DHARA PUMPS

'DHARA' External Gear Pump:

Design & Working of "DHARA" Rotary External Gear Pump: -

'DHARA' Rotary External Gear Pumps are available in various sizes and versions to available in various sizes & versions to suit every possible viscous fluid pumping application. 'DHARA' Rotary External Gear Pumps are designed for liquid with low to high viscous range liquids which are free from abrasive substances. Our pumps are use in low to medium pressure range, high pressure in exceptional cases. 'DHARA' Rotary External Gear Pumps consist of profile ground gears closely fitted in a housing. The liquid is carried to the periphery of the revolving gears from the suction to the discharge side. All the components precision machined and close clearance is maintained between the running and stationary parts to ensure high volumetric efficiency.

DRIVE: -

Direct Drive + HRA Flexible Coupling / 'v' Belt Drive / Gear Box Drive / Variable Speed Drives.

Instructions for Installation, Operation and Maintenance of 'DHARA' Rotary Gear Pumps: -

The information contained herein are of general character and should be supplemented by the specific instructions in case of special pumps. This instruction manual s intended to help keeping specific instructions in case of special pumps. This instruction manual is intended to help keeping pumps n an efficient and reliable condition at all times. It is, therefore, necessary that instruction book is made available to all the personnel who are involved in this function.

I) INSTALLATION:

a) Preparation for Shipment:

After a pup is assembled in the manufacturer's shop, all flanges and exposed machined metal surfaces are cleaned – off foreign material and treated with an anticorrosion compound such as greases or heavy oil. For protection during shipment and erection all pipe flanges and nozzles are protected by wooden flange covers. Usually the driver (motor) is delivered to the works, where it is assembled and aligned with the pump on a common base plate. Wherever the size and weigh permit, the entire unit is shop assembled on a common base plate.

b) Care of equipment in the fields:

If the pumping equipment is received, until use, it should be stored in dry location. The protective flange covers and coatings should remain on the pumps. The bearing & couplings must be carefully protected against sand, grit and other foreign materials.

c) Pump Location:

Working space must be checked to ensure adequate accessibility for maintenance. Space must be provided so that assembly can be pulled out without canting it. For large pumps with heavy casting and rotor, a travelling crane or other facility for attaching a host should be provided over the pump location. Pump should be located as close as practicable to the source of liquid supply. Wherever possible the pump centreline should be placed below the level of the liquid in the suction reservoir.

d) Foundations:

Foundation may consist of any structure strong enough to accord permanent rigid support to the full area of the bass plate and to withstand any normal strains or shocks. Concentrate foundations built-up on solid ground are the most ideal. The space required by the pumping unit and the location of the foundation bolts are determined from the drawings supplied.

e) Alignment:

When a complete unit is assembled at the factory, the unit is accurately aligned using shims under the pump and driver mounting surfaces wherever necessary. Since the base plate cannot be distorted by yielding or springing of the structure.

Following points should be observed for alignments

- The Coupling's flexible pad or bolts should be removed before the unit is levelled.
- Suction and discharge connection should be free from piping.
- During levelling operation accurate alignment of the coupling halves must be maintained by putting straight edge across the top and sides of the coupling and at the same time the face of the coupling halves should be checked with tapered thickness gauge or with feeler gauge to see that they are parallel.

We recommend the following permissible for alignment:

▪ Light Pump Set	Across top & side of coupling 0.050 to 0075 mm	Across Faces of coupling 0.050 to 0.075 mm
▪ Medium Pump Set	0.075 to 0.125 mm	0.075 to 0.125 mm
▪ Heavy Pump Set	0.150 to 0.020 mm	0.150 to 0.2 mm

f) Once the Pump and its drive are aligned, use a level gauge to check the angular position of the suction and discharge flanges.

g) Suction Piping:

Experience has proved that a faulty suction line is responsible for trouble with Rotary Pumps. Suction piping should never be less in diameter than the full size of the pump suction opening. It should be as short and direct as possible and thoroughly clean. It should be uniformly graded up from the source of supply to the pump. When drawing liquid from long distances or on be grated than the opening in the pump to convey the liquid with minimum pipe friction loss. Rotary Pump have excellent suction qualities but cannot be expected to do the impossible. Remember that the atmospheric pressure (14.71 Lbs. per sq. inch. Absolute) is all that forces liquid into a pump. If the static suction life plus suction pipe friction is equal to or greater than the equivalent of atmospheric pressure, the pump will not fill, resulting in reduce or entire less of capacity. When pumping highly volatile liquid such as butane, propane, hot oils, etc. there must be sufficient static head on the suction in addition to the vapour pressure to prevent vaporization of the liquid within the pump.

h) Discharge Piping:

Generally, both the check valve should be installed in the discharge line. The check valve s placed between the pump and the gate valve and protect the pump from reverse flow in the event of unexpected driver failure or from reverse flow from another operating pump. The gate valve is used when shutting it down for inspection and repairs.

i) Piping Strains:

Piping should not impose excessive force and moment on the pump to which it is connected, since these might spring the pump or pull it out of position. Piping flanges must be brought squarely together before the bolts are tightened. The suction and discharge piping and all associated valves, strainers, etc. should be supported and anchored near to but independent of the pump, so that no strain will be transmitted to the pump casing.

j) Suction Strainer:

Pumps are not intended to handled liquid containing foreign materials. If the practices are sufficiently large such foreign material can log the pump, reduce its capacity, or even render it altogether incapable of pumping. Small practices of foreign material may cause damage by lodging between close running clearances. Therefore, proper suction (40 mesh) strainers ay be required in suction line of pump. If necessary, micro filter should be provided n delivery line and not on suction line.

k) Relief Valves:

The pumps can withstand discharge pressure much in excess of their maximum design pressure. To protect these pumps against excessive pressure when the discharge is throttled or shut-off, a built-in relief valve is provided, which should operate frequently and in a very short duration. In case of frequent & long duration operation of relief valve, a relief valve with an external return connection must be used and liquid from relief valve must be pumped back to the source of supply.

II) OPERATION:

Pumps are generally selected for a given capacity and total head when operating at rated speed. Before starting a pump for the first the following points should be considered.

a) Do not run the computer with water to carry out hydrostatic test of the suction and discharge piping to see that there is no leakage. Flush all piping to remove dirt, welding beads, pipe scale thread furnings & other debris by closing suction & discharge parts of the pump.

b) Fill the pump casing with the liquid to be pumped / handled.

c) Open the suction and discharge valve before starting the pump.

d) Check the prime mover for its correct rotation.

e) It is advising to start operation at a reduce load by gradually opening suction valve to its full open position.

f) Relief valve should not be disturbed as it is set for its operation.

g) Important:

Where the pump is excessively heated in the initial running and jamming is caused, allow it to cool down to the temperature till the jamming is eliminated. Even if it is jam, loose all the cover bolds by half a turn and try to rotate the pump shaft with pipe wrench. If it rotates then start the pump and allow it to run smoothly and tight the bolts slowly till there is no jamming.

At the time of commissioning, under no circumstances, the pump should be dismantled due to any fault whatsoever without consulting the manufacturer…

At the commissioning stage, if the shaft is found tight, try to rotate the shaft with the help of a pipe wrench. If it rotates with pipes wrench then tightness should be considered as normal and the pump can be started without any trouble.

III) MAINTENANCE:

a) Daily observation of pump operation:

When operators are on constant duty, hourly and daily inspection should be made and any irregularity in the operation of the pump should be reported immediately. This applied particularly when there is change in the sound of a running pump, abrupt change in the bearing temperature and stuffing box leakage. The pressure gauge should be checked for its variations.

b) Semi-Annual Inspection:

The pump should be checked for its free movement. All bolts should be checked and tightened, if found loose.

Packaging should be inspected to determine whether it requires replacement.

The pump and driver alignment should be checked and corrected if necessary.

c) Annual Inspection:

In addition to semi-annual inspection a thorough inspection should be made once in a year.

The pump should be tested to determine whether proper performance is being obtained.

Relief valve performance should be rotated clockwise.

d) Dismantling and reassembly of 'DHARA' Rotary Gear Pumps.

Pumps fitted with bush bearings:

- Unbolt both side covers and pushout assembly of rotors and bushes making note of packing on either side.
- Slide out the bushes from shafts and check for face wear. If excessive wear is there, replace them and if minor wear is there, have a fine machine cut on the face such that both bushes on either side are exactly of same width.
- No. of packing should be there on should be corresponding to the reduction in bush width but minimum 1 packing should be there on either side.
- Remove all the burns in body bore, on body faces as well as on rotors. Insert the rotors first in the body and then fit the bushes on either end and check for free rotation.
- If seal is damaged, take out circlip and seals, replace with new seals and fit back in the cover.

- Put appropriate packings taking care that there is no over lapping on bush faces and then fit the covers with the bolts.
- Free rotation of the shaft should be checked with a small pipe wrench. If shaft is found tight, loosen cover bolts by quarter turn and start the pump. When it runs smoothly tighter the bolt equally and slowly. If seizure occurs, add one more packing.
- In case of any ovality found in bush bore, it should be replaced.
- If excessive wear is found on gear teeth, complete set is to be replaced.
- High pressure pumps are fitted with 'O' rings. In case of any wear on bush face in pump, it should be replaced.
- Minor scoring in body bore will not affect pump performance to great extent but if heavy scoring is found, body should be replaced.

Pump fitted with antifriction bearings

- Unbolt both side covers making note of packings on either side.
- Heavier pumps are provided with jacking arrangement to take out covers. Threaded holes are provided on covers. Insert suitable bolts and jack up the covers.
- Push out the assembly of rotors, wear plates and bearings such that wear plates of opposite side come out of the body. By mean of pullers, take out the bearings and wear plates and then push the remaining assembly out in the opposite direction. Take out the bearings and wear plates from the other side also means of pullers.
- Check the wear on wear plates. If excessive wear is there, replace the complete set of wear plates. In case of minor wear, take a fine machine cut on the face such that the width of top and bottom wear plates is equal.
- Check wear on gears and shaft. If minor wear is observed on faces of gears of grind the faces (in case of hardened gears) or take a fine machine cut on the faces of soft gears such that drivers and driven gear match perfectly well with the same face width.
- If seals are damaged remove the circlip and seals and fit new seals in the cover.
- Remove all burrs from body-bore, body face as well as on rotors and wear plates.
- Insert the rotors first in the body and then wear plates on both sides. Now fit the bearings in each wear plate. Keep a watch on free rotation of shaft with the help of a pipe wrench.
- Reduce the packing corresponding to the reduction in width of wear plates and gear. Place the packing on body face with grease such that there is no overlapping on wear plates.
- If seal is damaged, take out circlip and seals and fit new seals in the cover.
- Now fit front and back covers and bolt them. If dowel prints are provided covers should be first located with dowel pins and then they should be bolted.
- In case of excessive scoring in pump body, it should be replaced.
- If shaft is not rotating freely, loosen cover bolts slightly. Now start the pump and let it run for some time, then tighten all bolts equally. In case of seizure add one more packing.
- If the pump is having steam jacket, then before taking out covers remove jacket coupling and plugs from both covers.

External Bearing Pump

- Take out steam jacket coupling and plugs from the front the back covers, if pump is steam jacketed.
- Unbolt bearing covers from both covers.
- Jack up both covers by inserting suitable bolts in the threaded holes provided on the covers and make a note of packing on either side.
- Take out circlips, seals and bearings from the cover, clean them properly and refit in the cover. If they are damaged replace them.
- Push out the rotors and wear plates from the body.
- Check the wear plates for wear and if excessive wear is there replace them. If minor wear is there take a fine machine cut on the face such that width of top and bottom wear plates is the same.
- If slight wear is found on gear faces, grind the faces (in case of hardened gears) or take a fine machine cut for soft gears such that drivers and driven gears match perfectly and have exactly same face width.
- If scoring in body bore is too much, it should be replaced.
- Remove all burrs from body bore, face, rotors and wear plates. Insert the rotors in the body bore and then fit the wear plates.
- Reduce packing corresponding to the reduction in width of gears and wear plates and fix them with grease such that there is no overlapping on wear plates.
- Now fit the front and back covers by locating them with dowel pins. Care should be taken to see that seals do get damaged.
- Fit the bearing in cover such that shaft does not get jammed.
- Fit the bearing and bearing cover with high temperature bearings grease for lubrication. Only half of the space in bearing covers is to be filled up with greases. Now fit the bearing covers.
- Fit jacket coupling and plugs for steam jacketed pump.
- In case of seizure of pump on trial, add one more packing.

FAULT	CAUSE	ACTION
I. Pump does not prime	1. Rotation wrong	Check rotation, if necessary change connection on motor.
	2. Pump is dry.	Fill pump initially with oil.
	3. Suction line is not air tight.	Tighten all bolts and nuts on suction side. If necessary, pressure test suction line. Attach vacuum gauge which should show approximately 20 ins. Hg. Vacuum at closed suction valve.
	4. Relief Valve loose	Tight relief valve – Stud clockwise
In case of working against closed discharge line.	1. Evacuated air can't pass through the pressurized oil column and steams back into the suction line.	Arrange deaeration cock on discharge side of pump. When pump is started open this cock until all air is exhausted and then close. In the case of such arrangements, a non-return valve is necessary on the discharge line and also a foot valve is suggested so that the suction line, when switching off pump, remains full.
II. Loss of output.	1. Speed too low.	Check speed by means of a techno meter. Check frequency and voltage on motor name plate. Check pump as in the case of overload, speed can be dropped. Check star delta and compare with voltage.
	2. Relief Valve opens too soon or loose	Tight relief valve – Stud clockwise
	3. Loss in output due to air in stuffing box	See fault 1. Paragraph 3.
	4. Suction line friction too great. a) Suction pipe too small. b) Suction line too long. c) Suction filter blocked. d) Viscosity too high.	Fit vacuum gauge and check suction lift which should not be more than 5-6 MLC. Pump suction line should be at least equal to pump suction size. In case of viscous liquid, it should be one size higher then suction size. Suction line should be as short as possible.

FAULT	CAUSE	ACTION
III. Pump is noisy a) Mechanical Noise.	1. Badly aligned coupling	Disconnect pump from motor and align coupling.
	2. Gear flanks are damaged by foreign bodies.	Removes gears and correct damaged flanks with oil stone. Finally grind by hand-file.
	3. Delivery against low pressure in the case of thin liquids.	Load gear flank by closing discharge valve giving approximately 15-20 PSI noise will be eliminated.
b) Hydraulic or pneumatic noise.	4. The pump medium contains air.	Determine whether air is drawn through leak or whether return line is unsuitable in the case of a circulating pump. In such a case it is also necessary that the return pipe terminates below liquid level.
	5. Cavitating due to a) To high suction lift. b) Excessive speed in the case of very viscous liquids. c) Pumping of Liquid which are highly volatile like petrol, solvent etc.	a) Reduce the suction lift. b) Reduce speed. Only a low vacuum is permissible. c) Under certain circumstances liquid may require pressurisation, depending on its vapor pressure.
IV. Motor is heating up.	1. Wrong connection of motor or only two phases.	Connect motor according to name plate and check voltages in all three phases.
	2. Motor overloaded.	Check amps by means of an ammeter.
	3. Wrong frequency	Check frequency on name plate.
	4. Pump seizing	Disconnect the motor & check the pump can be turn by hand or pipe wrench. (Please refer II OPEERATION-G)
	5. Delivery Pressure too high	Connect Pressure gauge on the discharge branch and check whether delivery pressure is in accordance with the name plate of the pump.
	6. Viscosity too high.	Check viscosity at pumping temperature and compare with data sheet of the pump.
	7. Mis-alignment.	Re-align coupling.

		Fit new spring, check valve for easy movement in the valve seat.
FAULT	**CAUSE**	**ACTION**
V. Fluctuating Delivery.	1. Frothing medium	Avoid air entry in the oil (see that the case of the circulating pumps, the return line ends well below the oil level.)
VI. Pump Seized	1. Excessive pressure due to wrongly adjusted relief valve. 2. Foreign body in pumped medium. 3. Dry running 4. Insufficient lubricating quality of pumped medium.	Check relief valve pressure at close discharge valve, re-adjusted relief valve, so that it opens approximately at 10% above working pressure. Dismantle pump. Remove foreign body. Smoother seized area with oil stone. If necessary fit new bearings and provide suction filter. Remove seized area as above. Fill with oil and wet rotors before starting up. Check whether pumped medium has lost its lubricating properties due to elevated temperature. If a pump has seized, gears and bearings should be dismantled. All seized areas to be smoothened with oil stone. The bearing should be scraped re-assemble the pump and put it in operation initially at low pressure.
VII. Relief valve chattering	1. Valve is jammed	Fit new spring, check valve for easy movement in the valve seat.

RECOMMENDED SPARE PARTS FOR GEAR PUMPS.

Note: Since pumps are manufactured for different applications and different material of construction it is difficult to list out common spare part list. It is advisable to go through ordered pumps cross section drawing supplied with technical documents and order spares. In general, following spare parts are recommended.

	Quantity
(a) Normal Operation:	
(1) Oil Seal / Mech. Seal / Gland Packing	1 Set
(2) Relief Valve Spring	1 Set
(3) Packing Set (Gaskets / 'O' Ring Set	1 Set
(4) Rubber Spider / Bushes for Coupling	1 Set
(b) Recommends Spare Parts for two year trouble free operation:	
(In addition to recommend spare parts for normal operation)	
(1) Bearings (Bush bearing / steel antifriction)	1 Set
(2) Wear plates	1 Set
(c) Recommends Spare Parts for three year trouble free operation:	
(d) (In addition to spare for normal and two year operation as per a & b)	
(1) Set of Rotor (Shaft & Gears)	1 Set

Important: While floating an enquiry for spare for pumps it is necessary to furnish pump serial number (punched on nameplate and on body and covers) and / or Purchase Order Number – under which you had purchased this pumps initially.