

**VERTICALLY SUBMERGED
LUBE OIL PUMPS
CLASS VCRE**



**Instructions for Installation, Operation,
Disassembly, Inspection and Repairs**

**SERVICE
MANUAL**

**This Equipment Requires Periodic
Lubrication - (see pages 2 and 3)**

Buffalopumps

NORTH TONAWANDA, N.Y. 14120-3298

INTRODUCTION

These instructions cover a line of lube oil pumps with similar mechanical construction. The pump size, horsepower rating, capacity, and other pertinent specification data for a particular pump are contained in the instruction book for the equipment with which the pump is furnished.

Buffalo Pumps Warranty Will Be VOID If Lubrication Instructions Are Not Followed.

DESCRIPTION

These are vertical, submerged, single stage, end suction centrifugal pumps. The pumps may be driven by either a vertical shaft electric motor or gas or steam turbine, referred to in the text as the driver, which is mounted on a stand above the pump cover plate and is connected to the pump shaft through a flexible coupling. Refer to General Service Manual 3321.

INSTALLATION

ALIGNMENT:

1. Alignment between pump and driver must be correct to avoid mechanical trouble. A FLEXIBLE COUPLING WILL ONLY COMPENSATE FOR MINOR MISALIGNMENT. The pump and driver are correctly aligned before shipment. The pump and driver must be realigned prior to initial run, since factory alignment may have been disturbed during shipment and/or installation.

NOTE: Refer to Falk Corporation Service Manual Section 428-210 if equipped with a Falk Steelflex, Type T-20 Coupling. If another make of coupling is used, refer to appropriate instructions.

PIPING:

1. Lube oil pumps are installed on a pad on top of the lubricating oil tank. The user is responsible for connecting piping in a manner that will avoid pipe strains.

2. In the case of turbine driven pumps, provisions must be made to prevent temperature strains from being imposed on the turbine flanges.

OPERATION

PRIMING:

To prime this pump be certain that the oil level in the sump is 6 inches above the centerline of the pump casing. DO NOT RUN THE PUMP DRY. If the pump is run dry, it will be damaged. The lube oil tanks in which these pumps are installed should have an oil level indicating or alarm device to protect against low oil supply.

ROTATION:

Note the correct direction of rotation usually indicated by an arrow on the pump cover plate. "Bump" the motor electrically to check rotation prior to starting. If necessary, change the wiring to obtain correct direction of rotation.

INITIAL STARTING:

1. Before starting the pump for the first time after installation or overhaul, it is important to check the following:
 - a. Driver control operating instructions.
 - b. Coupling alignment.
 - c. Proper Lubrication of thrust bearing (27) and driver bearings (do not overgrease).
 - d. Check all connections for leaks.
 - e. Oil level in sump. It must be at least 6" above the centerline of the pump casing.
 - f. Cleanliness of the liquid and the pumping system.The piping and pump must be free from all foreign material that may tend to wedge in lower sleeve bearing (11B) or between wearing rings (9) and/or (10) and impeller (3).

NORMAL STARTING PROCEDURE:

1. Close the discharge control valve.
2. Start the drive.
3. Open the discharge control valve as soon as full speed is reached.

NORMAL STOPPING PROCEDURE:

1. Close the discharge control valve.
2. Stop the driver.

Proper Thrust Bearing Lubrication is CRITICAL!

MAINTENANCE

LUBRICATION:

The pump is initially assembled with Mobilgrease 28. The bearings should be re-lubricated with Mobilgrease 28 or equal.

CAUTION: GREASES ARE NOT COMPLETELY COMPATIBLE AND INTERCHANGEABLE IN ALL CASES. WHEN CHANGING FROM ONE TO ANOTHER, PURGE THE OLD GREASE COMPLETELY USING A CLEAN SOLVENT SUCH AS KEROSENE.

RE-LUBRICATION:

Special care must be taken when cleaning bearings. Dirt and other foreign substances will quickly destroy bearings. The bearing should be removed from the shaft and be thoroughly flushed with a clean solvent such as kerosene, then dried prior to re-lubrication. To re-lubricate the bearing, hand pack it full of Mobilgrease 28 or equal.

WARNING: DO NOT OVERGREASE

Normal re-lubrication periods are:

3550 rpm each 2000 hours of operation

1750 rpm each 4000 hours of operation

Time alone causes deterioration in grease. It is good practice to flush and re-lubricate all bearings on a yearly basis even if the re-lubrication interval has not been reached. Under no circumstances should a synthetic grease be mixed with an organic grease. They may not be compatible and may accelerate bearing failure.

REPLENISHMENT:

Replenishing grease is recommended to maintain a consistent volume of lubricant in the bearing. To replenish using the grease cup fitting (32A), remove grease cup fitting cover, fill with grease and thread cover on fitting full length of travel to inject 1/2 ounce of grease. One half ounce is the required volume to replenish the grease sufficiently. Do not remove and refill until next interval.

WARNING DO NOT OVERGREASE

Normal replenishment periods are:

3550 rpm each 1000 hours of operation

1770 rpm each 2000 hours of operation

DISASSEMBLY: (Refer to figures 1 & 2)

Disconnect all electrical connections if an electric motor is used, or inlet and exhaust piping for a turbine. Follow lockout/tagout procedures.

PUMP

1. Disconnect discharge pipe and remove cover-plate bolts. Remove the pump from the tank. A small quantity of oil trapped in internal passages will run out when the pump is removed from the tank. Remove the casing drain plug (74) and let oil drain back into supply tank.
2. Remove bolts (102) and lockwashers (124) holding strainer (59) to casing (2). Remove strainer (59).
3. Remove discharge pipe bolts (108), lockwashers (124), and nuts (109A). Break seal at discharge flange.
4. Remove oil circulation line (76) by loosening tube fittings (78). Do not allow the line to kink as it is used to lubricate the bearing and must be free of restrictions.
5. Loosen cap screws (102). Swing lugs (240) 90° out of contact with casing cover (6) and secure them by lightly tightening cap screws (102).
6. Tighten jack screws (242) evenly and break joint between casing cover (6) and casing (2). Remove casing (2).

7. Remove tru-arc, retaining ring (83).
8. Remove impeller locking nut (15) and washer (16).
9. Remove impeller (3) and feather key (17B). Impeller will normally slide off the shaft without using appreciable force. A little heat applied to the impeller hub may be beneficial. DO NOT HAMMER on the impeller under any circumstance. If use of a puller is required, be certain pull is even, steady at the impeller vanes and parallel to the shaft axis, in order to avoid damage to shaft or other parts. Pressure balance holes may be tapped so jack screws can be used. (This is an emergency procedure to be used only when other means are either not available or are ineffective).
10. Remove cap screws (102E).
11. Remove casing cover (6) with guide bearing (11B) from connecting pipe (50).

LOWER GUIDE BEARING (11B)

1. This bearing is located in casing cover (6) and if necessary may now be removed. Remove cap screw (102), lockwasher (124), and retaining clip (238B). Guide bearing (11B) is now free and may be removed. If the bearing is to be reused, it is suggested that it not be removed from the casing cover. Suitability for reuse may be determined by visual inspection of bearing surfaces and examination of clearance between shaft (7) and bearing (11B). The lower guide bearing should be replaced when diametrical clearance is double the initial value of 0.008 inches.

UPPER THRUST BALL BEARING (27)

The following procedure should be followed for disassembly of pumps as shown in Sectional Drawing Figures 1 & 2.

1. Remove pump half of coupling (68). This may require use of a puller. If a puller is used, be certain pull is even, steady, and parallel to the shaft to avoid possible damage to the shaft or other parts.
2. Remove cap screws (102C). Connecting pipe (50) with shaft (7) and upper bearing (27) is now free of motor stand (56) and may be removed.
3. Remove cap screws (102A), bearing cover (24), and gasket (65D). Tab in bearing lockwasher (28) may now be disengaged and bearing locknut (29) removed.
4. Remove shaft (7) with bearing assembly (27) from connecting pipe (50).
5. Remove bearing (27) from shaft (7) with a shop press. Remove spacer(s) (41) and save them for possible reuse.

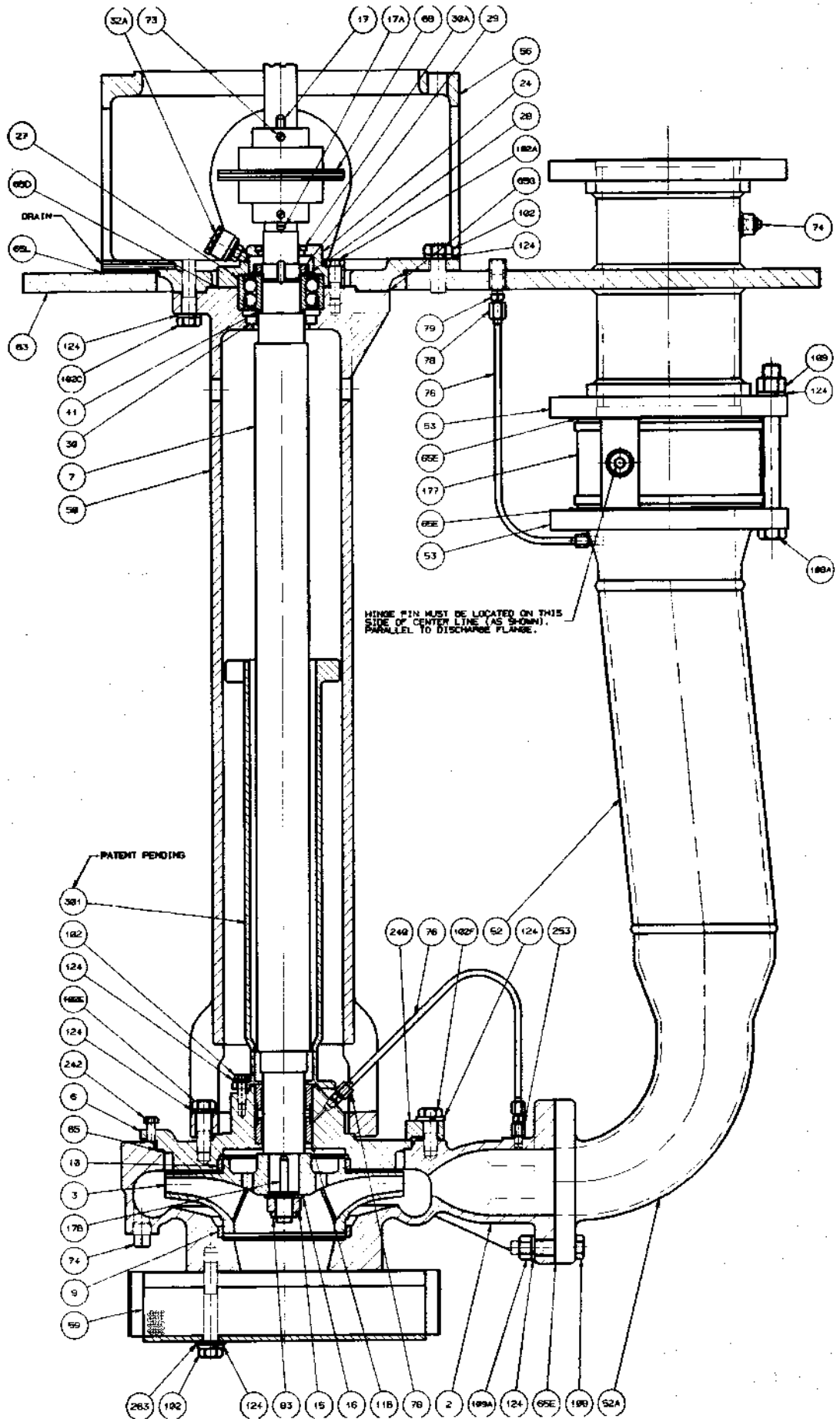


Figure 1. VCRE Vertical Lube Oil Pump with Fabricated Motor Stand and Flat Suction Strainer

NOTE: Refer to Falk Corporation Service Manual Section 428-210 if equipped with a Falk Steelflex, Type T-20 Coupling. If another make of coupling is used, refer to appropriate instructions.

6. Bearing seals (30) and (30A) should be removed and replaced

INSPECTION BALL BEARING

If ball bearing (27) is removed from the shaft, it should be replaced with a new bearing at reassembly, except in case of an emergency. If it is to be reused there must be no excess play between the balls and races, free running, not corroded, or heat discolored.

WEAR RINGS (9) AND (10)

Wearing ring (9) located in pump casing (2) and wearing ring (10) located in casing cover (6) will require replacement if diametral clearance has increased to 0.032 inches and/or if pump performance has been affected. The clearance is .012-.018 when pump is new. Wearing rings must be destroyed to remove them. Bronze rings should be drilled on opposite sides, split and removed in pieces. Graphitar rings should be broken out with a chisel or punch and hammer. **DO NOT DAMAGE HOUSING BORES.**

IMPELLER:

1. If impeller wearing journals are worn and scored, rings may be fitted to re-establish original diameter. Refer to factory.

2. Impeller must be dynamically balanced to within 0.2 ounce in or 1 mil peak to peak. Remove metal from the face of the shrouds near the O.D. as necessary by grinding and blend into the surrounding surface.

SHAFT:

Shaft (7) should be mounted in a lathe and checked for trueness with a dial indicator. It must be true within 0.002 inches TIR at bearing seats and within 0.005 inches TIR over entire shaft.

REASSEMBLY

1. Install wearing rings (9) and (10) in their respective bores in the casing (2) and casing cover (6).

Replacement wearing rings (9) and (10) may be either bronze or carbon-graphite regardless of the original material used. If bronze rings are used, clean and coat ring seats with a light film of oil. Tap the rings into place with a resilient mallet. After installation of rings in seats, check diameters (I.D.) at quarter points on rings and corresponding impeller surfaces to be sure clearances are correct. Bore these rings out if necessary to obtain the desired clearance. If carbon-graphite wearing rings

are used, clean the ring fit and wearing ring O.D. thoroughly to remove oil or foreign matter. Treat these surfaces with Locquick Primer Grade T or equal and then lightly coat with High Strength Loctite Grade 620 or equal. Slide the wearing rings in the casing and casing cover. Wipe away any excess sealant and allow to cure before proceeding.

2. Tap bearing seal (30A) into bearing cover (24) using a resilient mallet. Lubricate the sealing lip with bearing grease.

3. Slide bearing bushing (11B) in casing cover (6) and secure it with retaining clip (238), lockwasher (124) and cap screw (102).

4. Attach casing cover (6) to connecting pipe (50) with cap screws (102E), being sure the rabbet fit is properly engaged so that the gasket seat is square with the axis.

CAUTION: Be sure 1/8" vent through the casing cover inside the balance chamber is provided and clear.

5. Before mounting parts on the shaft, clean shaft and parts thoroughly. Apply clean machine oil to the shaft surface on which the part is to be mounted.

6. Check the ball thrust bearing (27) fits for wear especially if a bearing has failed. It should slide snugly into the bore in the connecting pipe (50) and have an interference fit on the shaft (7).

7. Slide shaft into connecting pipe (50) through the throat at the thrust bearing end and carefully enter it through the bearing bushing (11B). Lubricate the sealing lip on bearing seal (30) and tap into the upper connecting pipe flange using a resilient punch.

8. Tap the impeller feather key (17B) into the keyway in the shaft (7) being sure it does not extend beyond the shoulder at the thread.

9. Line up the key and keyway in the impeller (3) and slide or tap it onto the shaft all the way to the shoulder. Secure the impeller with the washer (16), locknut (15) and retaining ring (83).

10. Determine the required thickness for the spacer (41) such that the axial clearance between the casing cover (6) and impeller is 3/32" to 1/8". This is important to control axial bearing load. A piece of keystock can be used to make a tool for this purpose. Grind the ends so it will drop into the bearing bore in the connecting pipe and rest on the shoulder at the bottom of the bore while being close to the bearing seat on the shaft. Set the impeller at its proper location and measure the distance between the bottom of the bearing bore and shaft shoulder below the bearing. This then is required thickness

of spacer (41).

Have various thickness of steel or brass spacers (1/32, 1/16, 1/8) on hand as follows:

LO-1 - 1 1/2 OD 1.185/1.190 ID

LO-2 - 2 1/8 OD 1.775/1.780 ID

The required thickness should be between 1/8" & 1/4".

11. The thrust bearing (27) must be packed with grease prior to assembly. The upper bearing cavity (inside bearing cover) (24) should also be 1/3 filled with grease prior to slipping the bearing cover on the shaft. DO NOT pack the lower bearing cavity in connecting pipe (50).

12. Lubricate the bore of the ball thrust bearing (27) with light machine oil and press it onto the shaft using even contact on the inner race only from a shop press. Be sure it is all the way on and firmly against spacer (41).

13. Install the bearing lockwasher (28) and locknut (29). Be sure the locknut (29) clamps the inner race of the ball thrust bearing (27). Bend one tab on lockwasher (28) fully into a mating slot on locknut (29).

14. Bearing cover (24) must limit end play to within .003 - .005 inches and also provide a water tight seal against gasket (65D). Install the bearing cover (24) with the proper thickness gasket (65D) (usually between .008" to .032" thick) under it and secure it with cap screws (102A). IF OUTER RACE IS CLAMPED, BEARING TENDS TO OVERHEAT.

15. Install grease cup (32A).

16. Tap coupling key (17A) into the keyway in shaft (7) and slide pump half coupling (68) onto shaft (7) and, tighten the set screw (73).

17. Join the pit cover-motor stand (56) to the connecting pipe with lockwashers (124) and cap screw (102C).

18. Cement gaskets (65 & 65E) in place on the casing (2). Use Permatex "HIGHTACK" or equal. Take scale measurements to be sure the wearing ring will engage the impeller journal by at least 3/16".

19. Install casing (2) and secure with bolt lugs (240) and capscrews (102F). Install and tighten discharge flange bolts (108), lockwashers (124) and nuts (109A).

20. Install oil circulation line (76) with fittings (78).

21. Install strainer (59) and secure it with lockwasher (124) or locking plates (131) and bolts (102).

22. Rotate pump rotor by hand. It should rotate freely.

23. Tap coupling key (17) into the keyway in the motor shaft and slide coupling half (68) on the driver and bolt the driver to the pit cover-motor stand. Align the coupling in accordance with previous instructions and General Service Manual 3321.

24. Install the assembled unit in the tank and connect the discharge pipe. Recheck the coupling alignment. Make the electrical connections. Bump the motor electrically and check for proper rotation.

HANDLING PROCEDURE

WARNING: Make sure that all lifting devices (slings, chains, crane) are in good condition, and that the weight of the pump is within the safe weight which can be supported by the lifting device.

1.0 GENERAL:

1.1 The proper handling of vertical submerged pump assemblies in the shop and jobsite is important so that damage to the pump does not occur.

1.2 It must be remembered that a vertical submerged pump is a precision-machined and balanced assembly that must be handled with reasonable care during shipment and jobsite installation to avoid mechanical start-up problems.

2.0 LIFTING:

2.1 Lifting of vertical submerged pump assemblies involves the use of cranes, slings, chains, etc.

2.2 Prescribed lifting mechanisms or points should be used whenever possible.

2.3 If lifting mechanisms are not provided (or cannot be used), lifting should be accomplished with lifting slings placed so as to prevent stress concentrations or bending. **Do not use flange holes as lifting points.**

2.4 *Vertical submerged pump assemblies should be lifted from packing crates using two slings, each centered to properly balance the pump assembly weight.*

NOTE: The motor lifting lugs alone must not be used to lift the entire pump assembly. They are used to lift the motor only from the pump assembly.

2.5 *Submerged pump assemblies should be installed into the sump pit by lifting at the coverplate eyebolts (if furnished) and/or with slings located at the motor stand, as well as at the center of the connecting column assembly (1/2 the distance from the coverplate bottom to the pump end) as necessary.*

2.6 Reasonable care must be exercised during this operation to prevent bending damage to the connecting pipe assembly, internal bearings and shaft.

3.0 MOVING:

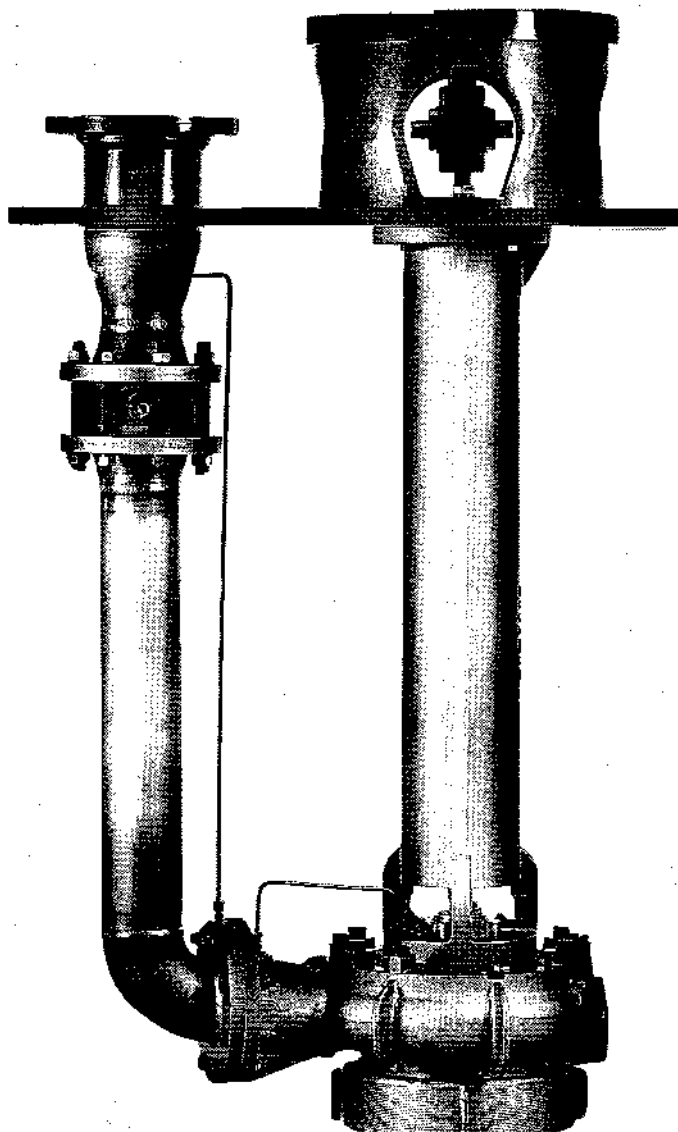
3.1 Moving of vertical submerged pumps involves the use of skids, fork lift or other mobile equipment.

3.2 Vertical submerged pump assemblies must always be placed on a wooden skid, properly supported and securely positioned or locked in place. The use of wooden blocks is recommended so as to prevent parts from being damaged and/or bent.

3.3 Lifting of vertical submerged pumps and placement onto skids should be done in reverse sequence of Paragraph 2.4 above.

3.4 Skids are normally moved using fork trucks or tow-motors. Care must be taken not to jolt or drop skidded equipment, since internal part damage could result.

**VERTICALLY SUBMERGED
LUBE OIL PUMPS
CLASS VCRE**



This vertical, submerged, single stage, end suction centrifugal pump. The pump may be driven by either a vertical shaft electric motor, gas, or steam turbine. For specifications please refer to bulletin 986.

SALES REPRESENTATIVES

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