

## OPERATING INSTRUCTIONS FOR THE TROCHOID PUMP

### IMPORTANT

Before selecting or installing the trochoid pump you should thoroughly read the operating instructions.

Be careful to make accurate and trouble-free installation and operation of the pump following the instructions.

The operating instructions explain how to make selection, installation, and operation of the pump and to take provisions against troubleshooting it. Human injury or equipment damage may result if the pump is operated without reading the operating instructions.

**It is recommended to keep the operating instructions at a safe and readily accessible location for the future reference.**



NIPPON OIL PUMP CO., LTD.



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## FOR THE SAFETY TROCHOID PUMP OPERATION

You should thoroughly understand the safety countermeasures and strictly follow the precautions and operating instructions described in the manual.

Remember the items with the followings symbols and titles represent the possibility of human injury or equipment damage.

Symbol	Title	Meaning
	<b>Danger</b>	Failure to observe the instruction can cause human death or severe injury.
	<b>Warning</b>	Failure to observe the instruction may cause human death or injury.
	<b>Caution</b>	Failure to observe the instruction may cause human injury, or pump or system damage.

### 1. APPLICABLE FLUID

You should notice that the trochoid pump is designed to use with oils although it is used for various applications.



#### CAUTION

- 1) All the pumps listed in the catalog are designed and rated with ISO VG56 turbine oil at 40°C unless otherwise specified. Accordingly, the pump performance and durability may vary when it is used with other oil. In such a case, it is recommended to consult us. Since the sliding parts and bearings in the trochoid pump are lubricated by the fluid handled by it, no fluid can be used that does not have the lubricating function. In addition, no corrosive liquids or water can be handled by it, either.
- 2) When the fuel oil is to be handled by the trochoid pump, oils having the low viscosity corresponding to that of kerosene can be handled. Further, it is necessary to pay sufficient attention since the maximum operating pressure is substantially limited.



#### WARNING

The pump can not handle volatile oils such as gasoline. Explosion or fire may result in case such a volatile oil is handled. It is requested to consult us when the fuel oil is to be handled by the pump since some of the fuel oils may swell the standard oil seal.



## 2. OPERATING AMBIENT TEMPERATURE RANGE FOR THE TROCHOID PUMP

The trochoid pump can be operated within the ambient temperature range from -20°C to +40°C. The operating temperature for the trochoid pumps with the motor ranges from -10°C to +40°C.

### CAUTION

A sever accident may cause when the trochoid pump or motor fractures as the result of operation outside the temperature range specified above.

## 3. TEMPERATURE AND VISCOSITY OF FLUID IN USE

The operating temperature for the trochoid pump ranges from -5°C to +80°C. The viscosity of the fluid in use ranges 10 cSt to 500 cSt.

### CAUTION

The operating life and performance of the trochoid pump may be substantially reduced and liquid leakage may occur when it is operated outside the ranges specified above. In addition, note that the maximum operating pressure is also substantially limited. Please consult us when the pump is to be operated outside the ranges specified above since it requires special specifications.

### WARNING

Burn may result upon contact with the pump or leaked oil when the pump is operated at a high temperature.

## 4. PIPING METHOD

### 1) Tightening torque for the pipe threads to be connected to the pump

The following table shows the maximum permissible tightening torque for the pipe threads to be connected to the pump.

Pipe diameter		Rc1/8	Rc1/4	Rc3/8	Rc1/2	Rc3/4
Tightening torque	N·m	9.81	19.62	19.62	24.52	29.43
	kg·cm	100	200	200	250	300

- Be sure to securely tighten the pipe into the pump to assure superior air tightness and to avoid any leakage.
- Be sure to install the supporting devices (pipe supports) so that the dead weight of the pipe will not be loaded onto the pump.





### CAUTION

The pipe connection on the pump may crack when the pipe is tightened to the torque exceeding those specified above.

#### 2) Be sure to use clean pipes and fittings.

It is necessary to clean the internal surface of the pipes and fitting prior to connecting them to the pump. Dusts may have been accumulated in them during the storage, or there are remaining machining chips after the threading operation.



### CAUTION

Insufficient cleaning of the pipes and fitting may result in the pump or other equipment failure.

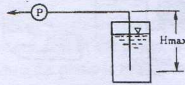
## 5. SUCTION AND DISCHARGE PIPES AND FILTERS

### 1) Suction capacity of the pump

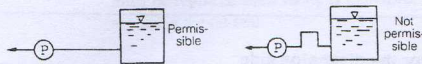
The suction head for the trochoid pump needs to be limited at a maximum of one meter above it when it is operated in the revolution speed range of 1,000 to 2,500  $\text{min}^{-1}$ . Or, the suction pressure at the pump inlet with the oil sucked needs to be limited at a maximum of  $-0.29 \text{ MPa}$  ( $-0.3 \text{ kgf/cm}^2$ ) or lower (to the direction closer to the atmospheric pressure).

### 2) Piping method for the suction side

- The pipe diameter needs to be selected to assure the maximum liquid flow velocity of 1.5 m/sec. inside the suction pipe.
- The suction head needs to be calculated based on the lowest oil level.



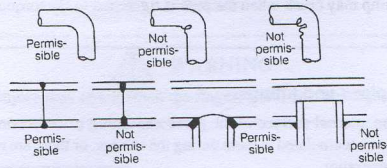
- Layout the suction pipe so that it is not affected by the relief valve or returning oil from the actuator.
- The length and bend of the suction pipe needs to be minimized.



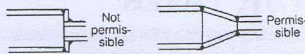
- Thoroughly check the valves and fittings to assure that they have sufficient port size, and they are free from any casting porosity or cracks.



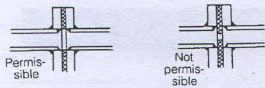
f. Attention needs to be paid when bending or welding the pipe to avoid any localized reduction in the cross sectional area.



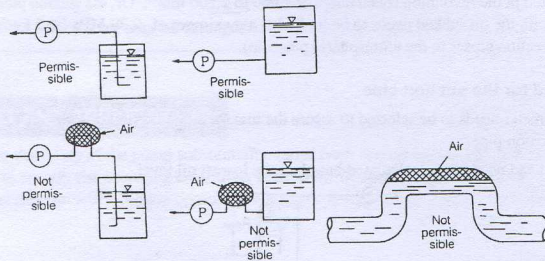
g. Avoid any drastic changes in the cross sectional area of the pipe.



h. Be sure to positively cut off any unwanted portion of the gaskets.



i. Pay attention not to allow the air to be sucked into the pipe.



**CAUTION**

Air sucked into the pipe or bubbles in the pipe results in excessive pump vibration, noise, or heat generation.

**3) Piping method for the discharge side**

Select the discharge pipe size that gives the maximum fluid velocity of 3 m/sec.

**4) Selection of the suction filter**

The suction filter needs to be installed.





### CAUTION

The operating life of the pump will be substantially reduced when foreign materials are mixed in the oil. In some cases, the pump may fracture. The filter needs periodical cleaning. Abnormal noise, excessive vibration or low discharge pressure may result which in turn leads to the pump failure when the pump is operated with the filter clogged.

## 6. DRIVE METHOD

### 1) Relationship between the rotating direction and flow direction

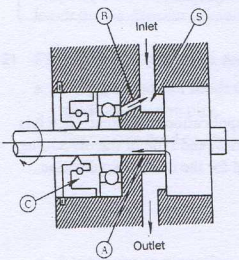
The rotating direction and flow direction of the trochoid pump are fixed except for some reversible models. Accordingly, be sure to operate the pump in proper rotating direction and flow direction.



### CAUTION

The oil seal may be damaged which will result in splashing the oil when the pump is operated in the wrong rotating direction or flow direction.

The pump mechanism is as follows.



As shown in the figure to the left, the oil is discharged to the discharge port. When the back pressure acts on the discharged oil, the oil passes through the bearing A, lubricates the ball bearing, and is stopped by the oil seal. When the pressure increases to around 0.1 MPa (1 kgf/cm<sup>2</sup>) as indicated by the pressure gage, the seal ruptures and the oil splashes toward outside the pump.

A small hole, B, is provided to return the oil to the suction port of the pump.

In other words, the oil trapped in the space C is always returned to the suction port of the pump, S.

When the pump is rotated in the wrong direction, the suction port and discharge port are reversed, which in turn causes the discharged oil pressure to directly act on the oil seal via the small hole B. Further, since there is no oil passage to relieve the pressure, the seal will rupture soon and end up in leaking the oil. When the oil seal ruptures, it must be replaced since its lip is damaged. Please consult us when replacing the oil seal.

### 2) Drive method

The trochoid pump is designed to be directly driven by the motor. Please consult us when the pump is to be driven using the method that results in loading of the pump along the radial direction or thrust direction.



### 3) Safety measures

Be sure to mount a protection device on the drive so that the finger, hand, or other object will not be rolled in.



#### **WARNING**

Unexpected injury may result when the finger, hand, or other object is rolled in.

## 7. INSTALLATION METHOD

### 1) Installation location

Do not operate the pump in the dusty, cold, or hot environment. (See the operating ambient temperature range under the item 2.) Please consult us when the pump is to be operated in a special environment other than the normal indoor environment.

### 2) Installation of the trochoid pump with the built-in motor

Do not install the pump so that the pump is located at an elevated location than the motor.



#### **CAUTION**

The motor may be damaged when the pump is installed improperly.

## 8. COOLANT APPLICATION

The operating durability of the pump substantially varies from one coolant application to another since it is not possible to specify the operating conditions such as the density, properties, and type of the machining chip, and operating pressure. Please consult us when the pump is to be used for the coolant application.

## 9. RELIEF VALVE

### 1) Selection of the relief valve

The relief valve can be used either as a safety valve or pressure regulating valve.

Depending on the application, there are two types of relief valves available; external drain type and internal drain type.





### WARNING

- 1) When an internal return system relief valve is used as the safety valve, do not operate the pump for more than 30 seconds with the valve on the discharge side of the pump completely closed. The pump seizure or burnt motor may result.
- 2) When an internal return system relief valve is used as the pressure regulating valve, do not set it to relieve the flow rate by more than 50% of the discharge capacity of the pump. Such a setting may result in overheating of the pump.
- 3) When an external return system relief valve is used, the pump can be satisfactorily operated under any of the conditions stated above. However, be sure to return the relieved oil into the oil reservoir of which oil level is always maintained at a level higher than the outlet of the returning oil.

## 1( PREPARATIONS FOR THE OPERATION

### 1) Before starting the operation

\* Check the rotating direction and flow direction of the pump.  
Connection method for the pump with the built-in motor. (For 1ME, 2MY, and 3MF)

- a) The connection method is shown inside the terminal box provided on the motor. Confirm the proper connection method before connecting the respective cables to the motor. Our standard motors are designed to rotate in the proper direction when the cables are connected to the motor as shown below, which may be different from other general purpose motors.

U	V	W
R	S	T



### CAUTION

Note that the connection method is different for the reversible models.

### b) Standard rotating direction

	When viewed from the motor
TOP-1ME	Counterclockwise rotation
TOP-2MY	Counterclockwise rotation
TOP-3MF	Clockwise rotation

Pump motor provided with the base

Be sure to check the proper rotating direction of the pump since different connection method may be required other than that stated above.

- \* Confirm that the pump is filled with clean oil.
- \* Confirm that the pipes and fittings are securely connected without being loosened.
- \* Confirm that the valves installed on the upstream side and downstream side of the pump are fully opened.

Commence the operation after confirming the points stated above.



## 2) Break in operation

- a) Unloaded operation  
Do not operate the pump for more than 10 seconds with it unloaded (without pumping the oil).  
Immediately stop the pump operation if it fails to suck the oil.
- b) When the pump fails to suck the oil  
Check for the following items which are the likely causes for the problem.
  - \* Resistance on the discharge side is too high,
  - \* Resistance on the suction side is too high or the suction pipe length is too high,
  - \* Only the air is sucked (air leakage from the pipe)
  - \* There is no oil in the pump or the suction pipe end is not immersed in the oil.
  - \* Revolution speed of the pump is too low.

## 11. SAFETY DEVICE AND SAFETY OPERATION

### 1) Safety device

- a) Be sure to install the earth leakage breaker and overload protector.  
Install other safety devices as required according to the "Electrical Facility Engineering Standard".
- b) Be sure to install the flow meter or pressure sensor at the pump outlet so that unloaded pump operation can be immediately detected, and to prevent the seizure of the bearing.
- c) The pump oil seal or gaskets are subject to wear and eventual failure. Accordingly, the pump should be located at a safe location or the protection device should be installed on it so that no human injury or equipment damage will be caused upon their failure.

### 2) Safety operation

Do not touch the pump or motor during its operation or immediately after stopping the operation.



### WARNING

One may burn when the motor or pump is touched since it may be overheated to a substantially high temperature.

### 3) Protection for the children or persons who can not judge the hazard

Do not allow anyone such as a child to approach or touch the motor or pump who can not judge the hazard.

## 12. ROUTINE INSPECTION

### 1) Startup inspection

Be sure to carry out the startup inspection. In particular, check the pump and motor for any oil leakage, abnormal noise, or excessive heat generation.

### 2) Routine inspection

Be sure to carry out the routine inspection by a minimum of once or twice every year to confirm satisfactory pump and motor conditions when it is to be used as a vital safety equipment.  
It is recommended that the inspection be carried out by the factory approved by us.