FLYGT

FLYGT CORPORATION

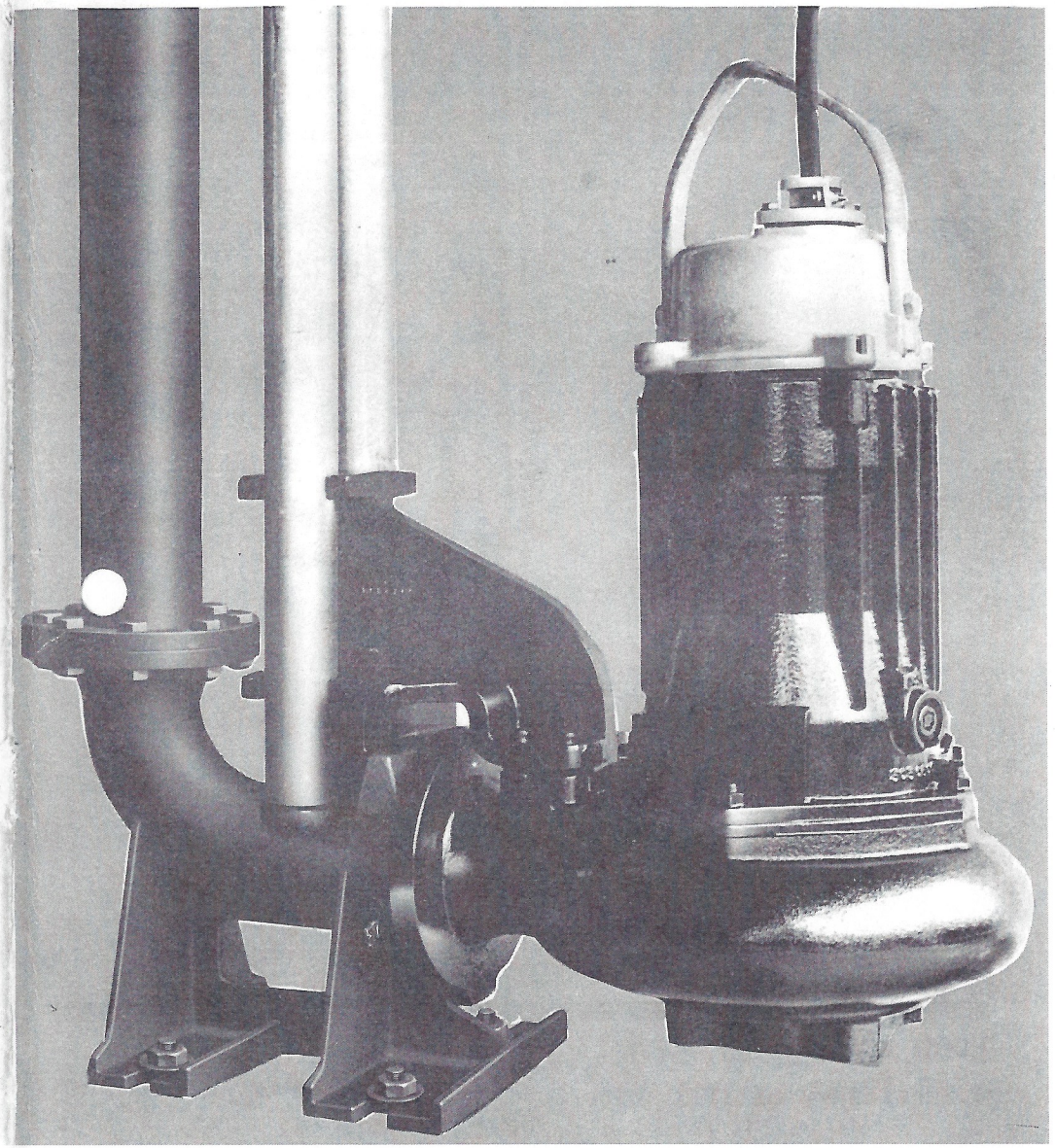
A Subsidiary of ITT

R6-1973-09 FC7102-1M

FLYGT

C-3082

Instruction and maintenance manual



NOTES

(Second Printing)*

CONTENTS

DESCRIPTION & SPECIFICATIONS

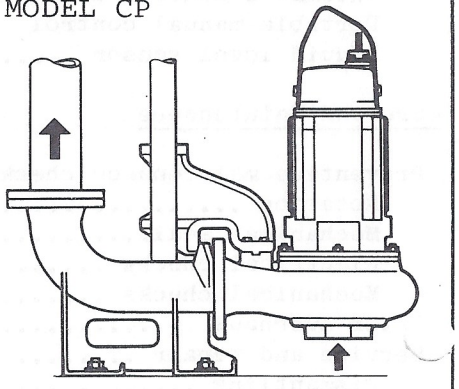
Description of CP, CT and CS models.

This manual refers to the following electric submersible centrifugal pumps: CP 3082, CT 3082 and CS 3082, 4 pole (1750 rpm) and 6 pole (1150 rpm). For converting one model into the other, see appropriate charts in separate Parts List.

CP 3082

This is a semi-permanently installed sewage pump delivered with lifting chain, intended to work entirely or partly submerged in a wet pit. The pump can be simply hoisted out of the sump for inspection without entering the pit or disconnecting any piping.

Fig. 1
MODEL CP



At the bottom of the chamber there is a discharge connection bolted to the floor, with a flange. The discharge flange on the pump matches the flange of the discharge connection and connects (or disconnects) automatically when the pump is lowered (or raised) along the guide rails in the sump.

Accessories: Access Cover with Upper Guide Bracket, Chain Hook and Cable Holder, Control Center and Liquid Level Sensor.

Weights: Pump & Sliding Bracket 216 lbs., Discharge Connection 77 lbs.

NOTES

3. Poor hydraulic performance:
   Pump undersized.
   Partially closed valve.
   Reverse rotation.
   Obstruction in pump or piping.
   Unsuitable liquid.
   Worn impeller: O-ring.
   Wear ring.
   Volute.

4. Oil in stator housing:
   Damaged or improperly assembled upper seal.

5. Water in stator housing:
   Loose or damaged inspection plug assembly.
   Stator housing O-ring (lower) leaks.
   Drainage from leaky junction box.

6. Water in junction box:
   Damaged cable jacket.
   Damaged or improperly tightened cable entry.
   Damaged or improperly seated junction box cover O-ring.
   Excessive depth of immersion. (160 ft. max.)

7. Oil and water in stator housing:
   Water in oil housing together with damage to upper seal.

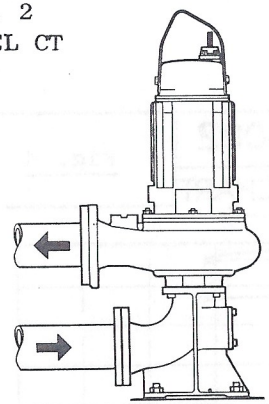
8. Water in oil housing:
   Damaged or improperly assembled lower seal.
   Loose or damaged oil plug assemblies.
   Excessive Vibration.
   Excessive discharge pressure from improper tandem operation.
   Leaking upper oil housing O-ring.

9. Pumps run separately but not together. (Duplex operation):
   Damage to either "lead pump on" or "lag pump on" sensor.

For spare parts see separate Parts List.

CT 3082

Fig. 2
MODEL CT



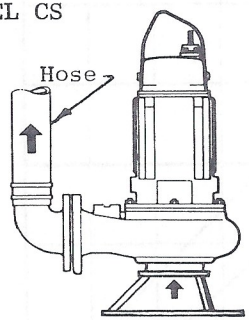
This is a permanently installed sewage pump for dry sump applications provided with standard Class 125 Cast Iron inlet and outlet flanges. Pump's watertight design prevents damage in the event of flooding.

Accessories: Mounting Stand/Suction Elbow, Control Center and Liquid Level Sensors.

Weights: Pump 189 lbs., Inlet Stand 62 lbs.

CS 3082

Fig. 3
MODEL CS

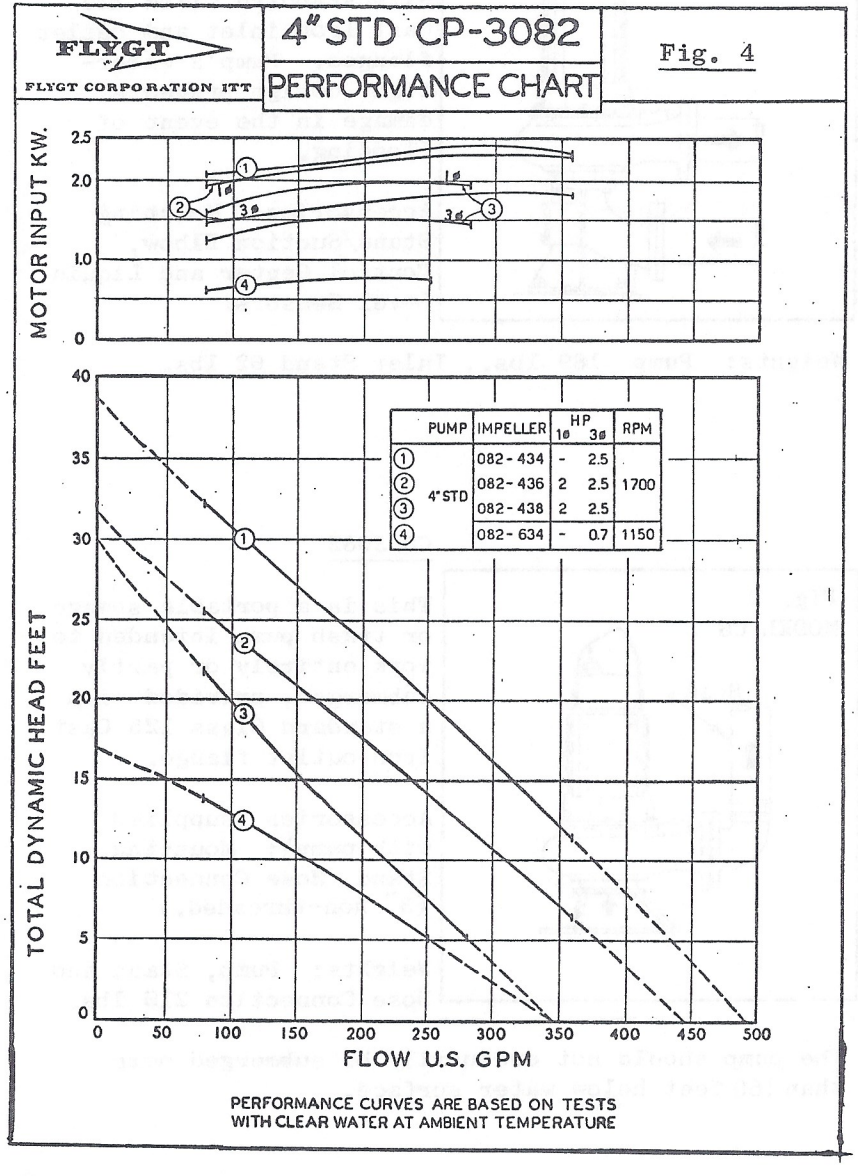


This is a portable sewage or trash pump intended to work entirely or partly submerged, provided with a standard Class 125 Cast Iron outlet flange.

Accessories (supplied with pump): Mounting Stand, Hose Connection (3" non-threaded.)

Weights: Pump, Stand and Hose Connection 216 lbs.

The pump should not ordinarily be submerged more than 160 feet below water surface.



Special Treatment of Seals at Reassembly.
When reassembling shaft seals or installing replacements the most ideal practice is to smear a thin film of Dow-Corning "Molycote Type G" paste on the seal ring surfaces.

The use of oil is satisfactory but the much lower breakaway friction afforded by the MoS_2 in the paste gives greater protection to the faces in starting when the pump has lain idle for some time, after repair, or when operating deeply submerged.

Molycote Treatment of Impeller and Bearings.
It is also suggested that the impeller hub and bearing bores as well as the matching surfaces on the shaft be coated with Molycote (MoS_2) before reassembly. This minimizes scuff damage and makes subsequent removal easier.

Troubleshooting. (Electrical faults should be serviced by a qualified electrician)

1. Pump won't start:
   - Power supply failure.
   - Burned-out fuse or tripped breaker.
   - Damaged cable.
   - Jammed impeller.
   - Burned-out stator.
   - Level sensor failure (if used).

2. Repeated tripping in control: *
   - Supply voltage too high or too low.
   - Wet or damaged wiring.
   - Jammed or partly bound impeller.
   - Specific gravity or viscosity too high.
   - Damaged stator or rotor.
   - Phase-voltage unbalanced.

* Do not restart pump unitl failure has been corrected. Repeated starts could damage stator windings.

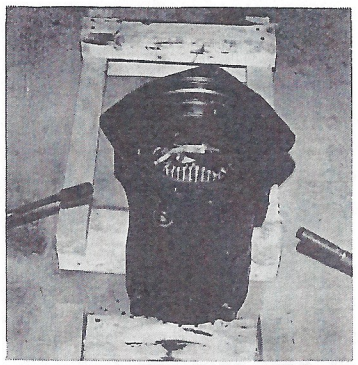


Fig. 30 REPLACING STATOR

Replacing Stator.

Turn stator and stator housing assembly upside down (stator leads facing downwards). Support the rim of the housing on a couple of short parallel sections of lumber in such a way that the assembly is approximately two inches above ground. Heat the stator housing rapidly and evenly all around using LP or butane gas in broad flame torches.

The stator may drop out by its own weight; if not, lift entire assembly with insulated gloves and bang lower rim against a wooden surface. When stator drops out, immediately turn housing around and lower new stator (with stator leads bunched into center) into position. Make sure that the stator seats firmly, touching against shoulder (I) inside the housing and that the Stator Indexing Pin (J) on the Stator is completely in the short slot of the Stator Housing.

NOTE: When lowering new stator into position, make sure that the stator leads are facing the terminal board.

Reassembly.

Reassemble the pump following a reversal of the dismantling sequence. Observe the following important points: Before starting reassembly carefully examine all reused parts for damage. (Bent or scratched shaft, burrs, stripped threads, bent studs, etc.) Start reassembly with carefully wiping off all sealing surfaces, cleaning and smearing all O-rings with a small amount of oil. Do not pinch or mark O-ring surfaces during assembly. Oil shaft and seal ring faces lightly before assembling and mounting shaft seals. Check that ball on stop spring fits snugly into recess of shaft.

Refill oil housing (2.0 pints) with a good grade of low temperature non-detergent type motor oil of SAE 20 viscosity. (EXXON (Extra) 10W30, or equivalent). Replace inspection and oil plug washers and tighten plugs securely. Disassemble cable entry and replace rubber grommet. (See page 14.)

Impeller Selection Chart:

Impeller Code	STANDARD ON					
	CP		CS		CT	
	3Ø	1Ø	3Ø	1Ø	3Ø	1Ø
082-434	X	-	X	-	-	-
082-436	X	X	X	-	X	-
082-438	X	X	X	X	X	X
082-634	X	-	-	-	X	-

NOTE: Impellers must be used only in the combinations marked with X.

082-634 impeller is used on 6-pole motor.

Electrical Specifications

	CP		CS		CT		CP & CT
	3 Ø	1 Ø	3 Ø	1 Ø	3 Ø	1 Ø	3 Ø
Rated Max. HP.	2.5	2.0	2.5	1.5	1.8	1.5	0.7
Rated Max. KW.	2.5	2.0	2.5	1.5	1.8	1.5	0.75
Rated Voltage	230/460 200 or 575*	230	230/460 200 or 575*	230	230/460 200 or 575*	230	230/460
Rated Max. Amp.	7.4/3.7 8.5 or 3.0	9.5	7.4/3.7 8.5 or 3.0	7.5	5.6/2.8 6.5 or 3.0	7.5	2.8/1.4
RPM	1700						1150
							6-pole motor

(*Separate stators for 200V and 575V Service.)

Motor.

Design: Dry, shell-type, NEMA Design B, Squirrel Cage Induction Motor, Class F Insulated. Rated 155° C Max, or 115°C Rise (40° C ambient). Combined Service Factor 1.10 (combined effect of voltage, frequency, and specific gravity variations not to exceed this value). Voltage tolerance +10%, -14% and frequency tolerance + 5% of name plate value, measured at pump top under full load conditions. NOTE: The same stator is used for 1 phase and 3 phase.

Environmental Temperature Limits

The upper limit for both the pumped liquid and the general surroundings of the pumps is 115°F. Operation at higher temperatures without reference to Flygt Engineering is not covered by warranty.

Operational Limits

To avoid undue Heat-Rise in the motor and consequent reduction of motor, seals, and bearing life, the pump should be subject to no more than 10 starts per hour (evenly spaced) on a continuous basis.

CAUTION: (FOR SAFETY'S SAKE:) WHEN LIFTING OR LOWERING A CP PUMP NO ONE SHOULD BE IN THE WET PIT AREA, UNTIL THE PUMP IS SECURELY SEATED ON THE DISCHARGE CONNECTION. ALWAYS STAND CLEAR OF ALL HOISTED PUMPS.

Check Stator.

Before replacing the stator the following checks should be carried out in order to determine its condition:

A. With pump cable and jumperstrips removed from terminal board, megger the electrical insulation between each stator winding and ground (stator housing). Readings should exceed 1.0 megohm.

B. Megger the electrical insulation between stator windings taken in pairs by attaching one megger lead to stator leads 1-4 and one megger lead to stator leads 2-5. Repeat check now between 2-5 and 3-6, etc. Readings should exceed 1.0 megohm.

C. With low range ohmmeter check ohm readings in each winding. Readings should be in accordance with values of Fig. 5, Page 7. Windings 7, 8 and 9 are permanently internally Y connected, thus reading taken on combination of leads 7, 8 and 9 will actually measure the resistance of two windings connected in series.

Values above were taken at 68° F. Winding resistance varies directly with temperature by approximately 0.22% per degree Fahrenheit.

NOTE: If winding resistance is not measured by an ohmmeter, the megger should be used to check continuity of each winding. Separate readings should be taken with the megger leads on 1-4, 2-5, 3-6, 7-8, 7-9 and 8-9. These tests should read zero resistance, signifying no break in the windings.
If stator windings are definitely burned out (low range ohmmeter readings) or if after washing with solvent and drying* it is impossible to regain normal insulation values (megger readings), the stator must be replaced.

* Dry preferably in a temperature controlled oven not exceeding 200° F. or for several days with a 100W lightbulb inside the stator.

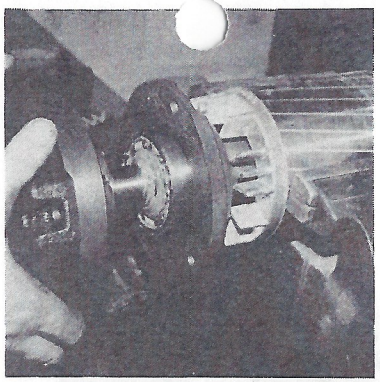


Fig. 28 LOWER BEARING

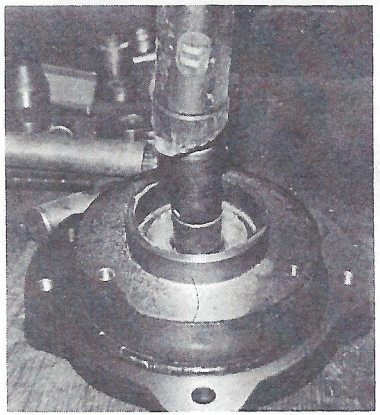


Fig. 29 STATIONARY SEAL RING

Replacing Bearings.
Place shaft and rotor assembly in a soft jaw vise. Remove screws that hold bearing cover to bearing housing and pull off bearing housing.

Knock out stationary seal ring gently from lower bearing housing(G).

Remove circlip under lower bearing. Upper and lower bearing can now be removed from shaft by using a bearing puller.

NOTE: An O-ring is located inside the upper bearing holder. This O-ring should be replaced during major overhaul.

On major overhaul, or if damaged, or if water-oil mixture has penetrated through lower bearing into stator housing, both bearings have to be replaced.

If new bearings are not grease-packed, heat them in a 220°-245° F oil bath, wipe all bearing surfaces and fit bearings snugly into place with filling grooves (for balls) facing downwards (thread shaft end).

NOTE: Pack bearings 2/3 to 3/4 full with one of the following greases: BP Energrease, Shell Alvania Grease No. 3 or equivalent.

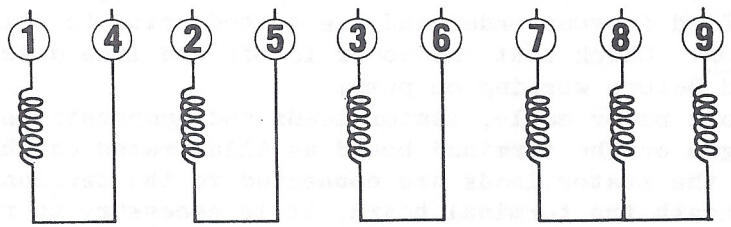
If bearings are pre-greased, heat to approximately same temperature on a thermostatically controlled hot plate or on a torch-heated flat iron plate, while being extremely careful not to overheat or melt out grease.

Wipe races and shaft surfaces clean and fit bearings as described above.

Fig. 5 Winding Resistances

RPM	STATOR PART NO.	VOLTAGE	RESISTANCE OHMS
1700	310 17 37	3-Ø, 230/460 V and 1-Ø, 230 V	S1-S4, S2-S5, S3-S6 = 2.1 ohm ± 3% * S7-S8, S7-S9, S8-S9 = 4.2 ohm ± 3% *
1700	304 00 51	3-Ø, 575 V	S1-S4, S2-S5, S3-S6 = 6.9 ohm ± 3% *
1150	304 00 27	3Ø, 200V	S1-S4, S3-S6 = ± 3% 0.86 ohm ± 3%*
1150	338 10 37	3Ø, 230/460V	S1-S4, S2-S5, S3-S6, = 6.2ohm ± 3% S7-S8, S8-S9 S9-S7, = 12-4ohm

*Values were taken at 68° F. Winding resistance varies directly with temperature by approximately 0.22% per degree Fahrenheit.



Windings 7-8-9 are eliminated in the 575V stator.

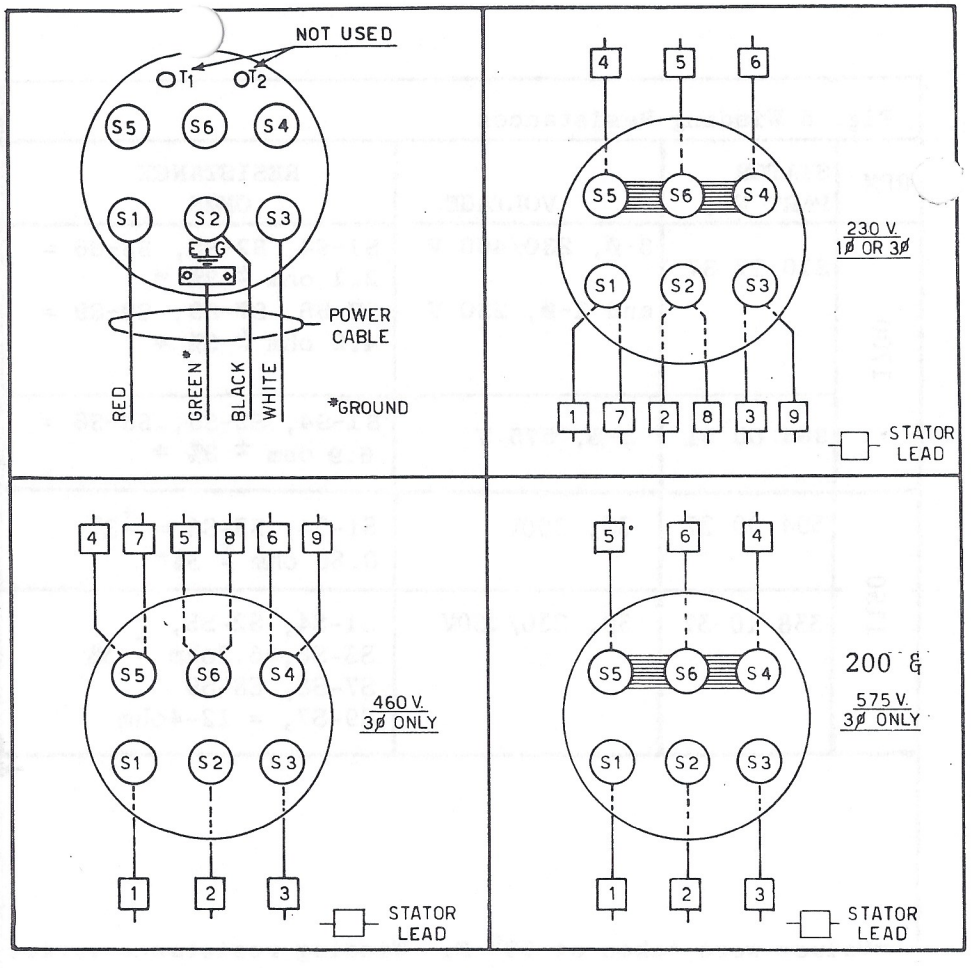


Fig. 6

Electrical Connections in Pump Junction Box. (Fig. 6)
Your C-3082 has been connected for the voltage as specified in your order and was tested prior to shipment.
CAUTION: Check that the power is off and line disconnected before working on pump.
The pump power cable, stator leads and jumperstrips are arranged on the terminal board as illustrated on this page. Since the stator leads are connected to the terminal studs underneath the terminal board, it is necessary to remove the terminal board from the upper bearing housing whenever the stator leads have to be rearranged for a different voltage. Be careful not to pinch stator leads when terminal board is being reassembled to the upper bearing housing.

Unscrew Allen head screws that hold the lower bearing (G) housing to the stator housing (H).

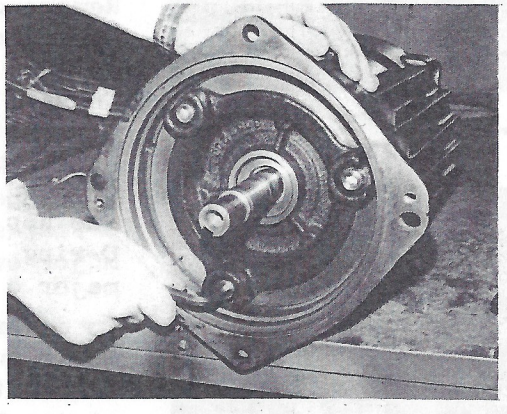


Fig. 26 LOWER BEARING HOUSING

At the upper bearing, gently tap the shaft with a soft metal hammer until the lower bearing housing separates from the stator housing. The shaft and rotor assembly can then be pulled out together with the lower bearing housing.

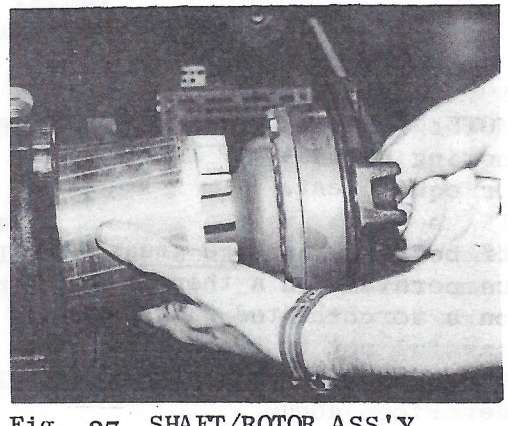


Fig. 27 SHAFT/ROTOR ASS'Y

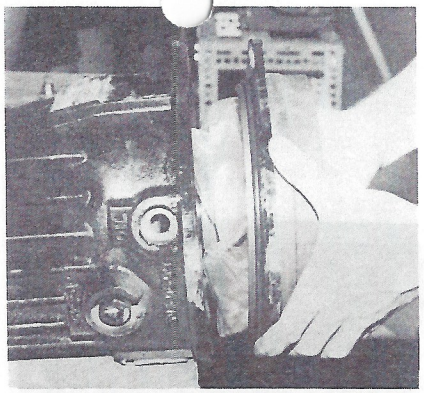


Fig. 23 OIL HOUSING

Remove screws that hold the oil housing to the stator housing. Remove oil housing (E) and pressure equalizer.

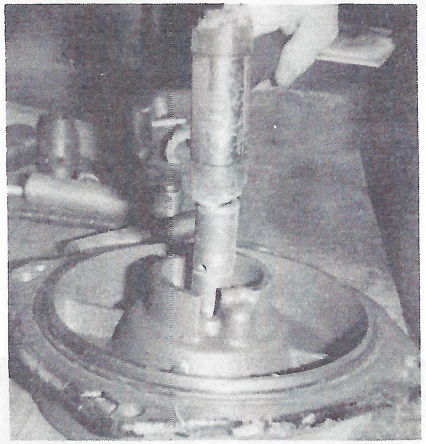


Fig. 24 STATIONARY SEAL RING

Knock out stationary seal ring gently from oil housing (E).

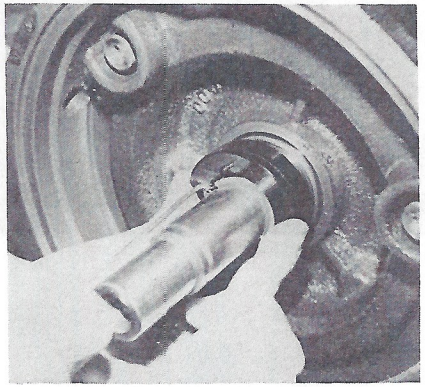


Fig. 25 STOP SPRING

The upper seal (F) which now is exposed can be removed by following the same dismantling procedure as for the lower seal. Remove stop spring, stop ring, compression spring and rotating seal ring.

ELECTRICAL CONTROL SYSTEMS.

Automatic F-200 or 300 Control Panels for CP & CT (Fig. 7).

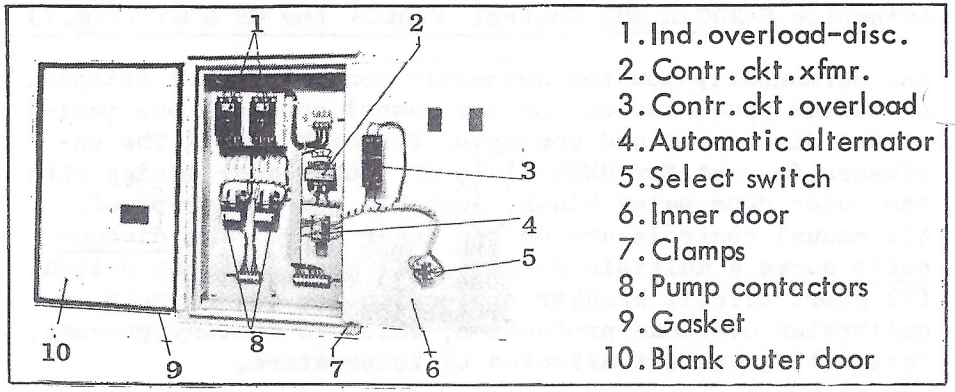
The permanently mounted automatic control panel (simplex or duplex panel for one or two pumps) contains one individual disconnect and contactor for each pump. The enclosure (except for NEMA-1) is of double-door design with the outer door being blank, lockable and tamper-proof. All manual controls are on the inner door. The disconnects serve a multiple purpose: (1) manual off-on switch, (2) short-circuit breaker protection and (3) closely calibrated overload protection, which is factory pre-set, fast-acting and not affected by temperature.

The control circuits driving the individual pump contactor are operated at reduced voltage (24 VAC) and the transformer is protected by a special disconnect of the same type described above. A three-position Hand-Off-Automatic selector switch is provided for manual test, lock-out, or normal automatic operation of the pumps.

In a duplex (two-pump) installation an automatic alternator ensures that the lead-lag pump sequence is alternated at every cycle to equalize wear. Flygt Liquid Level Sensors suspended by their cables in the wet pit control the start-stop sequence of pump operation at the desired levels. A basic simplex installation requires two Liquid Level Sensors; one for low-level shut-off, set just at the top of the pump volute; and the other to start the pump. In a basic duplex installation three sensors are required. The first one is a common low-level shut-off. The second one turns on the "lead" pump. The third one, set from six inches to a foot higher than the second one, will turn on the "lag" pump if the "lead" pump fails or if the inflow is too great for one pump. Both will remain operating until the low-level sensor shuts them off.

Alarm circuits may be connected to the third sensor or an additional sensor may be added (set slightly above all the rest) to give alarm if, with both pumps on, the liquid level still rises. A circuit diagram is inserted in every panel.

Fig. 7 TYPICAL AUTOMATIC CONTROL PANEL (CP-CT)



1. Ind. overload-disc.
2. Contr. ckt. xfmr.
3. Contr. ckt. overload
4. Automatic alternator
5. Select switch
6. Inner door
7. Clamps
8. Pump contactors
9. Gasket
10. Blank outer door

Portable, manual controls for CS-pumps (Figs. 8 & 9) The standard Flygt CS control panel is rated NEMA-3 (weatherproof). It must always be mounted vertically and protected from mud, water and dust. The heart of this control is the same special multi-purpose disconnect (switch/breaker/overload) as described in the CP-CT controls section. If the circuit-breaker trips repeatedly, consult troubleshooting section (on page 25). Never bypass the circuit-breaker under any circumstance. If level control is desired, Flygt's level control system (No. 8.408) can be supplied as optional extra.

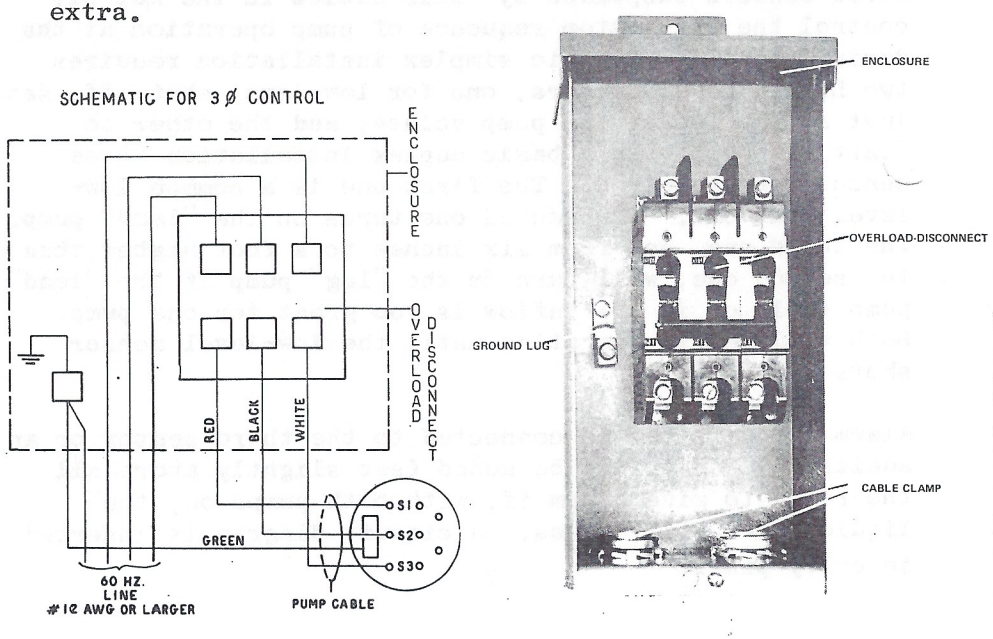


Fig. 8

Open inspection and oil ports and drain all liquids completely, observing their condition as described under "Preventive Maintenance".

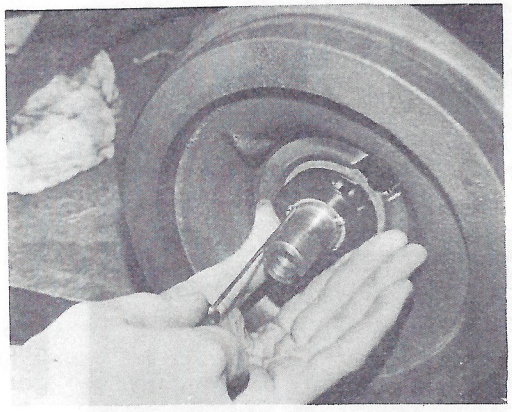


Fig. 21 STOP SPRING

The lower seal (D) may be taken out by pressing up the stop ring and removing the stop spring with special puller tool. (See separate parts list.)

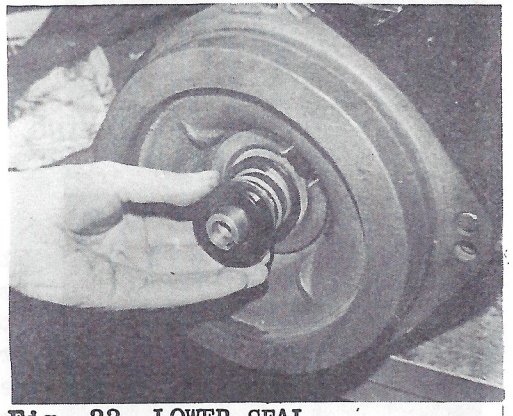


Fig. 22 LOWER SEAL

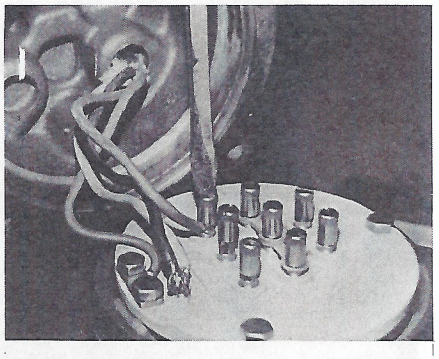


Fig. 18 JUNCTION BOX COVER

Remove junction box cove and disconnect pump cable leads from terminal board.

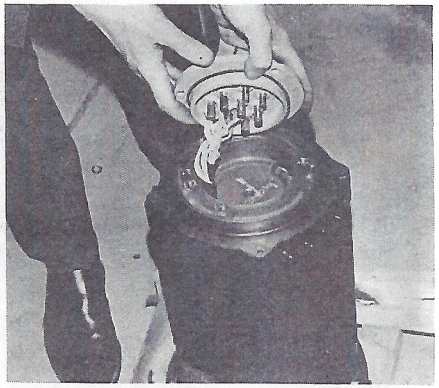


Fig. 19 TERMINAL BOARD

Unscrew the three cap screws holding terminal board to upper bearing holder. Remove terminal board. Disconnect all stator leads from terminal studs.

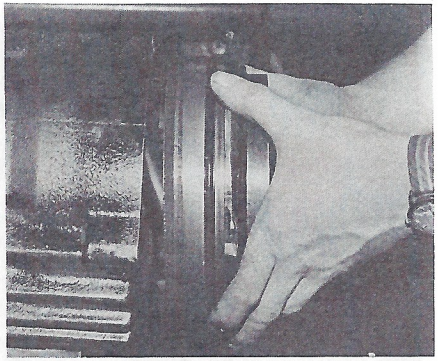
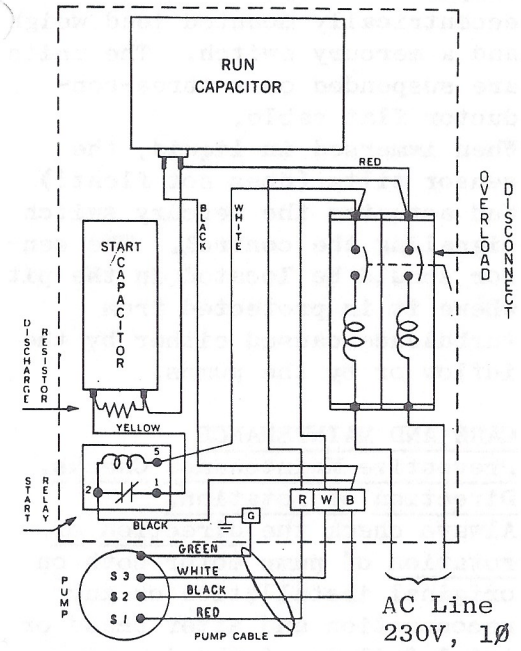


Fig. 20 UPPER BEARING HOLDER

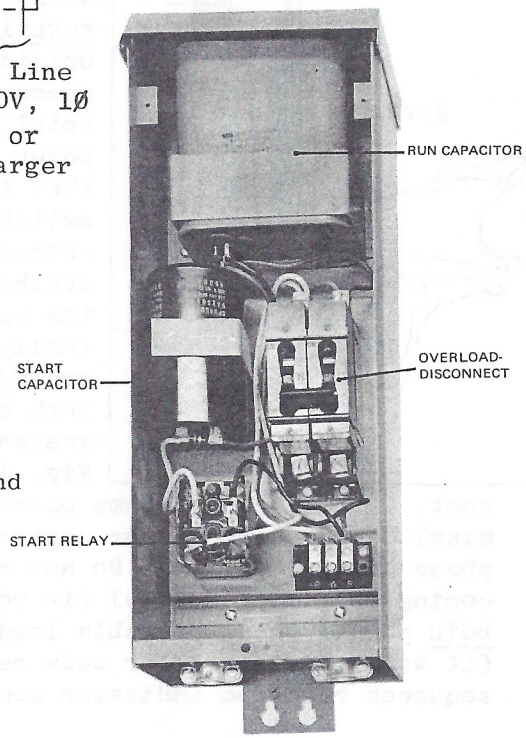
Pry off upper bearing holder (C) by inserting two screw-drivers in slots specially provided on the holder.

SINGLE PHASE CONTROL

Fig. 9



AC Line
230V, 1Ø
#12 AWG or
Larger



Mount box vertically and ground it.

Fig. 10 LIQUID LEVEL SENSOR ENH-10

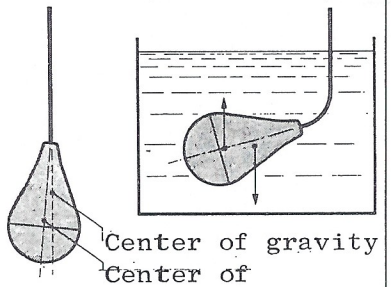
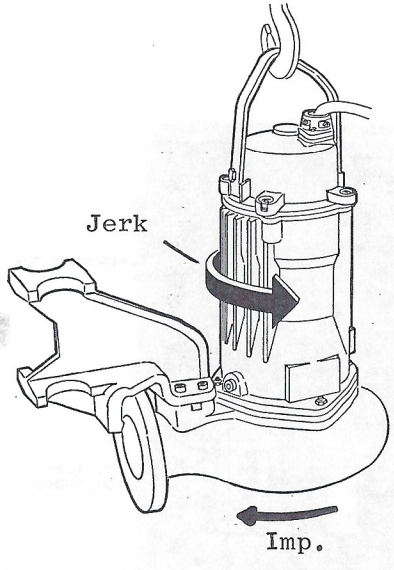


Fig. 11 TESTING ROTATION



Liquid Level Sensors (Fig. 10)
The Flygt liquid level sensor consists of a hollow, pear-shaped PVC body, containing an eccentrically mounted lead weigh and a mercury switch. The units are suspended on a three-conductor flat cable.
When immersed in liquid, the sensor tilts (does not float!) and actuates the mercury switch signaling the control. The sensor should be located in the pit where it is protected from turbulence caused either by the inflow or by the pumps.

CARE AND MAINTENANCE
Preventive Maintenance Checks.
Direction of rotation.
Always check the direction of rotation of pump motor both on original installation or any reconnection and after phase or total failure of the incoming power supply. It may happen that the phases have been switched. Incorrect rotation reduces capacity and causes overheating. Method: Hoist up the pump and switch on momentarily. If the phase connections are correct*, the pump should jerk counterclockwise at the instant of starting. (See Fig. 11.) If rotation is incorrect, switch any two pump power cable leads at the terminal board of the motor control center, valid for 3-phase only. CAUTION: Do not switch primary power leads coming into duplex panel (it would affect rotation of both pumps) or power-cable leads in pump junction box (it would disturb color code sequence and a phase-sequence rotation indicator would give incorrect reading).

*Rotation of single-phase CS on Page 11.

Service and Repair.

'Letters in brackets re-er to Fig.31 , cross-section on back cover fold-out page.)

Pump Removal (CP).
Hoist pump out of the sump and hose it down. Clean out volute and impeller. Disconnect pump cable leads from control. Remove junction box cover and disconnect pump cable leads from terminal board (see Fig. 18).
If junction box cover and cable must be left on the site, protect them with a waterproof covering.
Also cover open junction box when transporting pump.

Dismantling.
.th pump standing up, remove sliding bracket. Lay pump on its side. Unscrew six nuts (A) holding stator housing to volute (B) and remove volute.

Remove Allen head screw and washer holding impeller. Pull off impeller with special tool (supplied with pump) and remove key from shaft.

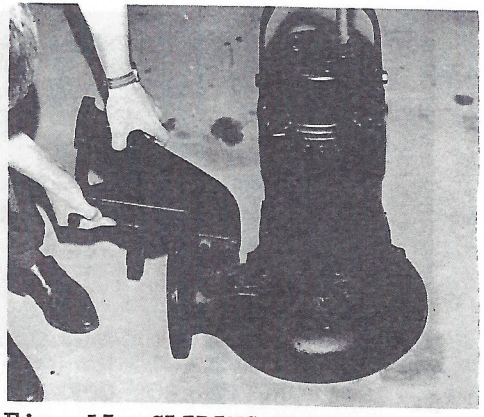


Fig. 15 SLIDING BRACKET

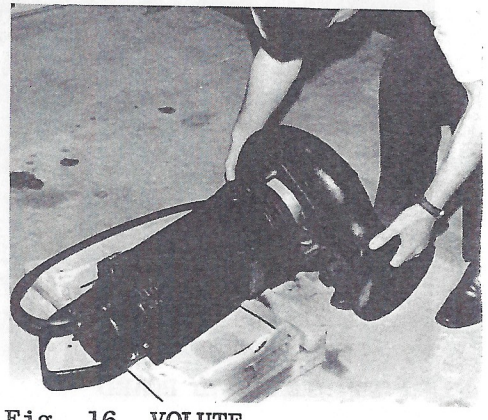


Fig. 16 VOLUTE

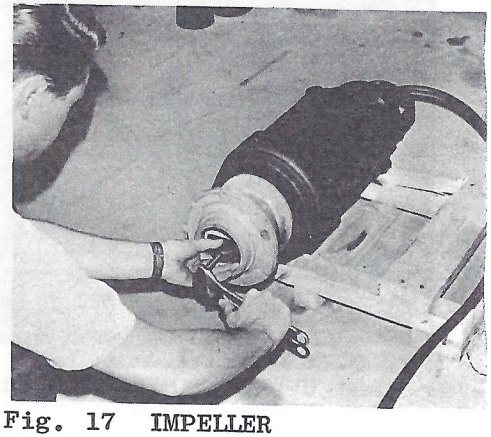
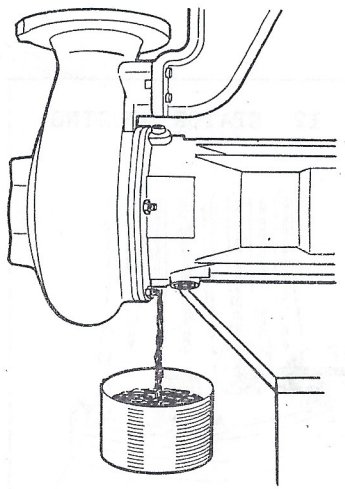


Fig. 17 IMPELLER

Fig. 13 OIL RESERVOIR



If the oil is clear and clean (no water present) the seal is in good condition. A slight discoloration of the oil (trace of water present) may or may not be significant: drain housing completely (Fig. 13) and refill with 2.0 pints of fresh oil. Repeat this check in a couple of weeks; if the oil is again discolored, the lower seal must be replaced. Extreme discoloration (yellowish-grey) or the presence of free water in the oil requires immediate replacement of the lower seal.
When inspections are completed, tighten the oil and inspection plugs carefully to prevent any leakage after first determining that their washers are clean and undamaged.

Electrical Checks.

Pump Cable.
Disconnect pump cable leads from terminal board in control box. Remove junction box cover and disconnect cable leads from pump terminal board. Using a 500 VDC Megge check the electrical insulation of all of the cable leads taken in all combinations, two at a time. If any reading is less than 0.5 megohm, some consideration should be given to replacing the cable.

For continuity test of the cable, attach one megger lead to the red lead at each end of the cable. If there is no break in the cable, the megger will indicate a zero reading, whereas a break in the cable will indicate an infinity reading. The same procedure should be applied to the remaining cable leads (black, white and green). If you should discover a break in one or more of the leads, there is a strong possibility that the cable is internally broken at the cable entry due to abnormal physical forces previously applied to the cable.

Cable jacket should be examined for cuts or cracks which could allow water to enter and "wick" its way into the junction box.

Cable Entry.
Examine cable entry to make sure that the cable is tightly held and that a small portion of the jacket protrudes inside the junction box cover.

It is absolutely necessary to use the proper grommet, washers and cable (see separate parts list) since proper sealing in this model is dependent upon the cable entry flange being bolted flush to the matching surface of the junction box cover. For check of stator see "Service and Repair".

Junction Box.
If water is found in the junction box, it must be completely drained and the cavity dried thoroughly. Remove terminal board assembly and examine stator leads and upper bearing; water may have seeped past the terminal board and into the stator housing, requiring stator to be thoroughly dried. (See "Checking Mechanical Seal--Stator Housing".) Before reassembly, megger stator windings (as described on page 23) and carefully examine O-rings and cable entry.

Liquid Level Sensors.
Lift bulbs from wet pit and remove any adhering material. Simulate start-stop sequence of pumps manually by tilting bulbs in proper order to determine if system is functioning properly. Before returning to pit, clean and examine cables for stiffness, cracking or wear.

Mechanical Checks.
Remove volute and check impeller for clogging. Inspect wear ring (fitted to volute) for damage or excessive wear. Check Allen head screw holding impeller to shaft for tightness.

Major Overhaul.

In accordance with the sugggested schedule, the pump should be periodically checked and be completely overhauled even when no obvious trouble occurs.

(See adjacent chart.)

A full overhaul should include the following:

(1) Complete dismantling of the pump.

(2) Cleaning and inspecting all sealing surfaces.

(3) Replacing of worn and damaged parts.

(4) Replacing ball bearings (regardless of condition).

(5) Replacing all O-rings.

Fig. 14

Recommended Frequency of Preventive Maintenance Checks

Pump Model	CP	CT	CS
Shaft Seals *	1 year	1 year	6 mo.
Volute, wear ring	1 year	1 year	6 mo.
Electrical	2 years	1 year	1 year
Major Overhaul	5 years	5 years	2 years

Note:

Under adverse conditions increase frequency of checks.

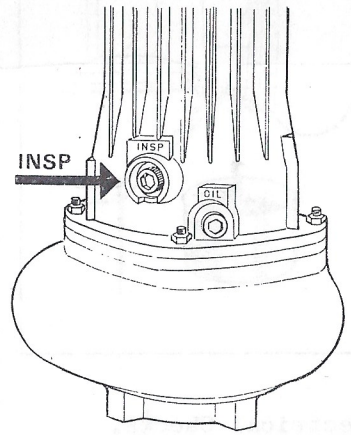
*(See on Page 13, Checking Mechanical Seal)

Checking Mechanical Seal.

By inspecting the stator housing and oil reservoir we can determine the condition of the mechanical shaft seal.

With the pump upright, remove the inspection plug after first determining whether it was properly sealed to begin with (Fig. 12).

Fig. 12 STATOR HOUSING



Tilt the pump in such a way as to allow any possible accumulation of liquid to drain out of the inspection hole.

If there is either oil or an oil-water mixture present, the upper seal may be damaged, must be removed, inspected and replaced as needed.

Water alone is an indication of leakage elsewhere (O-rings, junction box or inspection plug).

Small amount of oil can be tolerated, but water or water-oil mixture cannot be allowed in the stator housing.

CAUTION: If oil and water or large amount of oil are present, the lower bearing must be replaced. (See "Service and Repair" section.) Laying the pump on its side, rock it a few times before removing the oil plugs and draining a representative sample into a transparent container.