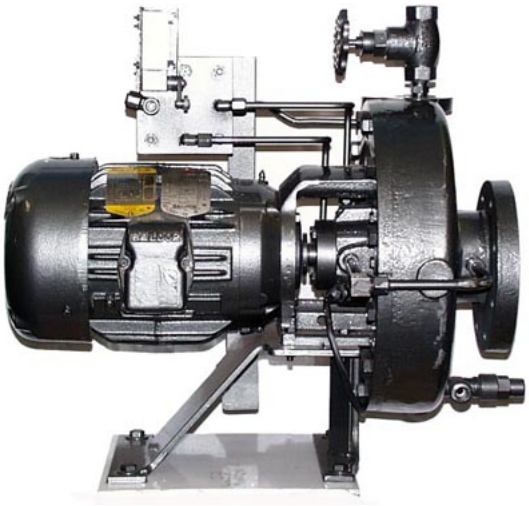
MANUAL 2311

# OWNERS MANUAL

## INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

# CB SERIES REFRIGERATION PUMPS



**PLEASE READ CAREFULLY**

**YOUR WARRANTY MAY BE VOID IF INSTRUCTIONS ARE NOT FOLLOWED**

**Note: When ordering parts give pump model and serial number**

**Cornell Pump Co.**
P.O. Box 6334, Portland, OR 97228 USA
Phone: 503-653-0330 Fax: 503-653-0338

# SERIES CB, CBH, CBS, CLB REFRIGERANT PUMP

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Cornell may suspend its performance of any order if Buyer defaults in the performance of its duties under any order or under any other agreement between Cornell and Buyer.

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**CHANGES:** Any changes proposed by Buyer after formation of this Agreement that affect the delivery schedule or requirements, or otherwise affect the scope of this Agreement, shall be submitted in writing by Buyer to Cornell and shall become binding only if agreed to in writing by Cornell. Any modifications to price or delivery as a result of such changes shall be determined by Cornell in its sole discretion.

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**PAYMENTS:** Standard terms for customers who qualify for credit are ½% 15 days, net 30. Unless otherwise agreed to in writing by Cornell, Buyer shall pay all amounts due within thirty (30) days of receipt of invoice. A monthly service charge of 1.5% may be charged on amounts owed by Buyer to Cornell that have not been paid on time, subject to the maximum amount permitted by law.

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**SHIPMENTS:** All sales are ex-works factory. Risk of loss shall pass to Buyer upon shipment. Shipping contracts made by Cornell shall be to Buyer's account. All claims for loss or damage after shipment shall be filed by Buyer with the carrier. Buyer shall be liable to Cornell for the full price of the goods, irrespective of loss or damage in transit. Cornell shall not be required to provide freight cost receipts to Buyer at the time of invoice.

**LIMITED WARRANTY:** Cornell warrants, to Buyer only, that Products manufactured by Cornell are free from defects in material and workmanship for the periods set forth in Exhibit 1. If a failure to conform to specifications or a defect in materials or workmanship is discovered within the applicable period, Cornell must be promptly notified in writing within thirty (30) days of such discovery. Within a reasonable time after such notification, Cornell shall correct any failure to conform to specifications or any defect in materials or workmanship, or in lieu of such repair, and at Cornell's sole option, shall replace the Products or the applicable portion thereof.

Any such repair shall be performed at Cornell's facility, unless otherwise designated by Cornell. Buyer shall pay any cost incurred as a result of shipping the Products, or any portion thereof, to Cornell. Cornell shall pay any cost incurred in returning the Products, or any portion thereof, to Buyer. For repairs done at Cornell's facility, Cornell will pay for any costs of labor and materials, and any expenses incurred by Cornell in making such repairs.

Cornell may opt to send replacement parts in lieu of repair at Cornell's facility. Cornell may also opt to perform repairs at Buyer's facility or site. If such repairs are performed for the convenience of Buyer, Buyer shall pay for all costs of labor and materials. If such repairs are performed for the convenience of Cornell, Buyer shall, in Cornell's sole discretion, pay a portion of the costs of labor and materials. Cornell shall have no obligation to pay or reimburse Buyer or any third party for any expense incurred as a result of any Products, or any repair or attempted repair of any Products.

The warranty provided herein shall not apply in the event of any (a) defects caused by a failure to provide a suitable installation environment for the Products, (b) damage caused by the use of the Products for purposes other than those for which the Products were designed or intended, (c) damage caused by disasters such as fire, flood, wind, or lightning, (d) damage caused by unauthorized attachments or modifications, (e) other abuse or misuse, including improper installation, (f) reasonable wear and tear, and (g) defects in equipment or components not manufactured by Cornell. Cornell shall pass on any warranties for equipment and components not manufactured by Cornell to the extent that such warranties may be passed on.

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**COMPLIANCE WITH LAWS:** Buyer shall comply with all laws and regulations governing the purchase or license, installation or use of the Products, including, without limitation, obtaining all licenses, permits and registrations and fulfilling all other requirements of governmental agencies, and Cornell shall have no obligation or responsibility of any kind with respect thereto. Buyer shall only export or re-export the Products in compliance with all applicable U.S. export control laws and regulations.

**LIMITATION OF LIABILITY:** Cornell's aggregate liability for any claim, loss, cost, damage, or liability arising out of or related to this Agreement, including, but not limited to, any liability arising from negligence, warranty, indemnity, contract, strict liability, or operation of law, shall in no event exceed the purchase price paid by Buyer for the affected Products. IN NO EVENT SHALL CORNELL BE LIABLE FOR, OR OBLIGATED IN ANY MANNER TO PAY, SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL, OR PUNITIVE DAMAGES OF ANY KIND.

**INDEMNIFICATION:** Buyer shall indemnify, defend and hold harmless Cornell, its affiliates, and their respective directors, officers, members, employees, agents, contractors, successors, and assigns from and against all losses, damages, expenses, claims, demands, suits, judgments, penalties, and costs of any kind whatsoever, including attorneys' fees and expenses arising out of this Agreement or Buyer's use, acts, or omissions in connection with any Products.

**GOVERNING LAW AND FORUM:** This Agreement shall be governed in all respects by the laws of the State of Oregon, U.S.A. (excluding any conflicts of laws principles that would lead to the application of another state's laws). Buyer submits to the jurisdiction of the state and federal courts of Oregon for the purposes of resolving any dispute arising under or in connection with this Agreement.

# WARNING PAGE



**Warning:** If the pump is isolated from the system by closing valves in the suction and discharge lines, the vent valve (246D) is to be opened. Otherwise, ambient heat may cause excessive pressure in the pump, leading to casing failure and possible serious personal injury.



**Warning:** Failure to follow instructions may damage mechanical seal or cause serious personal injury.



**Warning:** Refrigerant gases are hazardous. Obey safety regulations, or serious personal injury may result.



**Caution:** Lock screw failure can damage impeller and volute. Proper torque during installation is important.

# INSTALLATION INSTRUCTIONS
# REFRIGERANT PUMP SERIES "CB"

## Inspection

Examine pump for freight damage. Observe position of indicator rod (278). During shipment a seal may be jolted so as to cause leakage. Any leakage should stop after a brief run-in period. Check the oil level frequently during initial operation of signs of excessive oil consumption. Do not operate the pump if indicator rod (278) is fully extended.

## Pump Location

The pump must be located a vertical distance below the receiver minimum liquid level an amount at least equal to the pump's NPSHR plus 2 feet. The NPSHR is read from the pump performance curve for the highest flowrate at which the pump is anticipated to operate. Place the pump as close to the drop leg as is practical while allowing for two to three pipe diameters between the suction stop valve and the pump suction flange. Consider access requirements for normal servicing.

## Piping Connection and Support

The minimum pump leg pipe diameter should be the same size as the pump suction but otherwise should be sized for an optimum velocity of 2 feet per second. A low loss suction stop valve, such as a full port ball valve, angle valve or butterfly valve, should be located as close to the drop leg as practical and, again, two to three pipe diameters from the pump suction flange. Piping must be lined up squarely so that pipe flanges and pump flanges are parallel and not offset. Piping must be supported and expansion joints or bends employed so that strain is not transmitted to the pump. The pump base should be mounted in such a way as to permit removal of the rotating element of the pump without removing the volute from the system piping. Pipe flanges connecting to the pump should be flat faced and of the same size and rating as those of the pump (see page 100-18).

## Vent Lines

A 1/2-inch refrigeration duty globe valve is mounted on the top of the pump volute for connection to a vent line. The volute vent line must be connected to the receiver above the maximum liquid level and should be sloped so that no liquid can become trapped in the line. For best results, the volute vent should not be connected to a compressor wet suction line. Systems with widely or rapidly varying loads and those using horizontal receivers should have pump suction vent lines for limiting vapor entrainment into the pump. The suction vent line should be connected to the top of the suction pipe, just ahead of the pump suction flange. If the suction pipe size is reduced ahead of the pump by means of an eccentric reducer this reducer may be installed with the flat on the bottom. This provides a high point where vapor can be trapped and piped away. The suction vent line should be of at least 1.5-inch diameter and should include a valve for isolation. The suction vent must not be connected to a compressor wet suction and must be connected to the receiver above the maximum liquid level. A suction vent should not be feed into a volute vent line.

## Bypass Line

A bypass line is required to maintain a minimum flow through the pump during periods of reduced or zero system liquid demand. The bypass should be connected from the pump discharge, upstream of any check valve, to the receiver. It may be connected to a compressor wet suction line. The bypass should be at least 3/4-inch diameter and should include an isolation valve for service. The flow through the bypass can be controlled with

a throttling valve such as a hand expansion valve, with a fixed orifice or with a constant flow regulating device. If a fixed orifice or flow regulator is to be used, consult Cornell for minimum flow requirement for the particular pump model and application.

**Adjustment of Bypass Valve:** Start with the bypass valve completely open. Close the pump discharge stop valve and volute vent valve fully. Slowly close the bypass valve until the pump discharge pressure gauge becomes "shaky" or unsteady or other unsteady pumping conditions are noted. Slowly open the bypass valve until conditions become stable. Observe the pump long enough to be certain pump operation is stable, then open the discharge stop valve.

## Gauges

Install gauge valves on the suction side of the pump between the suction stop valve and pump suction flange and on the discharge side between the pump discharge flange and the first valve (check or stop). When possible locate the gauge valves at least two pipe diameters away from the pump or the nearest valve, bend or fitting.

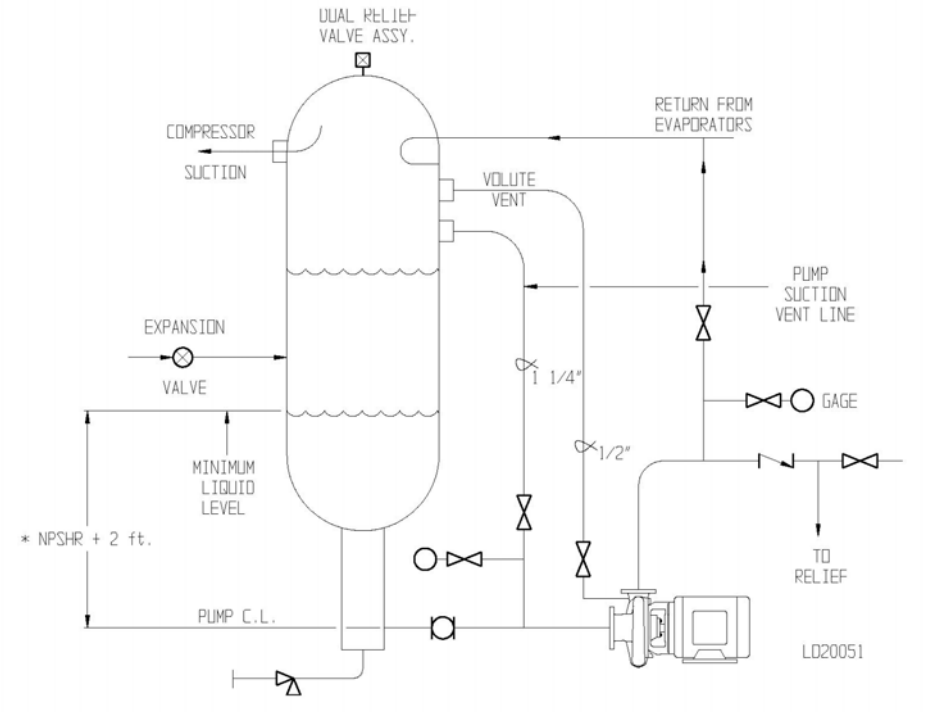
## Relief Valves

The pump must be protected from overpressurization by a relief valve in the system set at no higher than 250 PSIG. The pump must not be isolated from this valve while it contains liquid or gaseous refrigerant. During normal operation the receiver relief valves may serve to protect the pump, but where the pump may be isolated from the vessel while containing refrigerant (such as during preparation for servicing) other relief devices must protect the pump. As a manufacturer of a single component of the refrigeration system Cornell cannot design or dictate the design or installation of relief systems, but as a minimum Cornell recommends adherence to ANSI/IIAR 2-1992 "Equipment, Design and Installation of Ammonia Mechanical Refrigerating Systems," Section 3.8.2 a) except where this standard is superseded by more stringent standards or code requirements governing the particular site into which the pumps are being installed.

## Electrical Connections

**Motors:** Standard Cornell factory-supplied motors are all dual voltage for 230/460 volt, 60 Hz service or 190/380 volt, 50 Hz service. The motor nameplates give specific wiring instructions for low or high voltage connections.

**Limit Switch:** The low oil limit switch on the seal oil reservoir has a rated insulation voltage of 300V AC and a rated thermal current of 10A. Short circuit protection should be provided by a 10A type S.C. fuse (outside U.S. use type G1 or N fuse). The switch is a single pole, double throw design with one set of normally open contacts and one set of normally closed contacts.



Maximum cable size is AWG #14, and the cable conduit entry is ½ NPT. This limit switch can be wired to shut off the pump with actuation (using the normally closed contacts) or to activate an audible or visible signal (using the normally open contacts) or both. The switch roller arm can be adjusted to actuate at any desired reservoir indicator rod extension.

**Heater**: The seal chamber oil heater is 75 watt, 120 volt with optional 240 volt available. The cord is 3 lead with a green ground lead. For pump speeds up to 1800 RPM and discharge pressure up to 100 PSIG, heater is to be on continuously whether the pump is running or on standby. For speeds 1800 to 3000 RPM and discharge pressure up to 50 PSIG, heater is to be on continuously whether pump is running or on standby. For speeds greater than 3000 RPM at any discharge pressure, heater is to be on only during standby (pump not running).

**WARNING**

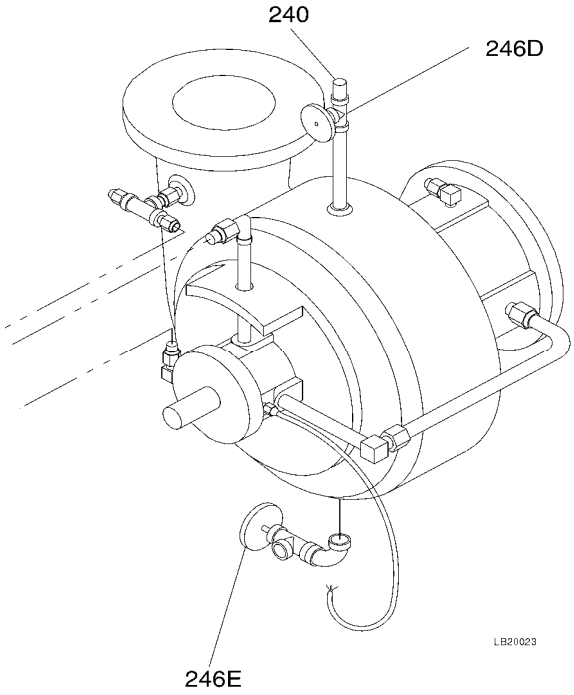
If pump is equipped with a heater dry-well, the heater can be replaced without valving off and draining pump of refrigerant, but extreme care must be taken to make sure that the dry-well is not loosened during heater removal.

Failure to prevent loosening of the dry-well could result in sudden leakage of refrigerant and possible serious personal injury.

# START-UP INSTRUCTIONS

## Parts List

240. VENT LINE
246D. PUMP VOLUTE VENT VALVE (normally closed)
OPEN TO REMOVE VAPOR FROM PUMP
246E. VENT DRAIN (normally closed)




## Before Starting The Pump

Adjust valves in following order:
1. Close drain valve (246E).
2. Open vent valve (246D).
3. Open valve in discharge line one quarter.
4. Slowly open valve in suction line fully.
5. Open suction vent valve (if present) fully.
6. Fill pump with liquid.
7. Open valve in bypass line.
8. Check wiring of motor and heater. Make certain that once liquid is admitted to pump, heater is on.
9. Allow pump to cool down for approximately one hour.

On any subsequent start-up of the pump, after it has been shut down for one or more days, the oil reservoir (157) should be vented of any vapor accumulation, and oil should be added as necessary. Review page 3200-351 for instructions on filling and bleeding the reservoir.

## Starting the Pump

1. Nudge starting switch and observe direction of motor shaft rotation. Direction of proper rotation is indicated by arrow on volute, and is clockwise when viewed from motor location. Correct, if necessary, by changing two connection leads (if three phase motor).
2. Close discharge valve. NOTE: If there is no bypass line, leave discharge valve 1/4 open.
3. Start pump. Close vent valve (246D) completely. NOTE: The vent valve will not vent gasses while the pump is running.
4. Slowly open pump discharge stop valve while observing discharge pressure and pump behavior. If discharge pressure becomes unstable or cavitation is heard, close discharge stop valve down to the point where pressure stabilizes.
5. Wait approximately five minutes, and then start slowly opening discharge stop valve again. As system becomes full, further opening of discharge stop valve should not result in unstable pump performance. If upon fully opening discharge stop valve, the pump differential pressure* drops more than two to three PSI below the design differential, it will be necessary to turn down hand expansion valves or other control devices to bring the pump back up to design differential.

* Pump discharge pressure minus pump suction pressure.

## Recommendations

On initial start-ups or after complete defrost, always start the pump before the compressor unless the system has a method of flow control to limit start-up capacity within the limits of NPSH requirements. In installations where a standby pump is used, it is best to rotate the standby/duty pump assignment at least every three months.

**WARNING**

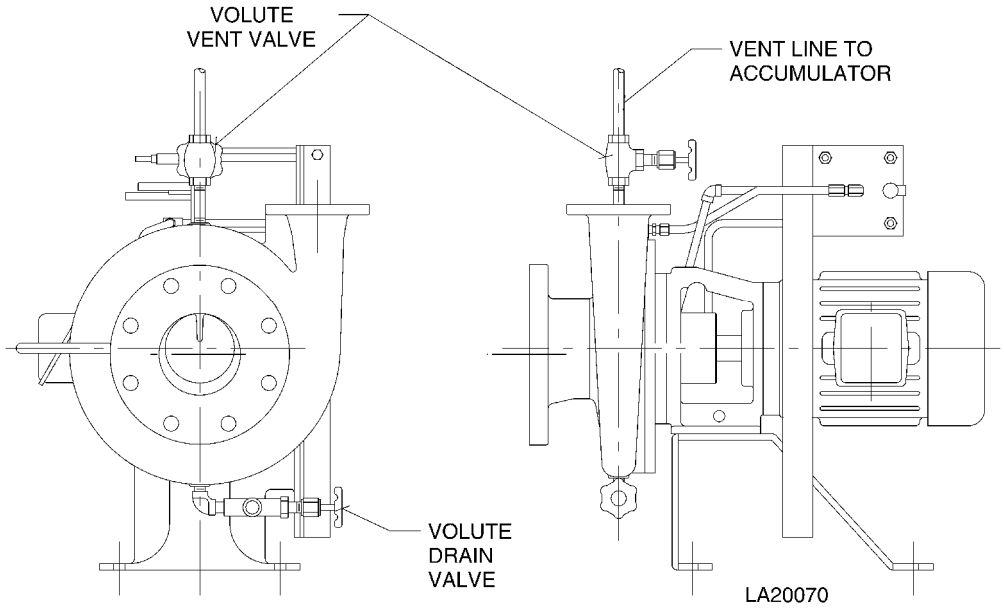
If the pump is isolated from the system by closing valves in the suction and discharge lines, the vent valve (246D) is to be opened. Otherwise, ambient heat may cause excessive pressure in the pump leading to casing failure and possible serious personal injury.

# STATIC PRESSURE TESTING
# REFRIGERANT PUMP SERIES "CB"

Every Cornell refrigerant pump is tested at the factory using nitrogen gas at 225 PSIG. While at this pressure every pressure containing component is checked with a leak detecting solution for joint and casting integrity. The mechanical seal is also checked for any loss of barrier oil. If the pump is to be further pressure tested as part of the refrigeration system, the maximum test pressure is to be no higher than 300 PSIG. This test may be performed with liquid or gas.

**WARNING**

Do not operate pump when at test pressure. Failure to follow instructions may seriously damage mechanical seal and possibly result in refrigerant leakage and serious personal injury.




## Static Test Procedure

A. Open all valves connected between the volute and accumulator starting with the vent valve as shown. Do not open volute drain valve.

B. Introduce liquid or gas gradually, and slowly raise pressure. Do not exceed maximum test pressure as stated above.

# OIL RESERVOIR OPERATION AND MAINTENANCE

Low viscosity refrigeration oil for lubrication and cooling of the mechanical seal is supplied from the reservoir. Oil and refrigerant are separated by a sealed piston inside the reservoir.

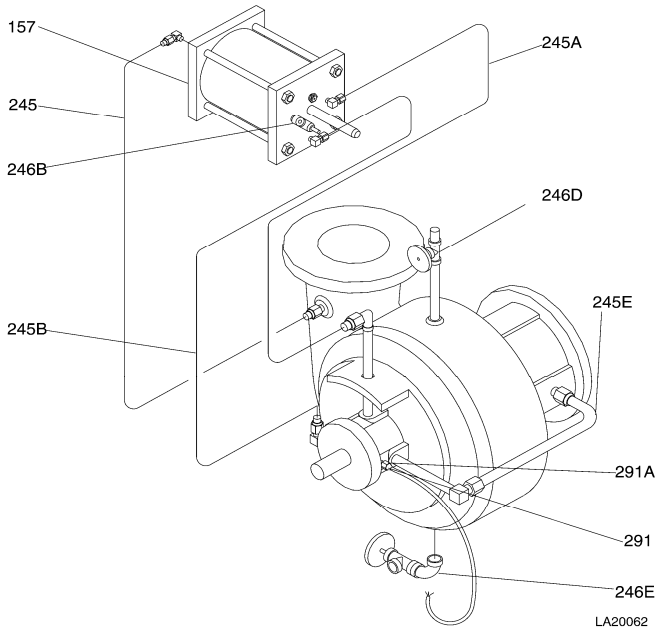
The oil level in the reservoir is indicated by rod (278); it is extended approximately 3/4-inch from the reservoir face when the reservoir is full. A limit switch is attached to the reservoir and can be wired to shut the pump off or turn on an alarm or both when the oil level reaches a refill point. The limit switch is triggered by the indicator rod and can be adjusted to any desired rod extension set point.

Pump discharge pressure is transmitted to the reservoir via a stainless steel tube from the discharge nozzle of the pump to the backside of the reservoir. This pressure is further boosted by a spring so that the oil pressure in the seal chamber is always higher than the pumpage pressure within the volute casing. This assures that a minute film of oil will be present between the seal faces, and pumpage will be kept out of the seal chamber.

The oil is circulated from the reservoir to the seal through line (245B) and back to the reservoir through line (245A) by a pumping ring attached to the seal.

## Parts List

157. OIL RESERVOIR
245. PRESSURIZING LINE
245A. OIL LUBRICATION RETURN LINE
245B. OIL LUBRICATION SUPPLY LINE
245E. BALANCE LINE
246B. REPLENISHING VALVE (normally closed) FOR OIL CHARGING
246D. PUMP VOLUTE VENT VALVE (normally closed) OPEN TO REMOVE VAPOR FROM PUMP
246E. DRAIN VALVE (normally closed)
291. HEATER
291A. HEATER WELL




## Filling the Reservoir

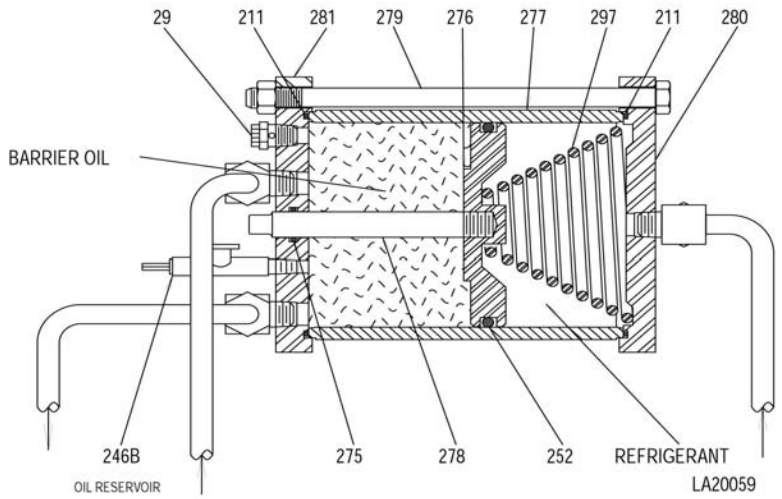
1. Use a hand pump which has a check valve.
2. Attach the charging tube of the oil pump to replenishing valve (246B).
3. Open replenishing valve. Pump oil in until rod (278) retracts to no closer than 3/4-inch from the reservoir face. Overfilling will result in venting of oil around rod (278) until excess oil is relieved. Loosen bleed valve screw and vent reservoir until only oil comes out. Tighten bleed screw and jam nut, then top off oil as necessary to bring rod extension back to 3/4-inch position.
4. Close replenishing valve before detaching filler tube.

## Correct Reservoir Oil

See page 3000-10. Use only recommended oils or approved equivalents.

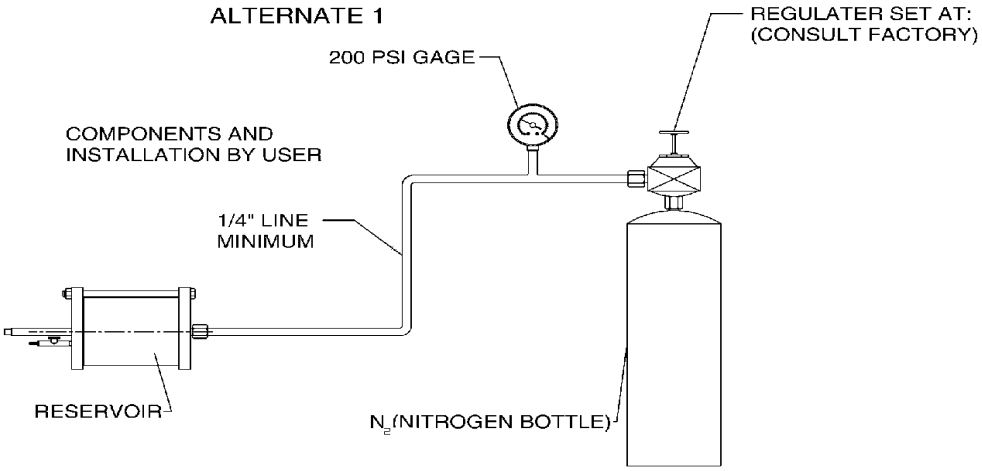
## Parts List

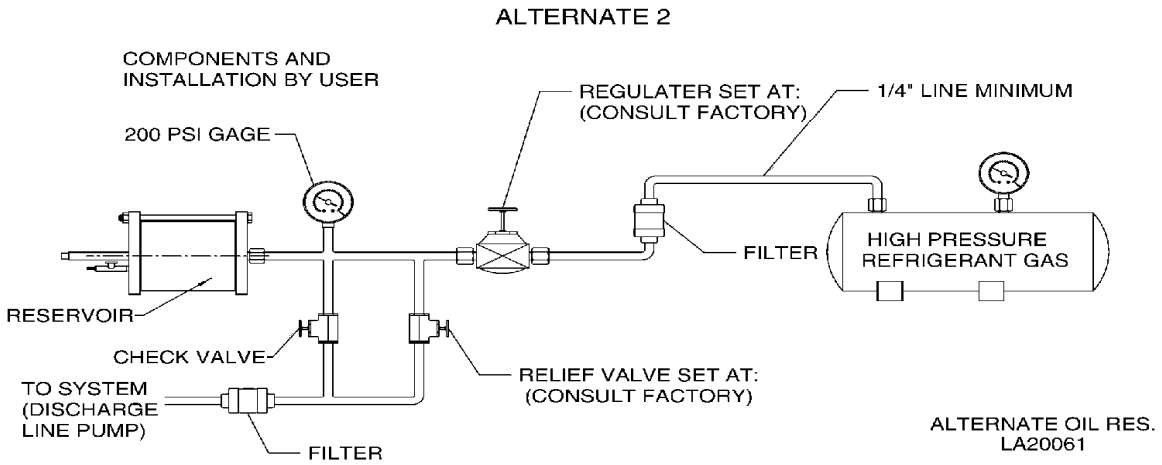
29. BLEED VALVE
211. O-RING (2)
246B. ANGLE VALVE (replenishing)
252. O-RING
275. O-RING
276. PISTON
277. CYLINDER
278. INDICATOR ROD
279. TIE ROD WITH NUTS
280. CYLINDER HEAD, PUMPAGE END
281. CYLINDER HEAD, OIL END
297. SPRING




## Alternate Reservoir Pressurization

Where the refrigeration system is unstable, the standard reservoir pressurization system may not be able to respond to system pressure spikes quickly enough to avoid chattering of the inboard seal faces. To reduce seal leakage caused by system pressure "spikes" the following alternative pressurization methods may be considered for field conversion.



## Seal Oil Reservoir Maintenance

Anytime maintenance is performed on the mechanical seal, the reservoir should be disassembled, inspected and cleaned and repaired as necessary. New reservoir O-rings should always be installed when the reservoir is disassembled. Reservoir O-rings are included in seal replacement kits.

**WARNING**

The reservoir contains a large compressed spring. To avoid injury, follow instructions below carefully.

## Disassembly

For disassembly, it is convenient to clamp the pumpage end cylinder head (280) in a vise.

Using a 9/16-inch wrench, remove any two diagonally opposite bolts (279) securing the reservoir heads to the cylinder (277). Very carefully remove the remaining two bolts; the spring (297) exerts a great deal of force, so it may be helpful to have an assistant holding the top reservoir head (281) down while the last two bolts are removed.

Alternately, the cylinder heads can be clamped in place with a large C-clamp and all the bolts removed at once. The clamp can then be carefully loosened.

Once the reservoir is apart, all O-rings should be removed and discarded.

Using a suitable solvent, clean all the reservoir parts, particularly the O-ring grooves. Inspect the cylinder for pits, scratches or corrosion.

If there is minor damage, a cylinder hone (available at auto parts store) can be used to recondition the cylinder. If there are deep pits or scratches, the cylinder should be replaced.

When replacing the O-rings, use only those supplied in the Cornell factory kit (BME178A-A00); the elastomers used in these O-rings were carefully selected for service in ammonia, halocarbons and refrigeration oils. Other elastomers may not be compatible with these environments.

When reassembling the reservoir, it is helpful to use STP or similar “tacky”, heavy consistency lubricant to “glue” the cylinder head O-rings into their grooves. This will prevent them from falling out during assembly. The cylinder wall should be well lubricated with refrigeration machinery oil prior to installing the piston (276).

As with disassembly, hold the pumpage end cylinder head in a vise and install the cylinder head O-ring. Set the cylinder on the head, and place the spring inside with the small end pointing up. After installing the piston O-ring in its groove, set the piston on the spring with the spring end over the raised pilot on the back of the piston. Slide the oil end cylinder head (281) over the piston indicator rod (278) and down against the piston face. Do not try to push the piston into the cylinder and then position the cylinder head. Instead, push the cylinder head against the piston and then down against the cylinder; the piston will be less likely to cock and bind.

While holding the cylinder down, have someone start two diagonally opposite bolts, and tighten them finger tight so that the cylinder head is held against the cylinder loosely. Install the remaining two bolts, and tighten all bolts in an alternating pattern.

Once the assembly is complete, push the indicator rod in to be sure that the piston moves freely. This will require considerable force, so it will be necessary to push with a block of wood against the end of the rod.

# GENERAL MAINTENANCE (CB SERIES)

**CAUTION**

Maintenance and inspection requirements vary with speed, power, load, ambient temperatures, exposure to contamination and moisture, seasonal or continuous operation and other factors. The brief recommendations which follow are general in nature and must be coupled with good judgment and consideration of the application and system conditions.

**IMPORTANT**

Initial inspection and installation of the pump unit must be made according to 3200-365. This is necessary to ensure the proper initial setup of the pump. See the table below for a general inspection and maintenance schedule.

**Inspection & Maintenance Schedule**

| TASK | FREQUENCY (minimum) | REFERENCE |
|---|---|---|
| Inspect for leaks | Weekly | |
| Inspect reservoir oil level | Weekly | 3200-351 |
| Inspect motor | 3 Months | 3200-20.5 |
| Inspect heater | Yearly | 3200-431 |
| Inspect volute and impeller | Yearly | See below |
| Replace reservoir oil | Yearly | 3200-351 |
| Replace motor grease | SEE 3200-20.5 | |
| Replace frame grease/oil | SEE 3200-901(grease), 3200-902(oil) | |

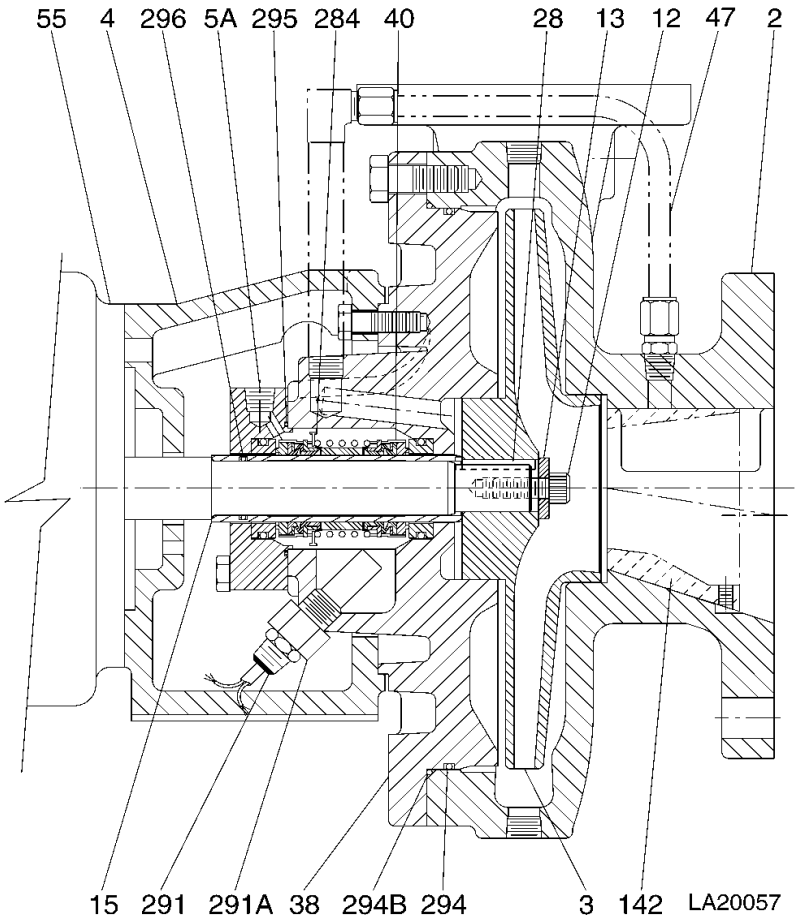
Rotating assembly should be removed from the volute casing and inspected regularly following the schedule above.

- Excessive oil found in the volute casing is an indication of contamination in the system.
- Impeller and volute casing should be inspected for signs of rubbing/interference. Signs of rubbing are indication of excessive shaft movement.
- O-rings should be replaced whenever the volute is removed.

# REFRIGERANT PUMP SEAL REPLACEMENT INSTRUCTIONS MODELS 1.5CBH, 2CB, 2CBS CLOSE COUPLED

## Parts List

2. VOLUTE
3. IMPELLER
4. BRACKET
5A. SEAL GLAND
12. IMPELLER LOCKSCREW
13. IMPELLER WASHER
15. SHAFT SLEEVE
28. IMPELLER KEY
38. BACK SIDE PLATE
40. MECHANICAL SEAL
47. BALANCE LINE
55. MOTOR
142. SUCTION NOZZLE (CBS only)
284. PUMP SEAL
291. HEATER
291A. HEATER WELL
294. O-RING (BACK SIDE PLATE)
294B. O-RING (BACK SIDE PLATE)
295. O-RING (GLAND)
296. O-RING (SLEEVE)




**WARNING**

Disconnect electrical power before working on the pump. Refrigerant gasses are hazardous. Obey safety regulations.

**WARNING**

Vent valve (246D) must be opened prior to isolating pump to avoid over-pressurization that could result in casing failure and serious personal injury.

It may be helpful to view the Cornell Pump Company video “Refrigerant Pump Seal Replacement” prior to undertaking the actual task. This video is available through Cornell dealers.

## Draining the Pump

Open vent valve (246D). Close suction and discharge stop valves and bypass valve. Allow ice to melt off. As the pump warms, gas forming in the casing will escape through the vent line. Refrigerant can be removed through drain valve (246E). All liquid and gaseous refrigerant must be removed from the pump before opening the case.

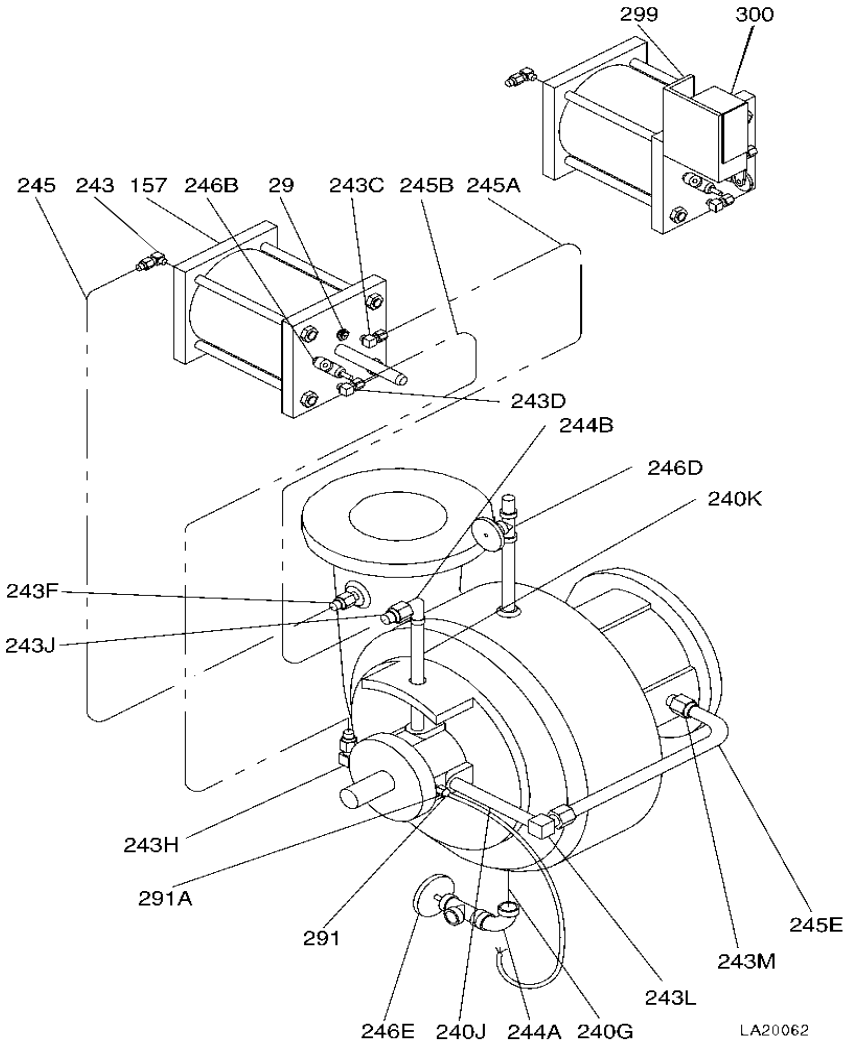
## Removal of Rotating Assembly from Volute

It is not necessary to disconnect the volute (2) from the piping. The "back pullout" design enables the removal of the rotating assembly to a workbench for servicing. Prior to disassembly, prepare a clean workbench where the necessary tools can be laid out and ready. Have a supply of clean rags handy and the following tools.

Box end/open end wrenches:
5/16"
3/8"
9/16"
5/8"
11/16"
3/4"
7/8"
15/16"
Small adjustable wrench (6" or 8")
5/16" Allen wrench
Blade type screwdriver, approximately 8"
Small pipe wrench (8" or 10")
Oil filter wrench or strap wrench
"Channel-lock" pliers
Two small prybars
90 weight or heavier gear oil

## Parts List

29. BLEED VALVE
157. OIL RESERVOIR
240D. NIPPLE
240G. NIPPLE
240J. NIPPLE
240K. NIPPLE
243. TUBE FITTING
243C. TUBE FITTING
243D. TUBE FITTING
243F. TUBE FITTING
243H. TUBE FITTING
243J. TUBE FITTING
243L. TUBE FITTING
243M. TUBE FITTING
244A. ELBOW
244B. ELBOW
245. TUBING
245A. TUBING
245B. TUBING
245E. TUBING
246B. ANGLE VALVE
246D. GLOBE VALVE
246E. ANGLE VALVE
291. HEATER
291A. HEATER WELL
299. SWITCH BRACKET
300. SAFETY SWITCH



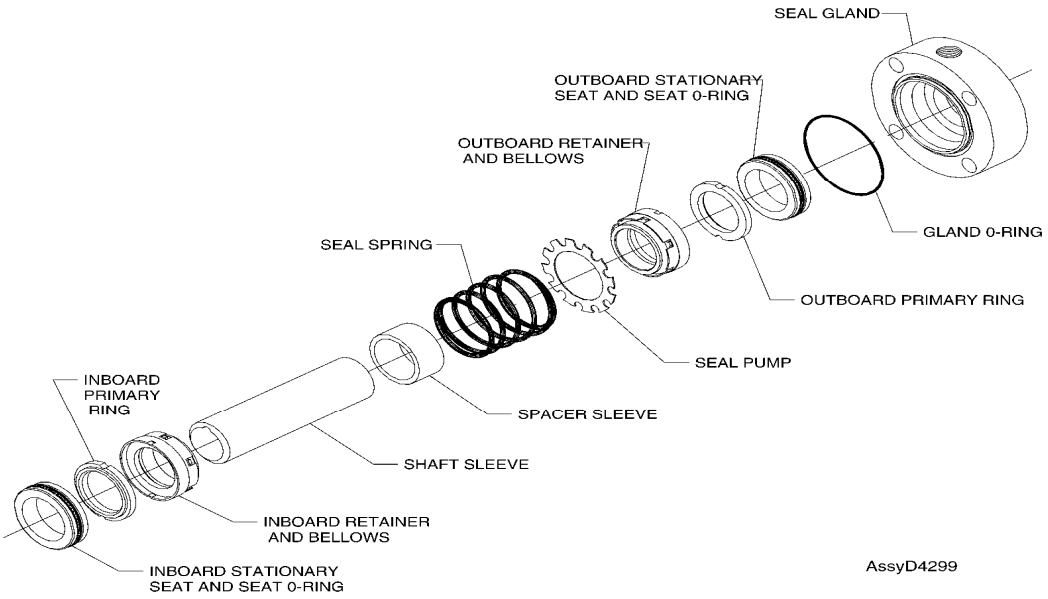
Once the pump has been valved off and drained of refrigerant, the oil can be drained from the seal oil reservoir and the seal chamber. Hold a container under the oil reservoir filler valve (246B). Using the small adjustable wrench or a valve wrench, open the valve. The oil will be under pressure due to the piston spring in the reservoir, so open the valve slowly. If there has been an inboard seal leak, the oil may contain ammonia; keep your face away from the valve while draining the oil.

When the reservoir indicator rod has extended fully and stopped, the oil flow will stop. Leave the valve open to aid in draining the seal chamber. If pump is equipped with a heater dry-well (291A), the heater (291) and well (291A) can be removed together using 7/8-inch wrench. For earlier models not equipped with the dry-well, use an 11/16-inch wrench to remove the heater (291), and drain the remaining oil from the seal chamber.

Using the 11/16-inch wrench, disconnect the reservoir pressurization line (245) at the reservoir fitting (243). Leave this line connected at the volute discharge, but loosen fitting (243F) just enough to allow the pressurization line to be rotated free of the reservoir fitting. Using the 7/8-inch wrench, disconnect the balance line (245E) at fitting (243L). Leave the balance line connected at the volute suction. Remove the bolts connecting the backplate (38) to the volute (2).

The formed pump support base, to which the bracket (4) is bolted, has slots where it is bolted to the foundation. It should be possible to loosen the foundation bolts and slide the pump, rotating assembly free of the volute.

If there is a misalignment between the volute and the rotating assembly, this will have to be corrected before the rotating assembly will slide out of the volute. If there is no misalignment and the backplate will not easily separate from the volute, then thread two volute bolts into two threaded jackscrew holes on the backplate, and tighten them evenly. The backplate will be pushed free of the volute. The entire pump assembly (rotating), less volute, can now be moved to the workbench for the remaining disassembly.




## Disassembly for Seal Removal

With the pump assembly on the workbench, remove the oil supply and return lines (if not already done). Using the pipe wrench, remove the balance line pipe nipple from the backplate - the tube fitting (243L) can be left attached to the nipple.

Using the 9/16-inch wrench, remove fitting (243H) from the seal gland (5A). Remove the impeller lockscrew (12) using the 5/16-inch Allen wrench; the impeller (3) can be held stationary by gripping the outside of the impeller eye with the oil filter wrench or strap wrench.

Insert the two prybars between the impeller backshroud and the backplate, and apply even pressure. The impeller should slide off without excessive force. Be sure that someone is holding onto the impeller; if it hits the floor it may break. Remove the impeller key (28).

Remove the four 9/16-inch bolts securing the seal gland to the backplate, and slide the gland back toward the motor face. Remove the 9/16-inch bolts securing the backplate to the bracket (4). Support the backplate while removing the bolts so that it doesn't fall against the shaft and seal. Remove the backplate, exercising care not to drag the seal chamber bore against seal or shaft.

Refer to the exploded seal drawing for the part names used in the following procedures.

The seal (40) and sleeve (15) are now exposed. Simply slide the sleeve, seal and all, off the motor shaft. The sleeve is sealed to the shaft with an O-ring and will slide off easily. It is likely that the seal primary rings will have stuck to the stationary seats during removal of the gland and backplate. Replace the primary rings in their proper retainers. If the seal is to be returned to Cornell for evaluation, leave it mounted on the sleeve just as you found it.

Remove the outboard stationary seat from the gland. This can be accomplished by laying the gland on the bench, open side down, placing the blade of a screwdriver against the back edge of the seat and firmly tapping the screwdriver with a hammer or the heal of the hand. Once removed, place the seat over the sleeve and against the outboard retainer.

Similarly, remove the inboard stationary seat from the backplate, and place it over the sleeve and against the inboard retainer. Band or wire the seal assembly for shipment to Cornell.

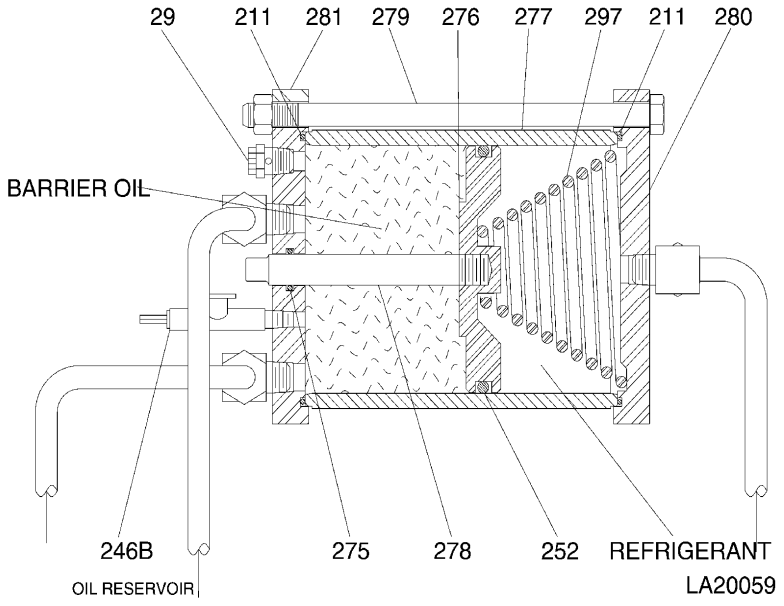
If the seal is not to be returned to Cornell and it is desired to reuse the shaft sleeve, then care must be taken not to scratch the sleeve during seal disassembly. The retainers will be firmly "seized" to the sleeve, and a great deal of force will be required to remove them. Place one jaw of a pair of "channel-lock" pliers against the backside of the retainer or against one coil of the seal spring and one jaw against the end of the sleeve, and apply pressure. The retainer should begin to move. Once all the hardware is removed, the sleeve should be inspected for scratches and buffed if necessary or replaced.

## Seal Oil Reservoir Maintenance

Anytime maintenance is performed on the mechanical seal, the reservoir should be disassembled, inspected and cleaned and repaired as necessary. New reservoir O-rings should always be installed when the reservoir is torn down.

## Parts List

29. BLEED VALVE
211. O-RING (2)
246B. ANGLE VALVE (replenishing)
252. O-RING
275. O-RING
276. PISTON
277. CYLINDER
278. INDICATOR ROD
279. TIE ROD WITH NUTS
280. CYLINDER HEAD, PUMPAGE END
281. CYLINDER HEAD, OIL END
297. SPRING



**WARNING**

The reservoir contains a large compressed spring. To avoid injury, follow instructions below carefully.

## Disassembly

For disassembly, it is convenient to clamp the pumpage end cylinder head (280) in a vise.

Using a 9/16-inch wrench, remove any two diagonally opposite bolts (279) securing the reservoir heads to the cylinder (277). Very carefully remove the remaining two bolts; the spring (297) exerts a great deal of force, so it may be helpful to have an assistant holding the top reservoir head (281) down while the last two bolts are removed.

Alternately, the cylinder heads can be clamped in place with a large C-clamp and all the bolts removed at once. The clamp can then be carefully loosened. Once the reservoir is apart all O-rings should be removed and discarded.

Using a suitable solvent, clean all the reservoir parts, particularly the O-ring grooves. Inspect the cylinder for pits, scratches or corrosion.

If there is minor damage, a cylinder hone (available at auto parts store) can be used to recondition the cylinder. If there are deep pits or scratches, the cylinder should be replaced.

When replacing the O-rings, use only those supplied in the Cornell factory kit (BME178A-A00); the elastomers used in these O-rings were carefully selected for service in ammonia, halocarbons and refrigeration oils. Other elastomers may not be compatible with these environments.

When reassembling the reservoir, it is helpful to use STP or similar "tacky," heavy consistency lubricant to "glue" the cylinder head O-rings into their grooves. This will prevent them from falling out during assembly. The cylinder wall should be well lubricated with refrigeration machinery oil prior to installing the piston (276).

As with disassembly, hold the pumpage end cylinder head in a vise and install the cylinder head O-ring. Set the cylinder on the head, and place the spring inside with the small end pointing up. After installing the piston O-ring in its groove, set the piston on the spring with the spring end over the raised pilot on the back of the piston.

Slide the oil end cylinder head (281) over the piston indicator rod (278) and down against the piston face. Do not try to push the piston into the cylinder and then position the cylinder head. Instead, push the cylinder head against the piston and then down against the cylinder; the piston will be less likely to cock and bind.

While holding the cylinder down, have someone start two diagonally opposite bolts and tighten them finger tight so that the cylinder head is held against the cylinder loosely. Install the remaining two bolts and tighten all bolts in an alternating pattern.

Once the assembly is complete, push the indicator rod in to be sure the piston moves freely. This will require considerable force so it will be necessary to push with a block of wood against the end of the rod.

## Seal Installation

Prior to installing the new seal, thoroughly clean the seal chamber and gland with a solvent and blow the seal chamber out with compressed air. Using rags may leave lint or strings behind which can interfere with the proper functioning of the seal.

Lightly lubricate the sleeve O-ring (296) and slide the sleeve onto the shaft. Be sure that the sleeve is installed with the chamfered end toward the end of the shaft. Line up the notch in the end of the sleeve with the shaft keyway. Using refrigeration oil, lightly lubricate the O-ring on the outboard stationary seat and press the seat into the gland bore using your thumbs. A piece of paper or a clean rag against the seat face will protect it during installation.
Make sure the lapped (polished) side of the seat faces the open side of the gland. Carefully inspect the seat to make sure that it is installed squarely in the gland. Coat the face of the stationary seat with clean refrigerant oil. Lubricate the O-ring on the inboard stationary seat and install it in the bore of the backplate.

Once the seat placed loosely against the seat bore, reach through from the impeller side of the backplate and pull the seat into place with your thumbs. Make sure that the seat is installed squarely in the bore. Coat the face of the stationary seat with clean refrigeration oil.

Apply a bead of heavy gear oil or STP to the O-ring groove of the seal gland, and install the O-ring (295) in the gland. The heavy oil will keep the O-ring in place during installation of the gland. Place the four 9/16" gland bolts through the gland bolt holes, and carefully slide the gland over the shaft and up against the motor face. Be careful not to drag the gland on the sleeve when placing it over the shaft. Thoroughly coat the sleeve with heavy consistency gear oil. Also, coat the inside of each seal bellows with gear oil.

Place the seal pump (284) against the backside of one of the retainers. Holding the seal pump against the back of the retainer, push the retainer onto the sleeve, primary ring facing the gland, and slide it nearly to the end of the sleeve nearest the motor face.

Once this procedure has been started, the rest of the seal installation must be performed very quickly. The bellows are designed to “seize” to the sleeve after a short time - this is what enables the shaft rotation to be transmitted to the seal retainers without them slipping. Slide the spacer sleeve onto the shaft sleeve and up against the back end of the outboard retainer. Apply more heavy consistency oil to the exposed portion of the shaft sleeve. Place the seal spring over the spacer and up against the seal pump on the back of the outboard retainer.

Now push the inboard retainer onto the sleeve, primary ring facing away from the motor face, and slide it toward the outboard retainer just far enough to rest against the spring. It may be fairly difficult to get the inboard retainer started on the sleeve because its bellows “squeegees” the installation lube off the shaft, but push hard, and it will go on. If for some reason it won’t slide on freely, apply a very thin coat of STP to the inside of the bellows and try again.

Quickly position the backplate over the shaft and seal and against the bracket register. Install two diagonally opposite bolts through the bracket and into the backplate holes and tighten them.

Be certain that once the inboard stationary seat in the backplate makes contact with the inboard primary ring, the backplate is not moved backward away from the motor face even momentarily. If this occurs, the primary ring and stationary seat will stick together and the primary ring will be pulled out of the retainer.

Quickly install the impeller onto the shaft and tighten the lockscrew. This needs to be done before the gland is bolted to the backplate since the impeller will hold the sleeve in its proper position when the gland is bolted up. Make sure that the oil port on the gland is in the proper orientation before pulling the gland up to the seal chamber face.

Using both hands, pull the gland up against the seal chamber face and start two diagonally opposite bolts. Do not relax pressure against the gland until at least two bolts are tightened down. If the gland is moved back toward the motor face at any time after the outboard stationary seat and outboard primary ring make contact, the outboard primary ring may be pulled out of its retainer.

Once the two gland bolts are tightened, the remaining gland and bracket bolts may be installed and tightened. Reinstall the heater into the heater port on the lower side of the backplate. A small amount of Teflon tape should be used on these threads.

## Pressure Testing The Seal

It is advisable to pressure test the seal assembly before installing the pump rotating assembly back into the volute and charging the seal system with oil. Install a 1/4-inch NPT plug into the oil exit port on the backplate. Use the 1/4-inch NPT oil supply tap on the gland to connect a compressed air line with gauge and valve or a Nitrogen or Freon bottle with gauge and valve. Slowly pressurize the seal chamber to a maximum of 250 PSI. Close the valve and watch the gauge for a continuous pressure drop.

Also listen for any hissing that would indicate a leak. If a slow leak is detected, relieve the pressure and turn the impeller by hand several quick revolutions.

Now repressurize and observe the gauge. If the slow leak continues, relieve the pressure, remove the pipe plug from the oil exit port on the backplate and pour enough clean refrigerant oil in through the port to fill the seal chamber. Wire the motor, (direction of rotation is unimportant at this point), plug the oil exit port, and run the motor for a maximum of 30 seconds.

Now drain the oil through the heater port, reinstall the heater, and again pressurize the seal chamber to a maximum of 250 PSI. If a leak is still present, it will be necessary to remove the seal and inspect it. If no obvious defect in the seal or the installation can be found, carefully remove the seal assembly from the sleeve, then reinstall it again following the same procedure as before. (When there is no visible cause for the leak, simply reinstalling the same seal often solves the problem.)

Once the seal has been successfully tested, reinstall the tube fittings on the gland oil supply port and the backplate oil return port. A small amount of Teflon tape sealant should be used on the threads where the fittings screw into the gland and backplate. No sealant should be used on the tube side of these fittings.

Follow instructions beginning on page 3200-351 for servicing and refilling the oil reservoir.

**Final Reassembly**

Now the pump rotating assembly can be reinstalled into the volute. At this point, the volute O-ring groove on the backplate should be cleaned and a new O-ring installed. If your pump was supplied with a backup O-ring (294B) installed between the backplate O-ring groove and the backplate bolting flange, replace this as well. Apply a coat of heavy consistency oil to the O-ring(s) to aid in installing the backplate into the volute.

Tighten all the volute bolts in an alternating pattern. If, after bolting the backplate to the volute, there is a gap between the pump support base and the foundation, do not bolt the base down. Shim under the support base before bolting down so that no bending stress is applied to the bracket, volute or motor.

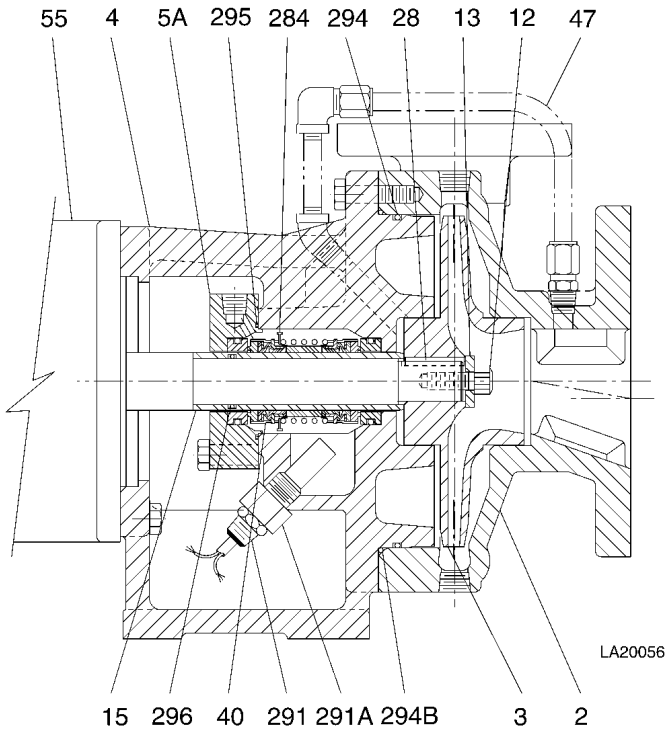
Reconnect the balance line from the pump suction flange to the backplate. If the oil reservoir was removed for maintenance, reinstall it on the upright at this time. Reconnect the oil supply and return lines between the backplate, seal gland and the reservoir face. Check all fittings for tightness. The pump is now ready to be flooded with refrigerant.

Carefully follow the start-up procedures outlined in your manual. If the manual is not available, please contact Cornell Pump Company at (503) 653-0330, and arrangements will be made to provide you with the necessary manual pages.

# REFRIGERANT PUMP SEAL REPLACEMENT INSTRUCTIONS MODEL 1.5CB AND 1.5CLB – CLOSE COUPLED

## Parts List

2. VOLUTE
3. IMPELLER
4. BRACKET
5A. SEAL GLAND
12. IMPELLER LOCKSCREW
13. IMPELLER WASHER
15. SHAFT SLEEVE
28. IMPELLER KEY
40. MECHANICAL SEAL
47. BALANCE LINE
55. MOTOR
284. PUMP SEAL
291. HEATER
291A. HEATER WELL
294. O-RING (BACKPLATE)
294B. O-RING (BACKPLATE) (except 1.5CB)
295. O-RING (GLAND)
296. O-RING (SLEEVE)




**WARNING**

Disconnect electrical power before working on the pump. Refrigerant gases are hazardous. Obey safety regulations.

**WARNING**

Vent valve (246D) must be opened prior to isolating pump to avoid overpressurization that could result in casing failure and serious personal injury.

It may be helpful to view the Cornell Pump Company videotape "Refrigerant Pump Seal Replacement" prior to undertaking the actual task. This video is available through Cornell dealers.

## Draining the Pump

Open vent valve (246D). Close suction and discharge stop valves and bypass valve. Allow ice to melt off. As the pump warms, gas forming in the casing will escape through the vent line.
Refrigerant can be removed through drain valve (246E). All liquid and gaseous refrigerant must be removed from the pump before opening the case.

## Removal of Rotating Assembly from Volute

It is not necessary to disconnect the volute (2) from the piping. The "back pullout" design enables the removal of the rotating assembly to a workbench for servicing.

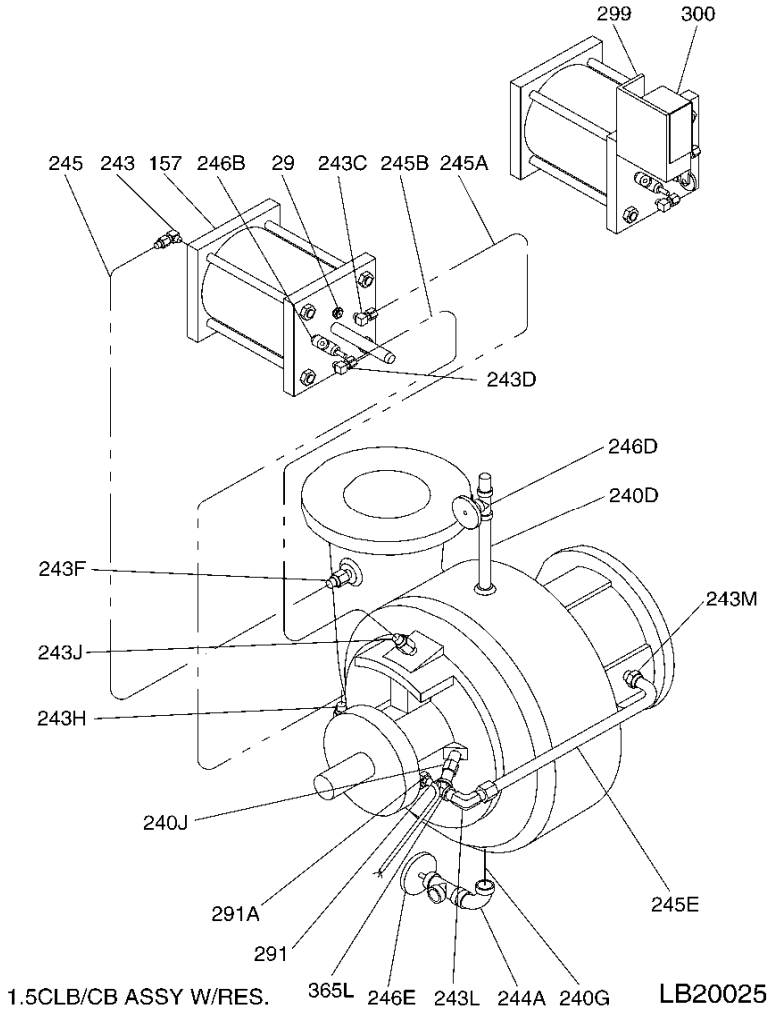
Prior to disassembly, prepare a clean workbench where the motor can be cradled or held in place with the bracket extending over the edge of the bench. This will make it much easier to remove the bracket from the motor and reinstall it.

Have a supply of clean rags handy and the following tools:

Box end/open end wrenches:
3/8"
9/16"
5/8"
11/16"
3/4"
7/8"
Small adjustable wrench (6" or 8")
5/16" Allen wrench
Blade type screwdriver, approximately 8"
Small pipe wrench, approximately 8"
Small oil filter wrench or strap wrench
"Channel-lock" pliers
Two small prybars
90 weight or heavier gear oil

**Parts List**

29. BLEED VALVE
157. OIL RESERVOIR
240D. NIPPLE
240G. NIPPLE
243. TUBE FITTING
243C. TUBE FITTING
243D. TUBE FITTING
243F. TUBE FITTING
243H. TUBE FITTING
243J. TUBE FITTING
243L. TUBE FITTING
243M. TUBE FITTING
244A. ELBOW
245. TUBING
245A. TUBING
245B. TUBING
245E. TUBING
246B. ANGLE VALVE
246D. GLOBE VALVE
246E. ANGLE VALVE
291. HEATER
291A. HEATER WELL
299. SWITCH BRACKET
300. SAFETY SWITCH



Once the pump has been valved off and drained off refrigerant, the oil can be drained from the seal oil reservoir and the seal chamber. Hold a container under the oil reservoir filler valve (246B). Using the small adjustable wrench or a valve wrench, open the valve. The oil will be under pressure due to the piston spring in the reservoir, so open the valve slowly. If there has been an inboard seal leak, the oil may contain ammonia; keep your face away from the valve while draining the oil.

When the reservoir indicator rod has extended fully and stopped, the oil flow will stop. Leave the valve open to aid in draining the seal chamber. If pump is equipped with a heater dry-well (291A), the heater (291) and well (291A) can be removed together, using a 7/8-inch wrench. For earlier models not equipped with the dry-well, use an 11/16-inch wrench to remove the heater (291), and drain the remaining oil from the seal chamber.

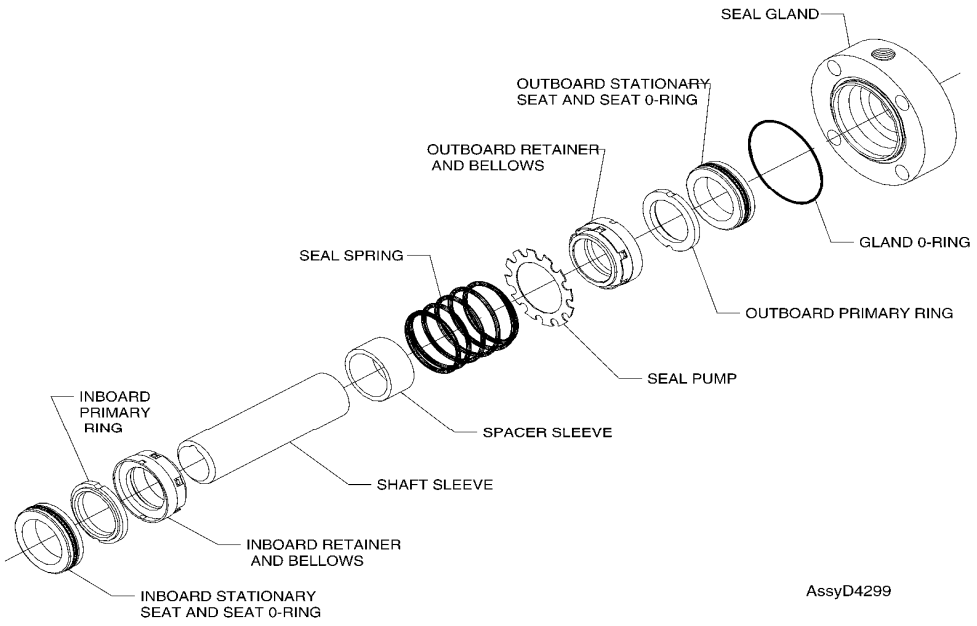
Unscrew the 11/16-inch nuts on tube fittings (243D, 243H, 243C, 243J) at each end of both the oil supply line (245B) and the oil return line (245A), and remove these lines.

Unscrew the 11/16-inch nut on fitting (243) of the reservoir pressurization line (245). Leave this line connected at the volute discharge nozzle, but loosen the nut on fitting (243F) just enough to allow the line to be rotated free from the reservoir fitting.

Unscrew the 11/16-inch nut on the balance line fitting (243L); leave this line (245E) connected at the suction nozzle fitting (243M). Remove the two 9/16-inch bolts connecting the reservoir (157) to the angle iron support, and set the reservoir aside. A threaded hole is now accessible on top of the motor for attachment of a 3/8-16NC eyebolt.

A hoist can be connected to the eyebolt to support the motor/bracket/impeller assembly while backing it out of the volute. Remove the four 9/16-inch bolts securing the pump bracket feet to the base. Remove the bolts that secure the volute to the bracket (9/16-inch for 1.5CLB and 3/4-inch for 1.5CB). Now the motor/bracket/impeller assembly can be backed out of the volute. If the bracket does not freely slide out of the volute, check for misalignment between the bracket and the volute and correct as necessary.

If the bracket and volute are properly aligned and the bracket still does not freely pull out of the volute, then thread two volute bolts into the threaded jackscrew holes on the bracket flange, and tighten them evenly. This will push the bracket free of the volute.



## Disassembly for Seal Removal

Arrange and secure the motor/bracket/impeller assembly on the workbench as previously noted (with the bracket extending over the side of the workbench).

With a 9/16-inch wrench, remove the right angle tube fitting (243H) from the seal gland (5A). Remove the impeller lockscrew (12) using the 5/16-inch allen wrench. The impeller (3) can be held stationary by gripping the impeller eye with the small oil filter wrench or strap wrench.

Insert the two prybars between the impeller backshroud and the bracket (4), and apply even pressure. The impeller should slide off without excessive force. Be sure that someone is holding onto the impeller, if it hits the floor it may break!

Remove the four 9/16-inch bolts securing the seal gland to the bracket, and slide the gland back against the motor face. Remove the four 9/16-inch bolts securing the bracket to the motor register, and carefully remove the bracket from the motor. Take care not to drag the bracket against the shaft or seal. The seal (40) and sleeve (15) are now exposed.

Simply slide the sleeve, seal and all, off the motor shaft. It is sealed to the shaft with an O-ring and will slide off easily. It is likely that the seal primary rings will stick to the stationary seats and be pulled out of their respective retainers. Remove the primary rings from the stationary seats, and replace them in their proper retainers. If the seal is to be returned to Cornell for evaluation, leave it mounted on the sleeve just as you found it.

Remove the outboard stationary seat from the gland. This can be accomplished by laying the gland on the bench, open side down, placing the blade of a screwdriver against the back edge of the seat and firmly tapping the screwdriver with a hammer or the heal of the hand. Once removed, place the seat over the sleeve and against the outboard retainer (see exploded drawing).

Similarly, remove the inboard stationary seat from the pump bracket, and place it over the sleeve and against the inboard retainer. Band or wire the seal assembly together for shipment to Cornell.

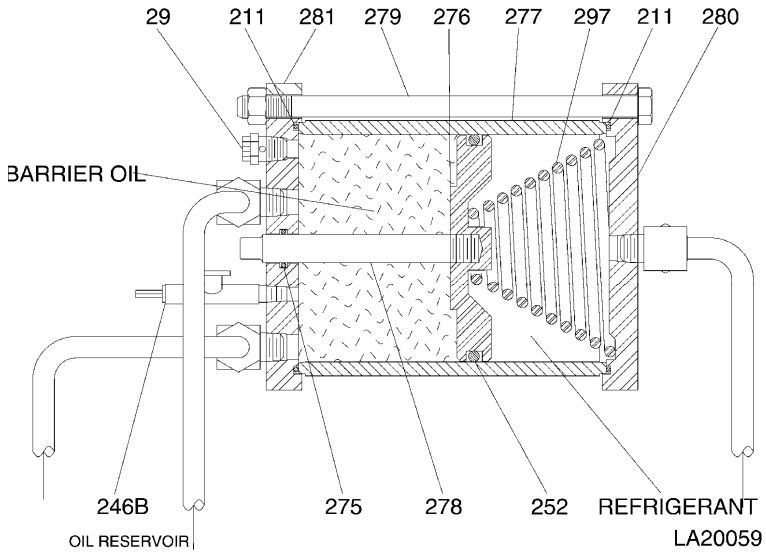
If the seal is not to be returned to Cornell and it is desired to reuse the shaft sleeve, then care must be taken not to scratch the sleeve during seal disassembly. The retainers will be firmly “seized” to the sleeve, and a great deal of force will be required to remove them. Place one jaw of a pair of “channel-lock” pliers against the backside of the retainer or against one coil of the seal spring and one jaw against the end of the sleeve, and apply pressure, and the retainer should begin to move. Once all the hardware is removed, the sleeve should be inspected for scratches and buffed if necessary or replaced.

## Seal Oil Reservoir Maintenance

Anytime maintenance is performed on the mechanical seal, the reservoir should be disassembled, inspected and cleaned and repaired as necessary. New reservoir O-rings should always be installed when the reservoir is torn down.

## Parts List

29. BLEED VALVE
211. O-RING (2)
246B. ANGLE VALVE (replenishing)
252. O-RING
275. O-RING
276. PISTON
277. CYLINDER
278. INDICATOR ROD
279. TIE ROD WITH NUTS
280. CYLINDER HEAD, PUMPAGE END
281. CYLINDER HEAD, OIL END
297. SPRING




**WARNING**

The reservoir contains a large compressed spring. To avoid injury, follow instructions below carefully.

## Disassembly

For disassembly, it is convenient to clamp the pumpage end cylinder head (280) in a vise.

Using a 9/16-inch wrench, remove any two diagonally opposite bolts (279) securing the reservoir heads to the cylinder (277). Very carefully remove the remaining two bolts; the spring (297) exerts a great deal of force, so it may be helpful to have an assistant holding the top reservoir head (281) down while the last two bolts are removed.

Alternately, the cylinder heads can be clamped in place with a large C-clamp and all the bolts removed at once. The clamp can then be carefully loosened. Once the reservoir is apart, all O-rings should be removed and discarded.

Using a suitable solvent, clean all the reservoir parts, particularly the O-ring grooves. Inspect the cylinder for pits, scratches or corrosion.

If there is minor damage, a cylinder hone (available at auto parts stores) can be used to recondition the cylinder. If there are deep pits or scratches, the cylinder should be replaced.

When replacing the O-rings, use only those supplied in the Cornell factory kit (BME178A-A00); the elastomers used in these O-rings were carefully selected for service in ammonia, halocarbons and refrigeration oils. Other elastomers may not be compatible with these environments.

When reassembling the reservoir, it is helpful to use STP or similar “tacky,” heavy consistency lubricant to “glue” the cylinder head O-rings into their grooves. This will prevent them from falling out during assembly. The cylinder wall should be lubricated with refrigeration machinery oil prior to installing the piston (276).

As with disassembly, hold the pumpage end cylinder head in a vise and install the cylinder head O-ring. Set the cylinder on the head, and place the spring inside with the small end pointing up. After installing the piston O-ring in its groove, set the piston on the spring with the spring end over the raised pilot on the back of the piston. Slide the oil end cylinder head (281) over the piston indicator rod (278) and down against the piston face. Do not try to push the piston into the cylinder and then position the cylinder head. Instead, push the cylinder head against the piston and then down against the cylinder; the piston will be less likely to cock and bind.

While holding the cylinder down, have someone start two diagonally opposite bolts, and tighten them finger tight so that the cylinder head is held against the cylinder loosely. Install the remaining two bolts, and tighten all bolts in an alternating pattern.

Once the assembly is complete, push the indicator rod in to be sure that the piston moves freely. This will require considerable force, so it will be necessary to push with a block of wood against the end of the rod.

**Seal Installation**

Prior to installing the new seal, thoroughly clean the seal chamber and gland with a solvent, and blow the seal chamber out with compressed air. Using rags may leave lint or strings behind which can interfere with the proper functioning of the seal.

Lightly lubricate the sleeve O-ring (296), and slide the sleeve onto the shaft. Be sure that the sleeve is installed with the chamfered end toward the end of the shaft. Line up the notch in the end of the sleeve with the shaft keyway. Using refrigeration oil, lightly lubricate the O-ring on the outboard stationary seat, and press the seat into the gland bore using your thumbs. A piece of paper or a clean rag against the seat face will protect it during installation.

Make sure that the lapped (polished) side of the seat faces the open side of the gland. Carefully inspect the seat to make sure that it is installed squarely in the gland. Coat the face of the stationary seat with clean refrigerant oil. Lubricate the O-ring on the inboard stationary seat and install it in the bore of the bracket.

Once the seat is placed loosely against the seat bore, reach through from the impeller side of the bracket, and pull the seat into place with your thumbs. Make sure that the seat is installed squarely in the bore. Coat the face of the stationary seat with clean refrigeration oil.

Apply a bead of heavy gear oil or STP to the O-ring groove of the seal gland, and install the O-ring (295) in the gland. The heavy oil will keep the O-ring in place during installation of the gland.

Place the four 9/16-inch gland bolts through the gland bolt holes, and carefully slide the gland over the shaft and up against the motor face. Be careful not to drag the gland on the sleeve when placing it over the shaft. Thoroughly coat the sleeve with heavy consistency gear oil. Also coat the inside of each seal bellows with gear oil.

Place the seal pump (284) against the backside of one of the retainers. Holding the seal pump against the back of the retainer, push the retainer onto the sleeve, primary ring facing the gland, and slide it nearly to the end of the sleeve nearest to the motor face.

Once this procedure has been started, the rest of the seal installation must be performed very quickly. The bellows are designed to “seize” to the sleeve after a short time; this is what enables the shaft rotation to be transmitted to the seal retainers without them slipping.

Slide the spacer sleeve onto the shaft sleeve and up against the back end of the outboard retainer. Apply more heavy consistency oil to the exposed portion of the shaft sleeve. Place the seal spring over the spacer and up against the seal pump on the back of the outboard retainer.
Now push the inboard retainer onto the sleeve, primary ring facing away from the motor face, and slide it toward the outboard retainer just far enough to rest against the spring. It may be fairly difficult to get the inboard retainer started on the sleeve because its bellows "squeegees" the installation lube off the shaft, but push hard, and it will go on. If, for some reason, it won't slide on freely, apply a very thin coat of STP to the inside of the bellows and try again. Quickly position the bracket over the shaft and seal and opposite bolts through the bracket and into the motor face, and tighten them.

Be certain that once the inboard stationary seat in the bracket makes contact with the inboard primary ring, the bracket is not moved backward away from the motor face even momentarily. If this occurs, the primary ring and stationary seat will stick together, and the primary ring will be pulled out of the retainer. Quickly install the impeller onto the shaft and tighten the lockscrew. This needs to be done before the gland is bolted to the bracket, since the impeller will hold the sleeve in its proper position when the gland is bolted up. Make sure that the oil port on the gland is in the proper orientation before pulling the gland up to the seal chamber face.

Using both hands, pull the gland up against the seal chamber face, and start two diagonally opposite bolts. Do not relax pressure against the gland until at least two bolts are tightened down. If the gland is moved back toward the motor face at any time after the outboard stationary seat and outboard primary ring make contact, the outboard primary ring may be pulled out of its retainer.

Once the two gland bolts are tightened, the remaining gland and bracket bolts may be installed and tightened. Reinstall the heater or heater dry-well into the heater port on the lower side of the bracket. A small amount of Teflon tape should be used on these threads. If the pump is equipped with a heater dry-well, do not apply any Teflon tape or thread sealant to the heater threads before installing it into the dry-well. While the dry-well should be tightened sufficiently to maintain a gas-tight seal, the heater should only be installed into the dry-well tight enough to resist vibrating loose. This will enable easy removal of the heater without loosening the dry-well when normal replacement of the heater becomes necessary.

## Pressure Testing the Seal

It is advisable to pressure test the seal assembly before installing the motor/bracket/impeller back into the volute and charging the seal system with oil. Remove the return oil tube fitting (243J) from the top of the bracket. Install a 1/4-inch NPT plug into the seal gland oil port. Use the 1/4-inch NPT return oil tap at the top of the bracket to connect a compressed air line with gauge and valve or a Nitrogen or Freon bottle with gauge and valve. Slowly pressurize the seal chamber to a maximum of 250 PSI. Close the valve, and watch the gauge for a continuous pressure drop. Also listen for any hissing that would indicate a leak. If a slow leak is detected, relieve the pressure, and turn the impeller by hand several quick revolutions.

Now repressurize and observe the gauge. If the slow leak continues, relieve the pressure, remove the air fitting from the top of the bracket and pour enough clean refrigerant oil in through the port to fill the seal chamber. Wire the motor, (direction of rotation is unimportant at this point), plug the oil return port, and run the motor for a maximum of 30 seconds.

Now drain the oil, reconnect the pressurizing line, and again pressurize the seal chamber to a maximum of 250 PSI. If a leak is still present, it will be necessary to remove the seal and inspect it. If no obvious defect in the seal or the installation can be found, carefully remove the seal assembly from the sleeve and reinstall it again,

following the same procedure as before. (When there is no visible cause for the leak, simply reinstalling the same seal often solves the problem!).

Once the seal has been successfully tested, reinstall the tube fittings on the gland oil supply port and the bracket oil return port. A small amount of teflon tape sealant should be used on the threads where the fittings screw into the gland and bracket. No sealant should be used on the tube side of these fittings.

**Final Reassembly**

Now the motor/bracket/impeller assembly can be reinstalled into the volute. At this point, the volute O-ring groove on the bracket should be cleaned and a new O-ring installed. If your pump was supplied with a back-up O-ring (294B) installed between the bracket O-ring groove and the bracket bolting flange, replace this as well. Apply a coat of heavy consistency oil to the O-ring to aid in installing the bracket into the volute.

Tighten all the volute bolts in an alternating pattern. If, after bolting the bracket to the volute, there is a gap between the bracket foot and the base, do not install the bracket foot bolts and tighten them down. Shim the foot before bolting down so that no bending stress is applied to the bracket or volute.

Reconnect the balance line from the pump suction flange to the bracket. Reconnect the oil supply and return lines between the bracket, seal gland and the reservoir face. Check all fittings for tightness. The pump is now ready to be flooded with refrigerant.

Carefully follow the start-up procedures outlined in your manual. If the manual is not available, please contact Cornell Pump Company at (503) 653-0330, and arrangements will be made to provide you with the necessary manual pages.

# MEDIUM PRESSURE
# HOW TO DISMANTLE AND REASSEMBLE A CORNELL MODEL CB REFRIGERANT PUMP WITH A 1-5/8 DOUBLE SEAL TYPE 8

**WARNING**

Disconnect the electrical power before working on the pump. Refrigerant gases are hazardous. Obey safety regulations.

## Draining the Pump

Open the vent valve (246D) and allow ice to melt off. Close suction, discharge and by-pass valves. As the pump warms, gas forming in the casing will escape through the vent line. Refrigerant can be removed through drain valve (246E).

NOTE: Some parts may be mentioned in these instructions that do not apply to your pump. Refer to your specific parts page for part names.

## Removing the Pump

Disconnect balance line (47) and pressurizing line (245). Remove capscrews fastening back side plate (38) (or bracket [4] or frame [8]) to volute (2). Remove foundation bolts. Insert two capscrews into tapped holes in back side plate (or bracket or frame). Tighten screws to jack the pump free from the volute. (If jack screw holes have become corroded, use chisels cautiously to pry the pump free. Withdraw pump from the volute (2). Remove screw (12) and washer (13). Pry off the impeller (3) with two thin bars placed between the impeller (3). Using even pressure the impeller will slide off. Remove the impeller key (28).

## Dismantling the Mechanical Seal

Have a container ready to collect oil from the oil reservoir (157). The oil will have some pressure. Once the pressure is relieved through filler valve (246B), disconnect line (245B) from the seal gland (5A) and drain oil into the container. Disconnect line (245A) from the seal chamber. Disconnect and remove heater (291) and heater dry-well (291A) (earlier units may not be equipped with dry-well). Unbolt the seal gland 5A and carefully move it back on the shaft. The drive end seat should remain in the seal gland, so use care not to damage this part.

Remove the side plate (38). Pump end seat should remain in the casting. Use care not to damage this part. The inner portion of the seal is now seen. This portion of the seal is called the rotating assembly. Observe the position of the seal pumping ring. The shaft sleeve (15) can be removed from the shaft with the seal (it will slide off easily, as it is not pressed on). If the sealing surfaces of the seal washers are in good condition the rotating assembly may be left on the sleeve and the stationary seats may be left in place. If the sealing surfaces are worn the entire seal must be replaced.

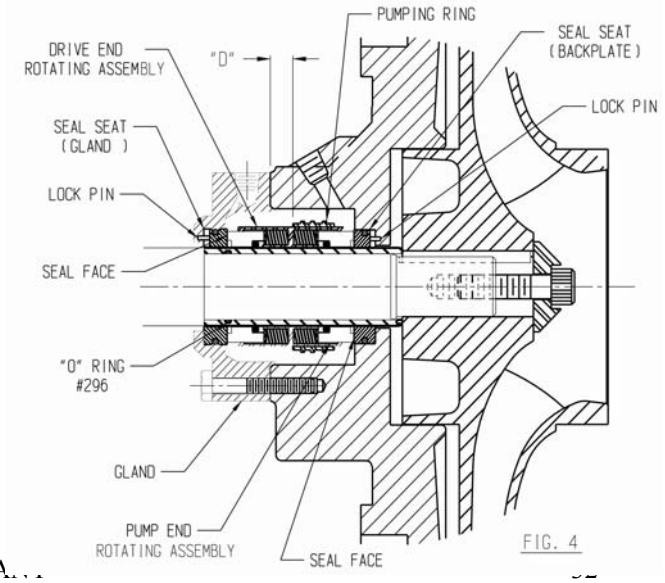


FIG. 4

**Removing the Rotating Assembly**

Loosen the set screws on rotating assembly. Pull each rotating assembly off the sleeve. Remove the seal gland. The seal seats in the gland and back side plate can be pushed out if damaged or worn. Note the slot in each and the lock pins*. Also note that the pumping ring (white Teflon) is on the pump end portion of the seal.

*PINS MAY NOT ALWAYS BE USED.

# ASSEMBLING REFRIGERANT PUMP

## Shaft Straightness

Measure shaft concentricity at the surface where impeller will mount. Concentricity should be within 0.002-inch total indicator reading. If reading exceeds this, have shaft straightened before proceeding (method of straightening must ensure bearings will not be damaged).

## Installing Mechanical Seal

Be sure that the shaft bores in the seal gland and seal chamber are free of nicks and burrs and are thoroughly clean. Remove all burrs, then clean, polish and oil the shaft sleeve. The shoulder on the shaft sleeve requires a slight radius with no sharp edge. Coat the bores with refrigeration oil. The most important part of the assembly procedure is to establish the "D" dimension of 3/8-inch as shown in Fig. 4. This dimension is the distance from the stuffing box face to the ends of both seal rotating assemblies. The only way this dimension can be established is by putting the sleeve on the shaft as shown without rotating assemblies or O-ring (296).

NOTE: Sleeve O-ring groove toward the motor end. Now push the back side plate over the sleeve to its register. Then scribe a line on the sleeve at the stuffing box face. Remove the back side plate and sleeve from the shaft. Then measure 3/8-inch from scribed on the sleeve in proper direction and scribe another mark. This second mark is the location where both rotating assemblies can be locked to the sleeve. However, before that can be started, the seal seats must be installed in the back side plate and the gland.

First note that both are slotted and that the lock pin 61 must fit into the slot*. Line up slot with pin, temporarily place a piece of cardboard on the sealing surface before pressing it into position. One seat in back side plate and one into seal gland. Be sure that the seats are properly positioned and firmly in place. Slide the seal gland (with seat and O-ring gasket) onto shaft as far as possible. It is convenient to have the gland bolts in place in the gland holes at this time.

## Final Seal Assembly

Lightly oil the shaft and install the O-ring (296) (inside the sleeve). Next, review Fig. 4 again. Note that rotating portion of seal with white Teflon pumping ring mounts on sleeve opposite O-ring (296). Lubricate both ends of the sleeve. Put pumping ring portion of seal on sleeve, locating it at the proper scribed mark. Tighten set screws. Avoid damaging or touching the polished sealing surfaces. Next, mount the other rotating assembly on the other end of the sleeve in the same manner. Next, slide the sleeve with rotating assemblies on the lubricated shaft until sleeve makes contact with shaft shoulder.

## Caution

When installing the back side plate, its bore must be carefully lined up on the shaft or the sealing surface of the seal will strike the end of the shaft, or a shaft shoulder, and be ruined. To prevent this, install two 3/8-inch x 3-inch studs in the back side plate in holes for capscrews. Line up seal gland squarely and tighten the capscrews.

## Heater (not required on all pumps)

If the pump is equipped with heater dry-well, remove and inspect the dry-well surface for carbon build-up and clean as necessary. If the heater is installed directly into the oil sump without a dry-well, remove and clean heater as necessary.

*Lock pin not always used.

## Final Pump Assembly

The mechanical seal may be checked by filling the oil reservoir as per page 3200-351. Then pressurize the oil reservoir at the pumpage end with dry air or nitrogen at the normal pumping pressure. Now re-wire and run the motor. Sometimes a minute leakage will be present at the start and disappear after a short running period. Do not run more than two minutes as there is no pumpage to carry away seal heat. A new impeller lock screw is recommended at each repair. The screw should be installed as explained in page 3200-14.

## O-rings

New O-rings are recommended at each repair because of the effect of low temperature on the elastomer. Oil the O-rings and the surfaces on which they slide at assembly. Use care to avoid shaving the O-ring. After assembly and re-installation, follow “Start-up instructions.”

# HOW TO DISMANTLE AND REASSEMBLE A CORNELL MODEL CB, CBS, CLB REFRIGERANT PUMP WITH DOUBLE TYPE (1) OR (2) SEAL

**WARNING**

Disconnect the electrical power before working on the pump, drain the pump of refrigerant. Refrigerant gases are hazardous. Obey safety regulations or serious personal injury may result.

Open vent valve (246D). Close suction, discharge and bypass valves. Allow ice to melt off. As the pump warms, gas forming in the casing will escape through the vent line. Refrigerant can be removed through drain valve (246E).

## Removing the Pump

Disconnect balance line (47) and pressurizing line (245). Remove capscrews fastening backplate (38) (or bracket 4 or frame 8) to volute (2).

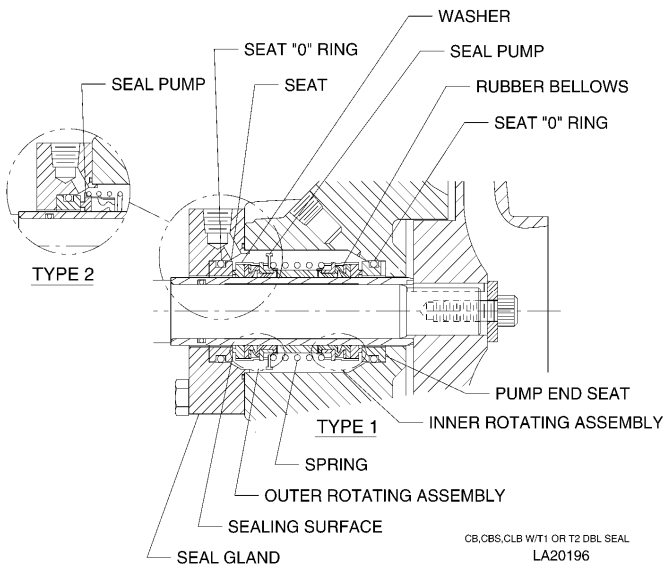
Insert two capscrews into tapped holes in backplate (or bracket or frame). Tighten screws to jack the pump free from the volute. Withdraw pump from the volute (2). Remove screw (12) and washer (13). Pry off the impeller (3) with two thin bars placed between the impeller (3) and backplate (38) (or bracket 4). Place the bars behind the impeller vanes so prying will not break the impeller (3). Using even pressure the impeller will slide off.

## Dismantling the Mechanical Seal (reference appropriate parts page and page 3005-254)

Drain the oil reservoir (157) via the filler valve (246B). Use caution as the oil will be under pressure and may contain some ammonia. Once the indicator rod has extended fully and the flow of oil has stopped, drain the remaining oil by removing the heater (291) and heater well (291A) assembly (earlier models may not be equipped with heater well).

Disconnect line 245B, and remove fitting (243B), and remove fitting (243H) from the seal gland (5A). Disconnect line (245A) from the seal chamber. Unbolt the seal gland (5A) and carefully move it back on the shaft. Remove the backplate (38) or bracket (4). Pump end seat should remain in the casting. Use care not to damage this part. The inner portion of the seal is now seen.

**Observe the position of the seal pump (284).** The shaft sleeve (15) can be removed from the shaft with the seal (it will slide off easily, as it is not pressed on). Use care so that the washers do not fall off. If the sealing surfaces of the washers are in good condition, the rotating assembly may be left on the sleeve and the stationary seats may be left in place. If the sealing surfaces are worn, the entire seal should be replaced.




## Removing the Rotating Assembly

Lubricate the sleeve. Work rubber bellows free from sleeve and remove them along with washers, spring and spacer. Remove the seal gland. Seats may be pushed out of the gland and side plate or bracket. Note the slot in the pump end seat.

# ASSEMBLING REFRIGERANT PUMPS

## Installing Mechanical Seal

Remove all burrs, then clean, polish and oil the shaft sleeve. The shoulder on the shaft sleeve requires a slight radius with no sharp edge. Coat the gland and backplate seat bores with light oil. The seat next to the impeller has a slot for a lock pin*. The seat must be located in the backplate or bracket so the pin is in the slot. Temporarily place a piece of cardboard on the sealing surface before pressing on it. Insert the seats. Be sure these parts are squarely and firmly in place. Lubricate the shaft and install the sleeve with the O-ring (inside the sleeve) toward the shaft shoulder. Slide the seal gland (with seat and O-ring gasket) onto the shaft as far towards the motor as possible. It is convenient to have the gland bolts in the gland bolt holes at this time.

**NOTE:** Have all components ready before proceeding with assembly, because once the rotating element has been placed on the sleeve the rest of the installation must be made at once. Delay may result in the rubber bellows seizing on the sleeve at an improper position. The bellows will eventually seize to the sleeve after installation. This is what allows the shaft to transmit torque the seal faces without bellows slippage.

When installing the backplate, its bore must be carefully lined up on the shaft or the sealing surface of the seal will strike the end of the shaft or the shaft shoulder and be ruined. To prevent this, install two 3/8-inch x 3-inch studs in the backplate in holes for capscrews which will hold the side plate to the bracket. (If the pump is a 1.5CLB, put these studs in the motor or frame). These will form a guide when sliding the back side plate into position.

## Final Seal Assembly

Lubricate the inside diameter of the rubber bellows and the outside diameter of the sleeve with a heavy consistency lubricant (such as 90 weight oil). Do not use grease products or silicone based lubricants. Place the seal pump on the rotating assembly as shown. (High pressure seals may have the pumping ring already installed). Slide the outer rotating assembly onto the sleeve. The rubber bellows of the outer rotating assembly will tend to wipe heavy consistency lubricant off the sleeve as it slides on; you may want to re-apply heavy consistency lubricant to the sleeve at this time. Place the spring on the shaft pressing against the pumping ring, slide the Teflon spacer on under the spring. Mount the inner rotating assembly on the sleeve. Use extreme care to avoid marking the sealing surfaces of the washer. This assembly can be pushed about a half-inch past the end of the sleeve. If any heavy consistency lubricant has found its way onto the sealing surfaces of the washer or stationary seat, it may be carefully wiped off with a clean cloth. Lubricate the sealing surfaces with a light coat of refrigeration machine oil used in the reservoir. Move the entire assembly back and forth on the sleeve to ensure that it is moving freely.

Now mount the back side plate or bracket using the studs as guides. Secure the side plate with two capscrews; then replace the studs with capscrews. Mount and torque the impeller. Use a new impeller lockscrew. Line up the seal gland squarely and tighten capscrews. Be sure the shaft sleeve is pushed all the way back against the shaft shoulder. Once the gland is pushed against the outboard (motor end) seal head, **do not** relax pressure until the gland is secured against the seal box face with two or more bolts. Otherwise the seal primary ring may be pulled out of the seal head.

## Heater

If the pump is equipped with a heater dry-well, remove and inspect the dry-well surface for carbon build-up and clean as necessary. If the heater is installed directly into the oil sump without a dry-well, then remove and clean the heater as necessary.

**WARNING**

Heater may be tested, but must be disconnected as soon as warming is detected because it will get hot enough to burn, which may result in serious personal injury.

## Final Pump Assembly

The mechanical seal may be checked by filling the oil reservoir as per "Operating Instructions." Then pressurize the oil reservoir at the pumpage end with dry air or nitrogen at the normal pumping pressure. Now re-wire and run the motor. Sometimes a minute leakage will be present at the start and disappear after a short running period. Do not run for more than about 2 minutes as there is no pumpage present to carry away seal heat.

**O-Rings:** New O-rings are recommended at each repair because of the effect of low temperature on the elastomer. Oil the O-rings and the surfaces on which they slide at assembly. Use care to avoid shaving the volute O-ring. After assembly and re-installation, follow "Start-up Instructions."

# IMPELLER LOCKSCREW INSTALLATION

Impeller lockscrews are always right hand socket head capscrews. Stainless steel lockscrews are supplied with Loctite 262, which should be applied to lockscrew thread and shaft thread prior to installation.

## Torque for Impeller Lockscrews

First determine size and material of lockscrew, then torque to the appropriate value listed in the table below.

| Size | Stainless Steel Lockscrew Nonmagnetic (302, 303, 304, 316 Series) |
|---|---|
| .38 – 16UNC | 20 Ft-lb |
| .50 – 13UNC | 40 Ft-lb |
| .62 – 11UNC | 90 Ft-lb |
| .75 – 10UNC | 135 Ft-lb |
| 1.00 – 8UNC | 265 Ft-lb |
| 1.12 – 7UNC | 360 Ft-lb |
| 1.25 – 7UNC | 510 Ft-lb |
| 1.50 – 6UNC | 875 Ft-lb |

## Lubrication

Do not lubricate impeller lockscrew or tapped hole or between the lockscrew and the impeller washer or between the impeller washer and the impeller. Make sure parts are clean and dry; however, it is not necessary to remove the protective coating from the screw. Lubricated bolts can be overstressed with the torques indicated.

**DO NOT USE LOCKSCREW TO INSTALL THE IMPELLER**

## CAUTION

Lockscrew failure can damage impeller and volute.

The impeller screw must be of the best material, properly forged and machined to rigid specifications not available from local suppliers.

Buy only lockscrews available from Cornell to be sure of quality.

## Impeller Lockscrew Removal

1. Break loose impeller lockscrew with breaker bar. **CAUTION**: Care should be taken when removing lockscrew to prevent damaging screw head.

2. If breaker bar will not loosen impeller lockscrew, apply heat to the lockscrew for 2-4 minutes. Do not exceed 400° F. **CAUTION**: Care should be taken when applying heat so as not to receive serious burns.

3. Allow lockscrew to cool and remove with breaker bar.

# LUBRICATION INSTRUCTIONS – ELECTRIC MOTORS

## BALL BEARING LUBRICATION

Bearings in motors are greased at the factory before shipment.

Lubrication requirements vary with speed, power, load, ambient temperatures, exposure to contamination and moisture, seasonal or continuous operation and other factors. The brief recommendations which follow are general in nature and must be coupled with good judgement and consideration of the application conditions. For regreasing periods refer to table below. When adding grease be sure the grease and fittings are absolutely clean.

Grease used for these bearings should be equivalent to one of the following manufacturer's products:

Exxon Polyrex EM
Mobil Mobilith SHC 220
Chevron SRI #2
Texaco Polystar RB

**CAUTION: These are Polyurea based greases and should never be mixed with lithium base greases. Mixing of the two greases can cause the base thickener to become ineffective allowing the grease to become pure oil and flowing out of the bearings causing bearing failure.**

**NOTE: If lubrication instructions are shown on motor, they will supersede these general instructions**.

To lubricate electric motor bearings, use a hand-operated grease gun only. Pump grease into fitting until new grease appears at pressure relief plug. For minimum possibility of over-greasing, and for best results, lubricate when the motor is not running.

Bearings will become unusually hot until excess grease escapes from the relief plug.

End of season: Pump in grease until old grease is expelled from relief plug. Store.

Beginning of season: Start up motor. Let motor run until surplus grease is expelled.

## RECOMMENDED REGREASING PERIODS FOR MOTORS

| | HORSEPOWER | | | |
|---|---|---|---|---|
| | **1.5 TO 7.5** | **10 TO 40** | **50 TO 150** | **200+** |
| **Total Running Time** | 2,000 hours | 1,500 hours | 1,000 hours | 750 hours |
| **8-Hour Day** | 36 weeks | 27 weeks | 18 weeks | 13 weeks |
| **24-Hour Day** | 12 weeks | 9 weeks | 6 weeks | 4 weeks |

# DISMANTLING AND ASSEMBLING CORNELL FRAMES F16 AND EM16 GREASE LUBED AND F16K OIL LUBED

Oil lubricated frames are denoted by a "K" on the serial plate and an oil level sight gauge on the side of the frame.

**Dismantling** (refer to parts page for names and locations of parts)

1. Remove the deflectors from the shaft.
2. Remove the drive end shaft key.
3. Remove the capscrews from the bearing cover or drive end bracket.

   **Note:** Oil lubricated frames have double lip seals at the drive and pump ends. Grease lubricated frames have a single lip seal at the drive and pump ends. If the lip seals are to be saved, the shaft should be cleared of burrs or sharp protrusions which would cut the seal. If the seals are removed or replaced, see parts page for orientation of the lips. Paired seals have a grease passageway between them and are arranged so that the grease will move through the inner and outer seal.

   Slide the bearing cover or drive end bracket off the shaft. Remove the capscrews from the pump bracket. Slide the pump bracket off the shaft.
4. The shaft and bearings can now be removed by pressing on the drive end of the shaft.
5. Remove the bearings from the shaft with a bearing puller. If the bearings are to be saved, keep them absolutely clean. If contaminated, wash only in clean fluid.

**CAUTION: Never hammer the shaft or parts attached to the shaft or you will ruin both the shaft and the bearings.**

**Assembling**

1. Press the drive end and pump end bearings onto the shaft. Pressure should be applied to the inner race.
2. Press the shaft into the frame through the drive end until the pump end bearing is approximately flush with the pump end of the frame.
3. Install the pump end lip seal(s) into the bracket as shown on the parts page. Slide the pump bracket (with gasket for oil lubed frames) over the shaft, taking care not to damage or fold the lip seal(s). Install and tighten the capscrews.
4. Install the lip seal(s) in the bearing cover or drive end bracket as shown on the parts page. Reinstall the shims in the drive end of the frame (if present when disassembled). If new shaft, bearings, frame, bearing cover or drive end bracket are being installed, insert shims to maintain 0.007" to 0.012" shaft end play. Slide the bearing cover (with gasket for oil lubed frames) or drive end bracket over the shaft. Install and tighten the capscrews.
5. Install the deflector and lubricate per section 3200-901 for grease lubed frames, or section 3200-902 for oil lubed frames.

# DISMANTLING AND ASSEMBLING CORNELL FRAME PUMPS F5 GREASE LUBE AND F5K OIL LUBE FRAMES – 1.5CB, CLB

Oil lubricated frames are denoted by a "K" on the serial plate and an oil level sight gauge on the side of the frame.

**Dismantling** (refer to parts page for names and locations of parts)

1. Remove the deflectors from the shaft.
2. Remove the drive end shaft key.
3. Remove capscrews from drive end bearing cover and pump end bracket.

   **Note:** Oil lubricated frames have double lip seals at the drive and pump ends. Grease lubricated frames have a single lip seal at the drive and pump ends. If the lip seals are to be saved, the shaft should be cleared of burrs or sharp protrusions which would cut the seal. If the seals are removed or replaced, see parts page for orientation of the lips. Paired seals have a grease passageway between them and are arranged so that the grease will move through the inner and outer seal. Slide the bearing covers and bracket off the shaft.
4. The shaft and bearings can now be removed by pressing on the drive end of the shaft.
5. Remove bearings from the shaft with a bearing puller. If the bearings are to be saved, keep them absolutely clean. If contaminated, wash only in clean fluid.

**CAUTION: Never hammer the shaft or parts attached to the shaft or you will ruin both the shaft and the bearings.**

**Assembling**

1. Press the drive end and pump end bearings onto the shaft.
2. Press the shaft into the frame through the drive end until the pump end bearing is approximately flush with the pump end of the housing.
3. Install the pump end lip seals into the bearing cover as shown on the parts page. Replace the pump end bearing cover O-ring as shown on the parts page. The O-ring can be held in place with a bead of grease or STP.
4. Slide the bearing cover over the shaft, taking care not to damage or fold the lip seals. Install the bracket against the bearing cover and bolt the bracket in place. Tighten the bracket bolts so that the bracket comes up against the frame face, metal to metal. Torque to 30 foot pounds.
5. Install the drive end lip seals into the bearing cover. Re-install shims in drive end bearing bore (if present when disassembled). If new shaft, bracket, frame, bearings or bearing cover are being installed, insert shims to maintain 0.002" to 0.010" shaft endplay. Place gasket on drive end bearing cover and slide bearing cover over shaft, taking care not to damage lip seals. Bolt the bearing cover down.
6. Replace the deflectors and lubricate per page 3200-901 for grease lubricated frames, or page 3200-902 for oil lubricated frames.

# DISMANTLING AND ASSEMBLING CORNELL FRAME PUMPS EM5/F5 GREASE LUBE AND EM5K/F5K OIL LUBE FRAMES

Oil lubricated frames are denoted by a "K" on the serial plate and an oil level sight on the side of the frame.

**Dismantling** (refer to parts page for names and locations of parts)

1. Remove the deflectors from the shaft.
2. Remove drive end shaft key.
3. Remove capscrews from drive end bearing cover, engine bracket, and pump end bracket.

   **NOTE:** Oil lubricated frames have double lip seals at drive and pump ends. Grease lubricated frames have a single lip seal at the drive and pump ends. If the lip seals are to be saved, the shaft should be cleared of burrs or sharp protrusions that would cut the seal. If the seals are removed or replaced, see parts page for orientation of the lips. Paired seals have a grease passageway between them and are arranged so that the grease will move through the inner and outer seal. Slide the bearing cover and bracket off the shaft.

4. The shaft and bearing can now be removed by pressing on the drive end of the shaft.
5. Remove bearings from the shaft with a bearing puller. If the bearings are to be saved, keep them absolutely clean. If contaminated, wash only in clean fluid.

**CAUTION: Never hammer the shaft or parts attached to the shaft or you will ruin both the shaft and the bearings.**

**Assembling**

1. Press the drive end and pump end bearings onto the shaft.
2. Press the shaft into the frame through the drive end until the pump end bearing is approximately flush with the pump end of the housing.
3. Install the pump end lip seals into the bracket as shown on the parts page. Hot oil pumps do not use pump end lip seals. Place the bracket O-ring in the counterbore of the bracket as shown on the parts page. The O-ring can be held in place with a bead of grease or STP.
4. Slide the bracket over the shaft, taking care not to damage or fold the lip seals and bolt the bracket in place. Tighten the bracket bolts so that the bracket comes up against the frame face, metal to metal. Torque to 30 foot pounds.
5. Install the drive end lip seals into the bearing cover. Re-install shims in drive end bearing bore (if present when disassembled). If new shaft, bracket, frame, engine bracket, bearings or bearing cover are being installed, insert shims to maintain 0.002" to 0.010" shaft endplay. Place gasket on drive end bearing cover and slide bearing cover over shaft, taking care not to damage lip seals. Bolt the bearing cover down.
6. Replace the deflectors and lubricate per page 3200-901 for grease lubricated frames; page 3200-902 for oil lubricated frames.

# DISMANTLING AND ASSEMBLING CORNELL FRAME PUMPS F5 GREASE LUBE FRAME FOR NAUTILUS

**Dismantling:** (Refer to parts page for names and locations of parts).

1. Remove the deflectors from the shaft.

2. Remove drive end shaft key.

3. Remove capscrews from drive end bearing cover and pump end bracket. F5 frames for the Nautilus pumps have a single lip seal at the drive end and a labyrinth seal in the bracket at the pump end. If the lip seal is to be saved, the shaft should be cleared of burrs or sharp protrusions which would cut the seal. If the seals are removed or replaced, see parts page for orientation of the lip. Slide the bearing cover and bracket off the shaft. Remove the wavespring.

4. The shaft and bearings can now be removed by pressing on the drive end of the shaft.

5. Remove bearings from the shaft with a bearing puller. If the bearings are to be saved, keep them absolutely clean. If contaminated, wash only in clean fluid.

**CAUTION: Never hammer the shaft or parts attached to the shaft or you will ruin both the shaft and the bearings.**

**Assembly:**

1. Press the drive end and pump end bearings onto the shaft.

2. Press the shaft into the frame through the drive end until the pump end bearing is approximately flush with the pump end of the housing.

3. Place the wavespring over the drive end of the shaft, and position it against the drive end bearing.

4. Slide the bracket over the shfat, and bolt the bracket in place. Tighten the bracket bolts so that the bracket comes up against the frame face, metal to metal. Torque to 30 foot pounds.

5. Install the drive end lip seal into the bearing cover. Place gasket on drive end bearing cover and slide bearing cover over shaft, taking care not to damage the lip seal. Bolt the bearing cover down.

6. Replace the deflectors and lubricate per manual page 3200-901 or 3200-902.

# LUBRICATION INSTRUCTIONS
# GREASE LUBRICATED FRAME PUMPS

If frame is oil lubricated (denoted by a 'K' on the serial number plate and view gauge on side of frame), see "Lubrication Instructions – Oil Lubricated Frame Pumps," page 3200-902.

Bearing in all frames are greased at the factory before shipment.

Lubrication requirements vary with speed, power, load, ambient temperatures, exposure to contamination and moisture, seasonal or continuous operation and other factors. The brief recommendations which follow are general in nature and must be coupled with good judgement and consideration of the application conditions. For regreasing periods refer to table below. When adding grease be sure the grease and fittings are absolutely clean.

Grease used for these bearings should be equivalent to one of the following manufacturer's products:

G.E. Long Life Grease No. D682C5
Mobil Mobilux No. EP2
Shell Alvania EP2
Texaco Multifak AFB 2

To lubricate frame bearings, remove plastic cover from zerk fittings and be sure the fitting and end of grease gun are clean. Use hand-operated grease gun only and pump a small amount of grease into each bearing cavity. The surplus grease will go through the bearing and into the center part of the frame.

For regreasing periods and approximate quantity, refer to table below.

First determine frame size (located on serial number plate).
Example: 5HH-65B4 4NNT-VF16 10YB-F18DB 6NHTA-VC18 4RB-EM16

**RECOMMENDED REGREASING PERIODS FOR FRAMES**

| | FRAME SIZE | | | | |
|---|---|---|---|---|---|
| | **2-5-11 and EM309** | **6-7-8-16 60B4 through 68B4** | **10-12-13-13D 18-18D** | **20-24** | **30** |
| **Total Running Time** | 2,000 hours | 1,500 hours | 1,000 hours | 1,350 hours | 2,000 hours |
| **8-Hour Day Service** | 36 weeks | 27 weeks | 18 weeks | 24 weeks | 36 weeks |
| **24-Hour Day Service** | 12 weeks | 9 weeks | 6 weeks | 8 weeks | 12 weeks |
| **Approximate Amount of Grease per Line Fitting** | .5 cubic inch | 1.25 cubic inch | 2 cubic inches | 3 cubic inches | 4 cubic inches |
| **Approximately** | 3 pumps with grease gun hand operated | 6 pumps | 12 pumps | 18 pumps | 23 pumps with grease gun hand operated |

# LUBRICATION INSTRUCTIONS
# OIL LUBRICATED FRAME PUMPS

If frame is grease lubricated, see "Lubrication Instructions – Grease Lubricated Frame Pumps," page 3200-901.

The ball bearings are lubricated by the oil in the frame housing.
Add oil through the pipe plug opening at the top of the housing and fill to the level indicated on the side of the housing. Be careful to keep out dirt and moisture. The oil level must be maintained; check and fill when pump is not operating. The type and grade of oil used is very important for maintenance-free operation.

Oil used should be a turbine oil equivalent to one of the following manufacturer's products:

| **Oil Temperature to $150^0$F** | **Oil Temperature Over $150^0$F** |
|---|---|
| ISO VG32 | ISO VG68 |
| Mobil DTE 797 | Mobil DTE Oil Heavy Medium |
| Lubriplate HO-0 | Lubriplate HO-2 |
| Chevron Turbine Oil GST 32 | Chevron Turbine Oil GST 68 |
| Shell Turbo T Oil 32 | Shell Turbo T Oil 68 |

If checking oil temperature is not feasible, measure the bearing frame temperature at the drain connection. In general, the bearing frame temperature will be approximately $10^0$F lower than the oil temperature.
Oil recommendation is based on a minimum of 70 SSU at operating temperature.

| FRAME SIZE | CAPACITY (OIL) | OIL RENEWAL |
|---|---|---|
| F5K | 1 QUART | 3-4 MONTHS |
| F85K/85DBK | 1.5 QUARTS | 3-4 MONTHS |
| F13K/13DBK | 1.5 QUARTS | 3-4 MONTHS |
| F16K | 2 QUARTS | 5-6 MONTHS |
| F18K/18DBK | 3 QUARTS | 5-6 MONTHS |
| F12K | 4 QUARTS | 5-6 MONTHS |
| F24DBK | 8 QUARTS | 5-6 MONTHS |
| F20DBK/TBK | 9 QUARTS | 5-6 MONTHS |

**Lip Seals (grease)**

All oil-filled frames will have lip seals in their bearing covers. All lip seals must be lubricated through the grease fittings placed in the bearing cover at either end of the frame. Lubricate with a small amount of multiple-purpose grease after every two to six months, depending upon environment.

# INSTRUCTIONS
# ALIGNMENT OF FLEXIBLE COUPLINGS AND BELT DRIVES

It is not commercially feasible to furnish bed plates which, when placed on an uneven foundation, will not spring and cause misalignment. It is, therefore, necessary to support them on foundations that can furnish the required rigidity.

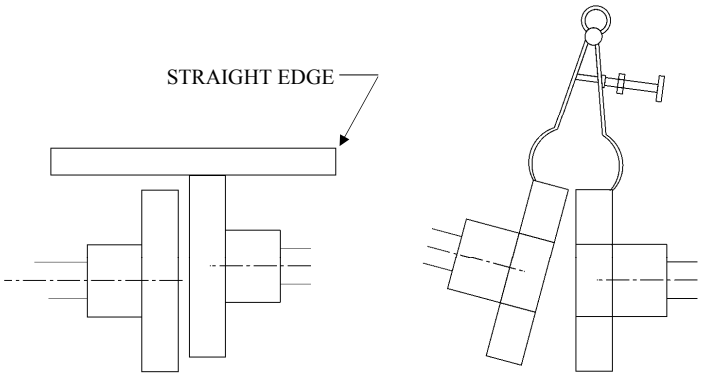
Misalignment causes whipping of the shaft, adds thrust to bearings, leads to excessive maintenance and potential failure of equipment. It is imperative that alignment be carefully checked prior to placing pump in operation. This is done after securing to bed plate or foundation and making pipe connections.

Flexible couplings must permit some lateral floating of the shaft to take care of thermal expansion and so move without excessive thrust on bearings.

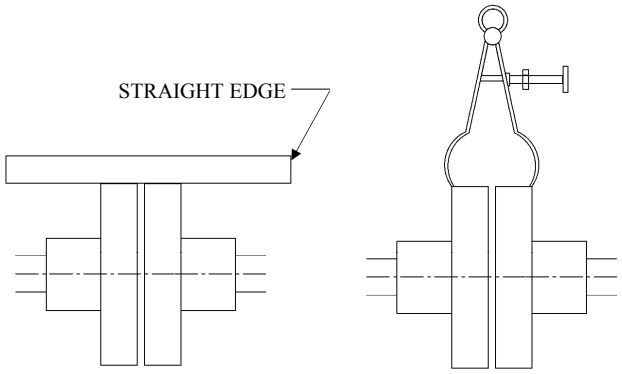
Numerous types of flexible couplings are available. Some are easier to align than others, but all serve the purpose of connecting two shafts capable of transmitting torque while allowing for minor misalignment (angular, parallel or a combination).

DO NOT assume the word flexible means the couplings are designed for misalignment. Couplings can be lined up by use of a straight edge, inside caliper, thickness gauge or outside caliper. The two ends of the couplings must be concentric and the sides parallel with no angular misalignment.

INCORRECT ALIGNMENT




CORRECT ALIGNMENT

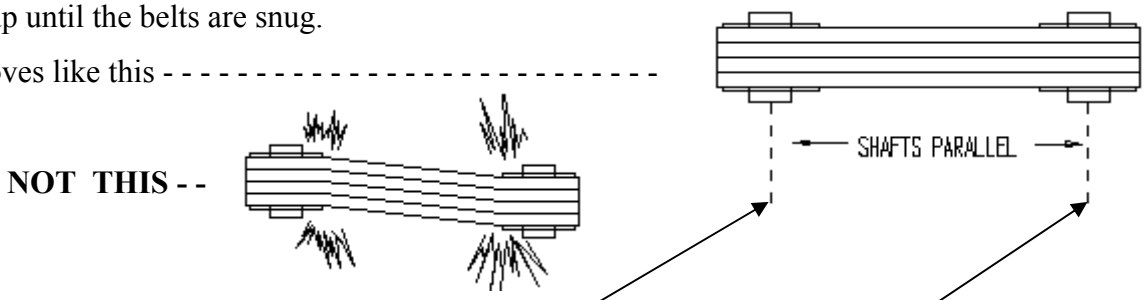



**WARNING**

All rotating parts should be properly protected. Guards should be installed to prevent the operator from coming in contact with shafts, drives, or other rotating elements. Do not operate pumps when the guards are removed or serious personal injury may result.

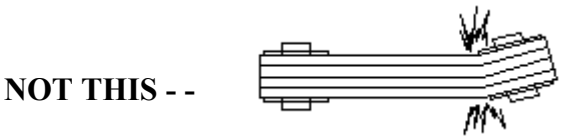
# INSTRUCTIONS
# BELT DRIVES

1. Use a matched set of V-Belts.
2. Clean oil and grease from sheaves.
   Remove rust and burrs.
3. Slack off on take-up until belts can be placed in grooves without forcing.
4. Tighten the take-up until the belts are snug.
5. Align sheave grooves like this - - - - - - - - - - - - - - - - - - - - - - - - - - - -




**NOT THIS - -**

6. Align shafts like this ————————————————————————————



**NOT THIS - -**

7. Run drive at full speed and adjust take-up until only slight bow appears in slack side of belts. Vertical drives, drives with extremely short centers, and drives carrying pulsating loads must be operated tighter than others.

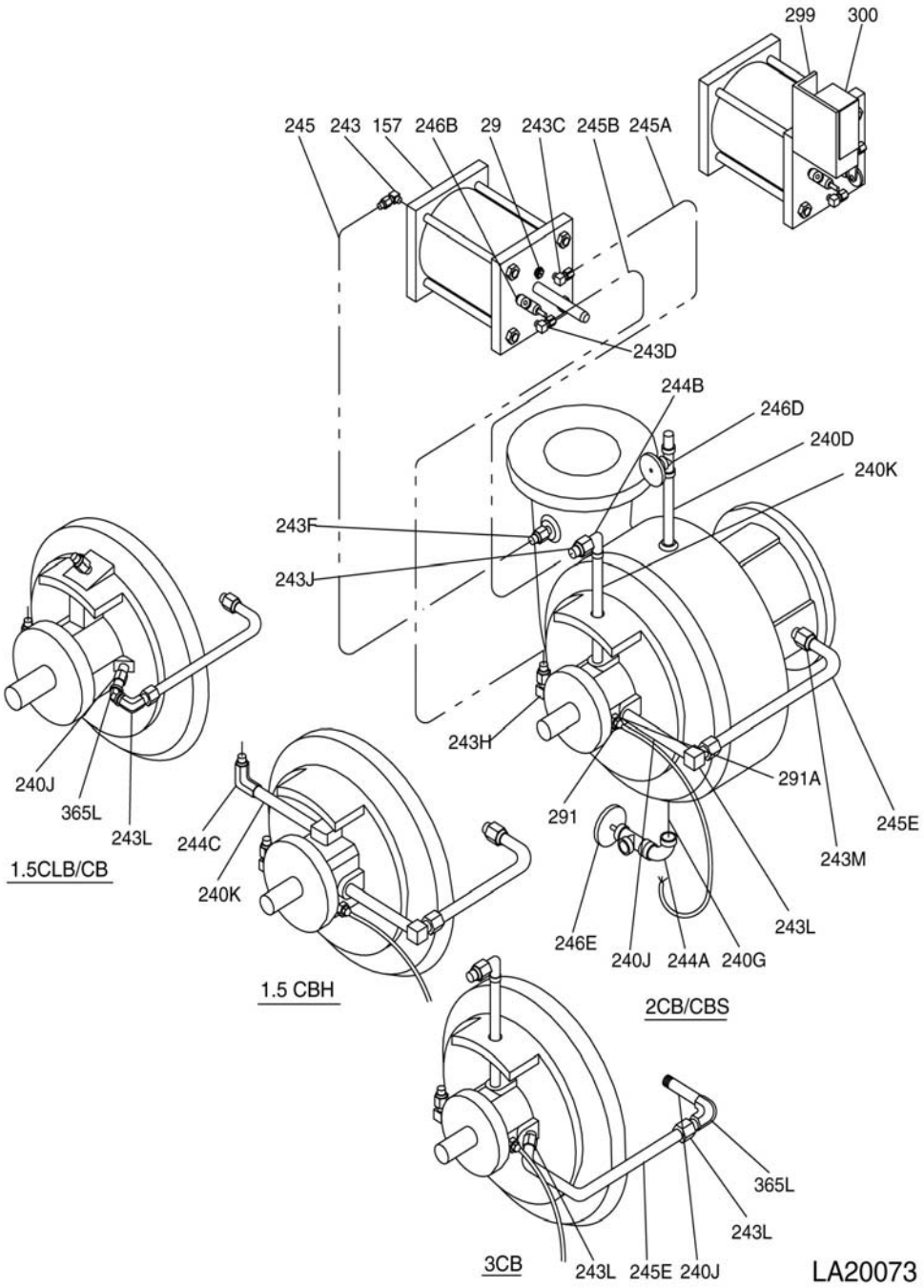
   Never use belt dressing.
8. Give belts a few days running time to become seated in sheave grooves, then readjust take-up.
9. Store belts in clean, cool, dark place.

**WARNING**

All rotating parts should be properly protected. Guards should be installed to prevent the operator from coming in contact with shafts, drives, or other rotating elements. Do not operate pumps when the guards are removed.

# CORNELL CB SERIES RESERVOIR ASSEMBLY

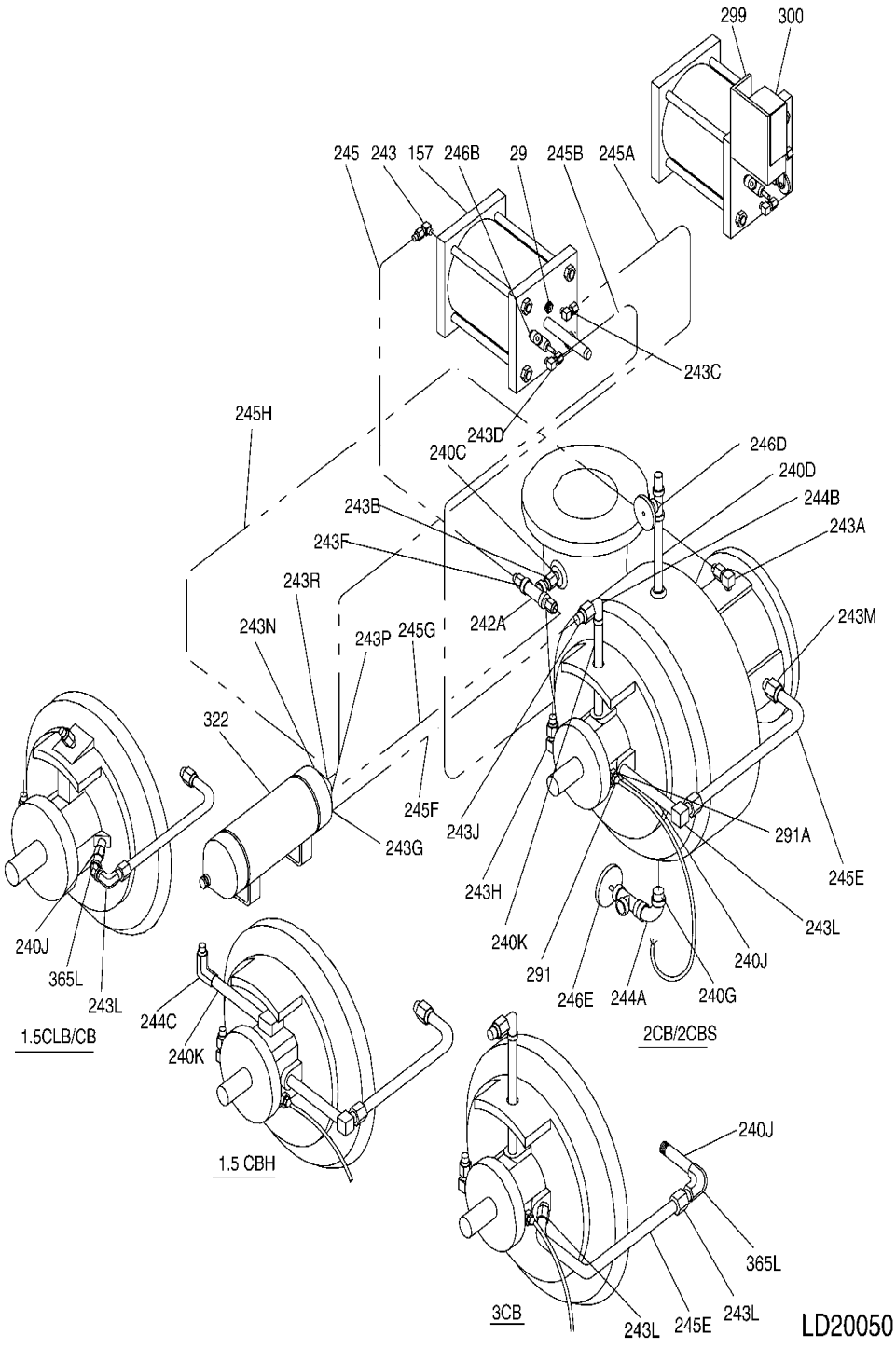
29. BLEED VALVE
157. OIL RESERVOIR
240D. NIPPLE
240G. NIPPLE (*)
240J. NIPPLE
240K. NIPPLE
243. TUBE FITTING
243C. TUBE FITTING
243D. TUBE FITTING
243F. TUBE FITTING
243H. TUBE FITTING
243J. TUBE FITTING
243L. TUBE FITTING
243M. TUBE FITTING
244A. ELBOW (*)
244B. TUBE FITTING
244C. TUBE FITTING
245. TUBING
245A. TUBING
245B. TUBING
245E. TUBING
246B. ANGLE VALVE
246D. GLOBE VALVE
246E. ANGLE VALVE
291. HEATER
291A. HEATER WELL
299. SWITCH BRACKET
300. SAFETY SWITCH
365L. ELBOW




***Not used on model 1.5CBH**

# CORNELL CB SERIES RESERVOIR ASSEMBLY WITH HEAT EXCHANGER

29. BLEED VALVE
157. OIL RESERVOIR
240B. NIPPLE
240C. NIPPLE
240D. NIPPLE
240G. NIPPLE (*)
240J. NIPPLE
240K. NIPPLE
241. BUSHING
242A. TEE
243. TUBE FITTING
243A. TUBE FITTING
243B. TUBE FITTING
243C. TUBE FITTING
243D. TUBE FITTING
243F. TUBE FITTING
243G. TUBE FITTING
243H. TUBE FITTING
243J. TUBE FITTING
243L. TUBE FITTING
243M. TUBE FITTING
243N. TUBE FITTING
243P. TUBE FITTING
243R. TUBE FITTING
244A. ELBOW (*)
244B. TUBE FITTING
244C. TUBE FITTING
245. TUBING
245A. TUBING
245B. TUBING
245E. TUBING
245F. TUBING
245G. TUBING
245H. TUBING
246B. ANGLE VALVE
246D. GLOBE VALVE
246E. ANGLE VALVE
291. HEATER (optional)
291A. HEATER WELL
299. SWITCH BRACKET
300. SAFETY SWITCH
322. HEAT EXCHANGER
365L. ELBOW




***Not used on model 1.5CBH**

**NOTE:**
**For units equipped with heat exchanger, contact the Cornell factory and provide serial number. Fittings will vary from pump to pump.**

# SEAL LUBRICANT OIL RECOMMENDATIONS

**CAUTION**

Use of oils with ISO viscosity grades or pour points higher than recommended on this page may result in seal failure and voiding of the warranty.

Remember, refrigeration compressors operate at high temperatures and require higher viscosity oils. Refrigeration liquid pumps operate cold, and lower viscosities are required; ISO viscosity grade 68 compressor oils are not suitable. For pumpage temperatures below 32°, Cornell Pump Company recommends the following:

**Conoco Refrigerant Compressor Oil 15**

Viscosity at:
- $100^0$F - 83.2 SSU
- $210^0$F - 36.7 SSU
- $40^0$C - 15.1 cSt
- 100°C – 3.1 cSt

Pour point: $-60^0$F
Available in one gallon cans from Cornell Pump Company.

**CAMCO 4600-15**

Viscosity at
- 100°F - 18.2 cSt
- $210^0$F - 3.9 cst

Pour point: –97°F
For nearest distributor, call CAMCO at 763-205-0828.

This list is not exhaustive. Refrigeration oils with ISO viscosity grades 15 or 22 and pour points of $-60^0$F or lower from manufacturers not listed may be suitable. User must determine compatibility of any oils used with other equipment in the refrigeration system.

For pumpage temperatures $32^0$F or higher only, Cornell Pump Company recommends the oil listed above as well as:

**Capella WF32**

Viscosity at $100^0$F 154 SSU
at $210^0$F 41 SSU
Pour point $-40^0$F

Or equivalent ISO viscosity grade 32 or lower refrigeration oil.

# PROCEDURES ON ORDERING A CORNELL PUMP PART

In order to assure the correct parts are supplied, please provide the following information at the time order is placed.

1. **Pump Model**
   Example: 2CB-5-4
2. **Cornell Serial Number**
   Example: #36442
3. **Parts Description**
   Example: Impeller (and impeller trim diameter)
4. **Any Desired Changes to the Pump From What was Originally Supplied**
   (This especially applies to material or impeller trim)
5. **When You Need the Part**
   Example: Four weeks
6. **Special Shipping Instructions**
   Example: Prepaid and add; collect; airfreight; or carrier desired
7. **Any Special Billing Instructions**
   Example: COD
8. **The Design Conditions (see worksheet, page 3000-3)**
   Flow rate: Gallons per minute (GPM)

   Differential Pressure: Required discharge pressure minus pump suction pressure

   Pressure in vessel from which pump takes suction, if not approximately equal to vapor pressure at pumping temperature

   Pumpage temperature

   Pumpage: Ammonia, R-22, R-12, etc.

   Net positive suction head available (NPSHA) or minimum liquid level above pump suction centerline

**Unless Otherwise Specified**

Pricing in the Cornell catalog reflects the current engineering designs. Obsolete or suspended parts may cost more and require additional manufacturing time.

For additional questions, please contact the Cornell Factory.

Cornell Pump Company
16261 SE 130th Ave.
Clackamas, OR 97015 USA
Phone (503) 653-0330
Fax (503) 653-0338

# REFRIGERANT PUMP APPLICATION WORKSHEET

LIQUID PUMPED _____ SPECIFIC GRAVITY _____

GPM _____ LIQUID TEMPERATURE _____ °F

Δ P REQUIRED OF PUMP (3) _____ ☐ PSI ☐ FEET

PRESSURE IN VESSEL _____ ☐ PSI ☐ FEET

IS LIQUID SUBCOOLED _____ ☐ YES ☐ NO

TOTAL DISCHARGE PRESSURE (1) _____ ☐ PSI ☐ FEET

MININUM SUCTION LIQUID LEVEL (5) _____ FEET

If available, the following information provides Cornell with a double check on design flow rate in order to assure the best possible pump selection.

Design recirculation rate (example: 4:1, 3:1, etc.) (4) ____

_____TONS AT_____ $^0$F EVAPORATING

_____TONS AT_____ $^0$F EVAPORATING

_____TONS AT_____ $^0$F EVAPORATING

_____TONS AT_____ $^0$F EVAPORATING

_____TONS AT_____ $^0$F EVAPORATING

_____TONS AT_____ $^0$F EVAPORATING

**NOTES:**

1. $\mathbf{P_d}$ is total pressure required or measured at pump discharge.
2. $\mathbf{P_s}$ is pressure measured at suction flange of pump (approximately the pressure in the vessel).
3. **Δ P** is the pressure boost required of the pump ($\mathbf{P_d - P_s}$).
4. **Recirculation rate** is the ratio, by weight, of liquid supplied to an evaporator to vapor leaving the evaporator.
5. **NPSHA** is the amount of liquid (vertical height) over the horizontal suction centerline of the pump, less suction piping losses.

FOR YOUR NOTES:

# PUMP TROUBLES, THEIR CAUSES AND THEIR CORRECTIONS
# REFRIGERANT PUMPS

| Problem | Probable Cause | Corrective Measure |
|---|---|---|
| Loss of prime at start up | Vent line has liquid trap, preventing gas movement to separator. | 1. Slope the vent line from the pump to the separator so all horizontal portions have slope with no sagging, which could cause a liquid trap. |
| | Vent line feeds to another line instead of directly into separator | 2. Vent piping should be directly into separator above the maximum liquid level. If lines are combined, arrange valves and slopes so pump being primed has no liquid in vent line and has separator pressure. |
| | Vent line closed. | 3. Open valves. |
| | Pump started before completely filled with liquid or before cooled down. | 4. Follow "Start-up Instructions" carefully and allow ample time for system to balance and pump to cool down |
| | Pump started with discharge valve fully open. | 5. Throttle discharge valve at start up to almost shut-off and open it very gradually. Maintain pressure just less than shut-off pressure. |
| | Suction valve not fully open or partly plugged. | 6. Open valve. Compare vacuum gage readings at pump suction and at separator when pump is running (but before it loses its prime). Reading at pump adjusted for liquid level in separator should be almost same as separator pressure. |
| Loss of prime while pump is running | System demand reduced to zero because all coil, etc., shut-off. Pressure gage goes to shut-off pressure and loss of prime is slow. | 7. Energy used to circulate liquid within the pump raises temperature of liquid until it boils and forms gas at eye of impeller. Open the valve in the by-pass line. Make sure the by-pass line does not contain a relief valve (which would normally be closed). A minimum flow of approximately 10 GPM is required to keep NPSHR down. |
| | System demand increased (as after a defrosting cycle), raising the NPSH required above the maximum NPSH available. | 8. Make suction line as large as pump suction and use low loss valve, properly located. Change system cycling to avoid periods of high capacity pumping. Install flow control to limit flow so NPSH available will be greater than NPSHR. Raise minimum level in separator or raise separator. |
| | Compressor lowers pressure in separator (for a fast temperature draw down) to a point where pressure in the suction piping is lower than the vapor pressure of the liquids. This results in instant boiling. | 9. Reduce rate of temperature draw down.<br>10. Frequently temperature draw down and increased system demand occur together after defrost and combined corrective measures are required. |

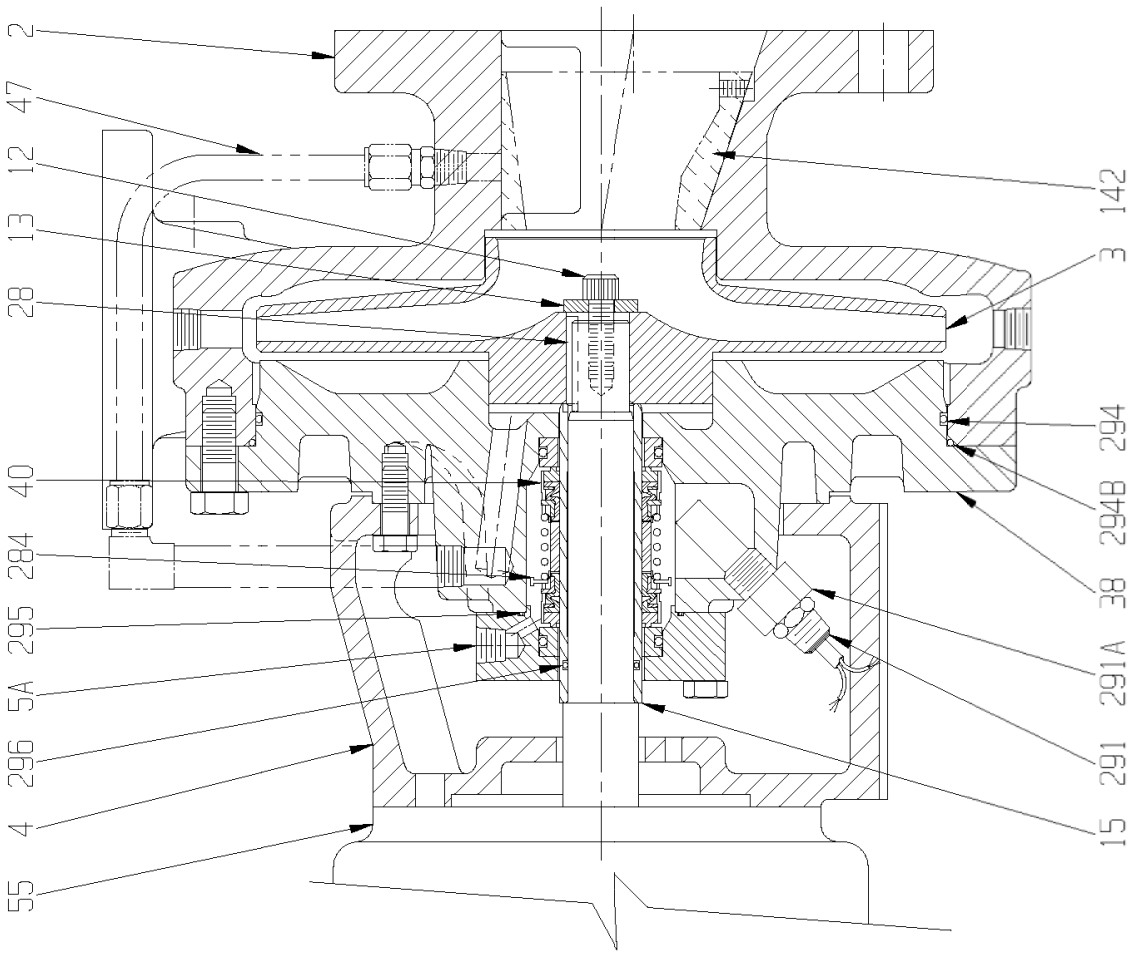
| | | |
|---|---|---|
| Re-priming difficult | One of a combination of above probable causes. | 11. When as many of the above measure as practical have been tried without success, an ejector system may be of assistance. For information on this, consult the factory. |
| Low pressure | Over capacity if a new system or if system has been changed. | 12. Check amperage and voltage. Compare with normal power demand. Higher capacity will require higher power. Evaluate system requirement. |
| | Plugged pump vane(s) | 13. Check power – lower if less liquid being pumped. Clean impeller. |
| | Restricted suction system. | 14. Make vacuum gage check as for Corrective Measure #6 and power check. |
| | Oil in pump from drop leg or leaking seal. | 15. Check amperage and voltage. Compare with normal power. Oil in pump will increase power requirement and reduce pump capacity, thus reducing refrigeration capability. Drain off the oil. Locate oil source and correct. |
| Motor overloading – new installation | Incorrect rotation. | 16. Check rotation – refer to ”Start-up Instructions.” |
| Motor overloading – existing installation | Pump Selection wrong. | 17. Review system and consult factory. |
| | Oil in pump. | 18. See Corrective Measure #15. |
| Oil leakage at seal gland | Outer mechanical seal is leaking | 19. Replace mechanical seal – see “Operating Instructions.” |
| Oil consumption high | Inner mechanical seal is leaking. | 20. Dismantle pump. After impeller has been removed, look for leakage at inner seal. If leakage is apparent, replace the seal following “Operating Instructions.” If leakage is not apparent, pressurize the reservoir at refrigerant inlet with dry air or nitrogen to normal operating pressure. Connect and run the motor. Leakage may occur only when the pump is running. |
| | Reservoir piston O-ring is allowing oil to leak into the pumpage side. | 21. Dismantle reservoir and examine the cylinder. If it has scratches, replace the cylinder. |
| Mechanical seal failure<br>- Ruptured bellows | Reservoir filled completely full with no reserve for oil expansion. | 22. Stop filling reservoir when indicator rod still projects .75 inch from the reservoir face. |
| - Carbon seal washer pitted | Oil viscosity too great. | 23. Use lightest ice machine oil available and never heavier than grade recommended in “Start-up Instructions.” Make sure the heater is working. Bronze seal washers generally appear to have better pitting resistance, but have greater oil leakage and wear. Some customers have had success with carbide washers running against carbide seats. |

| | | |
|---|---|---|
| - Refrigerant in oil | Sudden system changes causes surges that result in opening the inner seal, allowing pumpage to enter the seal chamber. Refrigerant in the oil degrades lubrication. | 24. Check by-pass line adjustment. If the sudden system changes cannot be eliminated, an external compressed air or nitrogen supply can be used to pressurize the reservoir – consult factory. See also "Corrective Measure #28" (below). |
| - Uneven wear of washer | Shaft may be bent. This can be done when removing the impeller unless extreme care is used. | 25. Shaft should be concentric within 0.002-inch total indicator reading. If shaft exceeds this, it should be straightened. (All shafts are checked at the factory when pumps are built). |
| | Face of bracket or frame may not be square with the shaft. | 26. Face of bracket or frame should be within 0.004-inch total indicator reading. If this amount is exceeded, consult factory. |
| | Piping loads have produced strain within the pump – localized wear showing on impeller wear surface. | 27. Check shaft and bracket as above. If these are correct, check piping to be sure it does not place stress on pump when installed and that piping has contraction provision which will prevent stress transfer. |
| - O-ring partly out of seal seat | Sudden system changes cause rapid dynamic pressure variations outside the seal. Seat is pushed into seal chamber far enough for O-ring to be displaced into seal chamber. | 28. Follow "Hydrostatic Test Instructions" and "Start-up Instructions" exactly. In addition, check by-pass line adjustment and liquid level in accumulator. |

PARTS LIST

2. VOLUTE
3. IMPELLER
4. BRACKET
5A. SEAL GLAND
12. IMPELLER LOCK SCREW
13. IMPELLER WASHER
15. SHAFT SLEEVE
28. IMPELLER KEY
38. BACKPLATE
40. MECHANICAL SEAL
47. BALANCE LINE
55. MOTOR
142. SUCTION NOZZLE (CBS ONLY)
284. SEAL PUMP
291. HEATER
291A. HEATER WELL
294. O-RING (BACK SIDE PLATE)
294B. O-RING (BACK SIDE PLATE)
295. O-RING (GLAND)
296. O-RING (SLEEVE)

NOTE: LUBRICATION PIPING NOT SHOWN

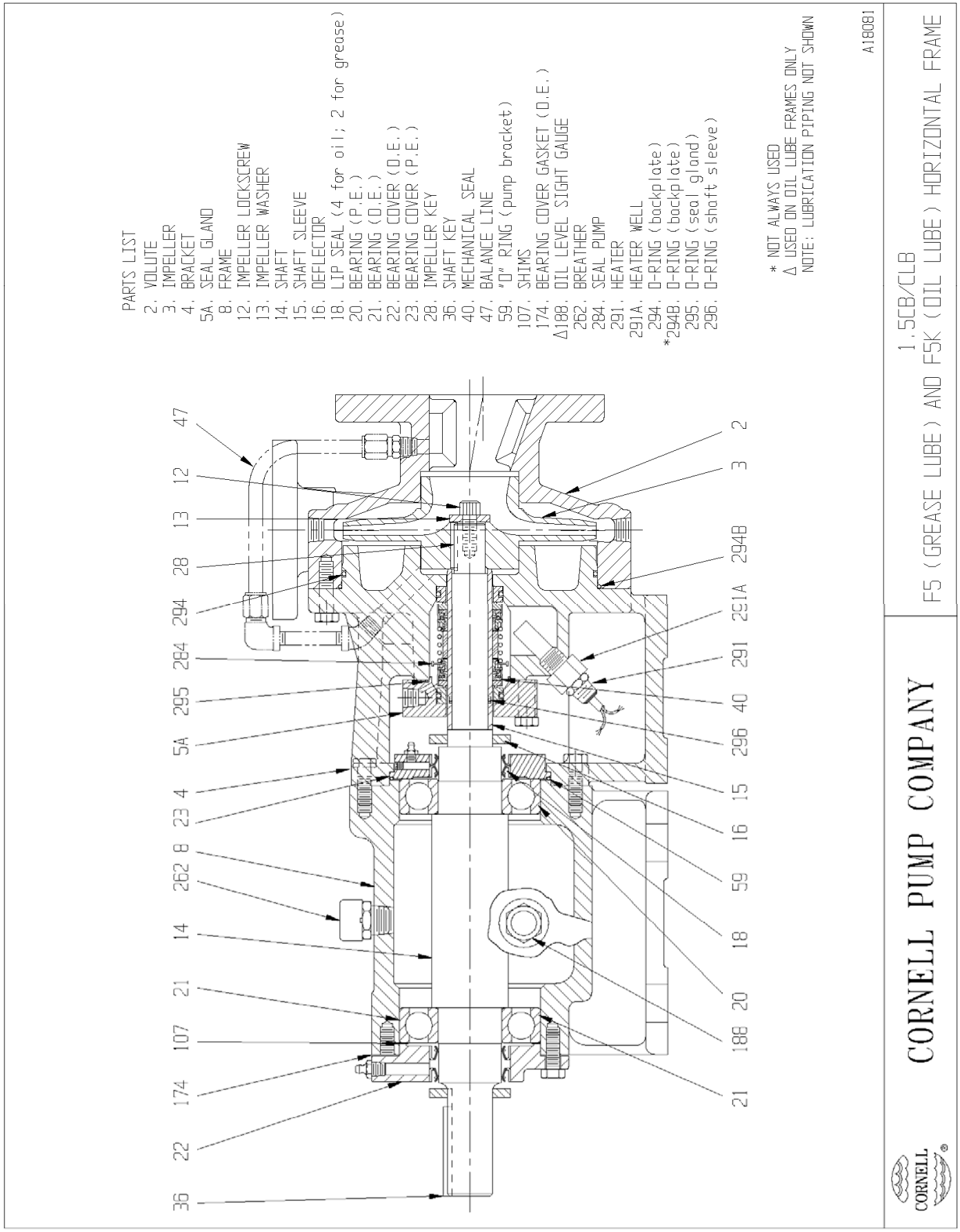


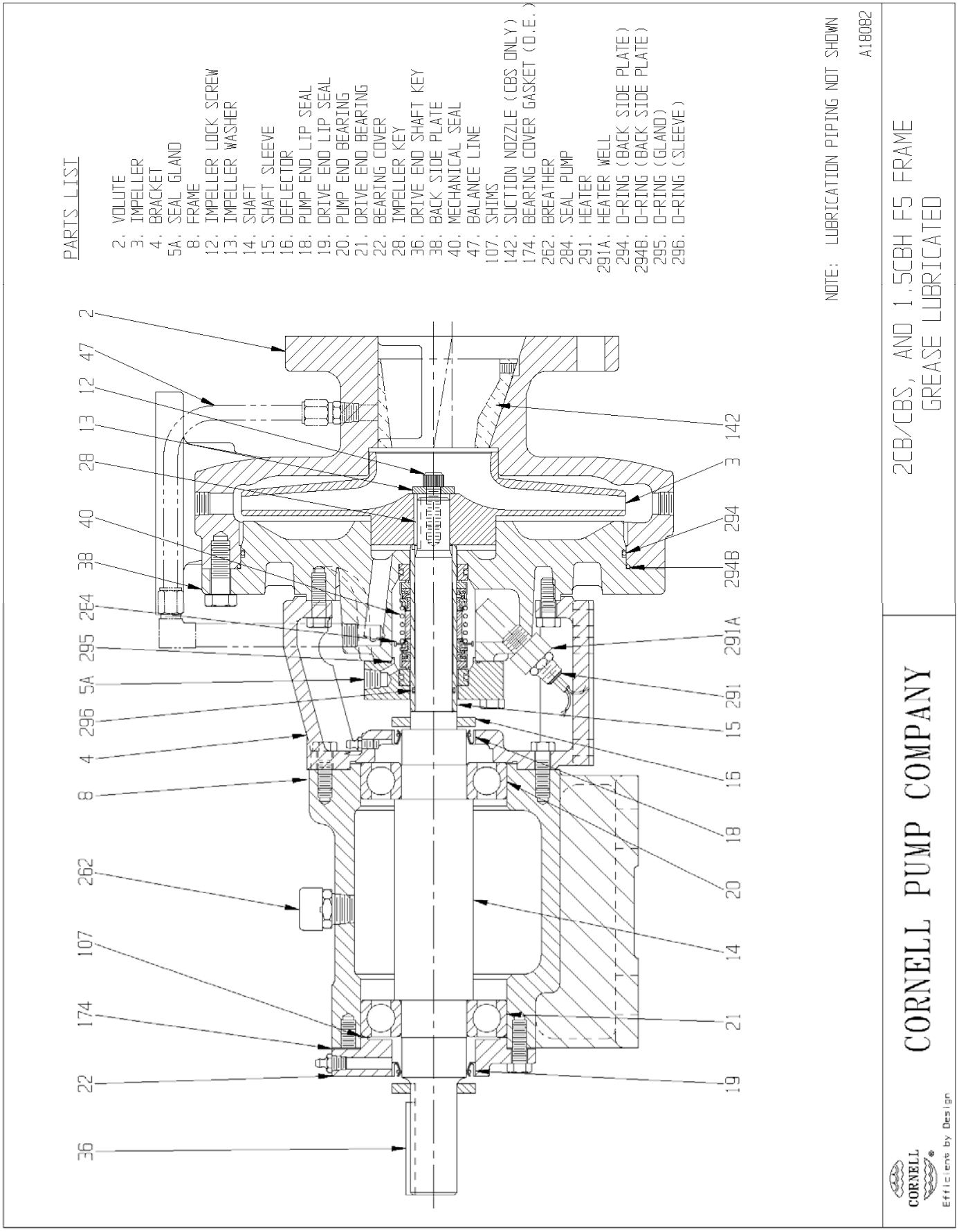

A1B072

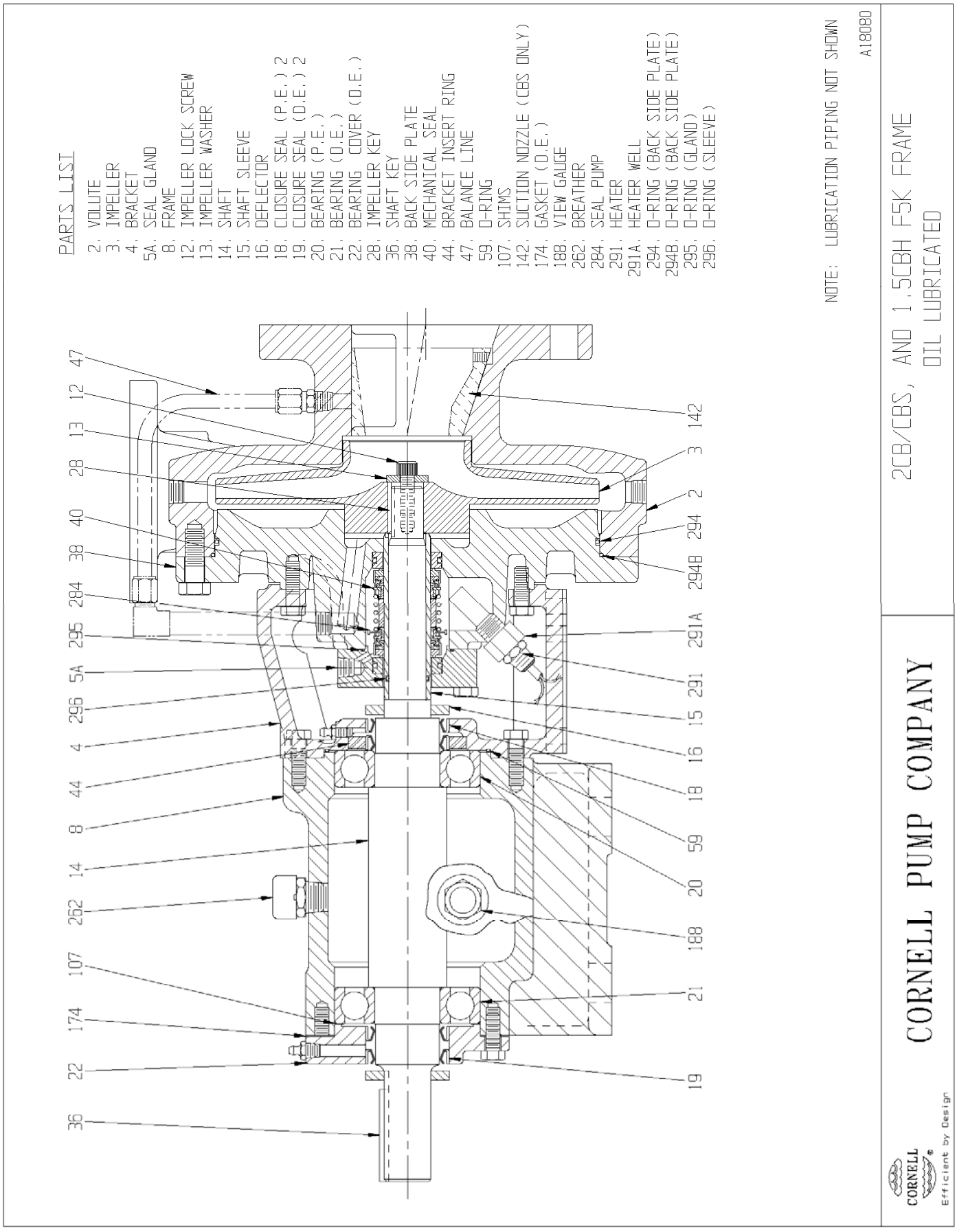
1.5CBH, 2CB/CBS, 2.5CBH, AND 3CB CLOSE COUPLED
ELECTRIC MOTOR DRIVE

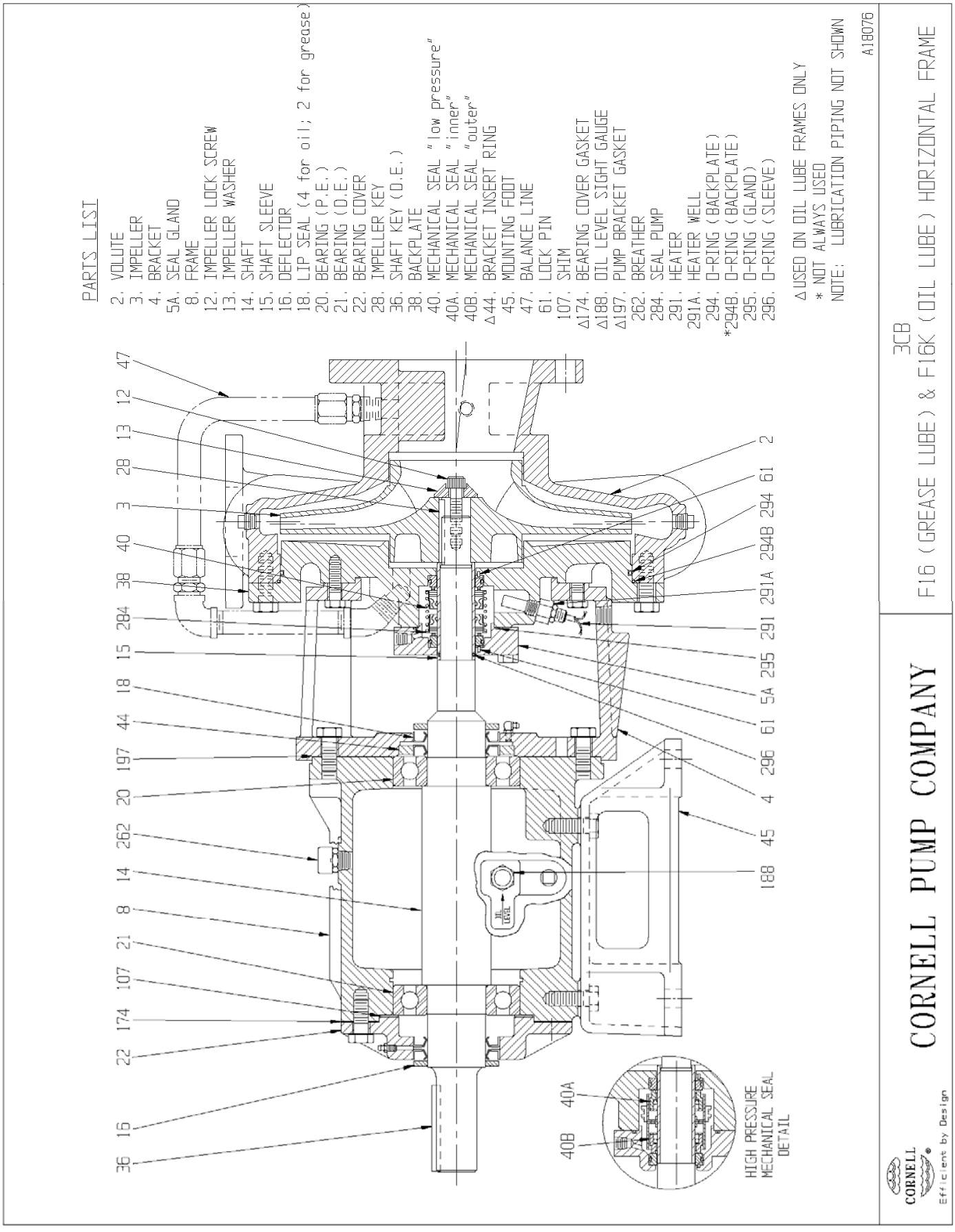
CORNELL PUMP COMPANY

CORNELL
Efficient by Design


PARTS LIST
2. VOLUTE
3. IMPELLER
4. BRACKET
5A. SEAL GLAND
8. FRAME
12. IMPELLER LOCKSCREW
13. IMPELLER WASHER
14. SHAFT
15. SHAFT SLEEVE
16. DEFLECTOR
18. LIP SEAL (4 for oil; 2 for grease)
20. BEARING (P.E.)
21. BEARING (D.E.)
22. BEARING COVER (D.E.)
23. BEARING COVER (P.E.)
28. IMPELLER KEY
36. SHAFT KEY
40. MECHANICAL SEAL
47. BALANCE LINE
59. "O" RING (pump bracket)
107. SHIMS
174. BEARING COVER GASKET (D.E.)
Δ188. OIL LEVEL SIGHT GAUGE
262. BREATHER
284. SEAL PUMP
291. HEATER
291A. HEATER WELL
294. O-RING (backplate)
*294B. O-RING (backplate)
295. O-RING (seal gland)
296. O-RING (shaft sleeve)
* NOT ALWAYS USED
Δ USED ON OIL LUBE FRAMES ONLY
NOTE: LUBRICATION PIPING NOT SHOWN
A18081
1.5CB/CLB
F5 (GREASE LUBE) AND F5K (OIL LUBE) HORIZONTAL FRAME
CORNELL PUMP COMPANY
CORNELL


PARTS LIST
2. VOLUTE
3. IMPELLER
4. BRACKET
5A. SEAL GLAND
8. FRAME
12. IMPELLER LOCK SCREW
13. IMPELLER WASHER
14. SHAFT
15. SHAFT SLEEVE
16. DEFLECTOR
18. PUMP END LIP SEAL
19. DRIVE END LIP SEAL
20. PUMP END BEARING
21. DRIVE END BEARING
22. BEARING COVER
28. IMPELLER KEY
36. DRIVE END SHAFT KEY
38. BACK SIDE PLATE
40. MECHANICAL SEAL
47. BALANCE LINE
107. SHIMS
142. SUCTION NOZZLE (CBS ONLY)
174. BEARING COVER GASKET (O.E.)
262. BREATHER
284. SEAL PUMP
291. HEATER
291A. HEATER WELL
294. O-RING (BACK SIDE PLATE)
294B. O-RING (BACK SIDE PLATE)
295. O-RING (GLAND)
296. O-RING (SLEEVE)
NOTE: LUBRICATION PIPING NOT SHOWN
A18082
2CB/CBS, AND 1.5CBH F5 FRAME
GREASE LUBRICATED
CORNELL PUMP COMPANY
CORNELL
Efficiency by Design


PARTS LIST
2. VOLUTE
3. IMPELLER
4. BRACKET
5A. SEAL GLAND
8. FRAME
12. IMPELLER LOCK SCREW
13. IMPELLER WASHER
14. SHAFT
15. SHAFT SLEEVE
16. DEFLECTOR
18. CLOSURE SEAL (P.E.) 2
19. CLOSURE SEAL (O.E.) 2
20. BEARING (P.E.)
21. BEARING (O.E.)
22. BEARING COVER (O.E.)
28. IMPELLER KEY
36. SHAFT KEY
38. BACK SIDE PLATE
40. MECHANICAL SEAL
44. BRACKET INSERT RING
47. BALANCE LINE
59. O-RING
107. SHIMS
142. SUCTION NOZZLE (CBS ONLY)
174. GASKET (O.E.)
188. VIEW GAUGE
262. BREATHER
284. SEAL PUMP
291. HEATER
291A. HEATER WELL
294. O-RING (BACK SIDE PLATE)
294B. O-RING (BACK SIDE PLATE)
295. O-RING (GLAND)
296. O-RING (SLEEVE)
NOTE: LUBRICATION PIPING NOT SHOWN
A18080
2CB/CBS, AND 1.5CBH F5K FRAME
OIL LUBRICATED
CORNELL PUMP COMPANY
CORNELL
Efficient by Design


PARTS LIST
2. VOLUTE
3. IMPELLER
4. BRACKET
5A. SEAL GLAND
8. FRAME
12. IMPELLER LOCK SCREW
13. IMPELLER WASHER
14. SHAFT
15. SHAFT SLEEVE
16. DEFLECTOR
18. LIP SEAL (4 for oil; 2 for grease)
20. BEARING (P.E.)
21. BEARING (O.E.)
22. BEARING COVER
28. IMPELLER KEY
36. SHAFT KEY (O.E.)
38. BACKPLATE
40. MECHANICAL SEAL "low pressure"
40A. MECHANICAL SEAL "inner"
40B. MECHANICAL SEAL "outer"
Δ44. BRACKET INSERT RING
45. MOUNTING FOOT
47. BALANCE LINE
61. LOCK PIN
107. SHIM
Δ174. BEARING COVER GASKET
Δ188. OIL LEVEL SIGHT GAUGE
Δ197. PUMP BRACKET GASKET
262. BREATHER
284. SEAL PUMP
291. HEATER
291A. HEATER WELL
294. O-RING (BACKPLATE)
*294B. O-RING (BACKPLATE)
295. O-RING (GLAND)
296. O-RING (SLEEVE)
Δ USED ON OIL LUBE FRAMES ONLY
* NOT ALWAYS USED
NOTE: LUBRICATION PIPING NOT SHOWN
A18076
3CB
F16 (GREASE LUBE) & F16K (OIL LUBE) HORIZONTAL FRAME
CORNELL PUMP COMPANY
CORNELL
Efficient by Design
HIGH PRESSURE MECHANICAL SEAL DETAIL
40A
40B
OIL LEVEL