CORVEX
Pumps
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SERVICE MANUAL

2BV, SK, 2SK, 2BE, Liquid ring vacuum pumps

CONTENTS

OPERATION
& MAINTENANCE
Liquid Ring Vacuum Pump

2 FOREWORD

Instructions for Installation, Operation and Maintenance
CORVEX PUMPS

This manual is intented to be a reference guide for users of pumps providing information on pump installation and maintenance instructions, pumps start-up, operacion and shut - down procedures.

3 GENERAL INFORMATION

3.1 INTRODUCTION

This manual will provide assistance in the set-up, operation, and maintenance of your CORVEX Liquid Ring Pump. Please read this manual completely prior to operating your Liquid Ring Pump. If you need to contact the Pump Service departament for assistance, please have available the pump serial number, model number, and ID number if possible.
CORVEX PUMPS has an extensive stock of spare parts and replacement pumps. Please have the model number, serial number and part number of the items required when placing an order. When a pumps is returned to the factory for repairs, please drain and flush the pump and incluide a Material Safety Data Sheet (MSDS) for the process in which the pump was used. A Return Material Authorization (RMA) Number, issued by CORVEX PUMPS, is requiered before returning a pump. Field Service Technicians are also available for travel to the jobsite for troubleshooting and repair or rebuilding of pumps. This document and the information contained here in are the property of CORVEX PUMPS and must not be copied, in whole or in part, nor used for manufacture or otherwise disclosed without the pior written consent of the company.

3.2 GENERAL DESCRIPTION AND PRINCIPLE OF OPERATION

CORVEX Vacuum Pumps and Compressors are of the liquid ring type. Single and two stage pumps are available in a wide range of sizes and materials. These options are listed in the CORVEX PUMPS Sales brochures. The major component of the CORVEX PUMPS LRVP is a multi-bladed rotating assembly positioned eccentrically in a cylindrical casing. (See **Figure 1**) This assembly is driven by an external source, normally an electric motor. Service liquid (usually water) is introduced into the pump. As the impeller rotates, centrifugal force creates a liquid ring which is concentric to the casing. At the inlet, the area between the impeller blades (buckets) increase in size, drawing gas in. As the impeller continues to rotate toward the discharge, the impeller bucket area decreases in size, compressing the gas. This gas, along with the liquid from the pump, is discharged throught the outlet nozzle. The service liquid is separated from the gas and cooled for reuse in the pump or sent to a drain. In addition to being the compressing medium, the liquid ring perfoms two other important functions: 1) It absorbs the heat generated by compression, friction, and condensation of the incoming vapor. 2) It absorbs and washes out any process contaminants entrained in the gas. A continuous supply of servicie liquid is necessary to limit the temperature rise in ther pump caused by the heat of compression, friction, and condensation. Any excessive rise in temperature will have a detrimental effect on performance, reducing the capacity and degree of vacuum attainable. Installation schematics for the supply of the service liquid and for the separation of the gas and liquid discharged from the pump are shown in Section 4.6

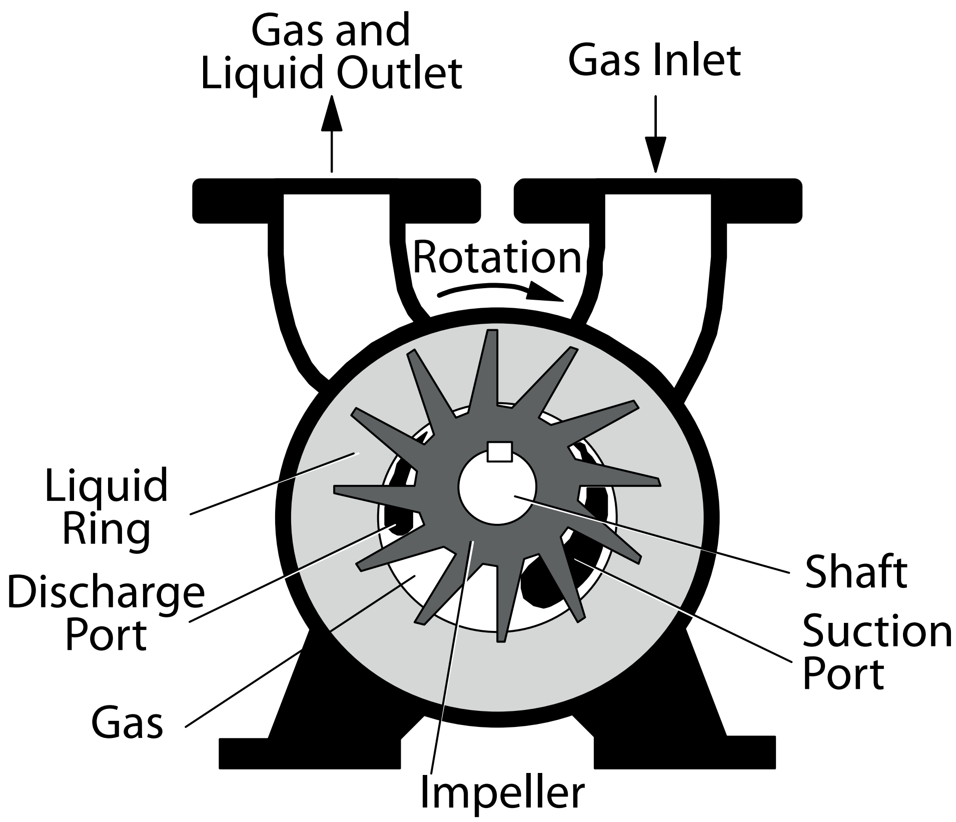


Figure 1

4 INSTALLATION INSTRUCTIONS

4.1 HANDLING

Carefully unpack the pump. Bare pumps may be lifted with a sling placed around the bearing housings or under the flanges.
Place slings around the motor and the pump for units supplied with C-Face motors attached.
For baseplate mounted units, lift the pump for-motor assemblies by the baseplate only. Do not attach slings nor hooks to the motor or the pump as this can cause misalignment. Do not attempt to run the until the installation work is complete.

CAUTION: DO NOT RUN THE PUMP WITHOUT SERVICE LIQUID AND SHAFT SEAL FLUID.

4.2 MOUNTING

Before operation, the pump package should be carefully set, leveled, and securely bolted in place. It is recommended that shims and grout be used as necessary under all structural members of the base.

The pumps are supplied as a standard to accept an adapter for mounting a NEMA C-Face motor. The pump and support bracket (adapter) should be bolted to the floor, a cement pad, or existing framework. Level and shim as required.

If baseplates are supplied with a pump and drive motor mounted at the factory, then they should be leveled, shimmed as required and firmly anchored.

4.3 INSTALLATION

All piping to the pump should be adequately supported to eliminate any stress at the pump connections.

All piping joints should be tested for leaks prior to start-up. A temporary start-up strainer in the process inlet piping may be used to keep large contaminates from entering the pump at start-up. The location of the installation or the storage of the pump should be in area that will not subject the pump to freezing.

Verify the pump's rotation direction by checking the arrow on the shaft end casing.

4.4 COUPLING ALIGNMENT

CAUTION: TO PREVENT PERSONAL INJURY, DO NOT OPERATE THE PUMP WITHOUT PROPERLY GUARDING THE DRIVE COUPLING.

The pumps utilize precise machining of the pump drive end bearing housing, motor adapter, and C-Face motor flange to eliminate shaft misalignment. The coupling should be inspected before start-up.

Baseplate mounted pumps and motors supplied from the factory have had the shafts aligned prior to shipment. This ensures that alignment can be done in the field. It is required that the shaft alignment be rechecked after mounting on a level foundation and prior to start-up.

For smoother operation and longer life of the coupled equipment, the following maximum misalignment tolerances are recommended for baseplate mounted units:

The maximum allowable parallel shaft misalignment is ±0.002" (0.05 mm).

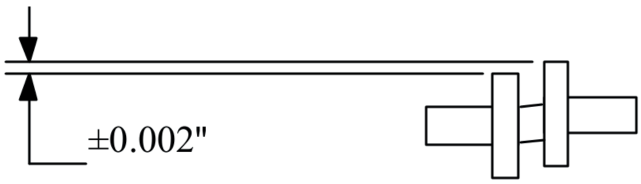


Figure 2

The maximum allowable angular shaft misalighment is ±0.0005" per inch (0.013 per mm) of coupling diameter.

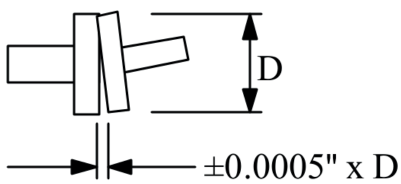


Figure 3

4.5 BELT DRIVES

CAUTION: TO PREVENT PERSONAL INJURY, DO NOT OPERATE THE PUMP WITHOUT PROPERLY GUARDING THE DRIVE BELTS.

When pumps are supplied with belt drives, follow the manufacturer's instructions to set the tension.

4.6 SERVICE LIQUID PIPING ARRANGEMENTS.

The operating principle of a liquid ring pump depends on a continuous supply of clean service liquid, which is normally water. The liquid enters the pump through a connection on the casing and is discharged from the pump along with the gas. There are two basic piping arrangements that can be used for liquid ring pump applications. A once-through method with no recovery of the service liquid and a recirculation method which re-uses the service liquid.
Both of these arrangements have four basic elements:

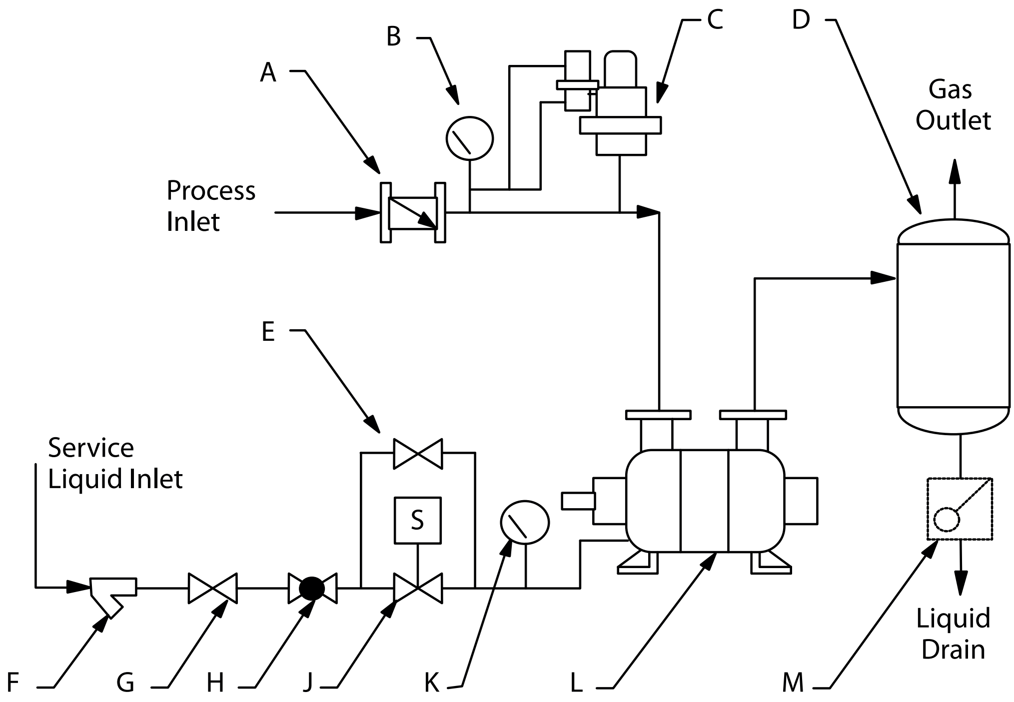
1) A supply of service liquid
2) A means to control flow of service liquid
3) A means of stopping the flow of service liquid when the pump is off
4) A means of separating the gas / liquid exhaust mixture

It is recommended to use a strainer to ensure that foreign matter does not enter the pump with the service liquid supply or make-up source. See **Diagram 1** and **Closed Loop-Total Recovery Diagram 2** for the proper piping arrangement scheme.

CAUTION: COMPLETE ALL PIPING INSTALLATION AND MAKE SURE ASUPPLY OF SERVICE LIQUID IS AVAILABLE BEFORE STARTING THE PUMP.

A) Typical Installation of Once Through with No Recovery

The service liquid is piped directly from a supply source to the pump. The liquid is separated from the gas in the separator and discharged to a drain. No recirculation nor recovery takes place. This is the most basic arrangement and can be used when service liquid conservation or contamination is not a concern. A solenoid operated valve provides for flow of the liquid simultaneously with the pump / motor operation.
When the motor stops, the valve closes to prevent the pump casing from filing with fluid. The by-pass valve is used to pre-fill the pump at initial start-up only. It also can be used should the solenoid fail. When a manual valve is used. it must be opened immediately after starting the motor and closed immediately before turning the motor off.

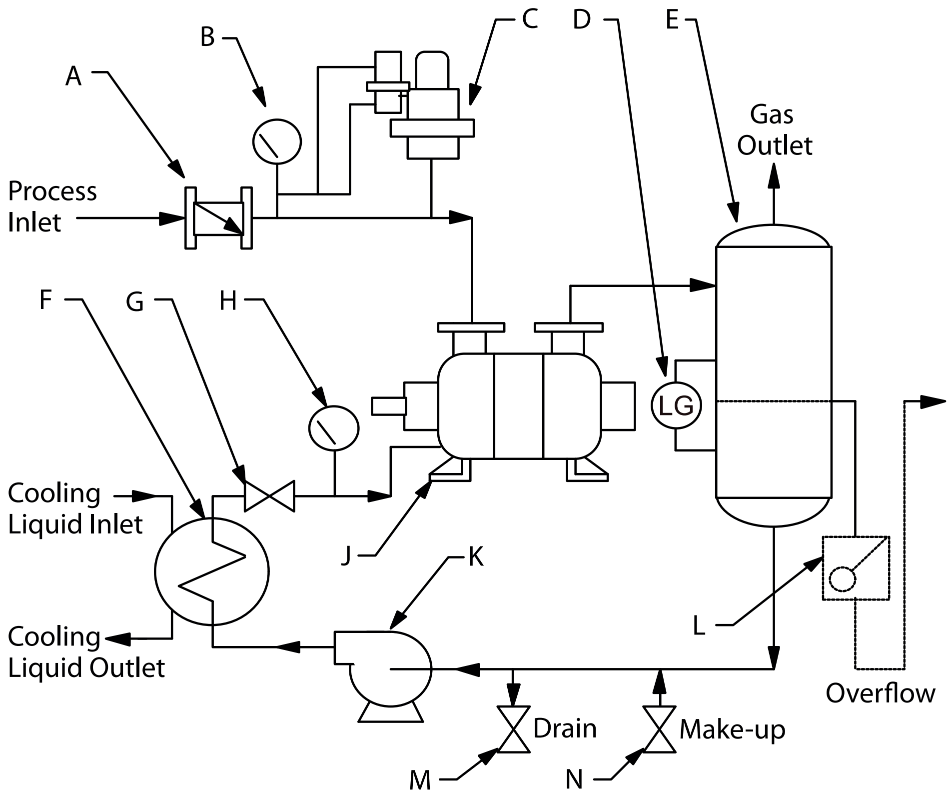


Once Through with No Recovery
Diagram 1

A. Inlet Check Valve
B. Pressure Gauge (vacuum gauge for vacuum service or compound gauge for compressor service)
C. Vacumm Relief Valve (not required for compressor service)
D. Separator
E. By-Pass Valve
F. Strainer
G. Shut-off Valve
H. Regulating Valve
J. Solenoid Valve
K. Compound Gauge
L. Liquid Ring Pump
M. Trap (required if discharge pressure is above atmospheric pressure)

B) Typical Installation of Closed Loop with Total Recovery

This arrangement provides for the local recirculation of the service liquid. A heat exchanger is added to the system to remove the heat of compression, friction and condensation from the service liquid before it is re-introduced to the pump. The service liquid level in the separator of a total recovery system should be at or slightly below the centerline of the pump shaft. A provision should be made for a high level overflow. This will prevent starting the pump while it is full of liquid, which will damage the pump or overload the motor.



Closed Loop - Total Recovery
Diagram 2

A. Inlet Check Valve
B. Pressure Gauge (vacuum gauge for vacuum service or compound gauge for compressor service)
C. Vacumm Relief Valve (not required for compressor service)
D. Level Gauge
E. Separator
F. Service Liquid Cooler
G. Shut-off or Throttling Valve
H. Compound Gauge
J. Liquid Ring Pump
K. Recirculation Pump (recommended)
L. Trap or Loop Seal(required if discharge pressure is above atmospheric pressure)
M. Drain Valve
N. Make-Up Valve

C) Draining Before Start-Up

CAUTION: DO NOT START THE PUMP WITH THE CASING FULL OF LIQUID

A Liquid Ring Pump should not be started with the casing full of liquid. Damage to the impeller(s) or the shaft will result. The normal liquid level should be no higher than the shaft centerline. The pump may be started with a low liquid level as long as a supply of service liquid is available immediately after start-up.

4.7 SHAFT SEAL COOLANT

The pumps are available with mechanical seals. The mechanical seals are flushed and cooled internally by the ring liquid in the pump. No separate external source of shaft seal coolant is required.

4.8 PIPING REQUIREMENTS

A) Suction and Discharge Piping

The suction and discharge connections on the pump are arranged vertically and are marked with arrows on the pump casing. The suction and discharge piping should be the same nominal size as the pump connections. The elevation of the discharge separator above the discharge connection should be limited to an elbow turning horizontally.

If necessary, a discharge leg can be used with a maximum of 24 inches (610mm) above the pump discharge flange. Too high an elevation in this line will cause excessive backpressure on the pump, overload the motor, and reduce the pump capacity

Remove the protective coverings from the pump openings just before attaching the piping. Check that all foreign matter such as weld slag, nuts, bolts, rags, and dirt has been cleaned out of the piping before connecting to the pump. The piping flanges must fit easily and without strain on the pump flanges and the flange bolt holes must be in alignment. The flange gaskets must not protrude into the bore of the piping or pump flanges. All piping must be supported independently on each side of the pump without transmitting any strain to the pump casing. A temporary suction strainer fitted at the suction inlet is recommended during the first 100 hours of operation.

B) Service Liquid Piping

In a once-through arrangement, the nominal pipe size should be the same size as the service liquid connection. In a total recirculation package with no recirculation pump, use one nominal pipe size larger than the service liquid connection of the pump. Also, use the least number of fittings to minimize the pressure drop. When a recirculation pump is used, the piping should be the same size as the service liquid connection.

4.9 ELECTRICAL REQUIREMENTS

All electrical wiring and installation must comply with local safety codes.
Alter the electrical work is complete, the motor should be jogged to check for proper rotation. First, turn the pump by hand to see that it rotates freely. The direction of rotation is marked on the pump. Second, jog the motor momentarily to check the rotation. It is recommended to use a non-reversing motor controller to prevent the pump from turning in the wrong direction.

5 OPERATING INSTRUCTIONS

5.1 START-UP PROCEDURES

Read all instructions before proceeding.

Turn the shaft manually to ensure it rotates freely. If the pump is binding or seized, refer to the troubleshooting chart in Section 5.
Fill the pump with service fluid to the shaft centerline, but do not overfill

CAUTION: DO NOT RUN THE PUMP WITHOUT SERVICE LIQUID AND SHAFT SEAL FLUID.

1) The normal service liquid level should be no highter than the shaft centerline. The pump may be started with a low service liquid level as long as a supply is available immediately after start-up.
2) Open any valves in the suction and discharge lines.
3) Confirm the pump rotation with the arrow on the casing by jogging the motor.
4) Start the motor, ensure service liquid supply, and set regulatiing valve, when used, for optimum pump performance.

5.2 SERVICE LIQUID REQUIREMENTS

A) Flow Rates

Service liquid flow rates depend on the type of piping arrangement used, the size and operating speed of the pump, and the allowable temperature rise through the pump. Nominal flow rates for standard pumps and compressors at normal conditions are given in **Table2** and **Table 1**.

Service Liquid Flow Rates*

Table 2 Single stage pumps

Model	Flow rates (LPM)
SK-1.5	15
SK-3	20
SK-6	30
SK-12	50
SK-15	60
SK-20	80
SK-30	100
SK-42	130

Table 1 Double stages pumps

Model	Flow rates (LPM)
2SK-1.5	15
2SK-3	20
2SK-6	30
2SK-12	50
2SK-15	60
2SK-20	80
2SK-30	100

B) Flow Control

If a flow device is not used to measure the service liquid quantity to the pump, a regulating valve and compound gauge in the service liquid line can be used to approximate the flowrate. For pump operating pressures between atmospheric and 400 mmHgA, the reading on the compound gauge should be in the range of 2" HgV to 5 psig (709 mmHgA to 0.35 barg). For operating pressures below 400 mmHgA, the compound gauge reading should be in the range of 15" HgV to 2 psig (379 mmHgA to 0.14 barg). This method is only an approximation of the service liquid quantity. The actual operating conditions will dictate the amount of sealant liquid required and also the compound gauge reading.

On some closed loop-total recirculation type systems, the vacuump pump will draw the amount of service liquid from the discharge separator tank that it requires. No othe flow control device needs to be installed on this type of system.

C) HARD WATER

If hard water is used as the service liquid, scale deposits caused by the precipitation of minerals will occur. This will vary with the temperature of the water. Scale deposits on the internal surfaces of the pump will cause an increase of the operating horsepower, wear on moving parts, and may cause the pump to seize. If the hardnessof the water is excessive, consider using a water softening treatment.

5.3 CAVITATION

Cavitation is identified by a characteristic metallic or grinding noise inside the pump. It is caused when the pump suction pressure is too close to the vapor pressure of the service liquid. if the service liquid temperature inside the pump rises such that its vapor pressure closely approaches the suction pressure of the pump. cavitation will occur.
When cavitation takes place, vapor bubbles form and collapse within the liquid ring. This will damage the surfaces of the impeller, side plates, and casing. Cavitation causes damage by tearing away metal particles. The damage may be more severe in a corrosive situation.
Cavitation may be prevented by bleeding air into the pump to raise the suction pressure. Vacuum relief valves can be fitted in the suction piping for this purpose. If the pump is provided with an air attenuation valve, it can be opened to bleed air into the second stage casing until noise stops.
If the problem is not caused by a low flow of non-condensable gases, the service liquid temperature should be checked. Ultimately, the vacuum at which the pump can be operated is governed by the vapor pressure of the service liquid inside the pump.

5.4 SHUT - DOWN PROCEDURES

1) Shut off the service liquid supply and immediately stop the motor.
2) If necessary, close all suction and discharge valves.
3) If necessary, drain the pump to protect it from freezing by removing all drain plugs.
4) Disconnect power from the motor if maintenance is to be performed.

6 ACCESSORY ITEMS

6.1 ACCESSORIES

There are many accessory items associated with Liquid Ring Vacuum Pumps and Compressors. They can be supplied by CORVEX PUMPS and shipped from the factory or can be supplied by others and installed in the field. The particular requirements, mode of operation, and type of control scheme desired dictate the necessity of various items. The following is a list of common accesories.

1) Inlet Check Valve
Used to prevent a black flow of gas into the process when the pumps is stopped. Check valves are normally installed in a horizontal line. An elbow can be provided to adapt the vertical pump inlet to accept a horizontal check valve.

2) Vacuum Relief Valve
Used to protect the pump from cavitation and control the pump suction pressure. When the pump capacity exceeds the system's flow requirements at a pre-determined level, the valve will open and bleed in atmospheric air or process gas.

3) Flexible Connector
Used to compensate for minor misalignment or expansion between the pump connections and the process piping.

4) Vacuum Gauge
Used to indicate vacuum at the pump inlet. Normally mounted directly ahead of the pump suction.

5) Shut-off Valve
Used to manually stop the flow of service liquid to the pump.

6) Strainer
Used to filter out solid particles that will damge the pump.

7) Flow Regulator
Used to control the service liquid flow rate to the pump. A manual valve, a fixed orifice, or a flexible element orifice may be used depending on the application.

8) Compound Gauge
Used to indicate pressure in the service liquid piping.

9) Discharge Separator.
Used to separate the service liquid from the discharged gas as it comes out of the pump. The liquid can be piped to a drain or recovered for reuse.

10)Solenoid Valve
Used to automatically stop or start the flow of service liquid to the pump. Normally interlocked to the pump motor.

11) By- pass Valve
Used to initially fill the pump with service liquid or for bypass in case the solenoid coil fails.

12)Recirculation Pump
Used to circulate the service liquid recovered from the discharge separator in some total recovery systems.

13) Heat Exchanger
Used to remove heat from the recirculated service liquid.

14) Atmospheric Air Ejector
Used to provide a suction pressure lower than the pump is capable of when operating alone. It may be added to a two stage pump to provide an inlet pressure as low as 3 mm HgA. The operation of the air ejector is similar to that of a steam ejector. Atmospheric air or recycled gas from the discharge separator is used as the motive force for compressing the process gas from the system design pressure up to the intel pressure of the pump. To enhance

pumping capacity at a higher suction pressure, an optional motive air shut-off valve or by -pass valve can be added (See Figura4)

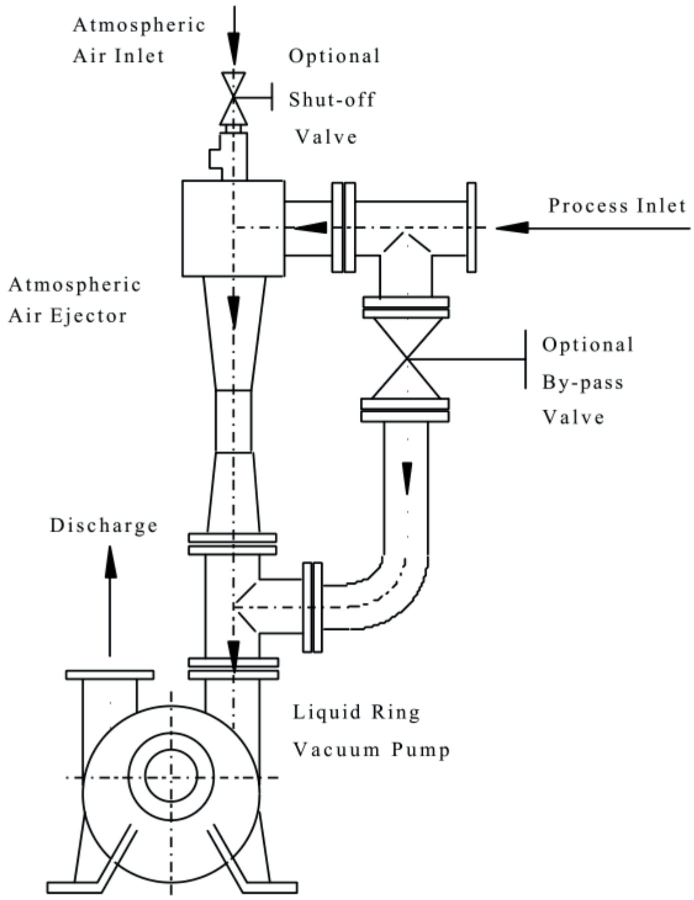


Figure 4

7 MAINTENANCE

7.1 PERFORMANCE

Optimum performance and long service life are dependent upon good maintenance procedures and periodic inspections. When preparing to dismantle a pump, make provisions for the safe handling of heavy parts.

7.2 SHAFT BEARINGS

The vacuum pumps use sealed-for-life bearings that are not regreasable.
The standard bearings are rated for an L10 h life of 80, 000 hours. The temperature of the bearings should not exceed 140°F (60°C). Overheating may be due to misalignment of the shafts or a bad bearing.

7.3 SHAFT SEALS

The vacuum pumps are filted with packing seal or single acting mechanical shaft seals. The should be replaced when

worm, scratched, or cracked, or when the rotating segment no longer grips the shaft.
When replacing the shaft seals, clean the shaft thoroughly. The Mechanical seal faces must be protected during installatin from particles which may scratch the surfaces.

CAUTION: DO NOT RUN THE PUMP WITHOUT SERVICE LIQUID AND SHAFT SEAL FLUID.

7.4 STORAGE

If a pump is to be out of service, it should be protected internally from rusting by using a rust inhibitor.
The pump should be drained completely by removing all the lower plugs. Install the plugs and fill with Oakite HPO (or equal) preservative solution. Remove the manifold(s) and spray the insides with preservative. Rotate the pump manually to circulate the solution. Drain the pump to below the shaft centerline and replace the manifold(s). This procedure may be disregarded for pumps made of stainless steel.
Seal any openings to prevent foreign material from entering the pum.
The pump shaft should be rotated each week to distribute the preservative and to prevent flat spots on the bearings. Document the time, date, and by whom this procedure was performed.
The manifold(s) should be re-sprayed monthly and the pump checked to see that the preservative is maintained. This will protect the pump for up to twelve months.
Pumps stored at low temperatures may need to be protected from freezing either by draining completely or by using an anti-freeze solution.
Pumps with V-belt drives should have the belts loosened to relieve the belt tension during storage. Do not store near running electric motors as ozone produced is detrimental to the rubber in the belts.

7.5 REMOVAL FROM STORAGE

The pump should be drained and flushed if necessary to remove the preservative solution. Refer to Section 5.1 of this manual for the recommended start-up procedure.

7.6 TROUBLESHOOTING CHART

Problem	Cause	Solution
Reduced capacity	1.Speed too low 2.Leak in suction line 3.Service liquid temperature too high 4.Insufficient or excess service liquid 5.Excessive back pressure	1.Check power supply and transmission 2.Repair 3.Check coolant flow & heat exchanger 4.Provide correct flow rate 5.Eliminate cause of back pressure
Excessive noise	1.Excessive or insufficient service liquid 2.Shaft misalignment 3.Defective bearing 4.Cavitation 5.Back pressure	1.Adjust flow rate 2.Realign shafts 3.Replace bearing 4.Open attenuation valve or adjust vacuum relief valve 5.Eliminate cause of back pressure

High power consumption	1.Excessive service liquid 2.Shaft misalignment 3.Excessive back pressure 4.Defective bearing 5.Improperly mounted pump	1.Reduce flow rate 2.Realign shafts 3.Eliminate cause of back pressure 4.Replace bearing 5.Make sure surface is level and all feet touch the surface, shim if necessary
Overheating	1.Service liquid temperature too high 2.Insufficient service liquid 3.Shaft misalignment 4.Defective bearing	1.Check coolant flow & heat exchanger 2.Provide correct flow rate 3.Realign shafts 4.Replace bearing
Vibration	1.Shaft misaligned 2.Pump or baseplate not properly anchored 3.Defective bearing 4.Improperly mounted pump 5.Cavitation 6.Back pressure 7.Excessive service liquid	1.Realign shafts 2.Anchor 3.Replace bearing 4.Make sure surface is level and all feet touch the surface, shim if necessary. 5.Open attenuation valve or adjust vacuum relief valve 6.Eliminate cause of back pressure 7.Provide correct flow rate
Abnormal bearing wear or failure	1.Shaft misalignment 2.Piping load on pump flange 3.Mechanical seal leakage 4.Shaft flinger missing	1.Realign shafts 2.Support connecting pipe work 3.Replace seals 4.Replace flinger
Shaft will not turn or partially seizes	1.Scale build-up 2.Foreign object in pump 3.Piping load on pump flange 4.Improperly mounted pump 5.Soft Foot	1.Descale pump 2.Remove foreign object 3.Support connecting pipe work 4.Make sure surface is level and all feet touch the surface, shim if necessary. 5.Correct pump / motor mounting

8 DISASSEMBLY AND REASSEMBLY PROCEDURES

8.1 GENERAL

Complete disassembly of the pump is seldom necessary and it may only need to be disassembled to the point required to repair or service it. Specific instructions are included with the documentation sent with your liquid ring pump. The cross-section drawing and parts list should be referred to when servicing the pump and when ordering spare parts.

Before any servicing takes place, it is recommended that gasket compound, bearings, and mechanical seals be on hand as spare parts. The stocking of additional items beyond these basic wearing parts is dependent upon the type of application, compatibility of pump materials with the process gas and service liquid, degree of corrosion and erosion to which the pump is subjected, importance of pump reliability to the process, etc.

When ordering spare parts, be sure to identify the pump size, serial number, part name and reference number, and if available, original purchase order number, CORVEX job number, or a drawing number.

8.2 IMPELLER END CLEARANCES

Impeller End Clearances *

Model	Cast Iron Construction (mm)	Stainless steel Construction (mm)
SK-1.5,2SK-1.5	0.10-0.15	0.15-0.20
SK-3,2SK-3	0.10-0.15	0.15-0.20
SK-6,2SK-6	0.10-0.15	0.15-0.20
SK-12, 2SK-12	0.10-0.15	0.15-0.20
SK-15,2SK-15	0.15-0.25	0.20-0.30
SK-20,2SK-20	0.15-0.25	0.20-0.30
SK-30,2SK-30	0.15-0.25	0.20-0.30
SK-42	0.15-0.30	0.20-0.30

A) Non- Gasketed Pumps

CORVEX PUMPS liquid ring vacuum pumps do not require casing gaskets, but use a joint sealing compound between the impeller casings and the end plates. They are machined for a metal fit. Refer to **Figure 5** and **Figure 6**. The headers or crossover manifolds require a gasket.

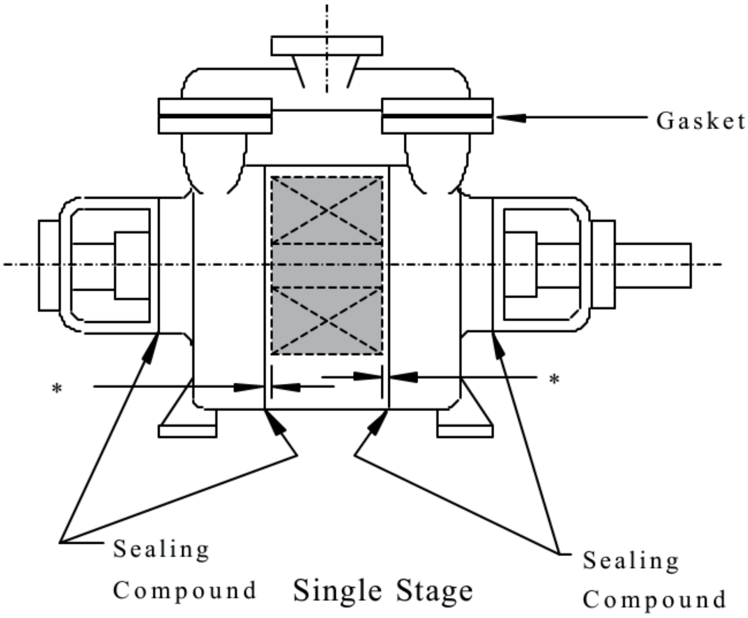


Figure 5

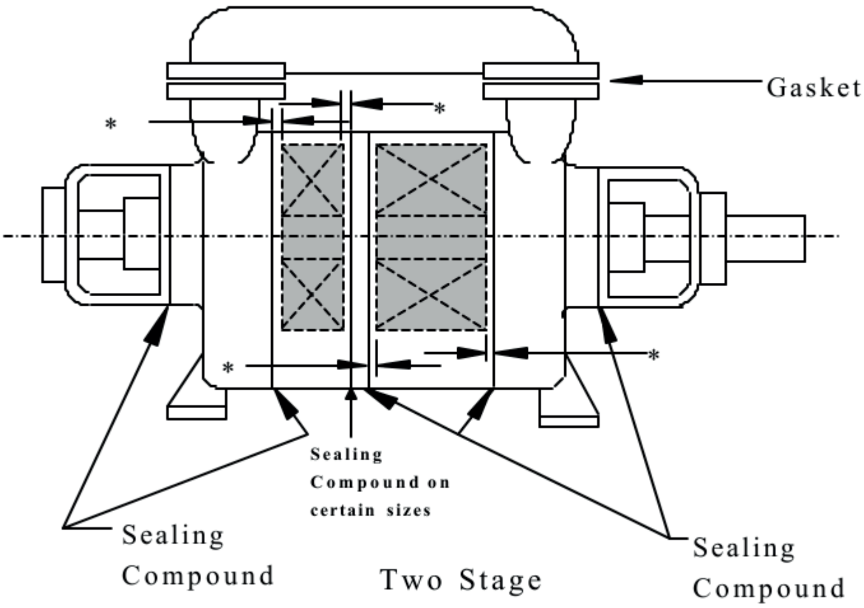


Figure 6

9. WARRANTY

THE FOLLOWING IS IN LIEU OF ALL WARRANTIES OF CORVEX PUMPS EXPRESSED OR IMPLIED AND ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND/OR ANY OTHER OBLIGATION ON THE PART OF CORVEX PUMPS ARE HEREBY EXCLUDED:

CORVEX PUMPS, except as otherwise provided, warrants goods of its own manufacture against faulty workmanship or the use of detective materials, under normal use and service, and that such goods will conform to mutually agreed upon written specifications, drawings, and is guaranteed to meet specified performance requirements, for a period of twelve (12) months from date of shipment of the goods from the factory.

CORVEX PUMPS assumes no responsibility for deterioration of the equipment due to corrosion, erosion, or flow induced tube vibration, or for fouling, maintenance problems or any other causes not specifically covered under the foregoing warranty. The sole remedy of Buyer with respect to any part not conforming to any warranty of CORVEX shall be the repair or, at CORVEX PUMPS option, replacement of any detective part at the point of manufacture, Buyer assuming all costs of removal, shipping, and reinstallation, provided that immediate written notice of the detect has been given to CORVEX PUMPS, and CORVEX PUMPS shall not be liable for any other expenses incurred because of failure of any part to meet CORVEX PUMPS warranty, nor for any special, indirect or consequential damages. Material returned to CORVEX PUMPS factory without its written consent will not be accepted. No back charges will be honored without CORVEX PUMPS advance approval of the work to be performed. CORVEX PUMPS liability on any claim of any kind, including negligence, for any loss or damage arising out of, connected with, or resulting from this transaction, or the design, manufacture, sale, delivery, resale, installation, technical direction of installation, inspection, repair, operation, or use of any equipment covered by or furnished hereunder shall in no case exceed the price paid by Buyer for the equipment. CORVEX PUMPS also disclaims all liability, whether in contract, tort, warranty, or otherwise, to any party other than the Buyer.

In the event the pumps are altered or repaired by any person or entity other than CORVEX PUMPS, without written approval by CORVEX PUMPS, all warranties are void. Bearings and shaft seals are warranted only to the extent of, and pursuant to, the original manufacturer's warranty.

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Pumps

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