

TRP Internal Gear Pump

Instruction Manual



Do not operate, service or inspect this pump until you have read and understood this manual.

Keep this manual in a safe place where it can be consulted at any time.

To: All mechanical Contractor

Make sure to supply copies of this manual to the customer's operator maintenance and inspection personnel.

TERAL INC.

Limit of Liability

1. Warranty period is for period of 18 months after date of the bill of lading or 12 months after installation whichever earlier.
2. During warranty period, equipment sold is warranted to the Buyer to be free from defective material and workmanship. If Buyer notifies Seller in writing of any claimed defect in the equipment and if, after appropriate reasonable opportunity to inspect and remedy any defect by Seller, the equipment is found not be in conformity with this warranty, the Seller will, at its option and expenses either repair the same or provided a replacement of defective parts, on condition of F.O.B. Japan.
3. The warranties set forth herein are exclusive and in lieu of all the warranties, express or implied by law or trade usage.
Seller shall not be liable for any special, indirect, or consequential damages, including but not limited to loss of use for lost of anticipated profits, arising out of this contract or a breach thereof. Seller does not warrant any auxiliary equipment.
4. The foregoing warranty does not cover, and the Seller makes no warranty with respect to:
 - (1) Defect is caused by other equipment which not supplied by Seller or use of improper parts not specified by Seller.
 - (2) Failures not reported the Seller within the warranty period above specified.
 - (3) Force Majeure:
The Seller shall not be liable in any manner for failures, damages, directly or indirectly owing to any causes or circumstances beyond Seller's control, including Acts of God, Governmental orders or restriction, war, war like conditions, hostilities, sanctions, riot, looting, strike, lockout, plague or other epidemics, fire and flood.
 - (4) Failures or damages due to negligence, accident, abuse, improper operation or maintenance or abnormal conditions of temperature, moisture, dirt, or corrosion, and repaired works by others without Seller's consent.
 - (5) Improper storage before installation.
 - (6) The cost of dismantling and installation of the equipment.
 - (7) Dispatching an engineer for repair.

Purpose of This Manual

This manual is designed to provide detailed information for correct operation, maintenance, and checking of the pump. It has been produced for experienced pump operators, or personnel under the guidance of such operators, and provides the following information.

Ensure that all relevant wiring work is performed by a qualified electrical installation technician.




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1. Safety

1.1 Warnings and Associated Explanations

Warnings employed in this manual are in four levels according to the degree of danger (or the severity of a potential accident). Ensure that you understand these four levels of warning before following the instructions in this manual.

Grade	Meaning
	Indicates imminent danger, resulting in death or serious injury if procedures and instructions are not followed in use.
	Indicates potential danger, resulting in possible death or serious injury if procedures and instructions are not followed in use.
	Indicates potential danger, resulting in moderate or light injury, or damage to equipment, if procedures and instructions are not followed in use.
<u>Note</u>	Particular care required, or information requiring particular attention, during use.

1.2 Observing Safety Requirements



Ensure that all warning labels on the equipment, and warnings noted in the users manual, are followed.

1.2.1 Observing Requirements for Operation

- (1) Ensure that the cover of the terminal box on the motor is fitted before switching power ON. Electric shock may result if live components inside the terminal box are touched.
- (2) Notify all related personnel, and check that no personnel are in potentially dangerous locations, when operating the pump.
- (3) Touch only the necessary components during pump operation.
- (4) Ensure that the pump is operated only by personnel permitted to do so by the site foreman.
- (5) Do not leave tools etc. on the pump during operation.
- (6) Do not operate the pump with defective or inoperable components.
- (7) Do not insert fingers or objects into the openings in the motor. Such behavior may result in electric shock and injury.

1.2.2 Requirements for Installation, Maintenance, and Checking

- (1) Always ensure that only personnel having been instructed in handling of the pump are involved in its installation, maintenance, and checking.
Ensure that all relevant wiring work is performed by a qualified electrical installation technician.
- (2) Ensure that all personnel in the area are fully notified when maintaining and checking the pump.
- (3) Always stop the pump, and switch power OFF at the source, before maintaining or checking the pump.
Electric shock may result if such work is conducted while power is switched ON.
Injury may result if the pump operates during maintenance or checking.
Ensure that an earth leakage breaker is installed at the power source.
- (4) After switching power ON, ensure that only the components relevant to operation are touched.
In particular, contact with electrical circuits may result in electric shock. Always fit the cover on the terminal box.

2. Pump Specifications

Refer to the standard specifications if you have purchased the standard pump. Special specifications may be implemented upon customer request. Refer to the dimensional drawings etc. in the special specifications in such cases.



Use this equipment only in accordance with the product specifications provided. Use in other conditions may result in electric shock, fire, oil leakage, or faults.

Standard Specifications		
Liquid	Quality	Oil: Recommended viscosity range: 20~100 mm ² /s Usable viscosity range: 15~500 mm ² /s
	Temperature	0~50°C
Location	Indoors or outdoors (Ambient temperature: 0~40°C)	

3. Installation

3.1 Before Using the Pump

Check the following immediately after receiving the pump.

Contact your retailer if there is a problem.



WARNING

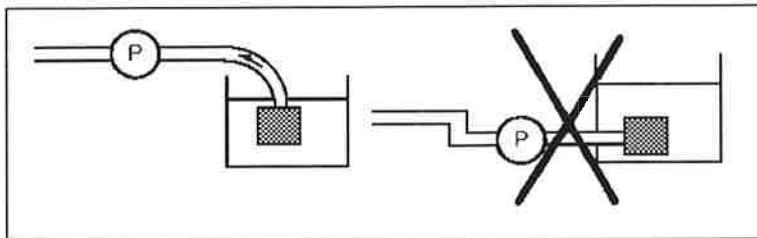
Before unpacking, make sure that the pump is the right side up. Especially if packing is wooden crate, beware of nails, or you could hurt yourself.

- (1) Check that the details on the nameplate are as ordered.
- (2) Check for damage during transit.
- (3) Check for loose bolts and nuts.
- (4) Check that all ordered accessories have been supplied.

3.2 Cautions During Installation

Install in a location in accordance with the following conditions.

- Ensure that the pump is not located below the oil level. Failure to follow this requirement may result in leakage from the oil seals while the pump is stopped.

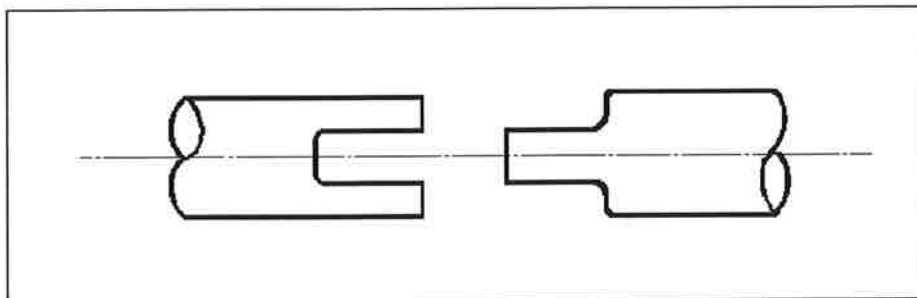


- Install in a location which is well ventilated, and with minimal dust and humidity.
- Install in a location readily accessible only to the appropriate persons, and in which the pump cannot be operated by others.

3.3 Pump Shaft Centering

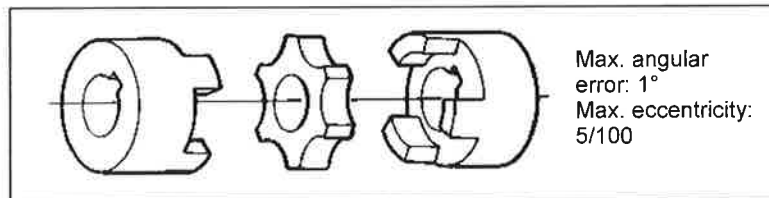
Incorrect centering may result in wear of shaft packing, bearing damage, a bent shaft, or noise during operation.

(A) Joint type (This type of joint should be avoided due to low wear resistance.)



As the pump shaft (and the flattened end) is hardened, if the other half of the joint is of low hardness it will wear and may result in dry-running of the pump.

(B) Flexible Couplings



3.4 Cautions for Piping

(1) Flow speed

Based on the size of the pump connections, select an suction pipe and discharge pipe so that the maximum flow rates are 1.5m/sec and 3m/sec respectively.

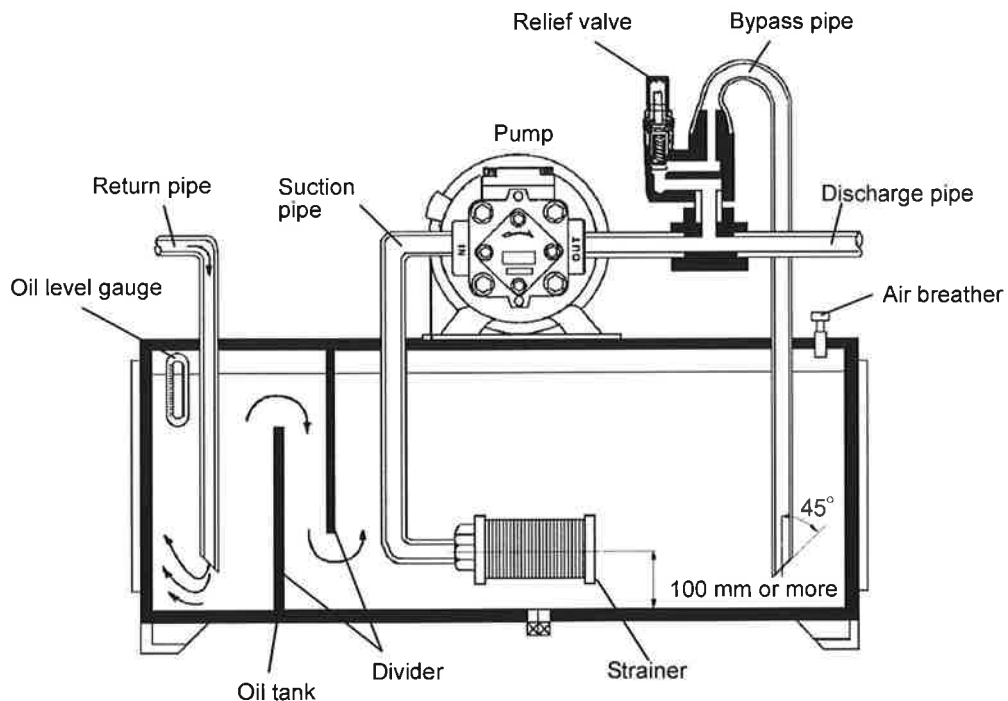
(2) Suction pressure

Increased suction resistance induces cavitation*¹ and prevents normal oil discharge. Trochoid pumps generally generate high vacuum — the HG6 generates pressures in excess of -0.1 MPa (760 mmHg) at 1800min^{-1} , and should be kept to a maximum of 0.03 MPa.

※1: Cavitation

A local reduction in pressure within the flowing fluid results in air in the fluid forming bubbles, which in turn results in noise and vibration.

(3) Piping

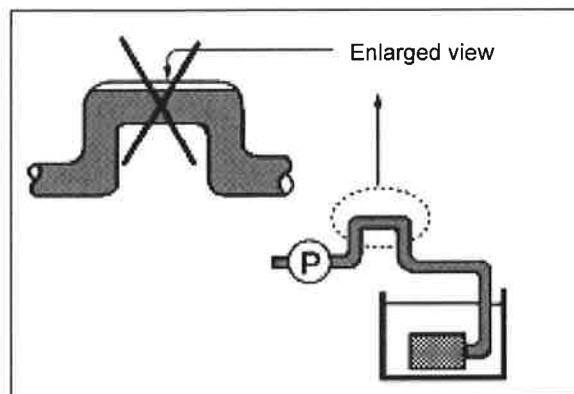


- Ensure that the pipe is supported with brackets to prevent its weight being applied to the pump.

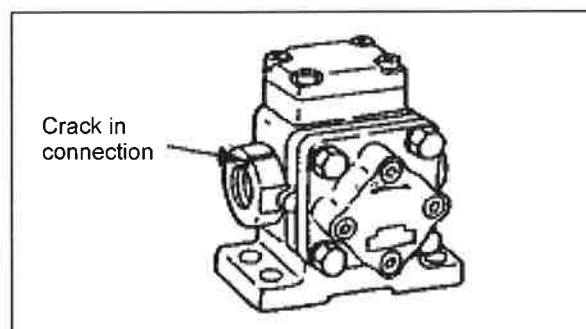


The pump may be damaged, resulting in vibration and noise during operation, if it is subject to the weight of the piping.

- Ensure that the appropriate seals are used to prevent air leakage into, and oil leakage from, piping.
Ensure that the suction pipe has a gradient of at least 1/100 upwards towards the pump to prevent air collecting in the piping.
Piping should be designed to prevent collection of air.



- Minimize the number of bends in the piping.
- As the resistance of the piping varies with the viscosity of the oil, care is required to ensure sufficient suction performance.
- After completing installation, ensure that the oil tank is cleaned and free of foreign objects which may be sucked into the pump.
- Connections may crack if over-tightened.



3.5 Oil Strainer

Always fit an oil strainer to the pump suction.

- Use a strainer of 100~150 mesh. Avoid fine particles such as polishing sludge.
- Use a strainer having a capacity of at least twice the pump discharge capacity.

3.6 Oil Tank

- (1) Ensure that the oil tank is as large as possible. A capacity of at least three times the pump discharge is recommended.

Note

If the oil tank is too small the oil temperature will rise, resulting in deterioration of the oil, which may in turn result in problems with oil suction.

- (2) Ensure that the design allows the tank to be cleaned easily.
- (3) Fit an oil level gauge to the tank.
- (4) Fit dividers in the tank to separate bubbles and foreign matter.
- (5) Separate the oil return and suction as far as possible.

3.7 Pump RPM

The volumetric efficiency of the pump is reduced, and operating noise is increased with oil of high viscosity. The pump should therefore be run at low speed when using high viscosity oil.

The pump may be run at either high or low speed when using normal oil (turbine oil ISO VG 32).

3.8 Cautions for Wiring Work



Use good quality equipment for wiring. Wire the pump safely, in accordance with local regulations. The pump must be wired by a qualified electrician or other suitably qualified person. It is illegal, and very dangerous, that unqualified people to perform wiring work.

- (1) Ensure that an earth leakage breaker and an overload protector are installed on the primary power supply side of the pump.
- (2) Always earth the pump to prevent electric shock.
Connect the earth cable to the earth terminal in the motor terminal box.



Connecting earth cables to gas piping or water piping is extremely dangerous.

- (3) Install wiring in shielded metal conduits or metal ducts, and earth the exterior.



Ensure that the electrical conduit from the motor terminal box is screwed tightly in place. A loose conduit may result in water leaking into the motor with a consequent fault.

- (4) Ensure that voltage variation is within $\pm 10\%$ of the rated voltage, and that power supply frequency is within $\pm 5\%$ of specifications.
Voltage or frequency outside these limits may result in a fault in the equipment.



If only two of the three terminals on a 3-phase motor are connected, the motor will run with only two phases and may burn out.

4. Preparations for Operation

4.1 Checks Prior to Operation

4.1.1 Checking the Electrical System

- (1) Check that all wiring has been correctly installed.
- (2) Check for loose terminals and conduits, and tighten as necessary.
- (3) Check that the system is earthed correctly.
- (4) Check that the setting for the overload protector is appropriate for the rated current value for the motor.

4.1.2 Checking the Pump System

- (1) Fully open the suction and discharge gate valves.

 **CAUTION**

Do not introduce oil into the pump suddenly if the difference in temperature between the oil and the pump casing exceeds approximately 40°C. Introducing the oil under such conditions may result in thermal distortion, consequent problems with the centering of the shaft, and associated seizing.

- (2) Clean the strainer and check for blockage.

4.2 Test Running

- (1) Turn the switch ON/OFF once or twice to check the direction of rotation of the pump.

 **WARNING**

Do not dry-run the pump under any conditions. Running under such conditions may result in seizure of the sliding components.

If the pump is running in reverse with a three-phase motor, interchange two of the three power supply connections.

If a single-phase motor is used, check that the wiring has been connected correctly, and re-connect as necessary.

Note that if the pump is running in the reverse direction, the seal may pop out.

(2) Switch power ON to operate the pump.



Ensure that the cover of the terminal box on the motor is fitted before switching power ON.
Electric shock may result if the cover is not fitted.

(3) Use the bypass pipe on the discharge side to adjust to the required pressure.

(4) Check for abnormal pressure, current, vibration, and noise etc.



Do not operate the pump while closed. Continuous operation under such conditions will increase oil temperature and pressure inside the pump, and may result in a fault.



Only open the pressure gauge and compound gauge valves when taking measurements. The probability of a fault developing is increased if they are left open.



If oil is not discharged within approximately 30 seconds of commencing pump operation, stop the pump immediately and check the suction pipe etc.



Note that when starting the pump in cold conditions, the increased viscosity of the oil will result in increased load on the motor, and a consequent increase in pump operating noise and vibration.

5. Maintenance and Checking

5.1 Cautions for Maintenance and Checking



Always turn power OFF at the source before checking the pump.
Failure to do so may result in electric shock.
If power has not been turned OFF, the pump may suddenly start automatically, resulting in injury.

- (1) Particular attention should be paid to the following points during daily checks.
- ① Excessive abnormal pump discharge pressure, current, vibration, or noise indicates an impending fault. Refer to “5.2 Periodic Checks” and take the appropriate measures immediately.
It is recommended that an operation log be kept.
 - ② Shut off the power supply in the event of a power failure.
Failure to do so will result in the pump starting suddenly when power is reconnected.
- (2) Note the following when the pump is not used for a long period of time.
- ① Turn the pump over either manually or with the motor at weekly intervals.
 - ② If a spare pump is kept in storage, run it at regular intervals to ensure that it is ready for operation if necessary.

5.2 Periodic Checks



CAUTION

Ensure that components are repaired or replaced by a specialized sub-contractor or by a service operator recommended by the manufacturer.

Any mistakes in this work may result in faults or accidents later on.

Item	Check/ adjustment	Check item	Check method	Criteria	Check cycle				Consumables		
					D	M	B	A	Name	Q'ty	Replacement cycle
Environment	Ambient temperature	Within range of specifications	Measurement	0 to 65°C	○						
	Dust etc.		Visual check	Free of dust	○						
Power supply	Power supply terminal block	Voltage	Measurement	Required voltage			○				
		Voltage variation	Measurement	Within allowable range			○				
		Loose screws or nuts	Tighten	No loose screws or nuts				○			
		Loose conduits	Tighten	No loose conduits				○			
Pump and motor	Vanes	Blockage	Overhaul	No blockage				○			
	Rotor shaft	Wear	Overhaul	No play				○			
	Main shaft rotation	Smooth rotation	Turn manually	Smooth rotation				○			
	Bearings	Heating	Touch	Reasonable temperature				○	Bearings	2	15000 hours
	Mechanical seals	Leakage	Visual check	No oil leakage		○			Mechanical seals	1	8000 hours
	Appearance	Abnormal noise and vibration	Listen	No abnormal noise or vibration	○						
	Insulation resistance	Between earth and leads	Insulation resistance meter	Minimum 1MΩ				○			

"D", "M", "B" and "A" in the "Check cycle" column indicates the following.

D: Daily

M: Monthly

B: Biannually (Every 6 months)

A: Annually

6. Troubleshooting

Thoroughly investigate the cause of any abnormality in the pump. Ensure that components are repaired or replaced by a specialized sub-contractor or by a service operator recommended by the manufacturer.

Fault		Cause	Solution
1	Insufficient discharge	Low oil level in tank	Add extra oil to raise the oil level.
		Problem with oil suction	Check for blockage of the suction pipe or filter, or leakage of air into the system.
		Problem with pump rotation	Check that pump rotation is normal.
		Problem with oil viscosity	Check oil viscosity.
		Problem with adjustment of valves	Check for presence of foreign matter. Adjust valves.
2	Low pressure	One of the causes noted in 1 above	One of the solutions noted in 1 above.
		Excessive internal leakage	Check cylinders and valves. Replace damaged packing and seal. Repair worn surfaces.
		Excessive external leakage	Check pump, valves and piping.
3	Pump noise	Cavitation Damaged or loose pump components	Check leakage of air into the system, blocked filters, capacity and oil viscosity. Check for ingress of foreign matter, lubrication problems, or fitting problems.
4	Oil leakage	Problems with piping Damage to packing or seal	Check piping connections. Check for damage to packing or seal. Check quality of materials used.
5	Irregular valve operation	Ingress of foreign matter	Check for ingress of foreign matter.
		Valve damage	Check for wear and damage.
6	Overheated oil	Excessive oil viscosity	Ensure that oil is of appropriate viscosity.
		Insufficient oil in tank	Check volume of oil.
		Excessive pressure setting on relief valve	Check and adjust.
		Excessive discharge pressure	
		Circuit restricted in places	Check piping diameter and valve capacity.
7	Irregular operation of pump	Leakage of air into system Problem with sliding components, ingress of foreign matter	Check seals on piping connections, sliding components, and bearings. Check for over-tightening of packing, ingress of foreign matter, or wear.

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