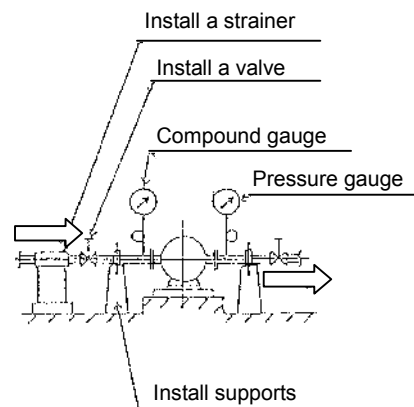
e = not more than 0.2 mm



3. Piping

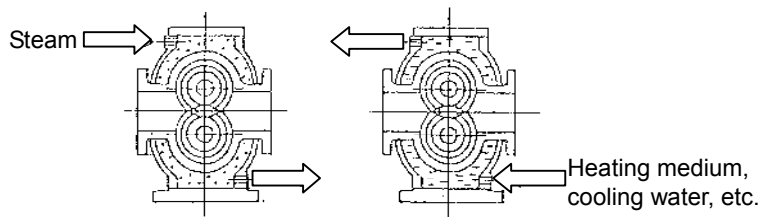
Note the following regarding piping.

- Ensure the pipeline is airtight. If air is sucked into the suction side pipeline from joints or others, it will affect the capacity of the pump.
- The pipeline should be supported on both sides of the pump, so that the stress and weight of the pipeline do not act on the pump.
- Install valves and pressure gauges (or compound gauges) on both sides of the pump for maintenance. If high viscosity fluid is supplied, install a gate valve or other low-resistance valve on the suction side. In case of screw jointing, union joints should be used on both sides of the pump.
- When the pump suction fluid from an underground tank or the piping of the suction side is long, install a non-return valve on the piping on the suction side so that the fluid inside the piping will not drop. When the piping on the discharge side is long, install a non-return valve on the pump outlet. For fluids that easily vaporize such as solvent and gasoline, install a relief valve so that the internal pressure will not act on the pump.



- Install a strainer on the suction side. The strainer should be of 40 mesh or higher and larger enough to make the pressure loss less than 20 kPa in relation to the viscosity of the fluid and flow rate.

- 6) If the pump has a jacket, the piping should be arranged so that the steam comes in from the upper side and goes out from the under side, while the heating medium, cooling water or other fluid comes in from the under side and goes out from the upper side.



- 7) During pressure-proof and airtightness tests of the pipeline, take care not to apply pressure to the pump. The oil seals and mechanical seals may be damaged by the pressure during non-operation.
- 8) Upon completion of the piping works, clean the inside of the pipeline to remove all welding waste, steel scraps and other foreign materials which would damage and bite the pump if drawn in.

4. Operation

Take the following precautions before starting operation.

- 1) Check that the installation, piping, etc. are complete and all the valves on the suction and discharge sides are fully open.
- 2) Before starting operation for the first time after installation, check the pump able to operate by manually rotating it, especially the coupling or V pulley.
- 3) Check that the supplied fluid will allow the pump to operate. In particular, check the temperature control in case the fluid hardens at ordinary temperature, and remove blind areas for piping works, etc.
- 4) For a jacketed pump, check that the steam or cooling water is flowing.
- 5) If the inside of the pump is cleaned and dried, take great care not to run a gear pump having an internal bearing without fluid.

Before using for the first time, be sure to draw the fluid into the pump before operating.

- 6) For all HP-S2 types and KH-S2 types, and other types of pumps instructed by the customer, the shaft seal portion is "vacant" at the time of shipment. Be sure to fill fluid which does not affect the supplied fluid before starting operation.
- 7) Some models of large geared motors and reduction gears, which are the motors delivered with the pumps, do not contain lubricating oil. Check the instruction manual of the motors before starting operation.
- 8) Switch on and off instantaneously and check the right and reverse directions of rotation.
- 9) Then switch on and check that the ampere meter, pressure gauge, and compound gauge are normal.
- 10) If handling a hot fluid, pre-heat the pump or gradually heat up the fluid's temperature. If the pump is subjected to a sudden change of temperature, it may not operate due to thermal expansion.

5. Abnormal Phenomena During Operation

If the pump has been working normally and then starts making a noise or the pressure or capacity decreases, or if it consumes an unusually large amount of power, check the following.

- 1) If air is sucked from the suction pipe or gland, if a volatile compound in the fluid evaporates and produces vapor, or if the fluid contains air bubbles, the pump will generate an unusual noise, the capacity will decrease, and the needle of the pressure gauge on the discharge side will deflect irregularly.
- 2) Clogging of the strainer will cause noisy cavitation and reduce the capacity and pressure.
- 3) If the viscosity of the fluid rises higher than as specified, the power needed for the pump will increase accordingly. Further, if the viscosity rises conspicuously, the pump will generate cavitation and noise, decreasing its capacity and pressure.
- 4) If the viscosity of the fluid becomes conspicuously lower than the specified value, the internal leakage of the pump will increase and the capacity and pressure will decrease.
- 5) If foreign matter enters the valve seat of the safety valve or the spring is damaged, the capacity and pressure will decrease.
- 6) If the center of the couplings extremely deviates, the pump will make a noise/vibration and the power consumed will increase greatly, which could eventually break the shaft.
- 7) If the discharge pipeline becomes clogged, the valve's opening is narrowed, or the fluid's viscosity increases unusually, the discharge pressure will exceed the specified value and the power consumed will increase greatly.
- 8) If the pump interior becomes severely worn over time (especially when fluid containing a slurry is used), noise will occur and the capacity and pressure will decrease. Also, wear of the bearing causes the gear to contact the casing, resulting in overloading. If this happens, the parts should be replaced.

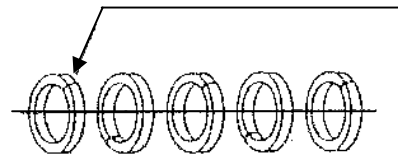
6. Maintenance

- 1) For a pump with gland packing at the shaft seal part, note the following.
 - a) Do not over-tighten the packing which completely stops leakage from the gland. Leakage of a drop every two or three minutes is normal and necessary for lubricating the gland part. Over-tightening the packing causes unusual heat, accelerating abrasion of the shaft.
 - b) If there is no interference at the gland, add another packing. The whole packing should be replaced if you cannot stop the leakage, or when disassembling for checking.

- c) Insert the gland packing as follows:

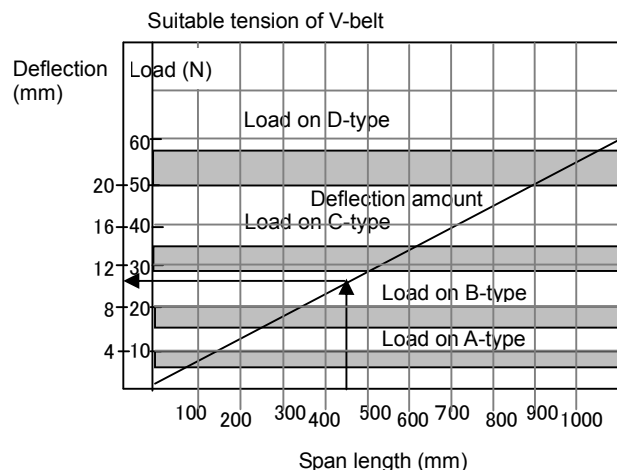
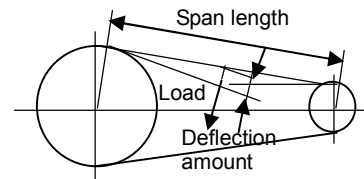
- Cut it so that there will be no gap when it is set as a ring. Cut with a sharp cutter to an adequate length.
- When inserting the gland packing, the packing should be placed such that the cut end of each ring packing is opposite to the next one, with lubricant applied to the friction surface.

The packings should be placed such that the cut end of each ring packing is on the side opposite to the next one



- 2) When you stop the pump or if it stops due to a power loss, switch off and close the valves on the suction and discharge sides.
- 3) The strainer in the suction side should be regularly cleaned to prevent harmful clogging.
- 4) In case of the V-belt, determine the suitable tension upon reinstallation as follows:

- a) Find the span length of the belt.
- b) Apply a load to the middle of the span length in the direction perpendicular to the belt, and use the deflection amount at the time as a measure of the tension.



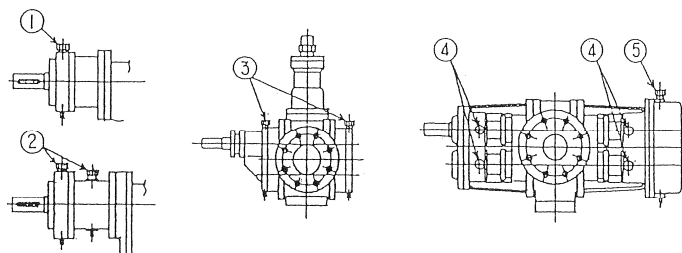
Explanation:

For the A-type belt having the span length of 450 mm, as shown in the graph on the right, apply a load of 7 to 10 N and reinstall the belt so that the deflection becomes about 10 mm.

5) Lubrication

All the necessary lubricants are filled before the pump is shipped from our factory, except the parts that require perfect degreasing. If lube oil must be replenished, do so regularly after starting operation. If a long time has passed between manufacture and the test run, check the lubricating oil before starting operation.

Places to be lubricated	Type of pump	Illustration	Name of lube oil	Lubricating method	Supplementary lubricating period	Exchange time or period	Remarks
Bearing portion	OH-type	④	Grease lithium type Density No. 1	Grease cup	Every 6 months	At the time of reassembling	
	KSR-BS type	③	Ditto	Ditto	Ditto	Ditto	
	KSR-BSM type	③	Turbine oil VG-32	Oil bath	Ditto	2 years	
	Others	Oiling is not necessary.					
Note 1: Primarily the pump is self oiled by the supplied fluid, so pumps of other types than the above do not need oiling. Note 2: If there is no grease cup on the OH-type pump, oilless bearings are used and oiling is not required.							
Shaft seal portion	Oil seal type KSR-S, VSR-S	-	Grease	Grease	Not necessary.	At the time of reassembling	See p. 10 for the HP-S2 and KH-S2 types.
	Oil seal type Other than KSR-S, VSR-S	①	Turbine oil VG-32	Oil bath	Every 6 months	2 years	
	Mechanical seal type	①	Ditto	Ditto	Ditto	Ditto	Not necessary for OH-type
	Double mechanical seal type	②	Ditto	Ditto	Ditto	Ditto	
	Double-bellows mechanical seal type	②	Ditto	Ditto	Ditto	Ditto	
	Gland packing type	Oiling is not necessary.					
Note 3: For customer's special designation and the status of use, for compatibility with the supplied fluid, or for a special mechanical seal, information on lubrication will be provided separately for each case. Note 4: Do not fully fill the oil, but only up to 80% of the full capacity.							
Guide gear portion	OH-G type	⑤	Grease lithium type Density No. 1	Grease cup	Not necessary	8,000 hrs or 1 year	Fill the oil to the level of the center of the upper side gear.
	Other types	Oiling is not necessary.					



6) Maintenance of the HP-S2 and KH-S2 types

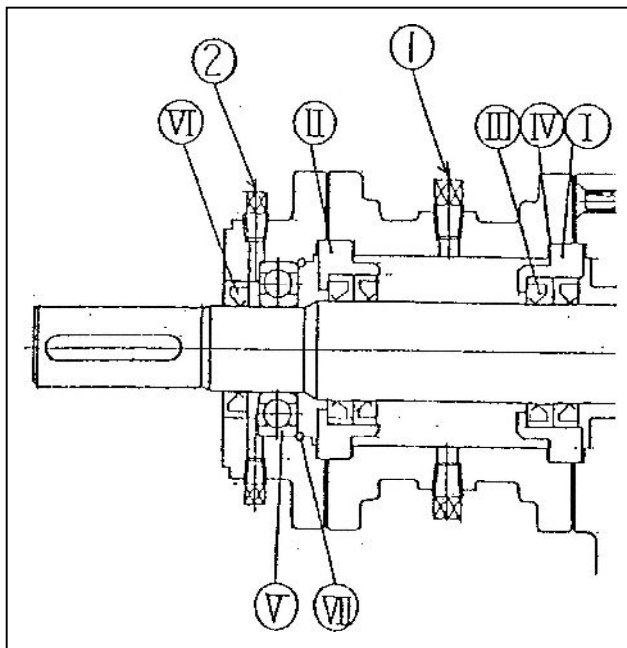
a) A Teflon oil seal is used to seal the shaft.

Fill seal liquid (liquid seal type) to prevent abrasion of the shaft and the oil seal as well as increase airtightness at the seal portion. Replace the seal liquid once every three months (Fig. (1)).

b) When contamination of the seal liquid becomes noticeable and the supplied fluid leaks out from the end of the shaft, the oil seal has come to the end of its life. In this case, it is necessary to replace the oil seal and the end bearing. The oil seal and the seal adapter are available as a seal set. It is recommended to keep one set as a spare for maintenance.

c) When removing the seal unit, do not scratch the shaft portion for any reason. (It is coated with ceramic.)

d) For lubrication of the bearing portion, replenish grease or turbine oil once every six months (Fig. (2)).



I	Seal case (A)	1 pc
II	Seal case (B)	1 pc
III	Oil seal	4 pcs *
IV	Packing	4 pcs
V	Ball bearing	1 pc
VI	Bearing oil seal	1 pc
VII	Stop ring	1 pc

* The HP-2S2 and HP-3S2 types have three oil seals and their structures differ from the above drawing.

7. Safety Valve

In case a safety valve is integrated in the pump or it is installed separately, follow the instructions below. The safety valve is of the spring reflux type. If the pressure in the pipeline exceeds the fixed level, the valve is opened by the force of the spring and the pressure is released to the suction side.

1) Adjusting the pressure

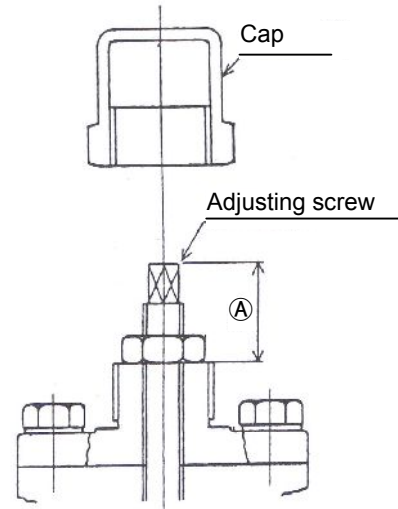
To adjust the pressure, take off the cap on the upper-most part of the valve, and turn the adjusting screw clockwise to increase the pressure or counterclockwise to reduce the pressure. (The safety valve is set at the specified pressure at the factory. Unless otherwise required, do not touch it.)

2) Disassembly

- a) When disassembling the safety valve, completely loosen the adjustment screw first.
- b) Then, it can be easily disassembled by removing the parts from the upper ones in turn.
- c) If you measure "A" shown in the illustration before disassembling, you can get the same pressure by reassembling to the same "A" measurement.
- d) The KR, HSR, and HPR types have different safety valve structures from the structure in the above drawing. Contact us if disassembly is necessary.

3) Notes on use

- a) The safety valve is designed to ensure safety against abnormal situations. If you close the circuit on the discharge side and make the safety valve work for a long time, the temperature of the fluid will rise and a trouble may occur.
Do not use the integrated safety valve for adjusting the pressure or flow rate.
- b) Contact us if the separately installed safety valve is used for adjusting the pressure or flow rate.
- c) Contact us if the integrated safety valve and the separately installed relief valve are used at the same time.
- d) It is common to find a small amount of fluid leaking out between the case and valve seat.



* Note: Contact us for pilot-type safety valves (LFP type, KH/OH/KS/VS-RP type) because the direction of the pressure adjustment screw as shown in above 1) may differ.

8. Procedure for long-term storage

When the pump is to be stored for a long time, store it following the procedure below.

- 1) Rust prevention of uncoated portions
 - a) Fill lubricating oil to the inner side of the gear pump, and apply it to the whole inner surface by hand.
 - b) Apply rust-preventive oil to the gear pump coupling and anchor bolt.
 - c) Seal the aperture flange of the gear pump using an oil-resistant packing.
 - d) Inspect the pump once every six months.
- 2) Storage until test run
 - a) In principle, store the pump indoors free from moisture. If it is necessary to store the pump outdoors for an unavoidable reason, cover the pump with a sheet etc. to prevent it from being exposed to rainwater directly.

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