Service Installation and Assembly Instructions for LIQUID RING VACUUM PUMPS

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SIHI
PUMPS

PGV-1165

INSTALLATION

Prior to installation it is essential that all protective inserts (if any) in gas and service liquid connections, at time of factory shipment, be removed.

Pump and motor shaft must be in correct alignment.

The diameters of the suction, discharge and service liquid lines should be at least equal to that of the corresponding connections of the pump. Any fittings in these lines should have ample passage, thus minimizing pipeline restriction.

In the suction pipe of the vacuum pump or compressor a non-return valve of low resistance or a shut-off valve should be fitted close to the pump to prevent the service liquid being drawn off or blown back through the suction pipe when the pump is stopped. When there is a possibility of impurities being drawn into the pump with the air, a reliable filter should be fitted in the suction pipe.

To prevent a back pressure inside the pump due to a liquid column on the discharge side, it is recommended limiting the vertical height of the discharge piping to a maximum of 24" above the discharge flange prior to separating the gas and service liquid.

START-UP PROCEDURE

1. Fill pump with service liquid up to shaft level.*
2. Rotate shaft by hand and check for any binding. If pump seizes then gently tap shaft end to free the impeller(s). If trouble persists fill the pump with a solvent to loosen any scale binding.
3. Check pump rotation by the arrows on the pump covers.
4. Open pump discharge valve (if any).
5. Open valve in pump suction line.
6. Check alignment of coupling.
7. Start driver.
8. Open service liquid supply line and set supply for optimum pump capacity.
9. Check RPM of driver, temperature of bearings, pump housing and glands for hot spots.

SHUTDOWN PROCEDURE

Before stopping the pump, shut off the service liquid and if supplied, the gland sealing liquid supply. The pump should be protected from frost and corrosion. Wherever possible, the pump should be completely drained and filled with anti-freeze or rust preventative. Necessary drain plugs are located in the pump. When draining rotate the shaft by hand.

MAINTENANCE

SIHI pumps require very little attention or maintenance. The ball bearings should be greased every 3000 hours of operation, with special ball bearing grease obtainable from any lubricant supplier.

Scale deposits forming inside the pump, due to impurities in the service liquid, or entrainment carry over from the process system, may be removed by periodic recirculation of a descalent. For further details contact our factory office.

LOCATING PROBLEMS

Every SIHI pump is factory tested. SIHI pumps are simple in design and construction with very little to go wrong. Should you, however, have any problems try to locate the trouble as suggested below. Should your trouble persist do not hesitate to contact our representative nearest you or to call one of the factory offices.

	CHECK:						
PROBLEM:	Speed Too Low	Leakage In Suction Line	Temp. Service Liquid Too High	Excessive Service Liquid	Insufficient Service Liquid	Worn Gland Packing	Coupling — Misalignment
REDUCED CAPACITY	●	●	●		●		
EXCESSIVE NOISE				●			●
HIGH POWER CONSUMPTION				●			●
OVERHEATING			●		●		●
VIBRATION				●			●
GLAND SEAL** LEAKAGE				●		●	

*Never start pump with liquid level above shaft line!

**See 7.0 inside pages.

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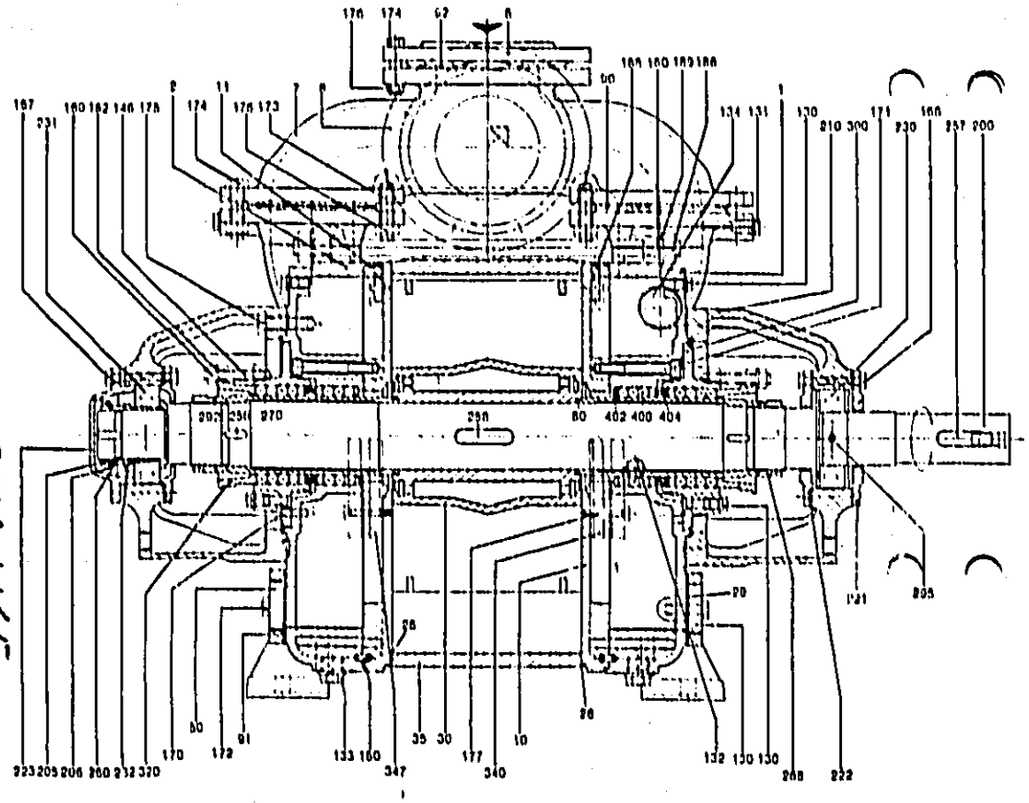

1	Cover	175	Bolt
2	Cover	176	Nut
6	Flange	177	Bolt
7	Manifold	180	Nut
8	Manifold	182	Washer
10	Intermediate	188	Nut
11	Intermediate	189	Washer
28	Gasket	200	Shaft
30	Impeller	205	Shaft nut
35	Centre body	206	Lockwasher
50	Counter flange	210	Bearing housing
80	O ring	221	Bearing cover
90	Gasket	222	Bearing cover
91	Flange gasket	223	Bearing cover
92	Flange gasket	230	Bearing
130	Plug	231	Bearing
131	Plug	232	Bearing sleeve
132	Plug	256	Key
133	Plug	257	Key
134	Plug	258	Key
146	Stud	260	Spacer
150	Locating pin	270	Shaft sleeve
160	Tie bolt	288	Nut shaft
163	Cylindrical bolt	292	Lockwasher
166	Bolt	295	Grease nipple
167	Bolt	300	Packing flange
168	Grub screw	320	Gland
170	Bolt	340	Orifice plate assy
171	Cylindrical bolt	347	Orifice plate assy
172	Bolt	400	Packing ring
173	Stud	402	Neck ring
174	Bolt	404	Lantern ring

.0 All parts, especially joint areas, are to be handled with care. All threads and fittings and the running faces of the intermediates 10 and 11 as well as the fittings (except sealing fitting) have to be brushed with a Molykote grease.

.1 Apply liquid compound gasket to the sealing fitting.

.2 When ordering spare parts please refer to part number, pump description and stock number.

4.0 Preparation for Assembly

4.1 When assembling the components make sure that all markings are properly lined up.

4.2 In the event one or more parts are being replaced which, due to their axial length may affect the location of the impeller, it is necessary to establish the new impeller location. The clearance on both sides of the impeller must be equal to half of the total clearance. The total clearance equals 0.4 - 0.5 mm.

NOTE: The impeller blades are INCLINED in the direction of rotation.
Complete rotating element with shaft sleeve 270, O-ring 80, impeller nut 288 and lock washer 292. Tighten nut 288 but do not secure with lock-washer.

4.5 Support cover 1 assembly in horizontal position and insert rotating element. Assemble centre body 35 and cover 2. Insert tie bolts 160 and tighten by hand.

4.9 Adjustment of Clearance

The clearance between impeller and adjacent intermediates 10 and 11 can be measured by consequently tightening and loosening of the bearing cover 223 and bearing cover 222 at the non driven end (loosen cover in direction of movement). The degree of axial movement in either direction can be measured with a dial clock at the shaft end and the total clearance is established by loosening the "tight" cover and tightening the "loose" cover.

6.0 Repacking of the pump

Packing is installed inside the pump cover and inside the stuffing box flange. It is therefore more practical to separate stuffing box flange from pump cover when repacking is required.
DO NOT REMOVE SHAFT SLEEVES as this will affect the pump clearance.

6.1 Remove nut 180 and slide gland 320 as far as possible towards the outboard bearing.

2.0 Preparation for Disassembly

2.1 Drain liquid out of pump.

2.2 Remove pump from installation.

2.3 Remove coupling hub from the pump.

3.0 Disassembly of Pump

3.1 Remove key number 257 and manifolds 7 and 8. Remove bearing cover 221 and bearing retainer 223 and shaft nut 205. Loosen bearing covers 222.

3.2 Remove carefully bearing housing 210 from cover 1 by applying 5/8" - 11 UNC push-off bolts in flange of bearing housing, remove bearing 230 and bearing cover 222.

3.3 Place pump in an up-right position with the free shaft end pointing downwards supporting the suction cover 1. Remove bearing housing 210 at non driven end as above and disassemble roller bearing 231 by using the withdrawal nut 233 which is attached to the outside of the pump. Loosen tie bolts 160 and remove cover 2 complete with intermediate 11 and stuffing box flange 300. Remove centre body 35.

3.4 Lift rotating element, consisting of shaft 200, impeller 30 and shaft sleeves 270, etc, from assembly.

3.5 Separate stuffing box flange 300, gland 320 from cover and press the packing 400, lantern ring 404 and neck ring 402 out and separate intermediates 10 and 11. Disconnect orifice plate assembly 340 and 347.

3.6 Remove nut 288, safety disc 292 and remove shaft sleeve 270. Insert M16 bolts in the impeller hub and pull impeller 30 from shaft.

Assembly of the Pump

4.3 Assemble orifice plate assembly 340 to intermediate 10, orifice plate assembly 347 to intermediate 11 and mount intermediate 10 to cover 1 and intermediate 11 to cover 2. Assemble stuffing box flanges 300 to cover 1 and 2 resp. and complete with the following items: neck ring 402, 3 rings of packing 400, lantern ring 404, 3 rings of packing 400 and gland 320. (Install gland rather loosely).

4.4 Assemble the rotating element as follows: Insert key 256 and fit the shaft sleeve 270 on the driven side in such a manner that the distance from the step in the shaft 65/75 mm and the impeller equals 292 mm (11.496 inches).

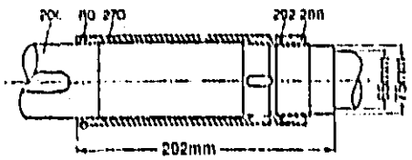

FIG. 1

Locate with shaft nut 288 and lockwashers 292 but do not secure.
Insert O-ring 80 and slide impeller 30 on shaft.

4.6 Place pump horizontally on flat surface and tighten the tie bolts 160 crosswise with a torque wrench set at approx. 13 kgm (100 foot pound).

4.7 Slip bearing cover 222 on shaft. Mount bearing housing 210 to cover 2 and install bearing 231 and spacer 260. Secure with shaft nut 205 and lockwasher 206.

4.8 Slide bearing cover 222 over shaft at the driven end and install bearing housing 210 to cover 1. Install ball bearing 230.
NOTE: The bearing 230 must be positioned in the centre of the bearing chamber, leaving equal clearance between bearing cover 221 and 222, 7 mm (0.2756 inches) from machined face - see figure 2, and complete assembly with the mounting of bearing covers 221 and 222 to the bearing housing 210.

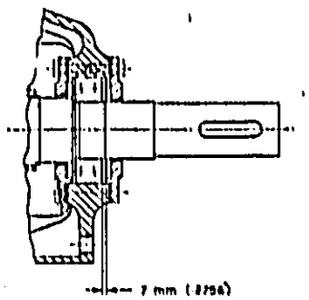

FIG. 2

moved backward until the dial clock indicates that half of the total clearance is obtained. At this point both bearing retainer 223 and bearing cover 222 are tightened. Tighten both impeller nuts 288 and secure with lock washer 292.

4.10 Install both manifolds 7 and 8 and key 257.

5.0 Exchange of bearings

5.1 Roller bearing 230 at driven end

Remove either pump or motor and remove coupling hub from pump shaft. Remove key 257 and bearing cover 221. Separate bearing housing 210 complete with bearing 230 and bearing cover 222 from cover 1 by using 5/8" - 11 UNC - push off bolts in flange of bearing housing in conjunction with a set of bearing pullers. Remove bearing cover 222 from bearing housing and push roller bearing out. Reassemble in opposite sequence and lubricate with ball bearing grease.

5.2 Roller bearing 231 at non driven end

Remove bearing retainer 223. Unlock lockwasher 206 and remove bearing nut 205, lockwasher 206 and spacer 260. Unbolt bearing cover 222 and remove bearing housing 210 from cover 2 by using 5/8" - 11 UNC - push-off bolts in flange of bearing housing. Loosen bearing sleeve 232 with withdrawal nut 233 which was attached to outside of pump. Remove bearing 231 and bearing cover 222. Assemble in opposite sequence. Lubricate every 3000 hours with SKF MMG 711 grease or equivalent.

Pump Bearing:

DE SKF 22213 C/W 33
ODE SKF 22213 CK/W 33

6.2 Remove packing up to the lantern ring.

6.3 Remove bolts 170 and separate stuffing box flange 300 from cover (use screw driver to facilitate separation).

6.4 Slide lantern ring 404 back and remove remaining packing rings.

6.5 Clean shaft sleeves and sealing faces of pump cover and stuffing box flange. Do not remove shaft sleeve as this will affect the pump clearance!

6.6 Install 3 new rings of packing 400. Slide lantern ring 404 in place.

6.7 Apply liquid gasket compound to cover and mount stuffing box flange 300 to cover using bolts 170.

6.8 Install 3 new rings of packing 400 and complete the assembly with the gland 320.

7.0 Leaking Stuffing Boxes

Excessive leakage of the packed stuffing boxes can be controlled by partially closing the gland lubrication channel in the intermediates by means of grub screws 168.

Packing

Packing size - 1/2" square.

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SIHI
PUMPS

vacuum pump service liquid

The principle of the liquid ring pump is dependent upon a continuous supply of cool, clean service liquid, normally water, which enters the pump on the suction side and is discharged with the compressed gas. The volume of the liquid ring within the pump should be regulated for optimum performance with the additional amount of service liquid entering and leaving the pump serving to carry away the heat of compression imparted to the liquid ring during the working cycle. The temperature rise across the vacuum pump will then be limited to approximately 7°F.

SERVICE LIQUID FLOW REGULATION

Check detail drawings for the number and location of service liquid connections on each pump.

At initial start up it is necessary to establish the correct amount of service liquid flowing into the vacuum pump. Once this is established only periodic checking or slight readjustment should be required.

In the service liquid line it is recommended that there be fitted a shut off valve, strainer, normally closed solenoid valve, flow regulating valve and compound vacuum/pressure gauge. The latter should be installed fairly close to the pump.

The flow regulating valve should be adjusted in such a manner that there is neither vacuum or pressure registered on the compound gauge when the vacuum pump is in operation.

As the vacuum pump only requires service liquid at atmospheric pressure any excess service liquid supply will be indicated by a pressure reading on the compound gauge.

Similarly, if insufficient service liquid is being supplied the vacuum pump will create a vacuum condition in the service liquid line which can be readily observed on the compound gauge.

This simple procedure will establish an optimum operating condition for the liquid ring vacuum pump.

NOTE THAT THIS PROCEDURE IS NOT APPLICABLE TO LIQUID RING COMPRESSORS.

Having established the aforementioned operating condition it is recommended that routine observations be made for cavitation and pump overheating due to insufficient service liquid supply or excessive vibration and increased power consumption due to excess supply of service liquid, which may be brought about by fluctuation in service liquid supply.

A "grinding" noise may be heard when vacuum pumps operate without enough air admission. To eliminate this noise most models are fitted with a relief valve which should be opened partially. We can supply an automatic valve for this purpose, which can be mounted on any type SIHI liquid ring vacuum pump.

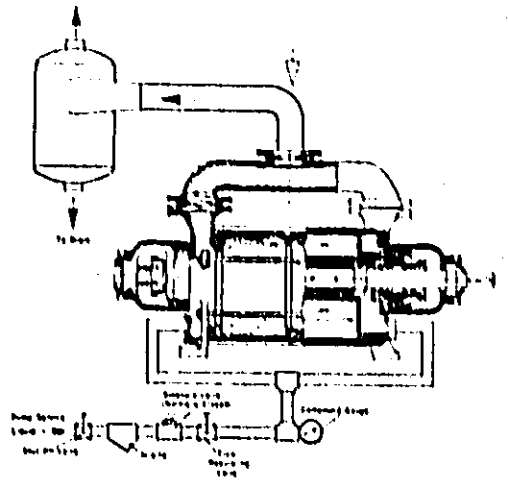
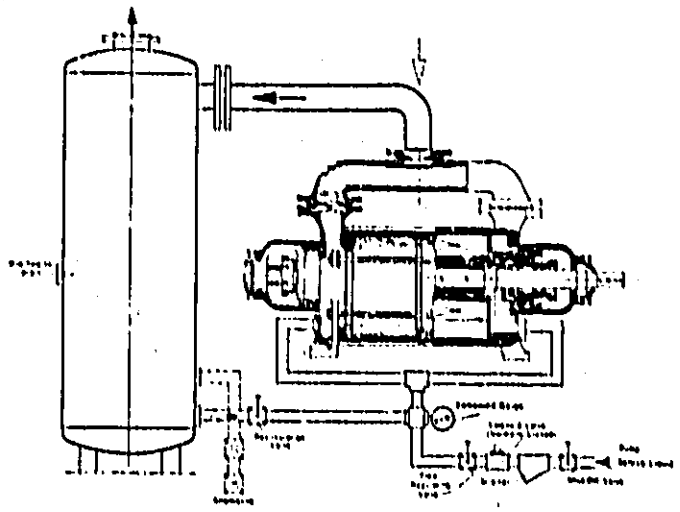
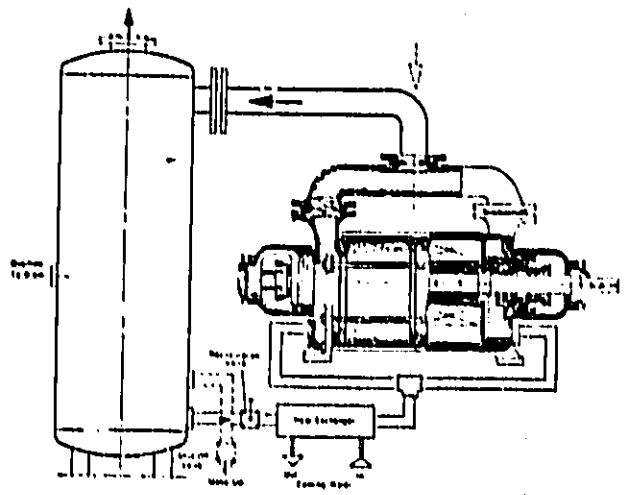


Figure 1—indicates the more common method of supplying service liquid to the pump where a supply at constant volume and pressure is available.



* Figure 2—shows a method where partial recirculation is employed. The service liquid enters the pump, is discharged to the recirculation tank where some heat may be dissipated by radiation. Meanwhile an additional controlled flow of cooled service liquid is added. A similar amount of service liquid is over-flowed to maintain the working level in the same horizontal plane as the pump shaft centre line.



* Figure 3—incorporates a closed recirculation system where the same service liquid is repeatedly passed through the pump. In order to cool the service liquid a heat exchanger is applied to the service liquid recirculating line. Coolant is required for the heat exchanger and provision for make up or drainage, to ensure a stable level of service liquid, is required.

* Note: Recirculation of service liquid in a vacuum system can result in economy of service liquid consumption. However, where vapors drawn from the system contain bacterial or toxic contaminants to be scrubbed out by the liquid ring pump and remain in the service liquid, consideration must be given to controlling the quality condition of the service liquid.

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81.900158.01