



# Trochoid™ Pump, Lunary™ Pump Operation Instructions [Please read all instructions before using.]


## INDEX

■ To Select a Pump .....	P. 136	■ Pump Drive Method .....	P. 140
■ To Select a Motor .....	P. 138	■ Preparations .....	P. 141
■ Safety Precautions .....	P. 138	■ Inspection .....	P. 141
■ Pump Installation .....	P. 138	■ Maintenance .....	P. 141
■ Suction Capacities .....	P. 139	■ Warranty .....	P. 141
■ Pipe Arrangement.....	P. 139		

Be aware of the safety measures and follow the indicated precautions and safety instructions.  
Pay particular attention to the symbols and headings below, as there is a possibility of personal injury or property damage.

 **Danger** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **Warning** Indicates an imminently hazardous situation which, if not avoided, could result in death or serious injury.

 **Caution** Indicates an imminently hazardous situation which, if not avoided, could result in injury or damage to the pump or other equipment.

## To Select a Pump

### ■ Required flow rate


- Please refer to the catalogs or drawings etc. (Catalog values are reference values)
- Flow rate is subject to the fluid type, temperature and discharge pressure. (The pressure and flow rate are subject to the operating conditions and environments.)
- Select a pump with a slightly higher capacity.


### ■ Required pressure


- Please refer to the catalogs and drawings.  
Set pressure should not exceed the maximum operating pressure and the motor output rating.

### ■ Set pressure of the relief valve

- The default set pressure of the relief valve is the cracking pressure\*.  
Set pressure should not exceed the maximum operating pressure and the motor output rating.  
\*The cracking pressure is the pressure at which the pressure in the circuit rises and the valve starts to open and a certain amount of flow is recognized. (Set pressure)
- The relief valve can be used either as a safety valve or a pressure regulator. Two types of relief valves are available according to the intended use: external return type and internal return type.

 **Caution** When using the internal-return type as the safety valve, do not run the pump continuously more than 30 seconds if running the pump against closed discharge. It could result in pump or motor burnout.


 **Caution** When using the internal-return type as a pressure control valve, do not make any settings that would allow for the relief amount to exceed 50% of the pump flow rate. This could result in abnormal pump heating or pump damage.

 **Caution** If an external-return type relief valve is selected, the relief oil must be returned to completely below the tank oil surface. Failure to do so might cause abnormal noise.

- Set the relief valve pressure higher than the required pressure. The relief valve system would start to be activated and return oil to the suction line long before the required discharge can be obtained, if the set pressure is lower than the required pressure.

### ■ Applicable liquids

- Operational liquid  
Trochoid Pumps · Lunary Pumps can be used in a wide range of applications, but be aware that they are intended to use with oils.  
·2HT and GD series (the low viscosity type) can be used for fuel oil (excluding gasoline and other volatile oils).  
·The 2HW series can be used for coolant liquid. Under certain temperature or environment, the product life may drastically be shortened or pump may get damaged. Please check with the supplier of coolant fluid for more information.
- The most of the pumps listed in the catalog ,except for the models for the special applications are designed to be operated in the oil of viscosity grade ISO VG46, 40C. So the specifications are also described based on this standard.  
If you use oils other than with above specifications, there may be differences in performance or durability.
- With the exception of some of the Trochoidal Pump and the Lunary Pump, we use a self-lubricating system to lubricate the sliding surface and the bearing with pumped fluid.

 **Caution** Using a non-lubricable liquid, a corrosive liquid, or a liquid without rust protection (water) will damage the pump. Please contact us if you use oil other than lubricating oil.

 **Caution** Ask the fluid manufacturer in advance for the compatibility of oil with the seal materials of the Trochoid Pump and Lunary Pump. Use of incompatible liquid may cause a leak.

- Though it is rare, a certain operating conditions, liquid, metal chips, work material and other factors might cause oil leakage and damage to the pump. Do not operate the pump in such cases.
- Please contact us if you use low viscosity oils as such oil can only be handled by special models and allowable maximum pressure is also limited.



### Caution

Use of considerably low viscosity oils may cause damage to the pump.

- Some fuel oils may expand the standard oil seals. Be sure to verify the specifications before using.



### Caution

Do not use volatile oils such as gasoline. Doing so could result in explosion or fire.

- Please contact us for more information on using fire resistant fluid. There are some seal materials which do not have durability against them.

### Ambient temperature

- Ambient temperature range for operating the Trochoid Pump and Lunary Pump: -20C to 40C.
- Ambient temperature range for operating the Motor: -10C to 40C



### Caution

Operation over the above temperature range may cause damage to the Trochoid Pump and Lunary Pump, and Motor. It may result in a serious accident.

### Liquid temperature range for operation

- An available temperature range for the liquid is -5C to 80C. (GD-2H: 20 to 130C)
- VF: An available temperature range for the liquid is 80 to 120C.
- VH: An available temperature range for the liquid is 120 to 200C.

Note: When you use liquid over 80C, the allowable maximum pressure is limited to 0.7MPa.

- The temperature difference between the pump and the pumped liquid should be within 40C.
- The pump and motor have the specified temperature range for operation. Take measures to operate the pump under that range.



### Caution

Operating outside the above range may drastically shorten the pump service life and reduce the performance and cause leaks. When using outside the above range, please contact us for more information.



### Warning

Operating with high temperature oil may cause severe burns from the hot pump and leaking oil.

### Viscosity range for operation

- The viscosity range of the fluid is 10 to 500 mm<sup>2</sup>/sec. Please also refer to the suction capacity on P.139.
- The viscosity range of 2HT series (for low viscosity oil) and 2HW series (for coolant) is 2 to 100 mm<sup>2</sup>/sec.
- The viscosity range of the pump for high viscosity liquid (Lunary Pump 3V) is 46 to 2000 mm<sup>2</sup>/sec.



### Caution

Operating outside the above range may drastically shorten the pump service life and reduce the performance and cause leaks.

- Lowering the viscosity decreases the volumetric efficiency. (Discharge amount will decrease.)
  - Raising the viscosity increases the required power. (Motor output will increase.)
- Note: Please take the temperature drop in winter into account when selecting the motor capacity.
- When you use low viscosity oil, the maximum operating pressure is also strictly limited. Please contact us.
  - Special specifications are required if you use the pump outside the above range. So please contact us for more information.

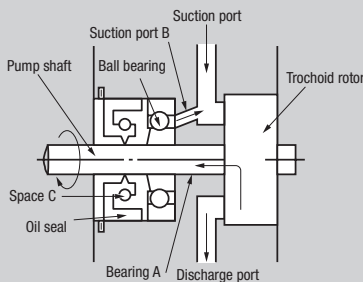


### Caution

Operating with high viscosity liquid or at low-speed rotation may cause pump failure.

### Check the direction of rotation

- The Trochoid pump and the Lunary pump have fixed direction of rotation and suction/discharge except for some reversible type Trochoid pump. Set the rotation direction of motor correctly in accordance with the direction displayed on the pump nameplate.
- The Trochoidal pump and Lunary pump have a pressure relief hole between the pump suction (negative pressure) and the oil seal area which is provided to protect the oil seal. If the direction of rotation is incorrect, the suction and discharge positions will be switched, and the pressure will be applied to the oil seal from the hole and the oil seal will puncture and the oil will blow out.



- In normal operation, the pump discharges oil from the discharge port as shown in the left figure. Some oil goes through the bearing section (A) and lubricates ball bearing due to internal leakage but the oil seal prevents oil from leaking outside. When applying pressure over 0.03MPa to the Space (C), oil seal may become damaged (punctured).
- Pressure oil returns to the suction port through the small hole (B) to protect the oil seal. If the pump rotates in the opposite direction indicated on the nameplate, however, the suction and discharge will be switched, and the pressure oil will be directly applied to the oil seal through the small hole (B). In that case, the oil seal will be damaged immediately (punctured) and oil leakage will occur. A damaged (punctured) oil seal needs replacement because the lip is damaged in most cases. Please contact us for replacement.

The figure is for illustrative purpose.

**Caution**

Do not operate the pump in the wrong rotation direction. If you make a mistake, the oil seal may be damaged and spout oil, resulting in an unexpected accident.

## To Select a Motor

### ■ Check the required power of the pump

- Refer to the performance table on the catalog and select a power with a little higher capacity.
- The required power of the pump changes depending on the pressure, flow rate and viscosity of the fluid.
- The required power increases as the viscosity of the liquid rises.
  - Please take the temperature drop in winter into account, when selecting the motor capacity.
- Single-phase motors do not comply with US motor efficiency regulations.

### ■ Check the voltage and frequency

- Use the power supply voltage indicated on the specification nameplate of the motor.

**Caution**

Incorrect voltage and frequency may cause damage to the motor, abnormal pressure or flow rate.

### ■ Surroundings of the Installation Site

- Please check the surroundings of the pump installation site. Depending on the installation location, select a motor for outdoor use or safety increased explosion-proof type.

## Safety Precautions

### ■ Safety Equipment

- Be sure to equip motor with an “Earth-Leakage Circuit Breaker (ELCB)” or overload protection equipment. Use this equipment only after confirming that the ratings are within the prescribed ratings stated on the motor’s nameplate.
- Be sure to comply with local electrical codes and regulations.

**Caution**

Failure to use “Earth-Leakage Circuit Breakers(ELCB)” and overload protection equipment could result in damage to the equipment or motor burnout.

- To avoid damage to pump outlet, install a galvanometer, pressure sensor, or such other devices in the pump’s outlet line to detect dry running.
- The oil seals and packings cannot be used indefinitely.
- Install the pump in a safe location, or provide a protective cover or device to prevent personal injury or equipment damage caused by an accidental oil leaks.

### ■ Safety Measures

- Keep children or other people incapable of judging risks away from the pumps.
- Protective equipment should be installed to prevent fingers, hands or other objects from getting caught in the rotating or moving parts.

**Warning**

Getting your fingers, hands or articles caught in the rotating or moving parts may cause unexpected injury.

- Do not touch a pump or motor during or immediately after the operations.

**Warning**

Touching the pump or motor during the operation may result in burns.

- Some single-phase motors (IME200S, 2ME200S, 2ME400S, 2MY750S) may spark from the centrifugal switch when start-up.

**Danger**

Do not place any flammable liquids or materials in the area surrounding the motor. Such items could catch fire.

## Pump Installation

### ■ Installation position

- The pump should be installed at a position that is within 1m above or below the oil surface level.
- It is advisable to mount the pump at a position where the suction port is above the height of the oil surface level.
- Please consult us if the pump should be used outside the specification range as mentioned above.

**Caution**

Installing the pump at a height of more than 1m above the oil surface could result in poor suction, depending on the operating conditions.

### ■ Installation Positions for the Trochoid Pump, Trochoid Pump with Motor, Trochoid Pump with Motor and Base Coupling, and Lunary Pump with Motor and Base Coupling

- There are no particular restrictions on the mounting directions when installing only the pump itself.
- When installing a Trochoid pump with a motor, the pump cannot be installed in a position higher than the motor (as seen from the horizontal position).
- When installing a Trochoid pump with a motor and a base coupling, the foundation where the base plate will be attached must be level.
- Align the attachment anchor so that it can be smoothly fitted to the base plate and the motor attachment holes.

**Caution**

The motor may get damaged if the motor and Trochoid pump are installed incorrectly.

**Caution**

If the installation site is not level, or if there is forcible installation in which the installation holes are not in exact alignment, the angle plate or base may get damaged or the axis may be deviated, which result in pump galling and damaging the pump.

**Installation Site**

The equipment should not be installed in locations with lots of dust, high or low temperatures (refer to P.137 "Ambient Temperature"). Please consult us when the equipment must be used in special surroundings (e.g. a place in which the pump will be exposed to water, place with high vibration or high humidity) other than the typical indoor installation sites.

## Suction Capacities

- Set the suction head for the Trochoid and Lunary pumps within 1m when running the motor at a speed of 1,000 ~ 2,500min<sup>-1</sup> or keep the suction pressure at the suction port within -0.03 ~ 0MPa when the port is fully filled with oil.
- Pressure on the suction side lower than -0.03MPa could result in cavitation, abnormal noise, heating, poor discharge and damage to the pump.
- Please consult us if the pump should be operated outside the specification range as mentioned above.

**Caution**

Suction capabilities will drop when there is large resistance in the discharge line.

**Caution**

Suction capabilities will drop significantly when air enters from the suction line.

- The pump must be mounted at a position below the oil surface level if the pump is operated at slow speed.

## Pipe Arrangement

- The maximum torque allowable for tightening the screws for the Trochoid pump's pipe connections are as shown in the table below.

Diameter Rc	1/8	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2
Torque N·m	10	20	20	25	30	70	80	90

**Caution**

The pump bore may get damaged if these values are exceeded.

**Caution**

The excess use of seal tape or liquid sealants may reduce friction and result in over tightening, which in turn could damage the pump bore.

**Pipe Connections**

- Make sure that the pipe connections are securely tightened and completely sealed to prevent leaks or intake of air.
- Always be sure to use pipe supports so that the pipes are self-supported and will not place any weight on the pump.
- Make sure that the pipe lengths and angles are correct when connected so that no unnecessary strain is placed on the pump.
- A pressure gauge should be installed so that pump conditions can be easily monitored.
- Stop valves, union jacks and some other couplings should be used to make pump maintenance easier.
- When handling oils with high viscosities, select pipes with diameters bigger than the pump to minimize pressure loss.
- Some of the high-pressure hoses and other parts have narrow internal diameters. Therefore, be sure to check not only the inner diameter of screw-in sections, but the whole area of the pipe as well before use.
- It is recommended that an air vent valve in discharge line and additional priming hole in suction line be provided to prevent possible startup troubles.

**Types of Pipes and Couplings**

- All pipes must be cleaned thoroughly before connected to the pump. Some pipes may have dust from storage or threading debris remaining inside. Be sure to flush out all pipes to ensure that they are thoroughly clean before use.

**Caution**

The pump and connected equipment may become damaged if the pipes are not adequately clean.

**Caution**

Do not attempt to flush the pipes after attaching to the pump.

**Caution**

Test the pipes for air tightness before installing the pump.

**Pipe Arrangement for Suction Line**

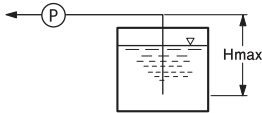
- For the suction line, select pipes with diameter that will keep the fluid velocity in the pipe at 1.5m/s or less and suction resistance at -0.03MPa or less.
- Make sure that the total pressure resistance of devices installed on the suction line, such as pipes, filter and valves is smaller than 0.03MPa.

< Calculation > Fluid Velocity (m/s) = 
$$\frac{\text{Pump Flow Rate (m}^3\text{/s)}}{\text{Pipe Cross-section Area (m}^2\text{)}}$$

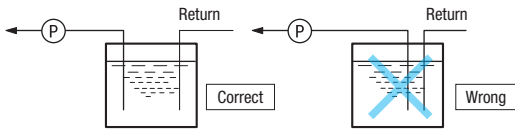
**Caution**

Trapped air or foam inside the pipes may result in pump noise, vibrations and heating, which in turn could damage the pump.

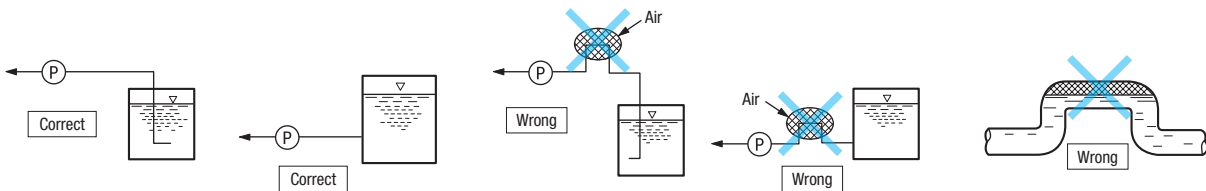
- Calculate the suction head based on the minimum oil level.



- Keep the piping in suction line as far away as possible from the return port of the relief valve or actuator so that there will be no negative influence from the returned oil.



- Piping in the suction line should be as short as possible and with minimum number of bends.
- Inspect all of the valves thoroughly, cocks and couplings before assembling the pipes. Do not use any items with cavities or narrow ports.
- When bending or soldering the pipes, make sure that those pipe bores do not become smaller.
- Make sure that pipe inside diameter doesn't change throughout the pipe.
- Make sure that the opening section of the packing is cut away in accurate diameter and without any burrs.
- Make sure that air doesn't enter the pipes.
- It is recommended that suction pipes with bore diameter of one or two size larger be selected to reduce suction resistance if pumping oil with viscosity of ISO VG68 or higher in viscosity.



- Use gate-type valves when installing valves.
- If the pressure still remains inside the pipes in discharge line after the operation is stopped, a non-return valve should be installed in discharge line, not in suction line.

**Caution** Make sure that the pressure in suction line won't exceed 0.03MPa. Excess pressure in suction line may cause oil seal damage, oil leakage. Special attention will be required particularly if you use the reversible type Trochoid pump.

### Discharge Pipework

- Select pipes which is wide enough to allow the fluids flowing through the discharge line at a speed of 3 m/s or less.

### Filters

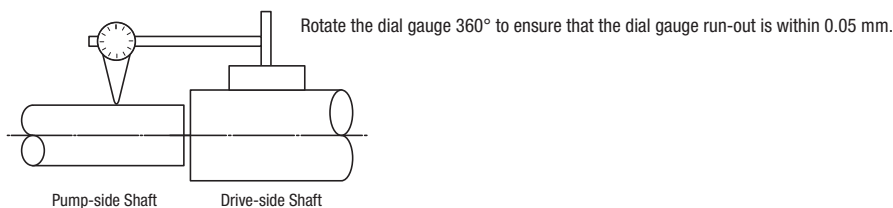
- It is recommended to install suction filter of 150-mesh with as large capacity as possible if operated in a normal condition.
- Select filters with a passage resistance of 0.01MPa or less after confirming the manufacturer's specifications.
- The purpose of installing suction filter is to remove large objects that could hamper normal pump operations. Even very tiny object passing through the filter could significantly shorten the pump service life. Therefore, the oil replacement should be performed on a regular basis, or clean the oil regularly with a filter with mesh smaller than 11µm.

**Caution** Foreign objects mixed in the oil may significantly shorten the pump service life or damage the pump. Very fine objects which can pass through the suction filter also can cause performance drop, shortened service life, oil leaks depending on the use conditions. Therefore, the filters need to be cleaned on a regular basis. Continuous use of clogged filters may result in an abnormal noise, vibrations and poor discharge.

## Pump Drive Method

### Driving Method

- Pump driven by special-purpose motor: Trochoid pump with integrated motor.
- Pump driven by general-purpose motor: Trochoid pump with base coupling mount type motor or Lunary pump with base coupling mount type motor.
- Power source other than using motor: Trochoid pump, Lunary pump.
- Trochoid and Lunary pumps are designed on the premise that the motor and shaft center are arranged in a straight line. Centering of the drive shaft and pump should be within 0.05mm TIR.



- Please contact us for the drive methods in which the load is placed on pump shaft along radial or thrust direction.

**Caution** Poor alignment between the motor and the Trochoid or Lunary pump may result in vibrations, loud noises and damage to the pump.

**Caution**

When attaching the coupling to the pump shaft, do not forcibly hammer the coupling. It could result in pump malfunctions.

**Caution**

Applying thrust load or radial load to the pump shaft may cause pump malfunctions.

## Preparations

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### ■ Before Operation

- Check the direction of the pump rotation, suction port and discharge port.
- The rotation direction of our integrated motors (which is designed to be coupled directly with NOP pump), is indicated on the motor frame or terminal box . Please confirm the direction of motor rotation before wiring.

1) Our NOP motor (3-phase power source) is designed to rotate in the standard rotation directions when wired in accordance with the wiring diagram as shown below.



2) Some types of general-purpose motor (3-phase) equipped with a base coupling may need to be wired differently from the diagram above. Please check the rotation direction indicated on both the motor and the pump before wiring.

**Caution**

Mistakes in the rotation direction and positioning of the suction and discharge ports could result in oil leaks or damage to the pump.

- Make sure that the tank on the suction side is filled with clean oil.
- Make sure that there are no loose areas in the piping.
- Make sure that the entire pipeline is unblocked.
- Make sure that the valves around the pump are all fully opened.
- On the initial startup, turn the pump on and off quickly for a few times to verify that the motor is rotating in the right direction.
- There is no ON / OFF switch on our pumps. It will start just after the wire is connected to the power supply. So, make sure that the power is completely disconnected before working on the wiring.

### ■ Test Run

1) Dry Run

- Do not run the pump dry for more than 10 seconds. Stop the operation if the pump cannot prime oil.
- If it takes long time until the pump starts to draw oil, pour oil into suction pipe beforehand.

## Inspection

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### ■ Daily Start-up Inspection

- Be sure to make the necessary inspections every time before start-up. In particular, for oil leaks from the pump or pipes, abnormal noise and heating.

**Caution**

If any abnormalities are discovered, immediately stop the pump and check for the problem area.

### ■ Regular Inspections

- If the pump is used as an important safety parts, regular inspections should be carried out at least once a year to ensure that they are operating correctly.
- Please consult with us when performing the inspection.

## Maintenance

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- Seal kits and spare parts should be kept on hand to deal with sudden faults or poor operation due to the pump deterioration.
- The most common cause of poor performance is the use of dirty or degraded fluid. So, the oil replacement and other maintenance work should be performed on a regular basis.
- Be sure to cease all operations and perform necessary inspections and maintenance if there are any abnormal sounds, heating or other abnormalities when using a motor that had been kept in storage for an extended period of time.
- The coupling and oil seals used for the Trochoid pump and motor are consumable parts and so will need to be replaced on a regular basis (1 year or 8,000 hours of use).
- The pump service life will become shorter than 1 year or 8,000 hours of use if it is operated in an environment other than as stated above.
- There are certain types of seal-kit that we cannot supply, such as ones for fuel oil, cutting-oil or heat-resistant types.

## Warranty

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- The warranty will not cover any faults caused by operation outside the stated specifications or attributed to foreign matter or other external causes.
- The Trochoid pump is warranted to be free from defects in workmanship and materials for 1 year after the delivery or 8,000 hours of use, whichever occurs first. The warranty applies only when operated within the product specifications and in accordance with the "Instruction Manual for Trochoid and Lunary Pumps" stated in this Trochoid Pump Catalog.
- The warranty doesn't cover any faults caused by any modifications or disassembling of the pump made by customer.