Hidrostal PUMPS

INSTALLATION

OPERATION

AND MAINTENANCE

MANUAL

SANDGATE NO1 PUMP STATION

EnviroTech AUSTRALIA
A division of Baker Hughes Australia Pty. Limited
A.C.N. 004 752 050

SCSQ

BRISBANE CITY COUNCIL

EAGLE FARM PUMPING STATION

ORDER No: P13960

ENVIROTECH JOB No: 944355

27.8.96 Sandgate No 1 P/Stn SP193. D. ADAMS

Test	No 1	Old impellor	3418 HRS.
	No 2	New flame hardened impellor	6202 HRS.
	No 3	Old impellor	4571 HRS.

Wet Well 30%

		FLOW lt/sec	Amps
HZ	No 1	51	60-62
35	No 2	93	64-66
	No 3	39	62-64
	No 1	99	68-70
40	No 2	151	77-79
	No 3	91	70-72
	No 1	158	78-79
45	No 2	207	88-90
	No 3	146	82-85
	No 1	207	89-90
50	No 2	272	102
	No 3	195	94-96.

Sandgate N81/P5N

Hidrostal PUMPS

BRISBANE CITY COUNCIL

EAGLE FARM PUMPING STATION

ORDER No: P13960

ENVIROTECH JOB No: 944355

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A division of Baker Hughes Australia Pty. Limited
A.C.N. 004 752 050

HIDROSTAL PUMPS

H12K-MD1+HE5T4-XSSK+N3B6-10

SERIAL No.	TAG No.
H 2259	----------
H 2260	----------
H 2261	----------

408 504

5 702236 210059

6210

Bantex
DENMARK

SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR IMMERSIBLE PUMPS

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SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR IMMERSIBLE PUMPS

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INSTALLATION AND OPERATION

1.1

INTRODUCTION

Each pump unit is equipped with a nameplate (Fig. 1) attached to the motor, containing all motor and pump date (See section 1.4). It is essential to give the complete data on the name-plate for any inquiry about parts or service.

On motors approved for explosion-proof application, an aditio-nal approval plate will be attached (see Fig. 2).

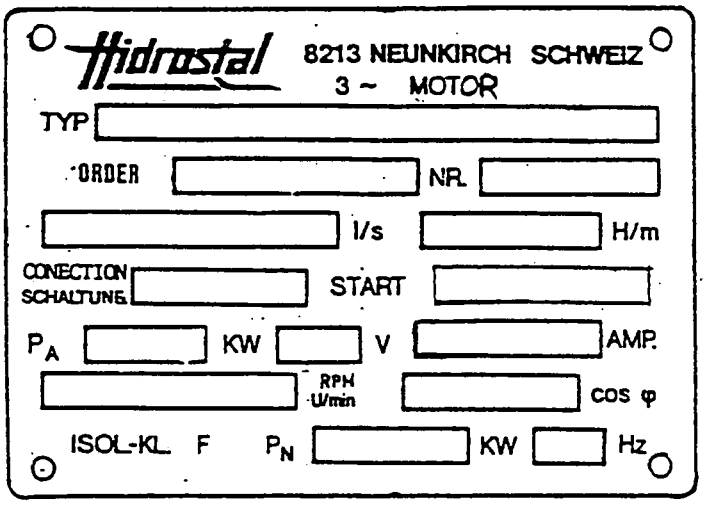


Fig. 1

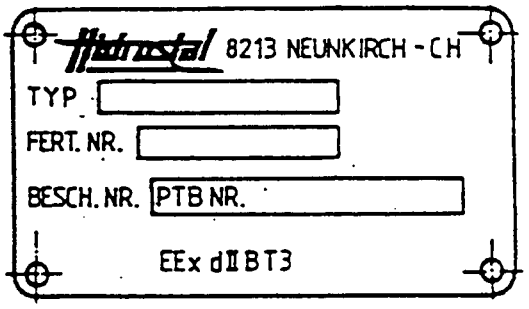


Fig. 2

The HIDROSTAL warranty is void unless the following require-ments are met:

1. Temperature protection circuit is wired so as to positively disconnect power to the motor when excessive winding temperatures are sensed. See Section 1.7.1.2F for wiring instructions.
2. Proper extra-quick-trip overload protectors, as described in Section 1.7.1.3E, MUST be used on all three phases of each motor.
3. Optional conductivity probe circuit (if used) is wired to a relay specifically approved by HIDROSTAL for use with these motors. See Section 1.7.2.2G for wiring instructions and a list of approved relays.
4. Any repairs must be made exactly as per instructions in this manual, and using only genuine HIDROSTAL replacement parts furnished through the HIDROSTAL distribution organi-zation. Use of any other parts (even - and especially - O-rings) will void the HIDROSTAL warranty.

   Prior to shipment, each pump has been tested by the factory for proper mechanical and electrical operation as well as absolute water-tightness of the motor housing (by pressure tests). Disassembly of the pump by other than official HIDROSTAL service centers may cause loss of any remaining warranty.

HIDROSTAL will not assume responsibility for damages to the pump that have been caused due to not following instructions in this manual, nor for consequential damages of any kind.

1.2 DELIVERY AND RECEPTION OF PUMP UNIT

Prior to signing any shipping documents, inspect the shipment for shortages or damage. Special attention should be given to the power cables and cable entry assemblies to make sure that they are not damaged. Report any discrepancies to the carrier. Use the lifting eyes to transport the pump. DO NOT lift pumps or pull them by the power cable. Doing so may break the hermetic seal at the entry assembly, possibly allowing moisture to penetrate into the motor, causing damage at start-up.

1.3 STORAGE

If the unit is not to be installed immediately, store in a dry and clean place without extreme changes in temperature. Make sure that storage room temperature stays within motor ambient limits of -10 to +40° C (14 to 104° F). The shaft must be rotated by turning the impeller once every two weeks to ensure positive coating on the lubricated surfaces and to prevent sticking of surfaces due to rust or oxidation. Do not store in a location where the pump would be subject to vibrations, otherwise brinneling of the bearings could occur.

Service manual for installation and operation for IMMERSIBLE pumps

Hidrostal

H E S T 4 - X S S K

MOTOR CODE

E K 3 A 6-M N G

Identification letter of the hydraulic size to which this motor can be assembled. Sizes are: D,E,F,H,I,L.

Identification letter of the cooling type of this motor.

K = Convection : aircooled-100% dry running permissible (*).

E = Internal cooling : forced circulation of internally contained cooling liquid: heat transferred to pumped media (*,**)

F = External cooling : external source of cooling water (*,**)

* = immersible, submergence not required

** = jacketed stator

motor size, according to IEC norms:

size:	0	B	1	2	3	4	5	6	7	8
IEC:	80	90	100	100	132	180	225	280	315	400

motor construction classification

motor speed

	Nominal Speed 50 Hz	60 Hz
2 - 2 pole motor	3000	3600
3 - two speed-2/4 poles	3000/1500	3600/1800
4 - 4 pole motor	1500	1800
5 - two speed-4/6 poles	1500/1000	1800/1200
6 - 6 pole motor	1000	1200
7 - two speed-6/8 poles	1000/750	1200/900
8 - 8 pole motor	750	900
9 - two speed-8/10 poles	750/600	900/720

X S S K

Motor Code, continued:

?

E K 3 A 6-M N G

Lower Mechanical Seal (Pump Side) Type

C = Fitted with Carbon-ceramic seal faces. Recommended for handling water, activated sludge and non-abrasive liquids.
M = Tungsten carbide - silicon carbide seal faces; rubber boot around springs. For sludges, slurries and abrasive liquids.
V = Fitted with silicon carbide (on converted carbon substrate) faces; for moderately abrasive liquids only.
X = Tungsten carbide - silicon carbide seal faces; stainless steel shell for higher pump pressures and/or higher motor speeds.

Electrical classification:

N = Normal, per IEC-68 norm

S = Normal, per IEC-68 norm, with moisture probes in seal chamber.

X = Explosion proof, per IEC: Ecx d II, B T3 (or T4).

Voltage of winding (see also voltage stamped on nameplate:

A = 230/460 V 60 hz
E = 380 V 50 hz
G = 415 V 50 hz
K = 575 V 60 hz
1 = 220/230/240 V 50/60 hz single phase
2 = 220 V 50 hz
3 = 380/415 V 50 hz
S = special voltage 415V / 50Hz ?

Cable code:

N2 A1 - 10

factory code (not important for instruction)

length in meters

1.7 ELECTRICAL CONNECTION

The motor winding leads will be factory-connected inside the motor to the cable, to match customer specifications regarding electrical current characteristics. These characteristics are marked on the nameplate.

Make sure that the power supply to the control panel is the same as on the pump nameplates. These motors can tolerate a voltage of +/- 5% from nameplate voltage with no adverse effects. From 5% to 10% lower voltage, there may be a slight diminishing of hydraulic performance and a slight increase in amperage, but no harm to the motor. For voltages lower than 10% of rating, severe performance drop and excessive draw (with motor overheating and nuisance trip-outs) can be ex- pected. Since this will cause considerable operating problems this situation should not be allowed to exist.
The motor ratings shown on the nameplate are for ambient temperature (liquid and air) of up to 40°C. For higher temperatures, contact factory.
All electrical connections are made according to diagrams shown at the end of this manual.

1.7.1 PANEL CONTROLS

1.7.1.1 OPERATOR SAFETY

Prior to any work on the pump or motor, the power supply to the unit must be disconnected in a safe manner either by means of a locked disconnect switch or by removing the fuses from the panel. It is not safe enough to just switch off the control switch because a wiring mistake or a control system malfunction could put the motor back into operation.

1.7.1.2 MINIMUM REQUIREMENTS

For proper operation and protection of the pump, the control panel must contain the following components:

a) Isolation switch, preferably lockable.

b) Slow trip fuses or circuit breakers in each incoming phase.

c) Lightning protection. Lightning arrestor on each incoming phase, if there is any possibility of lightning damage.

d) Motor starter. Full-voltage magnetic-contact starter should be sized according to local electrical code requirements based on motor power rating.

e) Extra quick trip overload protectors. The overload protectors must be selected according to the amperage indicated on the nameplate of the motor. The protectors must trip within 6 seconds or less on locked rotor condition (approximately 6 times full load amps) in order to adequately protect the motor windings; consult "trip curve" of overload protectors to ensure they meet this requirement.

CAUTION:

Warranty on immersible pump motor is void unless proper extra quick trip overload protectors are used on all three motor phases as specified above. Claims for warranty repair of motors must include documentation that proper overload protectors have been installed.

f) Temperature sensor circuit. Each motor is manufactured with temperature limit switches in the head of the winding (connection lead 1 and 2). The temperature limit switches are Bimetal-Types (Similar-Klixon) and they can be connected directly into the motor control circuit and operate at 220/240 Volts with a maximum of 2.5 Amps.

CAUTION

Warranty is void if these leads are not connected to immediately de-energize the motor when their circuit is opened due to internal motor malfunction or temporary overheating. For all immersible motors, the control lead (connection 1 and 2) must be connected in such a way that the pump cannot automatically come on again, even after the temperature limit sensors (Klixons) have cooled and re-closed the circuit, because the cause of overheating must be determined and corrected before the motor is put back into service.

NOTES: Note that the temperature sensors will only de-energize the motor when gradually overheated due to electrical malfunction. These devices are not a protection for quick temperature rise due to overload such as a locked rotor condition and thus are not a sufficient subsitute for the overload protectors specified in (e) above. The motor control circuit leads (leads 1 and 2 or 3) must be connected, to ensure that power to the motor is immediately disconnected when any of the devices in this circuit sense abnormal conditions.

1.7.1.3 RECOMMENDED ADDITIONAL CONTROLS

g)

h) Hand-off-automatic switch.

i) Low voltage terminals for level switches.

j) Pump-on and pump-failure lamps.

k) Hours run meter: Important to schedule service.

l) Change-over switch for multiple-pump stations.

m)

n)

1.7.2 CONNECTION TABULATION

Each cable set provides three or six power leads per speed, one earth lead and additional leads for temperature protection and seal failure circuits.

To connect the motors to the power supply it is not necessary to open the motor. This should be avoided in order to retain the original factory-thermetic seal. If the sealing of the motor cover is disturbed, tightness tests must be performed as per Section 2.4 in this manual.

Power and control leads are marked according to the following table:

MOTORTYPE	number of speeds	number of conductors (a)	speed (b)	winding connection (c)	old VDE 0570 denomination	markings on cable end, according new DIN 42-401 norms
up to 4 kw direct start	1	3+C		Y	U V W	U V W
over 4 kw star/delta start	1	6+C		△	U V W Z X Y	U1 V1 W1 W2 U2 V2
Two speed by Dahlander system Y/YY direct start	2	6+C	H N	YY Y	U2 V2 W2 U4 V4 W4	1U 1V 1W 2U 2V 2W
pole change, each speed direct start	2	6+C	H N	Y Y	Ua Va Wa Ub Vb Wb	1U1 1V1 1W1 2U1 2V1 2W1
pole change, high speed: star/delta start low speed: direct start	2	9+C	H N	△ Y	Ua Va Wa Za Xa Ya Ub Vb Wb	1U1 1V1 1W1 1W2 1U2 1V2 2U1 2V1 2W1
pole change, high and low speed:star/delta start	2	12+C	H N	△ △	Ua Va Wa Xa Ya Za Ub Vb Wb Xb Yb Zb	1U1 1V1 1W1 1U2 1V2 1W2 2U1 2V1 1W1 2U2 2V2 2W2

(See next page for explanation of symbols, and for notes)

NOTES:

a) C = control leads and earth.

For normal motors:	
temperature protection circuit	1 to 2
seal failure circuit (optional)	3 to 4 (or if no lead marked 4, use 3 to E)
earth	E (yellow-green)
For EEx (explosion-proof) motors, with two-level temperature protection circuits:	
lowest temperature (warning)	1 to 3
highest temperature (shutdown)	1 to 2
earth	E (yellow-green)

NOTE: on EEx, seal failure circuit will allways be in a separate cable originating near bottom of motor.

b) H = high speed
N = low speed

c) Y/YY = direct start (Dahlander)
= start posible by star/delta
1) = the starting current at this speed is lower than the starting current at high speed by star/delta.

1.7.3 LEVEL SWITCHES

It is recommended to use an intrinsically safe circuit for the level controls, for explosion-proof installations.

For the on and off levels, use control systems that are appropriate for the pumped liquid.

Use a floating-ball type switch for the high-level alarm, even when there is another type used for the pump control. (This has proven to be the most fail-safe type.)

The floating ball for the alarm should be placed at a reasonable distance above the highest pump start level to avoid false alarms.

1.7.4 LEVEL CONTROL

"ON" and "OFF" levels must be set in such a way as to provide sufficient sump capacity between ON and OFF so that in the most unfavorable case (feed 50% of pump output) the pump cannot be switched on more than 10 times per hour. Higher starting frequency may damage the motor control devices in the panel and will cause exessive power consumption. The following formula will calculate the required minimum sump capacity:

$$V = \frac{0.9\ Qp}{Z}$$

where V = sump capacity or volume, between on and off levels (in cubic meters)
Qp = pump flow (one pump), in liters/second
Z = number of starts per hour (recommend Z=10, maximum)

1.7.5 REQUIRED SUBMERGENCE

Hidrostal immersible pumps can work continuously submerged, or in a dry environment if desired (the motors do not require submergence in liquid for cooling). In the case of wet pit pumps the "OFF" level can therefore be set below the pump casing. However, care should be taken to provide sufficient submergence to avoid vortexing or pulling of air into the pump suction.

Priming of the pump will require the "ON" level to be at least as high as the tip of the impeller.

1.8 FLUSHING WATER CONNECTION

Pumps with motor sizes larger than size 2 are supplied with a flushing water connection (service connection "F", Fig 6) R 3/4" (=3/4" BS parallel pipe thread).
For normal sewage application this connection is not used. However, in special cases when pumping high concentrations of solids with a tendency to dehydration or sedementation, such as high concentrations of sludge or mud, there should be a connection to cleaning water. This connection will conduct cleaning water between the impeller flange (165) and the lower mechanical seal (515), providing periodic removal of accumulated solids.

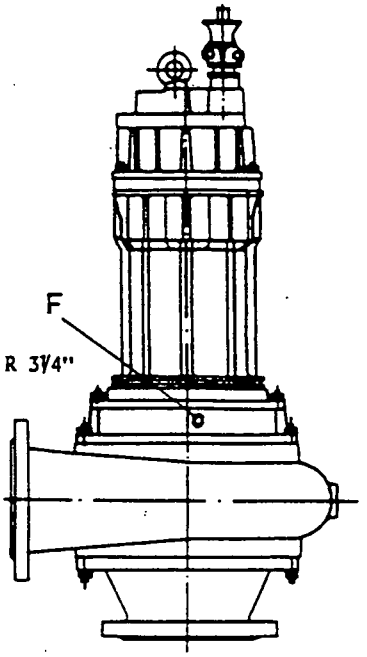


Fig. 6

Flushing water must be pressure-regulated between 7 and 14 psi (1/2 to 1 bar) above pump discharge pressure. Typically, water is controlled by a solenoid valve on a time clock. Adequate duration of each flushing is 60 seconds; frequency of flushing must be established for each different installation, starting with once per day.
The quantity of flushing water varies according to pumpsize and application: in most cases, flowrates of 6-8 l/min will be sufficient.

Alternatively or even in addition to the above function, connection "F" may be used to manually bleed the air from the casing prior to start-up, as per Section 1.5.2 d, if there is no other place for air to escape through the discharge piping.

1.9 OPERATING TROUBLES

1.9.1 Possible Reasons

	No flow	Flow not sufficient	Head not sufficient	Reduction of flow or head after start up	Vibrations	Motor overload	Motor does not start
1. RPM too low	X		X				
2. RPM too high					X	X	
3. Air entrance into suction line (flanges not tight)	X	X		X	X		
4. Discharge line clogged / Valve closed	X				X	X	
5. Air or gas in pumped liquid	X	X	X	X	X		
6. TDH too high	X	X			X		
7. Suction head too high				X	X		
8. Not sufficient suction head on hot liquids		X			X		
9. Insufficient submergence of suction	X	X	X	X	X		
10. Sludge concentration higher than assumed		X	X			X	
11. Specific weight of medium higher than assumed						X	
12. Impeller or suction line clogged	X	X			X		
13. Wrong direction of rotation	X	X	X		X	X	
14. Impeller clearances too high		X	X				
15. Damaged impeller		X	X		X		
16. Thermal overloads tripped; control switch off							X
17. Motor damage					X	X	X
18. Low voltage		X	X			X	X
19. Humidity switch tripped							X
20. Attachments loose					X		
21. Coolant loss							X
22. Bearings worn out					X		
23. Impeller out of balance					X		
24. On-level switch not overflowed, or damaged							X
25. Impeller too small			X				
26. Impeller dragging against suction cover					X	X	
27. Thick sludge and tight impeller clearance						X	
28. Air or gas on impeller backside	X		X				
29. Pump is not vented	X						

MAINTENANCE AND SERVICE

2.1 GENERAL

Before doing any work on the pump unit, switch off main switch (making sure that it cannot be switched back on) or remove fuses from panel.

The following checks in Section 2.2 can be done in the field. When a repair is indicated as a result of these checks, send the pump unit to your nearest authorized Hidrostal service station.

CAUTION:

When disconnecting the power cable at the control panel, watch that the cable ends CANNOT come in contact with water. Replace the plastic cable-end originally shipped with the pump -- (or if these are no longer available, wrap the cable ends inside a plastic bag and seal with tape) for water-tightness during handling and shipping.

2.1.1 COOLING TYPES

HIDROSTAL immersible motors can be operated on continuous duty either submerged in the liquid or totally outside of the liquid (as in dry-pit installation). There are three different cooling systems used, depending on motor size and application. (Second digit of motor code gives cooling type).

INTERNAL COOLING - Code "E"

This type (Fig. 8) transfers motor heat from the stator into a cooling oil which is circulated through a cooling jacket surrounding the stator housing.

The oil then transfers this heat to the pumped media through the motor seal chamber (pump backplate), which acts as a heat-exchanger. The oil is circulated by an impeller on the motor shaft.

EXTERNAL COOLING - Code " F"

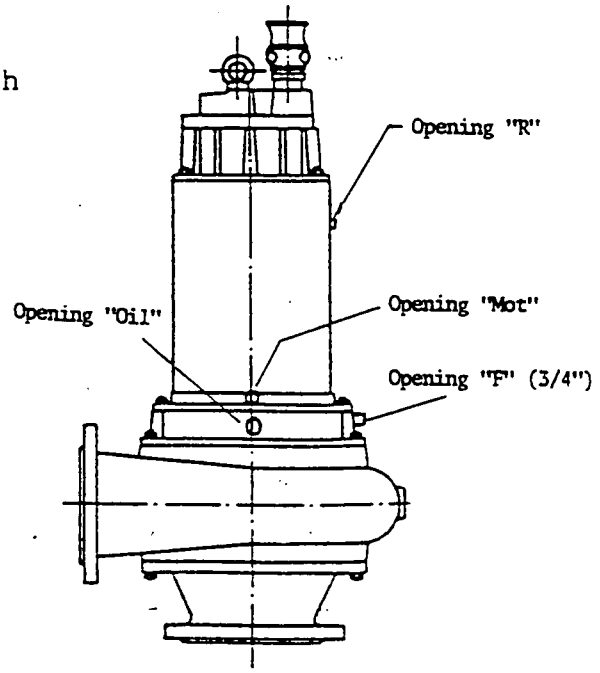


Fig. 8

KEY FOR SYMBOLS ON FIG 8

MOT = Stator housing plug
OIL = Oil drain plug
R = Oil refill plug (cooling outlet, for code F only)
F = Flushing connection
X = Cooling inlet(code F only)

2.2 FIELD TESTS

2.2.1 VISUAL CHECKS AFTER PULLING PUMP UNIT FORM SUMP

a) Check pump and motor for possible mechanical damage.

b) If pump volume or pressure are not acceptable, check factory-set impeller clearance, according to Section 3.1.

c) Check overload relay, contactors, fuses and time relays (if any) for correct setting.

d) Check correct function and condition of level control.

e) Check insulation resistance of motor windings and cables with a high-voltage ohm-meter ("megger"). This initial test should be made from the point where the cables attach to the motor starter. Check from each winding lead to the other two winding leads and to the ground lead.

INSULATION CHART		
CONDITION OF MOTOR AND CABLES	OHM VALUE	MEGOHM VALUE
A new motor.	2,000,000 (or more)	2
A used motor which can be re-installed in the well.	1,000,000 (or more)	1
MOTOR IN PIT. Ohm readings are for drop cable plus motor. A motor in the pit in reasonably good condition.	500,000 - 1,000,000	0.5 - 1.0
A motor which may have been damaged by lightning or with damaged leads. Do not pull the pump for this reason.	20,000 - 500,000	0.02 - 0.5
A motor which definitely has wet or damaged cable or windings. The pump should be pulled soon and repairs made to the cable or the motor dried and replaced. The motor will not fail for this reason alone, but it will probably not operate for long.	10,000 - 20,000	0.01 - 0.02
A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced. The motor will probably not operate for long.	Less than 10,000	0 - 0.01
A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced. The motor will not run in this condition.	0	0

CAUTION:

Do not "megger test" control leads when thermistors are fitted:
Voltages over 2,5V will cause thermistors to fail, and may destroy the winding.

Any reading less than 1,0 Megohm could indicate failure of cable or winding insulation (See "Insulation chart". If failure is indicated, remove pump with cable and proceed to Section 2.4 of this manual for further tests.

2.2.2 STATOR HOUSING TEST

This test consists of a check on the condition of the upper mechanical seal and/or stator housing "0" rings.

Stand pump vertically on its suction flange. Remove plug "MOT" (see Fig. 7,8 or 9) with copper washer (536) from stator housing so that any liquid can run out. Do the following repairs according to what comes out of the stator housing:

WATER	= General overhaul with change of bearings and seals
MIXTURE WATER/OIL	= General overhaul with change of bearings and seals
OIL	= Change upper mechanical seal, part (516)
NO LIQUID (DRY)	= Stator housing is OK. No defect.

CAUTION:

It is critical to ensure that this plug is completely water-tight. Sealing surfaces must be clean and smooth before assembly. Heat new copper ring to dull red and immediately quench in water to soften copper ring for best seal.
All copper rings supplied as new spare parts by Hidrostal are pre-softened.

2.2.3 OIL CHECKING ON IMMERSIBLE MOTORS

This is a check on the condition of the lower mechanical seal. For pump units supplied with moisture probes, total failure of the lower seal will be indicated by activation of the resistance relay. However, even with this circuit, a slow failure can be detected earlier by the following oil check.

For pump units without the conductivity probe circuit, the following check is the only way to determine condition of the lower seal.

Oil checking must be done after the first 1'000 hours of operation and once a year thereafter.

Immediately before checking, run the pump for a few minutes to distribute any impurities throughout the oil. Raise the pump out of the sump and clean it with a water hose. Perform the following:

Level check

1. For pumps cooling type F or K (second letter of motor code), stand pump with shaft vertical, and remove plug marked "oil". Coolant level should be close to level of plug "oil".

2. For pumps with cooling type E (second letter moto code), stand pump with shaft vertical and remove plug R. Oil level should be close to level of plug R.

If coolant is far below these levels, the lower mechanical seal may have leaked and may require replacement. Proceed to Section 3.1.4 and 3.2.1 of this manual. If oil level is only a few inches below these levels, top-up with new oil and re-check in 200 to 500 hours. Now proceed with oil quality test described below. See Fig. 10 and 11 for levels and actions.

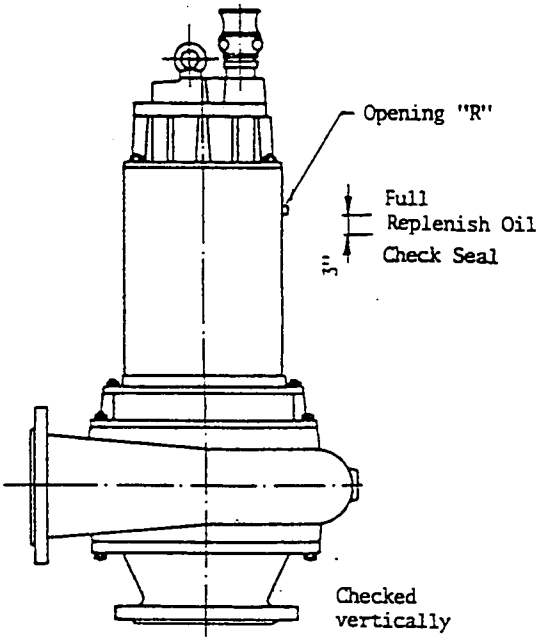


Fig. 11

Oil condition check

Lay pump down horizontally with plug "oil" (536)upwards. Remove plug "oil". Insert a tube or rubber hose, place a finger over top of tube and remove it with a small sample. Deposit sample in a glass and repeat this procedure until a sufficient quality has been collected for observation. Evaluation will show one of three conditions:

a) If oil is clear there are no problems with the lower seal. Fill oil back in again, and close opening "oil" with plug and a new copper seal. The copper sealing washer must be softened as follows: heat to dull red and quench immediately in cold water.
Note: all copper seals supplied by Hidrostal are pre-softened.

b) If there is just a little water in the oil but the oil is clean, repair of the pump is not necessary. The oil is re-usable after the water has been separated from the oil. Remove all oil as per Sections 2.2.3.1 or 2.2.3.2 in this manual, and separate water from oil.

Pour back the clean oil into the mechanical seal housing and close opening with plug "Oil" with copper seal (536), softened as in point (a), above. However, check oil quality again after 500 hours of operating.

With a new mechanical seal (515) it is possible that during the run-in period a little bit of water could enter into the oil chamber. Thus, if at the first check after start-up a small quantity of water is detected, it can be neglected.

Oil with a little bit of water will be milky in appearance, but will still be of very low viscosity, that is, it will still run much more freely than motor oil, almost as thin as kerosene.

c) If too much water has entered the oil, the viscosity will be much higher, then oil will be as thick as motor oil or even thicker. In this case, or when dirt or sewage smell are detected in the oil, the lower mechanical seal (515) must be repaired or replaced as per Section 3.1.4 and 3.2.1 in this manual.

For oil removal as indicated in (b) above or for oil removal prior to a major repair, refer to Section 2.2.3.1 for all motors with 2nd letter in motor code = K or F. Refer to Section 2.2.3.2 for all motors with 2nd letter of motor code = E.

Replace oil with new oil only if strongly contaminated, otherwise separate water from oil and re-use oil. Required oil must be extremely low viscosity. Factory uses the following oil:

MOTOREX 155	: Flame point min. 132°C or 270°F : Specific Gravity: 0.821
VISCOSITY AT 50°C	: 3.25 centistoke
VISCOSITY AT 40°C	: 3.87 centistoke

Other recomended oils:

Shell Pella A or S5585,
Gulf mineral seal oil 896, or others with equal specification as above: The specified low viscosity is very important for proper cooling.

2.2.3.2 OIL CHANGE FOR INTERNAL COOLED MOTORS (TYPE E)
(Second letter of motor code)

Remove plugs "oil" and "R" (See Fig. 13) and drain mechanical seal housing and cooling jacket completely by turning the pump around slowly, until plugs "oil" and "R" are upside down. See Figure 13. When oil has completely drained, turn the pump back and reinstall plug "O" only, with quenched copper ring seal. Then place pump vertically.

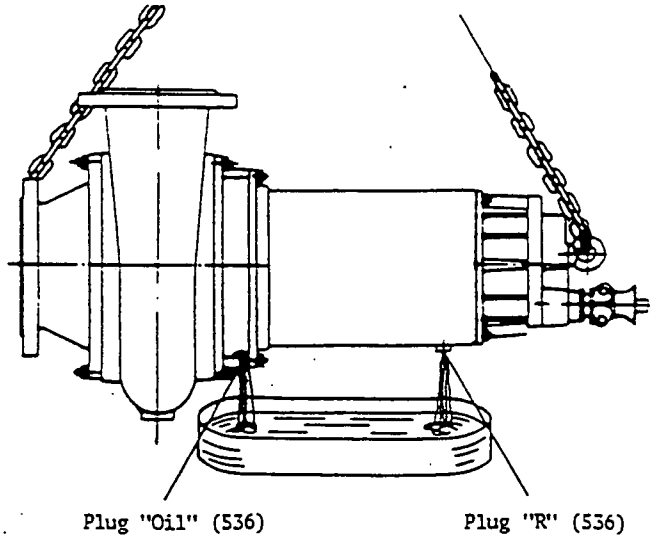


Fig. 13

Re-fill with separated oil or new oil of correct specification. The pump is full when the oil is flush with opening "R" (536) and the motor is in vertical position. Re-install plug "R", with quenched copper ring seal.

2.3 LUBRICATION

HIDROSTAL motors use ball bearings which are grease lubricated. For re-lubrication, grease is handpacked into the bearings when the motor is disassembled during a major overhaul. Sufficient grease is provided initially and at each overhaul to allow for the number of operating hours between overhauls specified in the "Overhaul Chart", Figure 14. We suggest the overhaul should be done by an authorezed Hidrostal service center.

CAUTION:

The overhaul of Ex-Motors must be done in factory or in a authorized Hidrostal service center, otherwise the Ex certification will be invalidated.

No other lubrication service is required between overhauls for these motors.

2.4 MOTOR CABLES

Note: Whenever opening motor housing, it is imperative that all 'O'-rings and rubber grommets be replaced with new items supplied from HIDROSTAL. In particular, we have found that 'O'-rings glued-up from bulk stock are totally unsatisfactory for this critical application; the glue joint will inevitably leak water into the motor after a few weeks.

If "megger" tests conducted through the cables in the field per Section 2.2.1 showed insufficient insulation resistance, and if humidity relay has not tripped (continuity exists between lead 1 and 2), it can be assumed that the insulation failure is in the cable rather than in the stator. Remove fasteners (509) and carefully lift off cable cover.

Cut the leads between cable and winding and now make a separate "megger" tests on cable and winding. If windings are at fault, send the entire motor to the nearest autorized Hidrostal service station. If cable is at fault, a new cable set can be installed.

2.4.1 RE-CONNECTION OF CABLE

Place a new 'O' ring (525) into position around the seal face on cover (500). Cables should be re-connected to the winding leads, using new insulated splices. Take care that this insulation is rated for 110°C.

"OVERHAUL CHART", 50 Hz Motors

Hidrostal

CAUTION:

The overhaul of Ex-Motors must be done in factory or in a authorized Hidrostal service center, otherwise the Ex certification will be invalidated.

motor type	motor side seal	pump side seal	seal oil (liters)	hours between regreasing
DN2P2	1 1/8	1 1/8	2	9000
DK2R2	1 1/8	1 1/8	2	"
DN2R2	1 1/8	1 1/8	2	"
DK2X2	1 1/9	1 1/8	2	"
DN2Y2	1 1/2	1 1/9	2	"
DN2Y3	1 1/2	1 1/9	2	9000
DN3B2	1 1/2	1 1/8	4	7000
DE3B2	1 1/2	1 1/8	8	7000
DK3B2	1 1/2	1 1/8	4	7000
DN3T2	1 1/2	1 1/8	4	6000
DE3T2	1 1/2	1 1/2	10	"
DN3Q3	1 1/2	1 1/2	5	"
DN3Z2	1 1/2	1 1/2	5	"
DE3Z2	1 1/2	1 1/2	11	6000
DNBSG	1 1/9	1 1/9	2	20,000
DN2A4	1 1/8	1 1/8	2	"
DN2P4	1 1/8	1 1/8	2	"
EN2P4	1 1/8	1 1/8	2	"
DK2R4	1 1/8	1 1/8	2	"
DN2R4	1 1/8	1 1/8	2	"
EN2R4	1 1/8	1 1/8	2	"
DK2X4	1 1/8	1 1/8	2	"
DN2Y4	1 1/2	1 1/9	2	"
EN2Y4	1 1/2	1 1/2	2	20,000
DK3A4	1 1/2	1 1/8	4	18,000
DE3A4	1 1/2	1 1/8	8	"
EK3A4	1 1/2	1 1/2	5	"
EE3A4	1 1/2	1 1/2	9	"
EN3A4	1 1/2	1 1/2	5	"
EE3R4	1 1/2	1 1/2	10	"
EN3R4	1 1/2	1 1/2	5	"
EE3R5	1 1/2	1 1/2	10	"
EN3R5	1 1/2	1 1/2	5	18,000
FE3T4	2	2	13	15,000
FN3T4	2	2	8	"
EE3Y4	1 1/2	1 1/2	11	"
EE3Y5	1 1/2	1 1/2	11	"
EN3Y4	1 1/2	1 1/2	5	"
FE3Z4	2	2	14	"
FN3Z4	2	2	8	15,000
FE4B4	2	2	24	14,000
FE4B5	2	2	24	"
FN4B4	2	2	10	"
FE4S4	2	2	28	"
FE4S5	2	2	28	"
FN4S4	2	2	10	14,000
FE5B4	2	2	38	12,000
FE5B5	2	2	38	"
FN5B4	2	2	16	"
HE5C4	3	3	44	"
HN5C4	3	3	22	"
HE5T4	3	3	44	"
HN5T4	3	3	22	12,000

Submersible Motors

motor type	motor side seal	pump side seal	seal oil (liters)	hours between regreasing
DNBSF	1 1/8	1 1/8	2	20,000
DN2A6	1 1/8	1 1/8	2	"
DN2P6	1 1/8	1 1/8	2	"
EN2P6	1 1/8	1 1/8	2	"
DN2R6	1 1/8	1 1/8	2	"
EN2R6	1 1/8	1 1/8	2	"
DK2X6	1 1/8	1 1/8	2	"
EN2Y6	1 1/2	1 1/2	2	20,000
DK3A6	1 1/2	1 1/8	4	20,000
EK3A6	1 1/2	1 1/2	5	"
EE3A6	1 1/2	1 1/2	9	"
EN3A6	1 1/2	1 1/2	5	"
EE3R6	1 1/2	1 1/2	10	"
EK3R7	1 1/2	1 1/2	5	"
EE3R7	1 1/2	1 1/2	10	"
FE3T6	2	2	13	"
FN3T6	2	2	8	"
EE3Y7	1 1/2	1 1/2	11	"
FE3Z6	2	2	14	"
FN3Z6	2	2	8	"
FE3Z7	2	2	14	"
FN3Z7	2	2	8	20,000
FE4A6	2	2	23	20,000
FN4A6	2	2	9	"
FE4A7	2	2	23	"
HE4B6	2	2	28	"
HN4B6	2	2	14	"
HE4S6	2	2	32	"
HN4S6	2	2	14	"
FE4S7	2	2	28	"
HE4S7	2	2	32	20,000
HE5B6	3	3	44	18,000
HN5B6	3	3	22	"
HE5B7	3	3	44	"
HE5S6	3	3	44	"
HN5S6	3	3	22	"
HE5S7	3	3	44	18,000
DK2A8	1 1/8	1 1/8	2	20,000
DN2A8	1 1/8	1 1/8	2	"
EK3R8	1 1/2	1 1/2	5	20,000
EN3R8	1 1/2	1 1/2	5	"
EE3R9	1 1/2	1 1/2	10	"
FE3T8	2	2	13	"
FK3T8	2	2	8	"
FN3T8	2	2	8	"
FE3Z8	2	2	14	"
FN3Z8	2	2	8	"
FE3Z9	2	2	14	"
FN3Z9	2	2	8	"
FE4A9	2	2	23	20,000
HE4B8	2	2	28	"
HN4B8	2	2	14	"
HE4B9	2	2	28	"
HE4S8	2	2	32	"
HN4S8	2	2	14	"
HE4S9	2	2	32	"
HE5B9	3	3	44	20,000
HE5S9	3	3	44	20,000

Immersible Motors

Fig. 14

2.4.2 TEST FOR LEAKS

Befor putting the pump back into operation after opening of the motor (as when changing cables), a test for leaks in the motor should be carried out as follows:

Connect source of dry air (from air compressor or bicycle hand pump) to opening left by removal of plug "Mot." (Fig. 7,8 or 9). Air pressure should be a maximum of 7 psi. Motor should then be totally submerged in a test tank.

CAUTION:

Do not immerse loose end of cables.

If any continuously escaping bubbles are detected, motor cover is not water-tight. The preceding procedure for cable installation should be repeated to eliminate leaks.

MAINTENANCE OF HYDRAULIC PARTS

3.1 IMPELLER CLEARANCE ADJUSTMENT FOR WEAR

After some time of operation, the impeller and suction cover (or liner) may have worn, increasing the impeller gap. The impeller gap should be checked and readjusted whenever a significant decrease in pump performance is noticed, or at least once every year (until a history is developed at each different application to indicate how often adjustment will be required). Adjustment is most critical on high-pressure pumps (D3, E4, F4, H5, I6, L8), and least critical on low-pressure pumps.

Excessive clearance is not desirable especially in the smaller pump sizes, as a greater percentage of total flow can thus re-circulate causing a drop in performance. Conversely, less clearance than the minimum listed can overload the motor and/or cause vibration due to too great a friction between the impeller and the suction cover.

When pumping thick sludges or viscous material, larger clearances may be necessary to avoid friction; larger clearances may actually increase flow capability. Therefore, for thick sludges and high consistency materials, double the clearances in Figure 14 should be used.

Some pumps are easily adjusted by means of a movable liner (421); its position is regulated by three external regulator nuts (446) found on the suction casing (416) volute or casing (400). These pumps are designated "regulable", and include the letter R or C in the pump code on the nameplate.

Other pumps have a one-piece suction cover (402) (or in pumps D3K and D4K, a fixed liner (421)); these pumps are adjusted by changing the thicknesss of the shims (411) between the motor and the volute casing (400).

Examine your pump for presence or absence of the regulator nuts, and proceed to the corresponding section of these adjustment instructions.

3.1.1 A. IMPELLER CLEARANCE ADJUSTMENT OF "REGULABLE" PUMPS

Loosen and back off standard hex nuts on end of each regulator nut assembly. Now slowly and evenly screw in each large threaded regulator nut just until pump shaft cannot be turned (this will eliminate all clearance between the impeller and the liner). Be sure to take the same number of turns on each threaded regulator nut; this keeps the liner concentric to the impeller.

Note: If impeller tip is binding on suction lip, see section 3.3.6.

Now back off the threaded regulator nut exactly the number of turns specified in the last column of Figure 14 (according to pump size). Holding each threaded regulator nut from turning, tighten the three standard hex nuts (this pulls liner away from impeller the required clearance, and also locks the regulator nut in place).

With a feeler gauge, check the actual clearance between impeller and liner (reaching in through the handhole cover (405) or through the suction of the pump). If the clearance is significantly different than clearance "C" shown in column 2 of Figure 14, it is possible that the wear is excessive or not uniform: disassembly and inspection is recommended.

3.1.2 IMPELLER CLEARANCE ADJUSTMENT FOR NON-"REGULABLE" PUMPS:

Adjustment is accomplished by moving the motor inward toward the volute casing. For the following steps it has proven easiest that the casing-suction cover assembly be placed with the suction flange flat on the floor or workbench, and the motor-impeller assembly be removed or lowered into place from above by a suitable hoist.

Loosen all fasteners (419) between motor and volute casing. Remove shims or shim wire.

To estimate correct shim thickness, lower motor into casing just until impeller cannot be turned. Measure gap between motor and volute casing at several places around motor flange and take average. Now add the distance "B" shown in column 3 of Figure 14 to the average gap measured; this will be approximate shim thickness required to obtain correct clearance "C" shown in column 2 of Figure 14.

Note: If impeller tip is binding on suction lip, see section 3.3.6.

Loosen fasteners (419), and place shims of calculated thickness between motor and volute casing. (Shims may be washers of uniform thickness, or U-shaped shimstock - these must be placed under each fastener (419). Thin shims may be a single piece of steel wire - diameter equal to calculated thickness - wrapped all the way around motor, under the studs (419); ends can be bent outward around last studs (419), to avoid overlapping.

Tighten fasteners (419) again, and with a feeler gauge, check the actual clearance between impeller and liner (reaching in through the handhole cover (405) or through the suction of the pump). If the clearance is significantly different than "C" shown in column 2 of Figure 14, it is possible that the wear is excessive or not uniform: disassembly and inspection is recommended.

If this adjustment procedure does not restore original pump performance, disassemble hydraulic end per followingsection to examine for uneven or excessive wear on impeller or suction cover/liner, and replace worn parts as necessary.

PUMP TYPE	Clearance C (mm.)	Travel of the regulator nut B (mm.)	Aprox. Nº of turns for regulator nut
D3K/D4K	0.35		
E 5 K	0.4	1.12	2/3
E8K-LS/LL			
E8K-HD/SS		1.55	1
F 4 K		0.68	1/2
F 6 K	0.5	1.40	1
F 10 K		1.93	1-1/3
H 5 K		0.85	1/2
H 8 K	0.6	1.67	1-1/6
H 12 K		2.32	1-1/2
I 6 K		1.02	2/3
I 10 K	0.75	2.09	1-1/3
I 16 K		2.90	2
L 8 K		1.28	5/6
L 12 K	0.9	2.51	1-2/3
L 20K		3.48	2-1/3

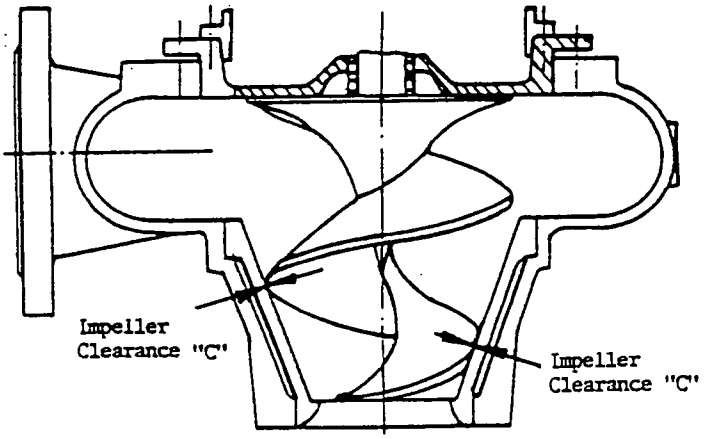


Fig. 14

Note: Clearance "C" should be checked along entire impeller edge, and again after rotating impeller 1/4, 1/2, and 3/4 turns.

3.2 DISASSEMBLY OF HYDRAULIC PARTS

3.2.1 DISASSEMBLY FOR INSPECTION

For the following steps the casing-suction cover assembly should be placed with the suction flange flat on the floor or workbench, and the motor-impeller assembly removed or lowered into place from above by a suitable hoist.

The rotating assembly including impeller and motor can be lifted from the pump casing after removing nuts (419) around the motor flange. Areas to be examined for wear will be the impeller surface (especially the edges) and the conical machined surface in the liner or suction cover. Uniform wear on any of these surfaces can, up to a point, be compensated for by re-shimming or adjusting according to Section 3.1. of this manual. However, excessive or uneven wear will require replacement of the worn parts.

3.2.2 REMOVAL OF IMPELLER

Hold the impeller (401) from turning by hand, or by a strap wrench, or by locking pliers clamped to the impeller. Inset a hexagonal key wrench (allen-head wrench) into the impeller bolt (415) and with a hammer, tap the wrench counterclockwise to loosen the bolt.

Wrench sizes

Pump size:	D	E	F	H	I	L
Wrench size:	8mm	10mm	14mm	19mm	27mm	27mm

After removal of bolt, the impeller can be tapped loose from its fit against the impeller flange (165) by a few taps with a rubber mallet.

Note: For pumps D3K, D4K-HS/S and E4T, the impeller is fitted directly onto the shaft taper (no impeller flange is used).

3.2.3 REMOVAL OF LINER OR SUCTION COVER

a) For D3K, D4K & E4T

These pumps have a non-adjustable liner (421) held in a fixed position inside a one-piece volute casing. After removal of the three allen-head setscrews (418), this liner can be pressed out of the casing. See Figure 15.

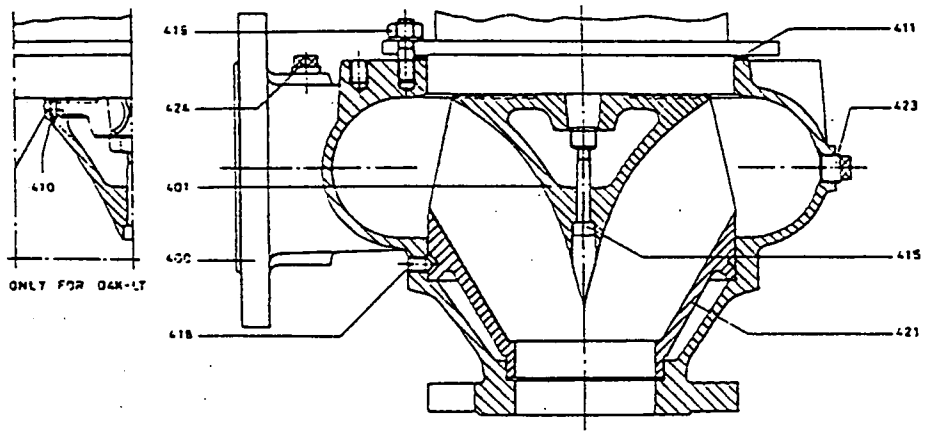


FIGURE 15 D3K, D4K, E4T

b) For all other pumps without "regulable" feature:

These pumps have a one-piece suction cover (402) which is bolted to the volute casing (400) by studs and nuts (417). Adjustment of clearance is by shims (411) between the volute casing and the motor. Note that on certain models there may be a spacer ring (414) between mating surfaces of the suction cover and the volute casing. When there is excessive wear on the conical surface, the suction cover (402) should be replaced. See Figure 16.

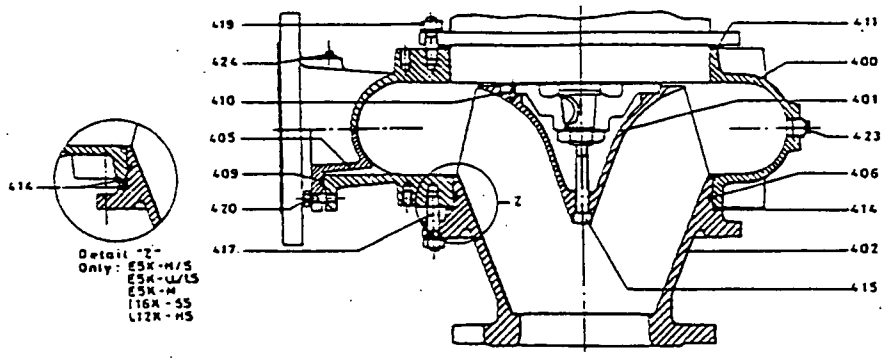


FIGURE 16: E5K, E8K, F6K, F10K, H8K, H12K, I10K, I16K, L12K, L20K: Non-Regulable.

c) For all other pumps with "regulable" feature:

These pumps have an externally-adjustable liner (421), held in place by a suction casing (416) which is bolted to the volute casing (400) by studs and nuts (417). This construction can be recognized by the presence of three large regulator nuts (446) threaded into the suction casing just behind the suction flange.

If the conical surface is worn, only the liner need be replaced. The liner can be removed while the volute casing and suction casing remain attached to the piping, if desired. Alternately, the suction casing may be removed from the volute casing by removing nuts (417), if more convenient. Note correct positioning of spacer ring (414) between suction casing and volute casing.

To remove liner, completely remove small nuts on end of regulators (446), then push the three studs through the holes in the large regulator nuts. If stubborn, the large regulator nuts can be turned all the way into the casing to force the liner out. No attempt should be made to disassemble the regulator studs from the liner until the liner is removed from the pump: they are loctited in place, and must be heated with a torch to break the locktite bond.

The suction ring (408) should not typically require disassembly; remove from suction casing only if badly damaged by unusual circumstances. (It will be necessary to heat the mating surfaces with a torch to destroy the special adhesive between these two parts. Then press out suction ring with a hydraulic press.) See Figure 17.

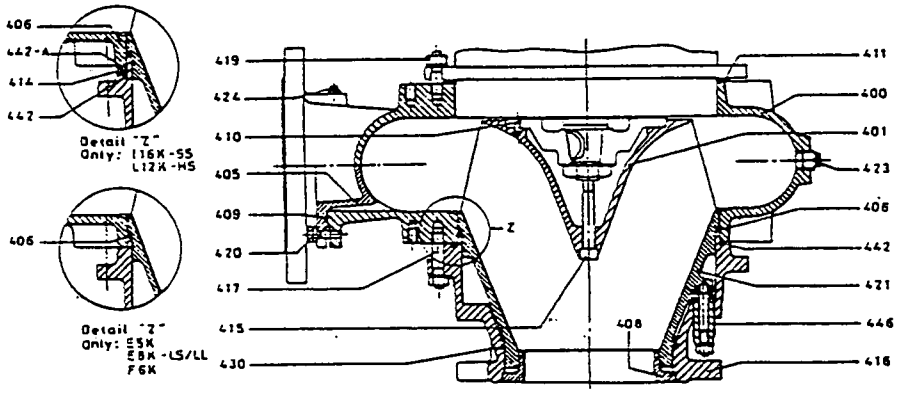


FIGURE 17 : E5K, E8K, F6K, F10K, H8K, H12K, I10K, I16K, L12K, L20K: Regulable.

Note: I6K and L8K pumps will not have a suction ring (the necessary lip is cast directly into the liner). See Figure 18.

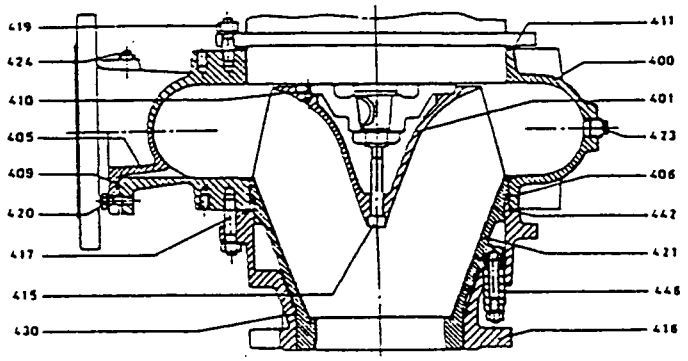


FIGURE 18: I6K, L8K: Regulable (also F4K, H5K regulable, when two-piece casing)

Also F4K and H5K may not have a separate suction casing bolted to the volute casing; the entire casing may be one-piece. See Figure 19. If the casing is two-piece, see Figure 18.

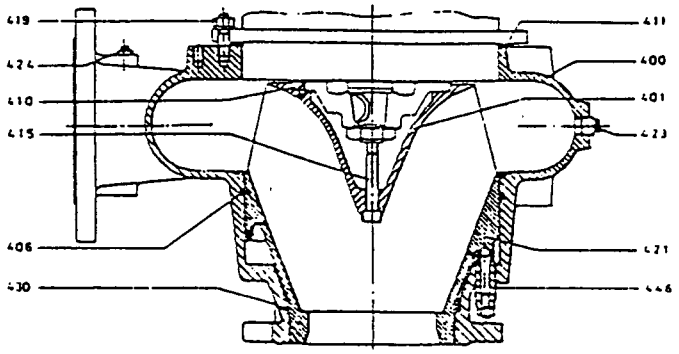
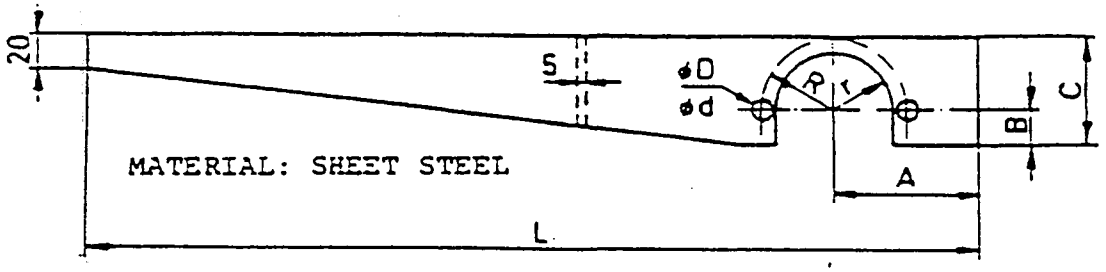


FIGURE 19: F4K, H5K: Regulable

3.2.4 REMOVAL OF IMPELLER FLANGE

(For pumps where impeller flange is used)

Bend tabs on the locking washer (167). When loosening the impeller flange nut (166), it may be necessary to hold the impeller flange from turning, by bolting up the special tool shown on Figure 20 to the tapped holes in the impeller flange. Use bolt thread size as indicated in last column of table in Figure 20. After nut is removed, tap impeller flange (165) with a mallet, and the impeller flange should drop off the shaft taper. If not, use a pully-extractor tool as shown in Figure 20, bolted to the impeller flange with bolts of the size shown in the last column of Figure 20.



PUMP SIZE	R	r	o D	A	B	C	L	Impeller Flange Nut Size	Wrench Size (1)	Hole Size
D	30	25	10	65	15	70	500	M20	32	M8
E	40	33	14	80	20	80	500	M28	41	M12
F	55	48	14	110	20	100	900	M35	46	M12
H	80	65	18	150	30	130	900	M35 (2)	46 (2)	M16

(1) MM across flats

(2) Except for "H" pump size with "H" motor size. In this case a special nut 70 mm across flats is used.

FIGURE 20

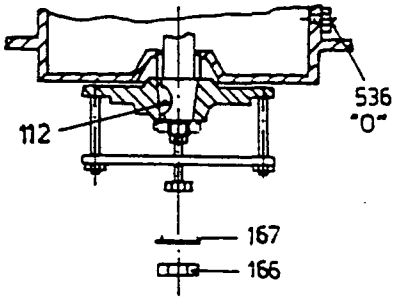


Fig. 21

3.2.5 Removal of Lower Mechanical Seal

a)

b) Rubber-boot type seal - "M"
(Figure 23)

Remove retaining ring "A" from the rubber boot of the seal by gently prying with two dull-edged screwdrivers on opposite sides, between the rubber boot and the retaining ring (see Figure 24).

CAUTION:

Use only dull-edged screwdrivers since sharp edges could cut the rubber boot. Do not twist screwdriver, as this can puncture rubber boot. Rather, lay some convenient object onto back-plate, to act as a fulcrum for each screwdriver, and pry ring directly up away from rubber boot. (See Figure 24.)

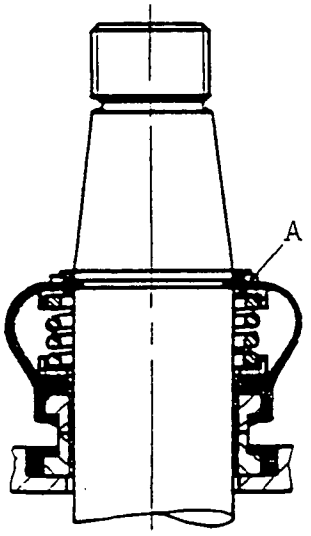


Fig. 23

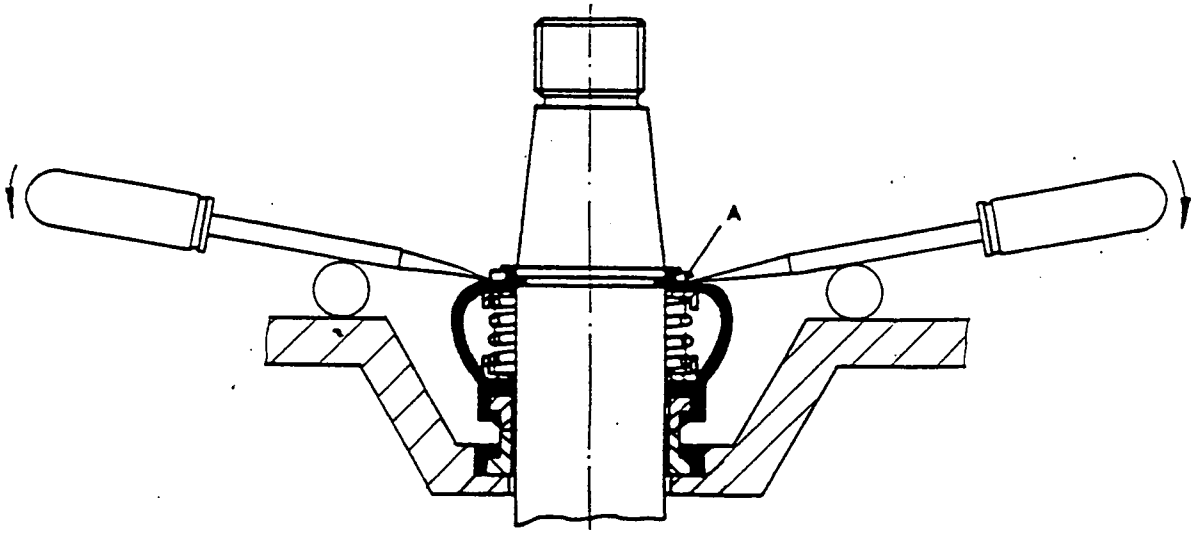


Fig. 24

Make sure the Woodruff key groove has no sharp edges so that the rubber parts cannot be damaged as they are removed. Gently insert a small dull screwdriver between the shaft and the rubber boot.

By lifting and turning the screwdriver around the shaft, the lip of the rubber boot can be lifted out of the shaft groove. Lubrication of the shaft and the boot helps this disassembly. Once the boot is free of the groove, the entire rotating part of the seal with boot can be pulled off the shaft. If necessary, use two screwdrivers deep into the seal area to pry the seal face loose. See Figure 25.

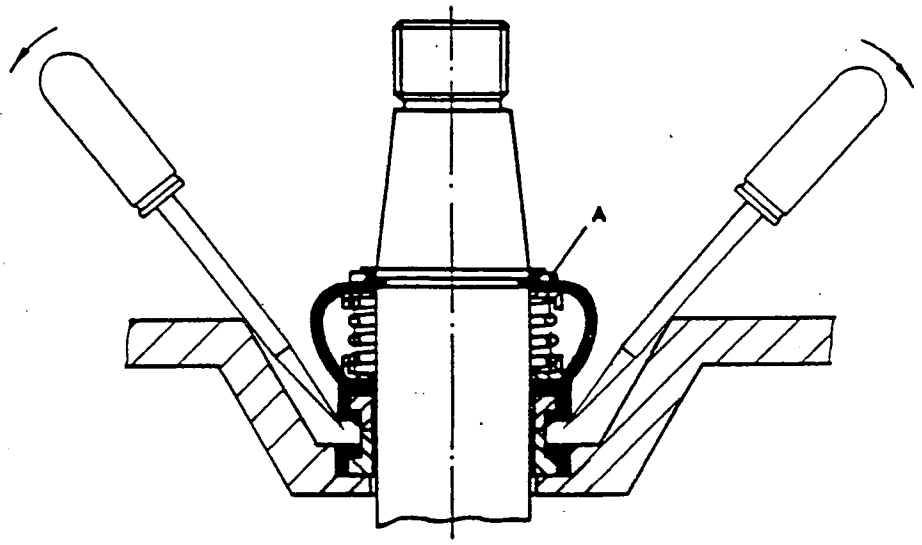
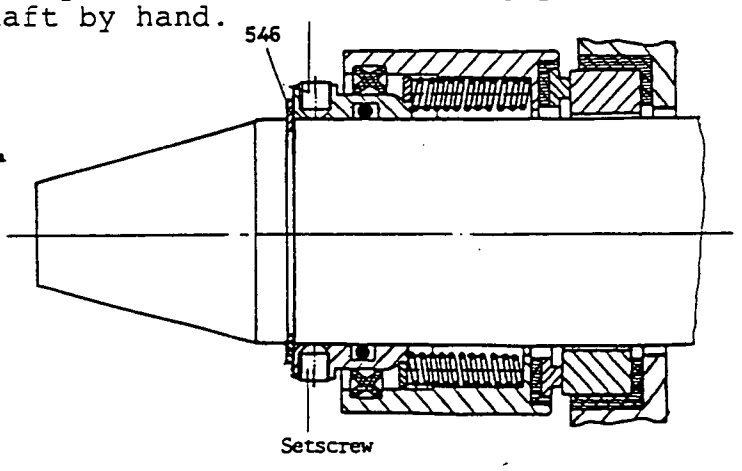


Fig. 25

c) Stainless-steel-shroud type seal - "X"
(Figure 26)

Remove all three small setscrews from outer body of rotating part. Remove snapring (546). Oil the shaft for ease of disassembly. Now the seal rotating part can be pulled off the shaft by hand.



NOTE:

Snapring 546 is not used with 2 inch "X" seal.

Fig. 26

d) For removal of stationary seat (all types)

Refer to Figure 27. Remove static part of the mechanical seal as follows:

Unfasten nuts (534) and carefully remove seal chamber (507) from motor housing. Make sure that the static part of the seal (515) does not hit the shaft so that it is not damaged as the seal chamber is pulled off.

Now the static part of the seal can be carefully pushed out of the chamber from the back side.

Sometimes an old seal can be repolished or repaired by HIDROSTAL. Consult nearest service center for this service. When sending a seal for inspection or repair, it is important to thoroughly protect the seal faces to prevent damage during transportation.

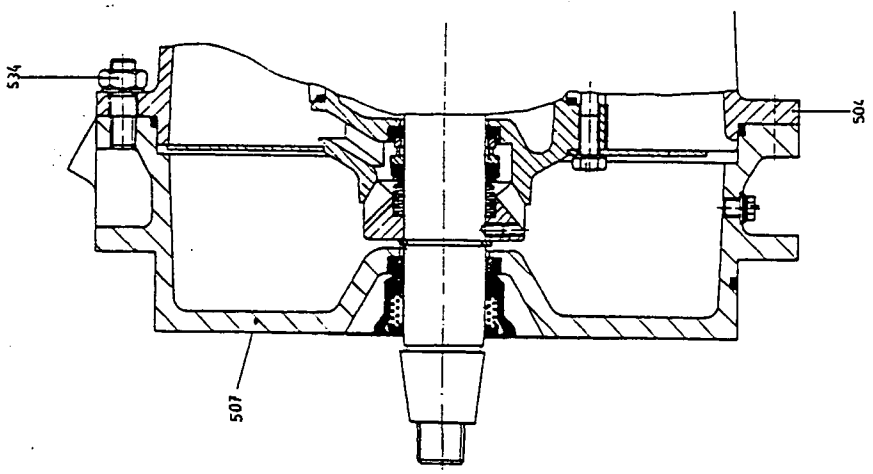


Fig. 27

3.2.6 UPPER MECHANICAL SEAL (516)

It is IMPORTANT to note that removal of this seal should not be attempted in the field. If leakage of this seal has been detected from the stator housing test as described in Section 2.2.2, the entire motor should be sent to the nearest authorized HIDROSTAL service center for a complete inspection. It is likely that in this case special attention must be given to the windings and bearings.

3.3 RE-ASSEMBLY OF SEAL CHAMBER AND HYDRAULIC PARTS

Cleanliness is of utmost importance for this assembly work. All parts must be washed in solvent prior to assembly. Pay paarticular attention that all machined mating surfaces are clean and are free from burrs. All grooves and landings for "O"-rings and other static seals must be cleaned of all sealants and inspected for nicks or scratches. All threads must be clean especially those in holes for studs. All "O"-rings MUST be replaced with new ones and they should be lubricated with light oil prior to assemly.

WARNING:

For "O"-rings in the motor (that is, "O"-rings with 500 series numbers), never use "O"-rings glued from "O"-ring stock. Our experience is that this glue joint will inevitably leak. Glued "O"-rings may be used in the hydraulic end (that is "O"-rings with 400 series numbers) if a slight leakage from the pump is not a problem.

3.3.1 REPLACEMENT OF LOWER MECHANICAL SEAL

a) Replacement of stationary seat (all types)

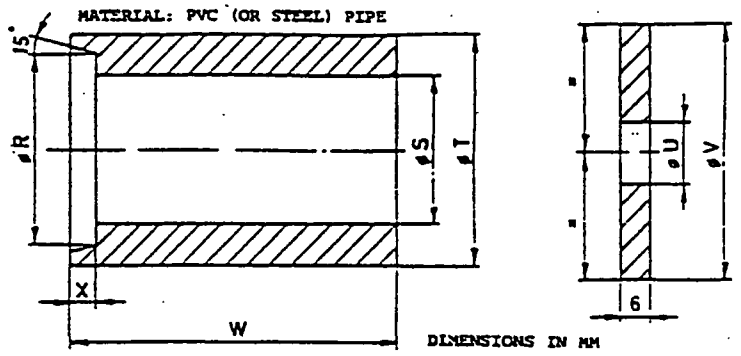
Place a new "O"-ring on the stator housing (527). Carefully assemble seal chamber (507) to the stator housing and fasten with fastening set (534).

Lubricate with oil the rubber circumference of the static mechanical seal part and carefully press all the way into its seat in the seal chamber (507). The ring must fit tightly in place. Protect the seal face during this operation. Examine gap between shaft and inner diameter of seal face; when face is correctly installed, gap will be uniform all the way around.

WARNING:

The seal face is very brittle, and can easily snap unless pressure is uniform during installation. We suggest pushing in with special tool (Figure 28).

Make sure the Woodruff key groove on the shaft taper has no sharp edges, so that the rubber part or the mechanical seal cannot be damaged. File groove edges if necessary.



PUMP SIZE	o R	o S	o T	o U	o V	o W	o X	BOLT SIZE
D	40 ± 1	29 $^{+1}_{-0}$	45 ± 1	12	50	65	5	M10
E	50 ± 1	39 $^{+1}_{-0}$	55 ± 1	14	60	75	5	M12
F	65 ± 1	51 $^{+1}_{-0}$	70 ± 1	18	80	95	5	M16
H	92 ± 1	77 $^{+1}_{-0}$	100 ±1	28	110	170	5	M27

SPECIAL TOOL TO MOUNT "W" TYPE SEAL

Fig. 28

b) Replacement of exposed-spring type seal - "C" and "V"

Remove spring and spring retaining ring from mechanical seal. Seal surfaces must be absolutely clean. (Make sure there is not even a speck of dust on the surfaces). Place a few drops of light oil on the rotating (carbon) face of the mechanical seal, then lubricate inner bore of rubber part of the seal with oil and put a small amount of oil onto shaft. Install rotating face (with its rubber part) over shaft, and press gently down length of exposed shaft until carbon face touches stationary face. It may help to use a small wood "pusher", or better, a plastic pipe mandrel only slightly larger than shaft diameter, to push directly on the rubber part of the seal to slide it along the shaft. (Suitable dimensions for such a mandrel are shown in Figure 28.) Be sure rubber part sits uniformly on shaft, and has NOT rolled out from under the metal part of the seal. Put on seal spring, and spring retaining ring.

Install snap ring (546) and turn shaft by hand to check for free running.

c) Replacement of rubber-bellows type seal - "M"

Lubricate with oil the rotating part of the mechanical seal, put the retaining ring "A" on the rubber boot with rounded edge towards the rubber boot. (See Figure 29.) Push the whole assembly by hand over the shaft as far as possible. Mount the special tool over the shaft tip (see Figure 30), and compress the mechanical seal until the lip of the rubber boot is engaged in the shaft groove. Remove special tool. Turn the shaft by hand and watch that the retaining ring turns perfectly in line with the rubber boot and that it is not cocked. Then try to pull the rubber boot off shaft by hand to make sure that the lip has reliably engaged in the shaft groove.

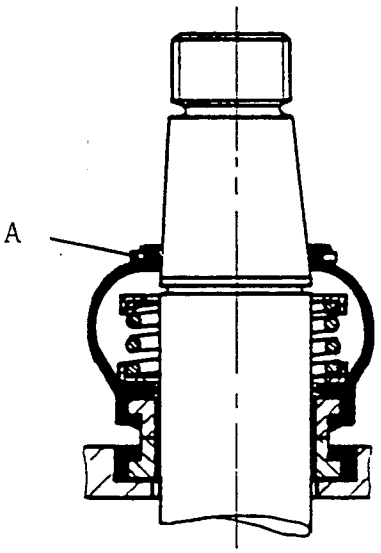


Fig. 29

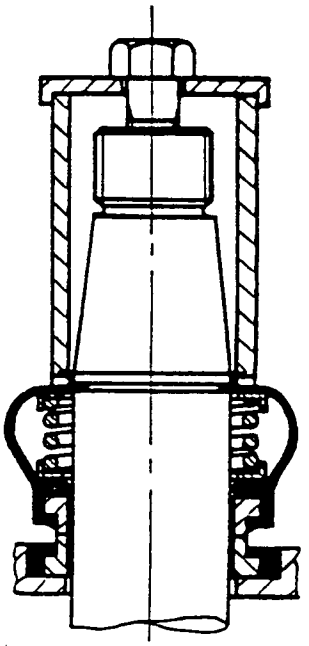


Fig. 30

d) Replacement of stainless-steel-shroud type seal - "X"

Lubricate inner rubber "O"-rings of seal with light oil, and put a small amount of oil onto shaft. Install entire seal over shaft, and press gently down shaft until rotating face touches stationary face. Now install snapring over shaft, and push on snapring (compressing springs in seal) until snapring snaps into its groove. It may be necessary to use the special tool (Figure 28) pushing against the snapring, turning the tool's bolt to provide sufficient pressure to start the snapring. Remove special tool. Then re-install the three small setscrews into the seal rotating part, and tighten firmly.

(NOTE: Snapring 546 is NOT used with 2 inch "X" seal. Instead, the thee setscrew tips should engage the snapring groove, to ensure correct location of the seal.)

3.3.2 TIGHTNESS TEST FOR LOWER MECHANICAL SEAL (All Types)

Remove oil plug "Oil" (536). This test assumes thatoil has been previously drained from the motor. Connect dry compressed air source such as bicycle tyre pump to the opening. Use a pressure reducing valve and relief valve set to 1 psi (1/2 bar).

WARNING:

Make sure that the pressure never exceeds 1 bar. This could displace the seal. Do not immerse end of cable;

Immerse the motor into a test tank full of water and watch for continuously escaping bubbles. This would indicate leakage past the seal or associated "O" ring. Correct failure if leakage has been found. After finishing tightness test remove pressure connection hose and fill with oil according to Section 2.2.3.1 or 2.2.3.2.

3.3.3 ASSEMBLY OF IMPELLER FLANGE (Where used)

Put in Woodruff key (112), coat the shaft taper with an anti-rust paste, put on the impeller flange (165), the locking washer (167) and the nut (166).

The impeller flange nut mustbe tightened to12 mkp (90 ft-lbs) by using torque wrench. Bend overlocking washer tab. Measure the clearance between the impeller flange (165) and the housing (507) with a feeler gauge. This clearance must be within the values given in the table below. If ever the clearance has to be adjusted, this can be done by inserting or revising shims between oil chamber casing (504) and seal chamber (507) close to fastening sets (534). See arrow, Figure 31.

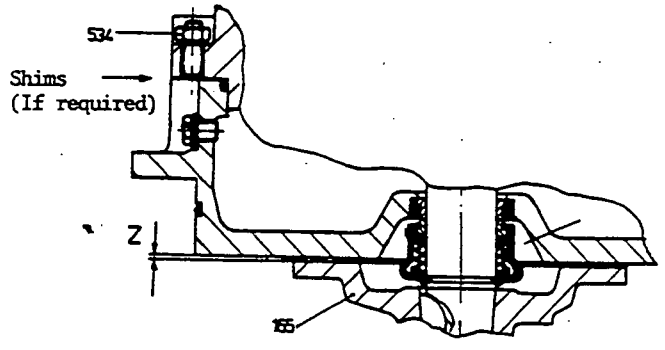


Fig. 31

Hidrostal

LIST OF PARTS MOTOR
POSITIONSNUMMERVERZEICHNIS MOTOR

Dat: 23.07.87 | No: 87-TU 3637/1 | File: T-LSTPRT

POS	DESCRIPTION	BESCHREIBUNG	CODE	MATERIAL* a	MATERIAL* b/c**
104	Spacer ring P.S.	Stützring (Fettring) P.S.	1RD	K	K
106	Bearing spacer	Distanzring	1RD	K	K
112	Woodruff key	Woodruffkeil	2FK	L	F
121	Angular contact ball bearing	Schrägkugellager	8LW	-	-
126	Lock nut for shaft	Mutter SKF für Welle		L	L
127	Lock washer for 126	Sicherungsblech zu 126		O	O
157	Spacer ring	Stützring aussen	1RD	K	K
165	Impeller flange	Laufradaufnahme	2SF	B	C
166	Impeller nut	Laufradmutter	2FM	K	F
167	Impeller locking washer for 165	Sicherungsblech für 165	2FF	K	F
209	O-ring for 507	O-Ring zu 200		Q	Q
500	Junction box cover	Kabeldeckel	5DK	A	C
501	Upper motor cover	Motordeckel oben	5DM	A	A
502	Motor stator	Wicklung	5ES	-	-
503	Shaft (Rotor)	Welle (Rotor)	5WO(5ER)	H	F/H
504	Oil chamber casing	Oelkammergehäuse	5GO	A	A/F
505	Lower bearing cap P.S.	Lagerdeckel P.S.	5DL	A	A
506	Retaining ring	Fettring		K	K
507	Back cover	Mech.Dichttell	5GD/1TD	A	C
508	Snap ring for 514	Seegerring zu 514		O	O
509	Fastening set 500-501	Befestigung 500-501		H	F
510	O-ring for 557 P.S. ex-proof old type	O-Ring zu 557 P.S. Ex		Q	Q
511	Snap ring for upper ball bearing M.S.	Seegerring für Welle bei Lager M.S.		O	O
512	Lower ball bearing P.S.	Lager für Radialbelastung P.S.	8LW	-	-
513	Upper ball bearing cable side	Lager Kabelseite	8LW	-	-
514	Louble row angular contact ball bearing	Lager P.S. (für Pumpe bis 5 kW)	8LW	-	-
515	Mechanical seal P.S.	Mech.Dichtung P.S.	8DM/8dm	-	-
516	Mechanical seal M.S.	Mech.Dichtung M.S.	8DM	-	-
517	Humidity relay	Feuchtigkeitsschutz-Relais	5EU	-	-
518	Cable	Kabel	5EK	-	-
519	Terminal board	Klemmenbrett		-	-
520	Ground cable connection (earth)	Befestigung für Erdanschlusskabel		K	K
521	Terminal connectors ex-proof	Leitungsdurchführung Ex-Schutz		-	-
522	Terminal connectors	Leitungsdurchführung		-	-
523	Cable entry assembly (Intermittent fitting)	Kabeleinführung komplett (Zwischenstück)	5EE (5EZ)	- -	- -
524	O-ring for 501	O-Ring zu 501		Q	Q
525	O-ring for 500	O-Ring zu 500		Q	Q
526	O-ring for 558 on top	O-Ring zu 558 oben		Q	Q
527	O-ring for 200 M.S.	O-Ring zu 200		Q	Q
528	O-ring for 519	O-Ring zu 519		Q	Q
529	O-ring for 558 bottom	O-Ring zu 558 unten		Q	Q
530	O-ring for 504 M.S.	O-Ring zu 504 M.S.		Q	Q
531	O-ring for 505	O-Ring zu 505		Q	Q
532	Fastening set 557-501 (small Motors)	Befestigung 501-557 (kleine Motoren)	5FB	H	F
533	Fastening set 504-505	Befestigung 505-504		H	F
534	Fastening set 507-557/504	Befestigung 507-557/504		H	F
535	Fastening set 501-519	Befestigung für 519		H	F
536	Plug with gasket	Stopfen		F+C	F
537	Fastening set 561	Befestigung für 561		H	F
538	Fastening set 504-557	Befestigung 504-557		H	F
539	Snap ring for 534 (C-Type)	Seegerring für 534 (Typ C)		O	-
540	Distance bolt for 519	Distanzbolzen zu 519		K	K
541	O-ring for 540	O-Ring zu 540		Q	Q
542	Grease retaining disc P.S.	Fettscheibe P.S. + Monobloc M.S.	5SF	K	K
543	Holding ring for 519	Halterring zu 519		K	K
544	Snap ring for 553	Seegerring zu 553		O	O
545	Snap ring for 516	Seegerring zu 516		O	O
546	Snap ring for 515	Seegerring zu 515		O	F
547	O-ring for 59	O-Ring 598		Q	Q
548	Plug for lubricating hole	Stopfen zu Schmierloch		F+P	F
550	Driving pin for 560	Oelradmitnehmer		G	G
552	Plug for flushing connection 581	Stopfen für Spülwasseranschluss 581		N	F
553	Oil seal sleeve	Laufbüchse für Simmerring	5DB	J	J
554	Spacer (If no oil Impeller)	Distanzring (wenn kein Kühlrad)	5KD	K	K
555	Oil seal sleeve	Simmerring		Q	Q
557	Stator housing	Statorgehäuse	5GM	A	A/F
558	Cooling jacket	Kühlmantel	5KG	K	F
559	Spring ring for 558	Sprengring zu 558	5RF	K	F
560	Impeller for circ. of cooling liquid	Kühlrad	5KI	A	A
561	Guidance sheet	Leitblech	5KB	K	K
577	Probeholding	Sondenblech		K	K
578	Moisture detector	Oelmessonde	5ef	-	-
579	Fastening set 593-300	Befestigung 593-300		M	-
580	O-ring for 593 gear side	O-Ring zu 593,getriebeseitig		Q	Q

* For material explanations see sheet of section "ENGINEERING DATA"
** a: Standard material execution
b: All internal wetted parts stainless steel
c: All wetted parts stainless steel depending on size

* Für Materialangaben s. Spetiflkations-blatt des Kapitels "ENGINEERING DATEN"
** a: Stadardmässige Materialausführung
b: Alle intern benetzten Teile rostfrei
c: Alle benetzten Teile rostfrei Grössenabhängig

Hidrostal

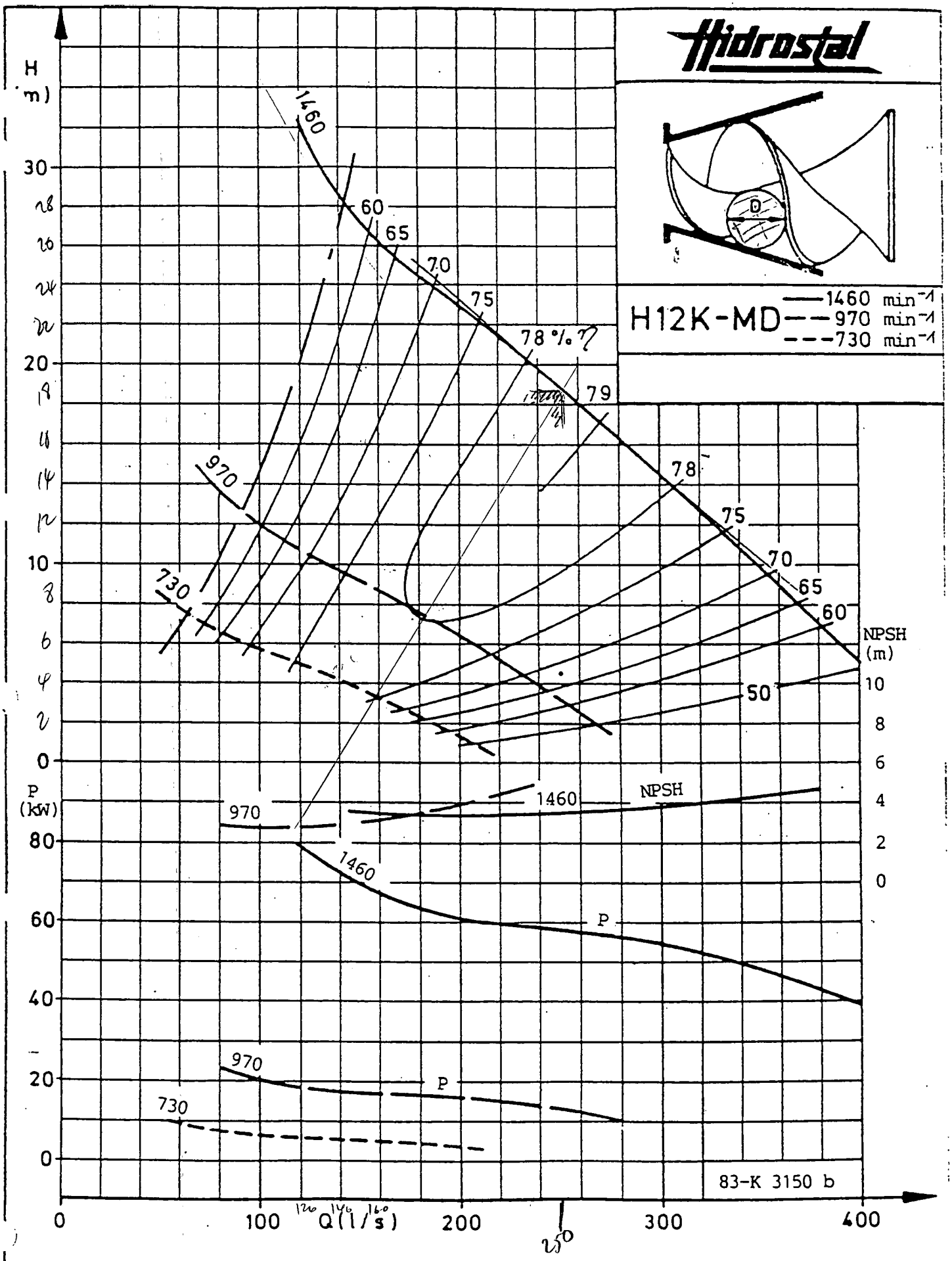
LIST OF PARTS MOTOR
POSITIONSNUMMERVERZEICHNIS MOTOR

Dat:24.07.87 | No: 87-TU 3637/2 | File: T-LSTPRT

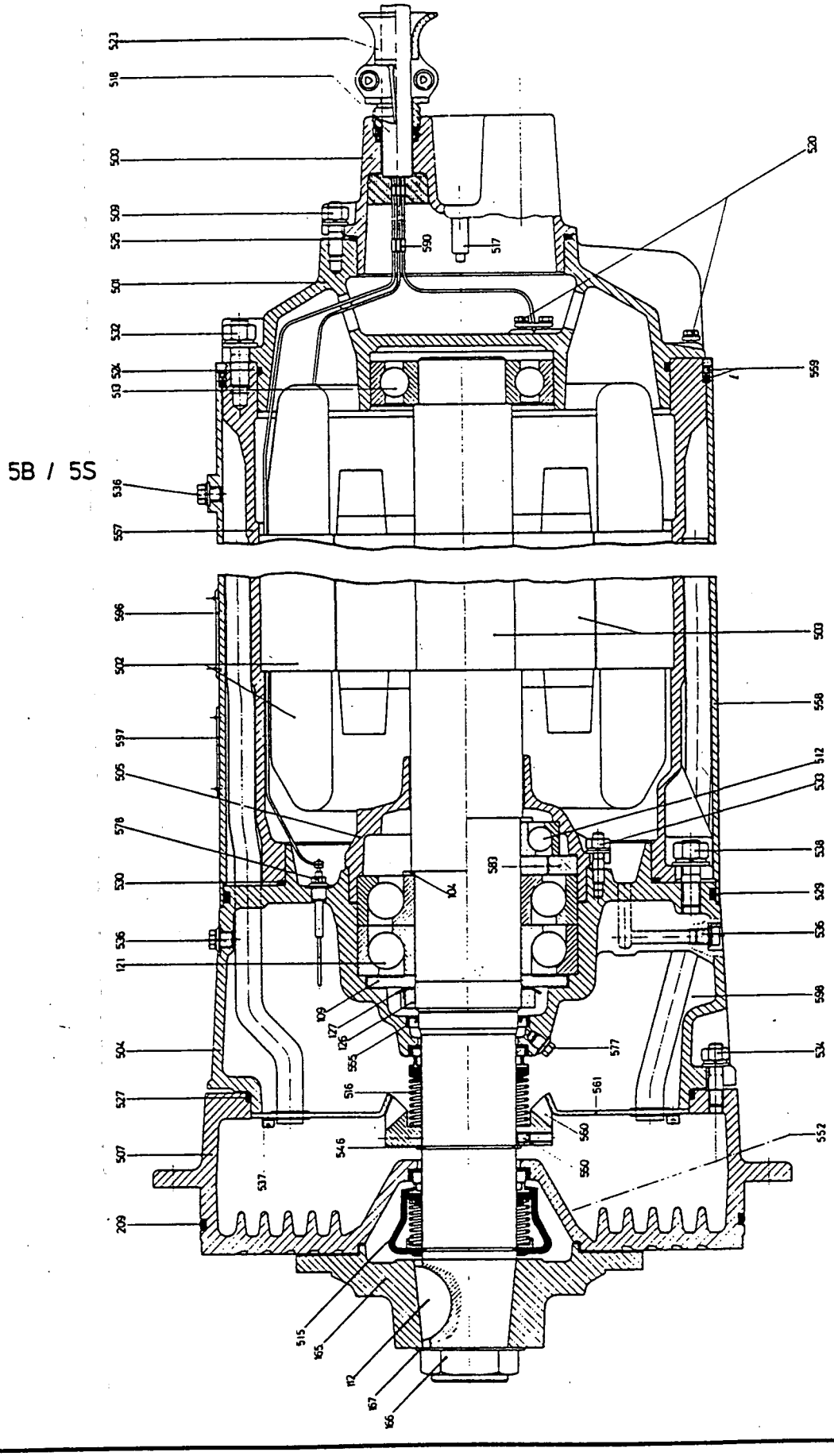
POS	DESCRIPTION	BESCHREIBUNG	CODE	MATERIAL* a	MATERIAL* b/c**
581	Pipe for 507 old types	Spühlrohr zu 507		N	-
582	Inset for 557 ex-proof old types	Einsatz zu 557, ex-Schutz		A	A
583	Grease disc M.S.	Fettscheibe M.S.	5SS	K	K
584	Spacer for 503 standard bearing	Distanzring zu 503, normale Lagerung		K	K
585	Spacer for 557 standard bearing	Distanzring zu 557, normale Lagerung		K	K
586	Small plate for ground cable (earth)	Plättchen für Erdanschluss		P	P
587	Spacer P.S.	Distanzring P.S.		K	K
588	Grease disc, cable side	Fettscheibe kabelseitig		K	K
589	Snap ring for 588	Seegerring zu 588		O	O
590	Cable connection	Miniklemme	5EV	-	-
591	Carrying plate for 590	Tragschiene zu 590		-	-
592	Winding	Paket		-	-
593	Motor support	Motor Support		A	-
594	Snap ring for 595	Seegerring zu 595		O	-
595	Heat shield	Hitzeschutzschild		-	-
596	Name plate ex-proof	Prüfschild ex-Schutz		F	F
597	Name plate	Hauptschild		F	F
598	Oil tubes (ellbow for oil)	Oelröhrchen (Anschlussbogen)	5KR/5BO	A/P/K	P/F
599	Fastening set 598	Befestigung von 598		H	F

* For material explanations see sheet of section "ENGINEERING DATA"
** a: Standard material execution
b: All internal wetted parts stainless steel
c: All wetted parts stainless steel depending on size

* Für Materialangaben s. Spetifikationsblatt des Kapitels "ENGINEERING DATEN"
** a: Stadardmässige Materialausführung
b: Alle intern benetzten Teile rostfrei
c: Alle benetzten Teile rostfrei Grössenabhängig


Hidrostal
H12K-MD
1460 min⁻¹
970 min⁻¹
730 min⁻¹
H (m)
1460
60
65
70
75
78 %
79
970
78
75
70
65
60
730
50
NPSH (m)
P (kW)
970
1460
NPSH
1460
P
970
P
730
83-K 3150 b
0
100
Q (l/s)
200
300
400

Hidrostal	SECTIONAL DRAWINGS MOTOR SCHNITTZEICHNUNGEN MOTOR 5B/5S/5T/5C	
Dat: 22.06.87	No: 83-TU 3075	File:



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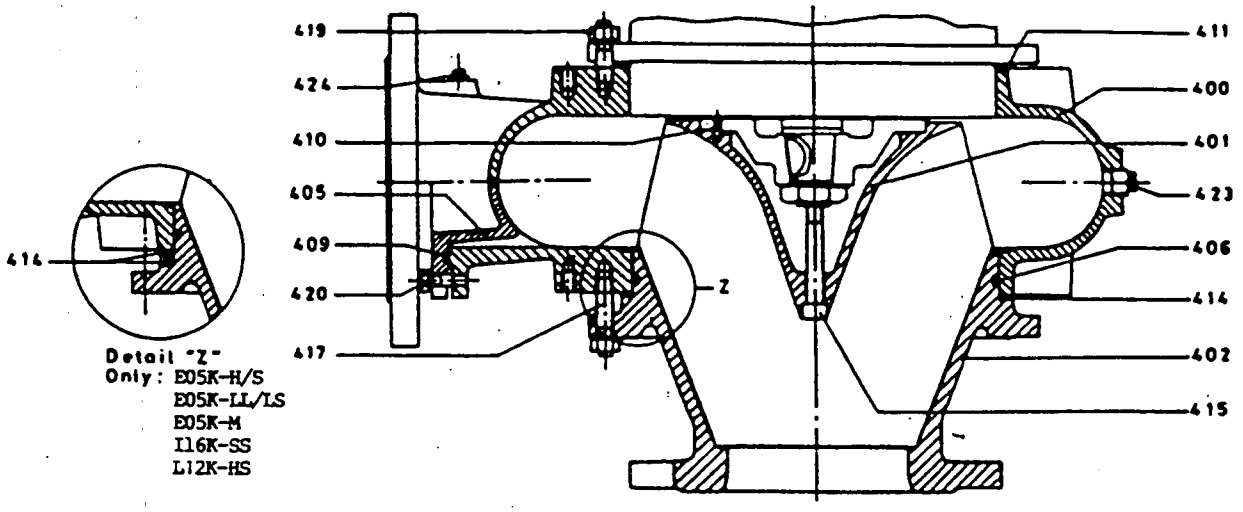
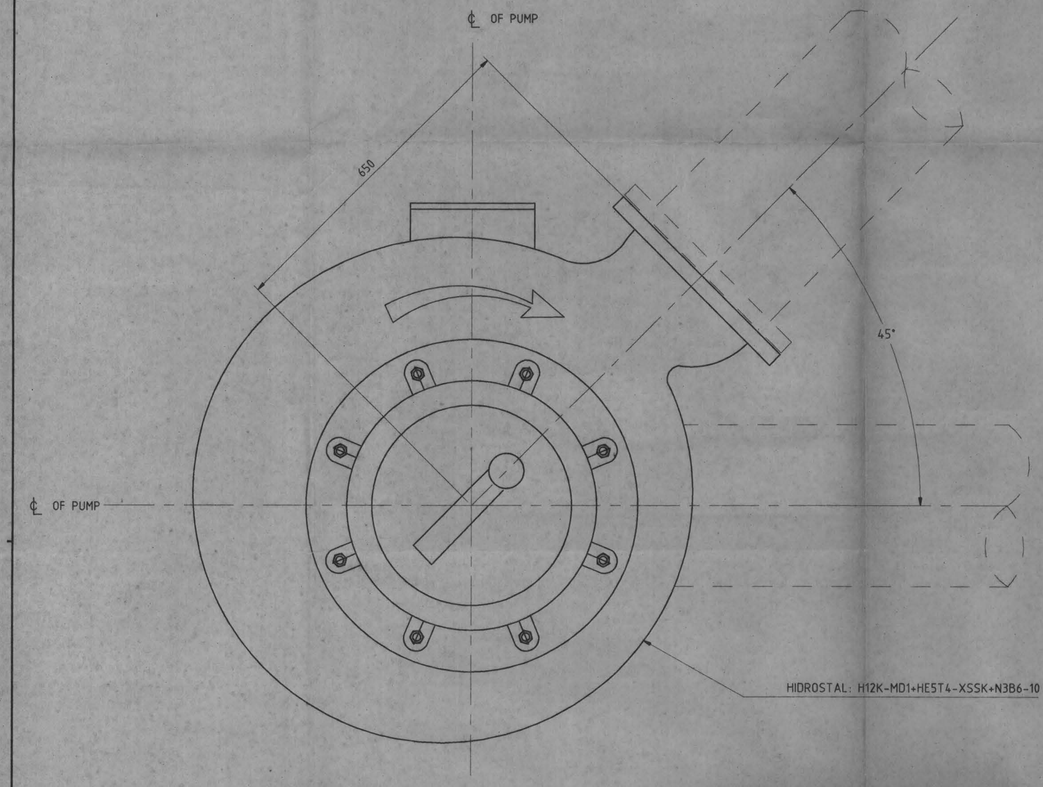
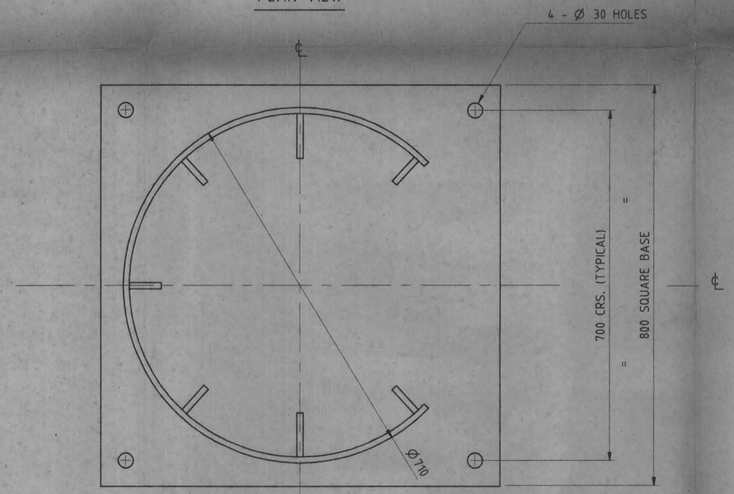
Dat: 26.06.87	No: 87-TU 3552	File:



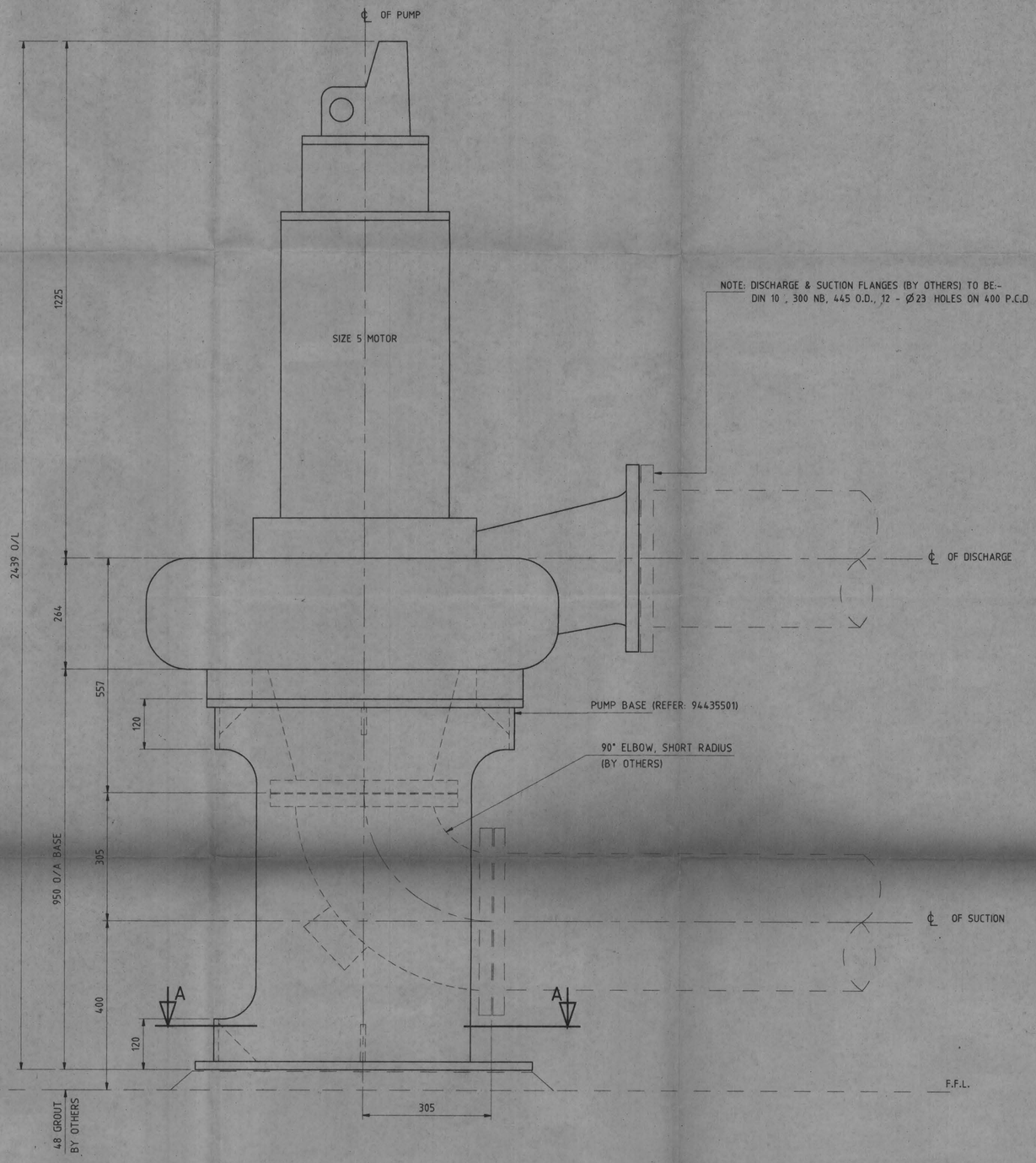
PART	DESCRIPTION	MATERIALS OF CONSTRUCTION 1	5
400	VOLUTE	GREY CAST IRON	STAINLESS STEEL A4
401	IMPELLER	NODULAR IRON	STAINLESS STEEL A4
402	SUCTION COVER	GREY CAST IRON	STAINLESS STEEL A4
405	HANDHOLE COVER	GREY CAST IRON	STAINLESS STEEL A4
406	O - RING	NITRILE	
409	O - RING	NITRILE	
410	DRIVING PIN	STAINLESS STEEL A4	
411	SHIMS	CARBON STEEL	
414	SPACER	CARBON STEEL	
415	IMPELLER BOLT	RUSTLESS STEEL	STAINLESS STEEL A4
417	FASTENING SET	RUSTLESS STEEL	STAINLESS STEEL A4
419	FASTENING SET	RUSTLESS STEEL	STAINLESS STEEL A4
420	FASTENING SET	RUSTLESS STEEL	STAINLESS STEEL A4
423	DRAIN PLUG	STEEL	STAINLESS STEEL A4
424	PLUG	STEEL	STAINLESS STEEL A4



PLAN VIEW



SECTION - "AA"
BASE & MOUNTING DETAIL



SIDE ELEVATION

JOB: EAGLE FARM PUMPING STATION (BRISBANE CITY COUNCIL)
JOB NO: 94 4355
CLIENT NO: P13960
SERIAL NO'S: H2259, H2260, H2261

ECN	REV.	AMENDMENTS	BY	CHK.	DATE
	2	BASE WAS 880 HIGH, REAR OPENING REV/D.	JP	B.M.	26.5.94
	1	ISSUED FOR APPROVAL	JP		10.5.94

SCALE	1:5	DATE
DRAWN	JP	10.5.94
CHECKED	B.W.M.	31.5.94
APPROVED		
ISSUED		31.5.94

REF. DRGS.

EnviroTech AUSTRALIA
A division of Baker Hughes Australia Pty Limited A.C.N. 004 752 050
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PO Box 461, Gosford, NSW 2250
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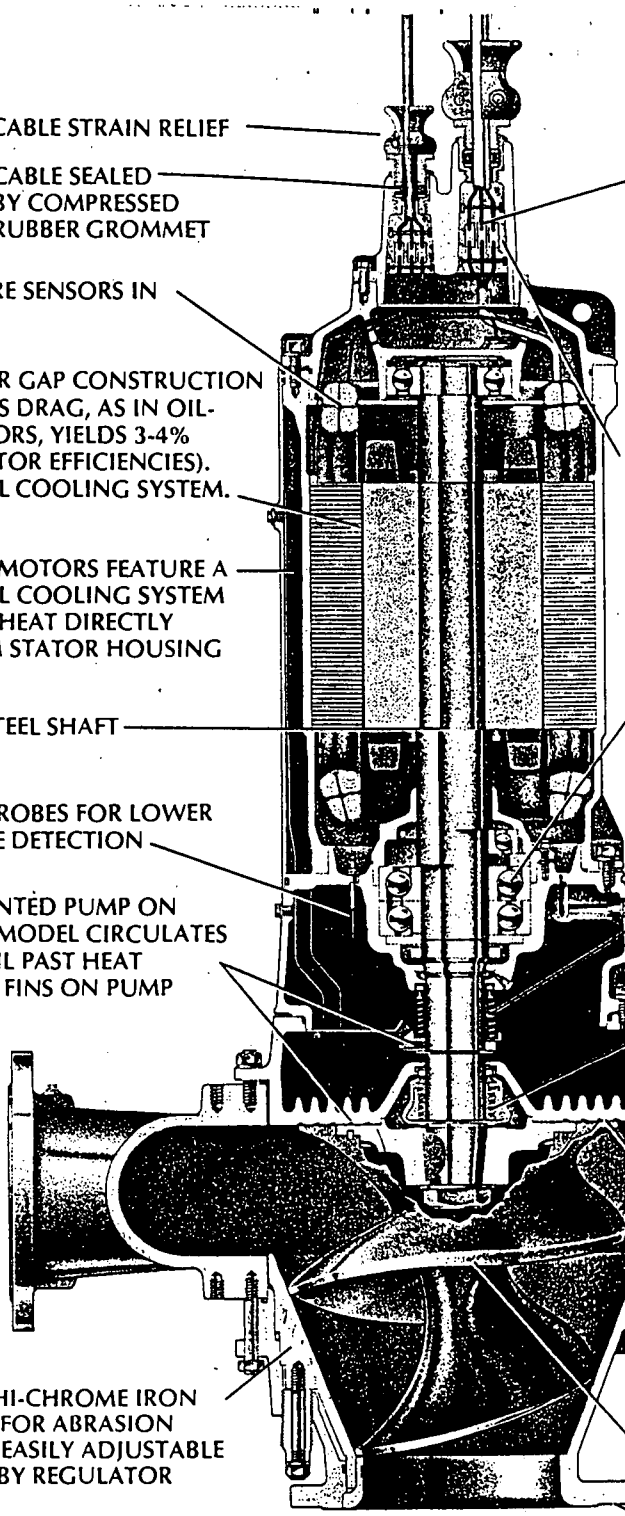
"HIDROSTAL" H12K PUMP DETAIL

PROJECTION | B1 | DRG. No. 94435502 | REV. 2 | MICROFILM SECURITY ROLL

PLOTTED AT 13.58.02
31-05-94

IMMERSIBLE MOTOR DESIGN FEATURES



CABLE STRAIN RELIEF

CABLE SEALED BY COMPRESSED RUBBER GROMMET

COPPER DAMS IN EACH CONDUCTOR ISOLATE INCOMING POWER LEADS FROM MOTOR LEADS TO PREVENT CABLE WICKING. MOISTURE WILL *NOT* ENTER MOTOR WHEN CABLE IS DAMAGED!

TEMPERATURE SENSORS IN WINDING

ADDITIONAL CABLE SEALING BY EPOXY

EFFICIENT AIR GAP CONSTRUCTION (NO VISCOUS DRAG, AS IN OIL-FILLED MOTORS, YIELDS 3-4% HIGHER MOTOR EFFICIENCIES). SEPARATE OIL COOLING SYSTEM.

IMMERSIBLE MOTORS FEATURE A SEPARATE OIL COOLING SYSTEM THAT PULLS HEAT DIRECTLY AWAY FROM STATOR HOUSING

30-50 THOUSAND HOUR L-10 BEARING LIFE.

STAINLESS STEEL SHAFT

MOISTURE PROBES FOR LOWER SEAL FAILURE DETECTION

STANDARD JOHN CRANE® UPPER SEAL (INCH DIMENSIONS).

SHAFT MOUNTED PUMP ON IMMERSIBLE MODEL CIRCULATES COOLING OIL PAST HEAT EXCHANGER FINS ON PUMP BACKPLATE

HIDROSTAL SILICON CARBIDE/TUNGSTEN CARBIDE LOWER SEAL

LABYRINTH AND PUMP-OUT GROOVES TO KEEP CONTAMINANTS AWAY FROM LOWER SEAL

HARDENED HI-CHROME IRON HARD LINER FOR ABRASION RESISTANCE. EASILY ADJUSTABLE CLEARANCE BY REGULATOR SCREWS

DUCTILE IRON IMPELLER.

CAST IRON SUCTION COVER WHEN ABRASION IS NOT EXPECTED

EnviroTech™
AUSTRALIA
A division of Baker Hughes Australia Pty. Limited
A.C.N. 004 752 050

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Process Equipment: EIMCO • WEMCO • SHRIVER • AGITAIR

Rubber Engineering: Mill liners • Ceramic wearpads • Impact bar assemblies

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