Client : *BRISBANE WATER*

Brisbane Water Project Management

Document Title : **Centenary Highway SP19 Pump Upgrade**

OPERATION and MAINTENANCE DATA MANUAL

Book 1 of 1

Brisbane City

Brisbane Water

SP19
CENTENARY HIGHWAY PUMP STATION REFURBISHMENT

COMMISSIONING REPORT

1/6/2004

Brett Lawrence

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Issue 1 / Rev 0 2 June 2004

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COMMISSIONING REPORT

1 INTRODUCTION

Centenary Highway sewerage pumping station was converted to VSD operation in July 2000. The operation of the station was effectively changed from stop-start to continuous flow in order to minimise odour issues downstream of the station.

Since the conversion to continuous flow operation the station has experienced a significant increase in pump blockages. For example 11 pump blockages where recorded for the period 7/1997 to 4/2000 (31 months), where there were 31 recorded pump blockages in an equivalent period from 5/2000 to 11/2002 (31 months).

The minimum flow of the pumps was increased to try and minimise recirculation blockages with little success. The minimum flows have been increased to the extent that the station is virtually operating as a stop – start station, which eliminates the benefits of the VSD control recently installed to control odour.

The proposed solution is to replace the existing Flygt pumps with an alternate model of pump with the proven capability to operate under VSD control and at minimum flows without blocking.

The Centenary Highway pumping station pumps into a combined rising main with the following reported flows.

- 85 L/s with all other pumping stations on (in 1998)
- 115 L/s by itself (in 1998)
- 60 L/s with all other pumping stations on (at Ultimate)
- 122 L/s by itself (at Ultimate)

The proposed pump shall be able to handle these flows as well as an elected range of minimum flows in the order of 40-60 L/s. At the minimum selected flow, the pump should operate at not less than 65% of its BEP flow at the same head to prevent pump failure.

In addition to pump replacement, a separate minor capital project submission identified that the pump station SP19 wet well does not have a valve to isolate the incoming sewer when work is being undertaken within the pump station. Presently, a plug (375mm) has to be manually installed at the inlet sewer whenever work is to be conducted inside the wet well, which is contrary to Brisbane Water policy.

2 PROJECT SCOPE SUMMARY

Works to be included in the project are:

- Flow bypassing or tankering during pump station modifications;
- Remove existing Flyght pumps at SP19;
- Supply and installation of two new pumps;
- Supply and installation of 300 mm knife gate valve complete with actuator, gearbox and guides;

3 PLANNING & COMMISSIONING

3.1 Project Deliverables

A fully commissioned and operational facility.
Complete set of As Built drawings and O&M Manuals.
All defects to be rectified.
All necessary and agreed training.

3.2 Scope of Commissioning

The commissioning tests will confirm the project deliverables will achieve the performance as specified in the Project Delivery Document.

3.3 Commissioning Team

Kirrily Addison – BW Project Branch
Brett Lawrence – BW Project Branch
Paul Daley - BW Network Services (IT Engineering)
Bill Collie - BW Networks Branch
James Reid - BW Networks Branch
Warren Henderson - BW Networks Branch
Neil Gliddon – BW Networks Branch
John Waller - BW Networks Branch

3.4 Review of Pre-commissioning Tests

Precommissioning tests results for the control systems and pump flows are attached in Appendix A.

3.5 Commissioning Activities

Commissioning activities will include confirmation of the pump flows and confirmation of the control systems and alarms.

4 COMMISSIONING RESULTS

4.1 Pumps and Penstock

The Hydrostal H05k-S04R+HEVT4-GMSK+NDB6-25 – 68kW pumps were checked and the flows were measured by the magnetic flowmeter. Pump curves are attached in Appendix B.

No: 1 Pump - 10581 hours 90 amps. No: 2 Pump - 10152 hours 90 amps.
The pressure on the rising main during pump operation was 65 kPa. There were no sewage leaks on the pumps or pipework and the refluxes were working correctly. No:2 pump (see Fig 1) had a slight weep of oil at the impellor casing which will be monitored.No:2 Reflux had a slight leak on the shaft that may take up when the "o" ring swells (see Fig 2). The wet well penstock (see Fig 3) was checked and the Hercus gearbox was touched up with Cold Galv and the oil seal was starting to perish which will be monitored.

Fig 1

Fig 2

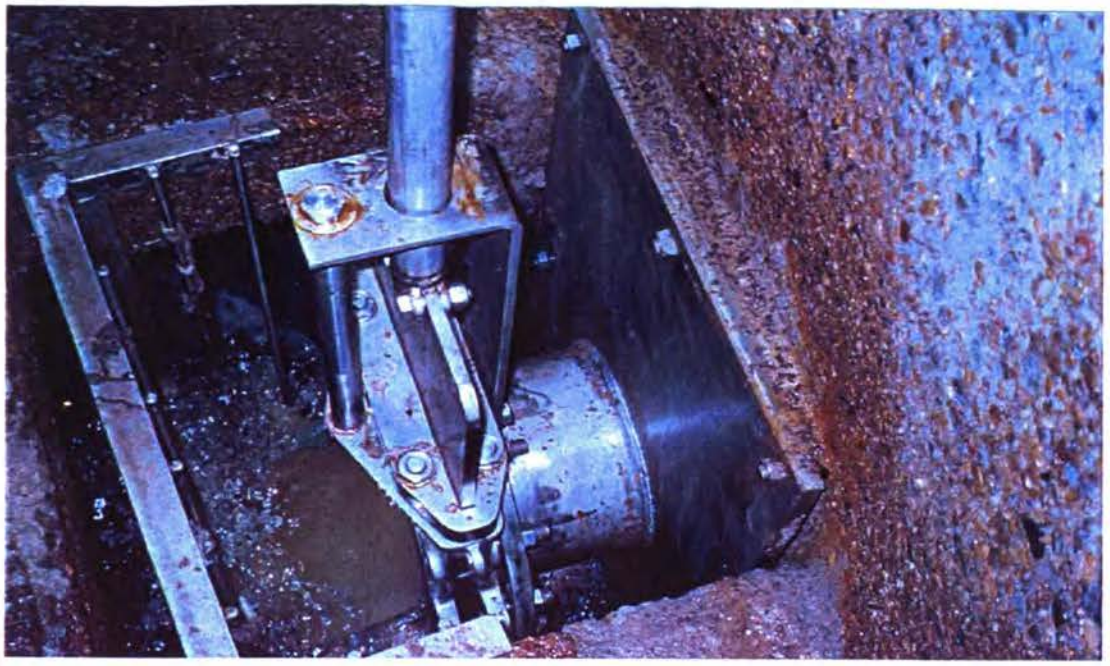


Fig 3

4.2 Switchboard

The switchboard had the water in oil alarm installed.

4.3 SCADA

The Alarms were checked and operated correctly

4.4 O & M Manuals

The O & M Manuals are being compiled and will be distributed as soon as the As Constructed drawings are completed.

5 FINDINGS & DISCUSSIONS

5.1 Pumps

The drain valves were supplied from Tyco Water with the wrong rotation direction cast into the handle.

5.2 Switchboard

No problems were found.

5.3 SCADA

The alarms are now configured.

5.4 O & M Manuals

There were no issues with the O&M Manuals.

6 DEFECTS

There are no outstanding defects for the installation.

7 RECOMMENDATIONS

The reflux valves "o" ring and Hercus gearbox oil seal will have to be monitored by M&E.

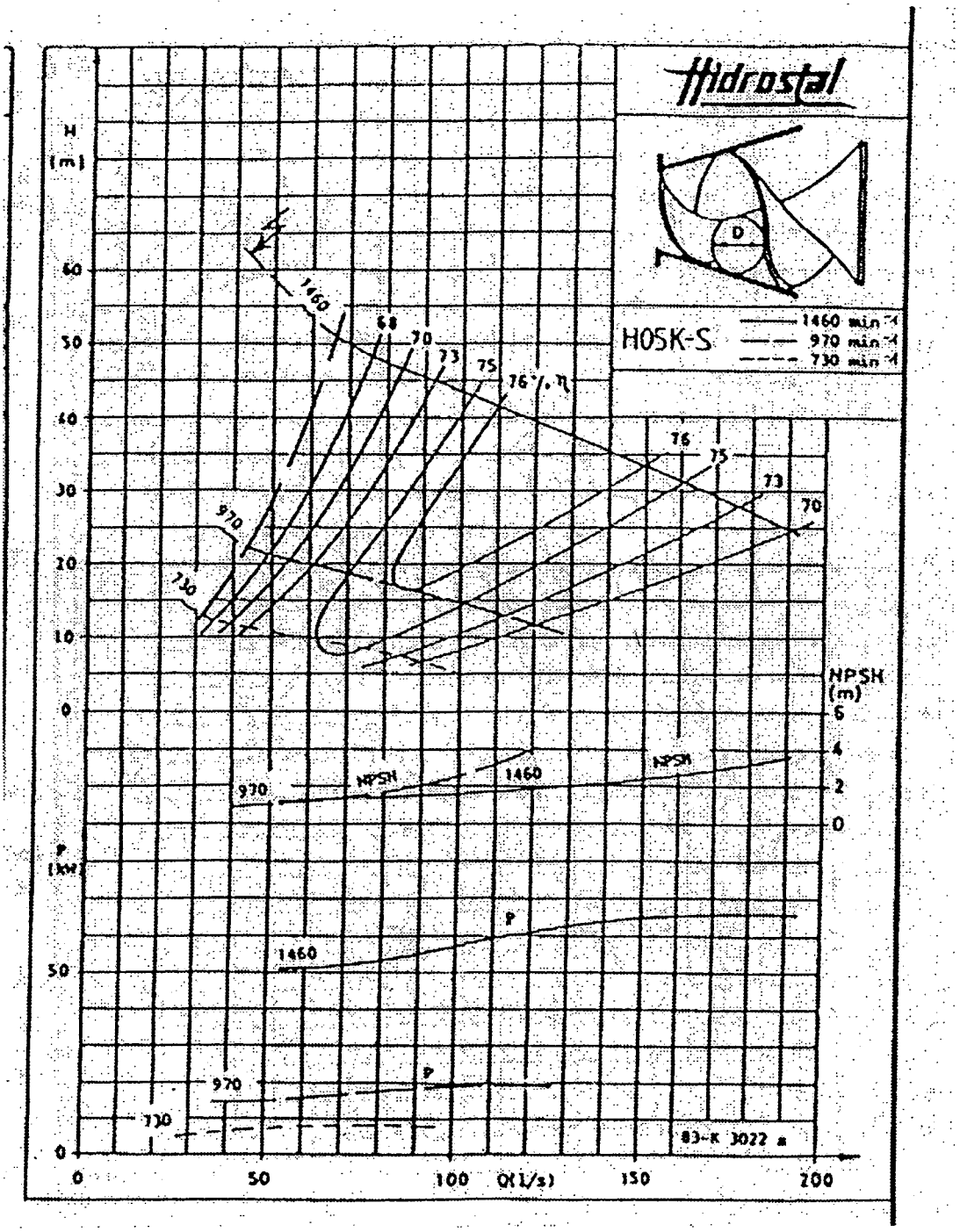
Appendix A – Commissioning Checklist

Centenary Highway Pump Station Upgrade Commissioning		Date:25/5/04
	Pump 1	Pump 2
Pimms No:	PUS 331	PUS 332
Hours Run	10581	10152
Current @ 50 Hz		
Red Phase	87	88
Blue Phase	90	91
White Phase	90	92
Volts @ 50 Hz		
Red Phase	412	412
Blue Phase	409	409
White Phase	413	414
Static Head	0 kPa	0 kPa
Static Head on Rising Main	15 kPa	15 kPa
Dynamic Head	50 - 80 kPa 150 kPa star	50 - 80 kPa 150 kPa star
Dynamic Head on Rising Mair	65 kPa	65 kPa
Flow	150 l/s @ 50HZ 108 l/s @ 38 HZ	150 l/s @ 50HZ 108 l/s @ 38 HZ
Time to pump down (Secs)	166 seconds	170 seconds
VSD operation	ok	ok
Alarms	ok	ok
Pump Blockage	ok	ok
Water in oil	ok	ok
Reflux operation	O ring leaking but should take up Counterweight size reduced	Counterweight size reduced
Valves operation	ok	ok
Bleeder operations	ok	
Oil Level	ok	ok
Vibrations	Nil	Nil
Generator Start Up	ok	ok
O&M Manual		
As Constructeds	ok	ok

Attended on site:	Paul Daley
Neil Gliddon	Kirrily Addison
Lachlan Brewer	John Waller
Warren Henderson	James Reid
Bill Collie	Brett Lawrence

Comments:
2 pump slight oil weep
75mm drain valves supplied with wrong direction of rotation on handwheels
Hercus gearbox coating repaired and top seal is showing signs of perishing

Appendix B – Pump Curve and Flow Tests


Hidrostal
H05K-S
1460 min⁻¹
970 min⁻¹
730 min⁻¹
D
H (m)
P (kW)
NPSH (m)
Q(l/s)
η
NPSH
P
83-K 3022 a

Excellent
Engineering
Solutions

WEIR SERVICES

Installation and Operating Instructions

Hidrostal Pump

H05K-S04R+HEVT4-GMSK+NDB6-25

Client: Brisbane City Council
Site: -

Job No.: 208737
Hidrostal Fab No.: 132145
Hidrostal Serial No: H3033

Prepared by:

WEIR SERVICES
15 Gindurra Road
SOMERSBY NSW 2250
Australia

Phone:(02) 4349 2999
Fax: (02) 4349 2802

Hidrostal	INSTRUCTION MANUAL GENERAL USE	
Dat.: 14.07.99	No: 94-BA 5030E/1c	File: ALLG_E

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Part 0

Part I

Hidrostal	INSTRUCTION MANUAL GENERAL USE	
Dat.: 14.07.99	No: 94-BA 5030E/2b	File: ALLG_E

0. GENERAL DIRECTIONS

0.1 GENERAL SAFETY DIRECTIONS

0.1.1 SAFETY AND WARNING DIRECTIONS

The following symbols and names will be used in this manual as safety and warning directions:

WARNING!
If the handling instructions, with this symbol, are not strictly adhered to then serious injuries or even fatal accidents could occur.

Warning symbols have to be kept **strictly**.

ATTENTION!
If the handling instructions, with this symbol, are not strictly adhered to then serious damage to the machine and/or other equipment could occur.

Directions marked with "Attention" have to be kept **exactly**.

DIRECTION!
If the handling instructions with this symbol will be observed the consequence will be more effective work. Directions make the work easier.

PARTICULAR INFORMATIONS

LEGAL DIRECTIONS

Hidrostal	INSTRUCTION MANUAL GENERAL USE	
Dat.: 14.07.99	No: 94-BA 5030E/3b	File: ALLG_E

1.0 PUMP CODE EXPLANATION

The pump-code is a combination of joined-together in series construction groups. The **"plus sign"** is the separation between these groups, and the **"dash"** is the separation between general and specific description of each construction group.

PUMP CODE

CONSTRUCTION GROUPS

	Group 1		Group 2		Group 3
EXAMPLES:	F10K-HD1R	+	FE4S4-MNGK	+	N3B4-10
	D04Q-L010E	+	DNXT2-MXEQ	+	X2B1-15
	F10D-L01	+	FE3Z7-CNEK	+	N2E1-10
			A2QR2-CC3	+	A01-10
	F150-S03R	+	FFM1O-XM.Q		
	H06F-M01	+	H2S10-L		
	E05K-M01	+	EDM1F-MM.K		
	Hydraulic		Hidrostal-Motor or Bearing Frame		Cable Set

1.1 DELIVERY

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

1.1.1 RECEPTION OF PUMP UNIT

Inspect the shipment for shortages or damage. Report any discrepancies to the carrier, note them on the shipping documents and sign them with date together with the carrier.

1.1.2 NAMEPLATE DATA

i Each pump is equipped with a nameplate showing all technical data of the pump. It is essential to give the complete data when enquiring about parts or service.

An explanation of the meaning of this code can be found under Section 1.0 "Pump Code Explanation".

1.1.3 STORAGE

If the unit is not to be installed immediately, note:
- Store in a dry and clean place without extreme changes in temperature (storage room temperature -10° to +40°C (14° to 104°F).
- Rotate the shaft 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 brinelling of the bearings could occur.

1.2 INSTALLATION

The pump should be placed as near to the liquid source as possible, and as low as possible, to provide the maximum possible suction head, avoiding elbows and excessive pipe lengths wherever possible.

Provide adequate ventilation of pump room.

WARNING:
If the pump can be exposed to temperatures at or below the freezing point of the media, the pump should be drained when not in use (formation of ice within the pump can cause cracking and other damage to the construction.

1.2.1 MOUNTING

- General:
  The pump can be mounted in a horizontal or vertical position.

- Fastenings:
  When mounted horizontally pumps should be mounted using the feet provided on the volute or use a bracket attached to the rear of the volute.

  When mounted vertically the pump can be stood using a special suction elbow on its suction flange or using a bracket bolted to the volute casing.

1.3 PIPING

The suction and discharge piping should be independently supported near the pump and be installed in such a manner so as not to impose stresses and strains on the pump casing.

1.3.1 SUCTION PIPING

To obtain maximum available suction head, the suction line should be as direct and as short as possible, avoiding elbows. If elbows must be used, a long radius type is preferred. It is important to avoid any sagging in a suction line in which air may accumulate and cause loss of prime. For the same reason, it is important to have the suction line airtight when suction lift exists.

The suction pipe must be such that no air pockets can form, and must slope upward to the pump intake.

Hidrostal	INSTRUCTION MANUAL GENERAL USE	
Dat.: 14.07.99	No: 94-BA 5030E/5c	File: ALLG_E

1.3.2 SIZING OF SUCTION PIPEWORK

The losses of the suction side should be kept to a minimum, the pipework should never be less than the suction diameter of the pump and preferably be one pipe size larger. When larger diameter pipework is required the transition should be made close to the pump using flat-topped tapers (Fig. 1 + 3). Concentric tapers should never be used, as air pockets could result (Fig. 2 + 4).

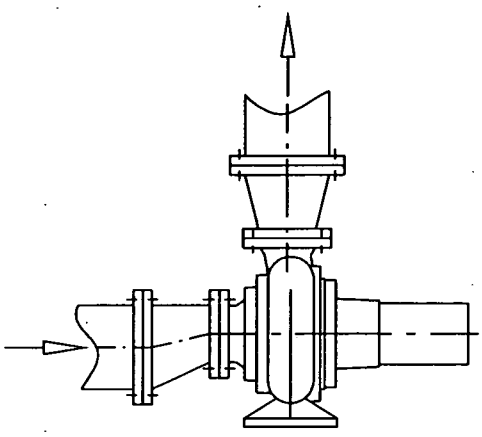

Fig. 1

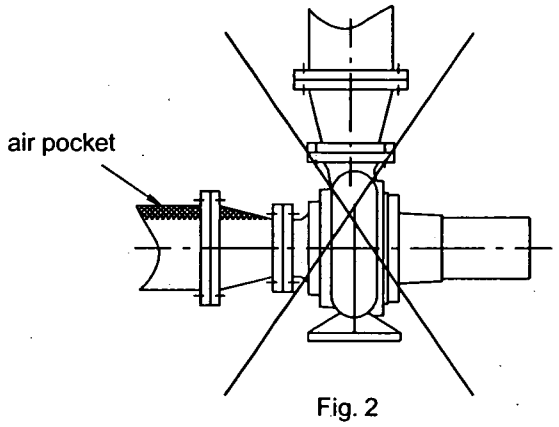

Fig. 2

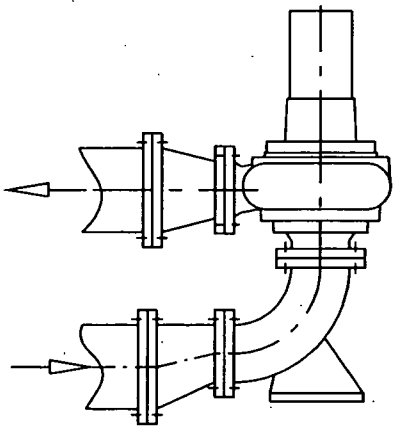

Fig. 3

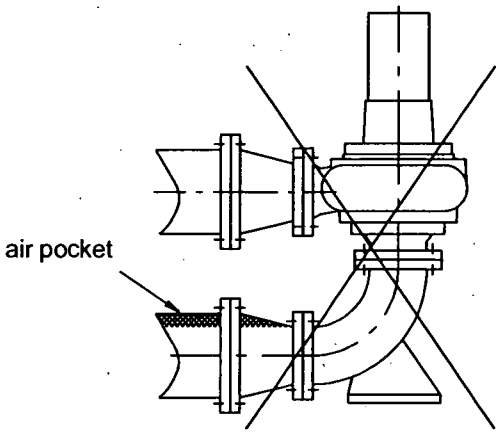

Fig. 4

Unusual suction conditions such as high liquid temperature, altitude above sea level and high specific gravity or viscous liquids should be compensated for, by proper engineering of a sufficiently sized suction pipe.

WARNING:
The pump should not operate on a suction lift when pumping liquids with entrained air or gas. Non-return valves should not be used in the suction line. Gate valves should preferably be installed with the spindle horizontal to prevent trapping air or gas. Suction valves must be fully open during operation.

1.3.3 DISCHARGE PIPING

Use as few fittings as possible and when elevating to any height, go vertically upward from the pump, **then** horizontal to the point of discharge.

When using non retum valves in the discharge line it is important the maximum permitted velocity specified by the manufacturer is not exceeded. For single-flap valves operating on dirty liquids a typical maximum velocity is 3.5 m/second.

If these values are exceeded shock waves can result when the valve closes, which may cause the face of mechanical seals to open and allow material to become trapped between the faces resulting in premature seal failure and contamination/loss of the seal oil.

WARNING:
Does the pump work with closed or blocked up suction or discharge piping, there is a danger of overheating in the volute casing. It is possible to dry out the medium occluding gas bubbles. They could cause damages on person or machine if they will be eliminated inexpert.

1.3.4 CONNECTION OF PIPING

This should only be undertaken after the grout (if used) has thorough set and holding down bolts have been tightened.

The pipework should be connected to the pump flanges with gaskets in place and the bolts properly tightened. Make sure the pipe flanges are parallel and in line.

WARNING:
For all pumps in cast iron, great care must be used in connecting these flanges. Tighten evenly and adjust to a snug fit. Under no circumstances should the casing be subjected to piping strains. Such strains could result in structural failure leading to operator injury.

1.4 SPECIAL APPLICATIONS

If the pump is used for production or further processing of **food**, please check the following points:

- Observe the relevant guidelines.
- Replace the coolant and sealing liquids mentionned in the manuals by a media, allowable with the requested characteristics for food.
  (e.g. vegetable oil)
- Pay attention to extremely cleanness.
  (Evacuating and cleaning of pump and systems)
- After cleaning pay attention to the correct mounting of pump and systems.

Hidrostal	INSTRUCTION MANUAL K-HYDRAULIC	
Dat: 30.05.00	No: 94-BA 5074E/1a	File: K_HYD_E

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Part III

Hidrostal	INSTRUCTION MANUAL K-HYDRAULIC	
Dat: 30.05.00	No: 94-BA 5074E/2a	File: K_HYD_E

3.0 TYPE CODE EXPLANATION

The type code is found on the first line of the pump name plate.

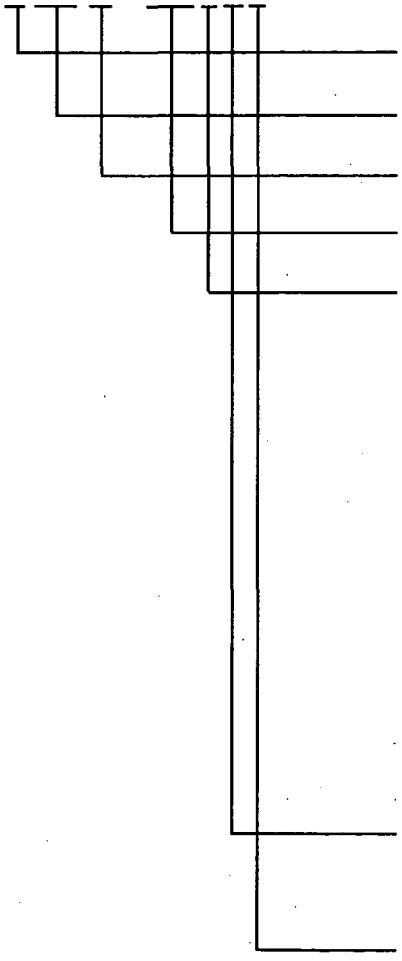
Example:

E05K-M010D

hydraulic code

HYDRAULIC CODE:

D 0 4 K - L 0 3 0 E
E 0 5 K - M L 3 R S
F 1 0 K - L L 3 R



hydraulic size (C,D,E,F,H,I,L)

discharge flange size (in inches)

impeller type (K)

impeller size

material:

1 = standard pump: all castings of grey iron (GG20), except impeller of nodular iron (GGG60).

2 = Advanced wear resistance: liner of Hi-chrome, other parts as 1.

3 = for improved wear resistance: casing and suction casing same as 1, impeller of stainless steel, liner and wear-ring of Hi-chrome.

4 = for improved wear and corrosion resistance: same as 3, except with Hi-chrome impeller.

5 = corrosion resistance: all wetted parts of stainless steel.

R = "regulable" construction: impeller clearance adjustable by three external screws (Absence of "R" in code implies impeller clearance is adjustable by shims).

S = special execution

D = bigger or smaller cone size than standard (first digit of code) D < E etc.
C = 20, D = 28, E = 38, F = 50 etc.

3.1 SERVICE CONNECTIONS

On Volute

These comprise of a gauge connection (424) on the discharge flange (see table).

When the pump is mounted horizontally with the discharge flange vertical, and drain plug (423) is provided at the lowest part of the volute casing.

When the pump is mounted horizontally with the discharge flange horizonal, additional drain plugs are possible on position "D".

Pos Type	423	424	D mm
C0CK	-	-	-
C03K	R 1/2"	R 1/4"	-
D0DK	-	-	-
D03K/D04K	R 1/2"	R 1/4"	35
E05K/E08K	R 1/2"	R 1/2"	50
F04K/F06K	R 1/2"	R 1/2"	50
F10K	R 1/2"	R 1/2"	35
H05K/H08K	R 1/2"	R 1/2"	35
H12K	R 1"	R 1/2"	60
I06K/I10K	R 1"	R 1/2"	60
I16K	R 1"	R 1/2"	60
L12K/L20K	R 1"	R 1/2"	60

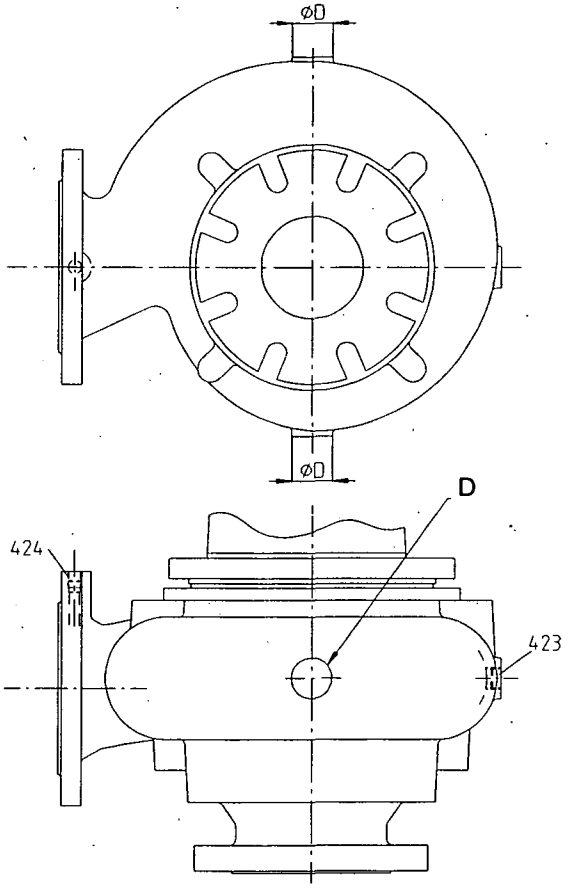


Fig. 1

3.2 IMPELLER CLEARANCE ADJUSTMENT FOR WEAR

- The impeller gap should be checked and readjusted whenever a significant decrease in pump performance is noticed, or at least once every year (until experience indicates how often this will be required).
- Excessive clearance can cause a drop in performance.
- Less clearance than the minimum listed can overload the motor and/or cause vibration due to a too great friction.
- When pumping thick sludges or high consistency material, it may be necessary to double the clearances in Figure 3.
- Regulable pumps are adjusted by means of a movable liner (421); its position is regulated by three external regulator nuts (422) found on the suction casing (416) or volute casing (400). These pumps include the letter "R" in the pump code (Section 3.0).
- Other pumps have a one-piece suction cover (402), or in pumps D03K and D04K, a fixed liner (421). These pumps are adjusted by changing the thickness of the shims (411) between the drive unit and the volute casing (400).

3.2.1 IMPELLER CLEARANCE ADJUSTMENT FOR "REGULABLE" PUMPS

Loosen and back off hex nuts (413) on end of each regulator nut (422). 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, see section 3.5.

Now back off the threaded regulator nut a bit. Holding each threaded regulator nut from turning, tighten the three hex nuts (413) (this pulls liner (421) away from impeller (401) 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 suction of the pump). If the clearance "C" is significantly different to the table (Fig. 3), it is possible that the wear is excessive or not uniform: disassembly and inspection is recommended.

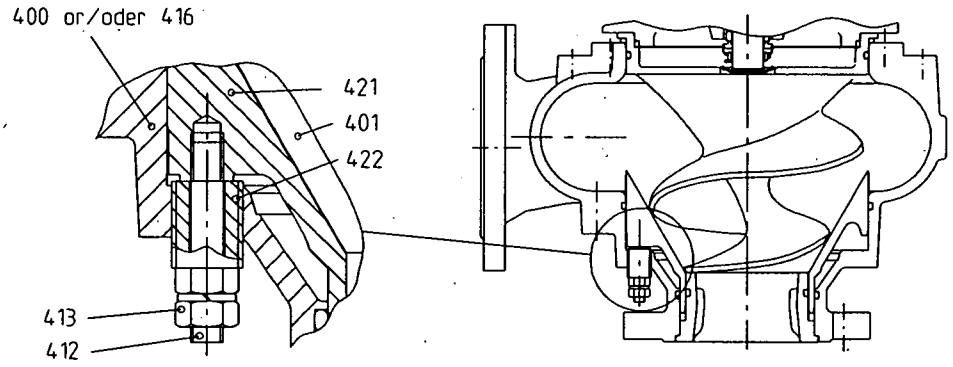


Fig. 2

3.2.2 IMPELLER CLEARANCE ADJUSTMENT FOR "NON-REGULABLE" PUMPS

For final assembly: Place the hydraulic (already built together) with the suction flange on a flat and hard underground. Lower the drive unit - impeller assembly into casing (400) by a suitable hoist.
For wear adjustment: Loosen all fasteners (419) between drive unit and volute casing. Remove shims.

General: To **estimate correct shim** (411) **thickness**, lower drive unit into casing just until impeller cannot be turned. Measure gap between drive unit and volute casing at several places and take average. Now add the distance "B" (Fig. 3) to the average gap measured; this will be approximate shim thickness required to obtain correct clearance "C" (Fig. 3).

NOTE: If impeller tip is binding, see section 3.5.

If necessary, loosen fasteners (419) again, lift drive unit as much as required to place shims of calculated thickness between drive unit and volute casing. Use 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 = calculated thickness) wrapped all the way around drive unit, 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 suction of the pump). If the clearance "C" is significantly different to the table (Fig. 3), 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, examine wear on impeller or suction cover/liner, and replace worn parts as necessary.

Pump size	Clearance	
	"C" mm	"B" mm
C	0.3	0.3 - 0.5
D	0.3	0.3 - 0.5
E	0.4	0.3 - 0.5
F	0.5	0.4 - 0.6
H	0.6	0.4 - 0.6
I	0.7	0.6 - 1.0
L	0.9	0.6 - 1.0
M	1.2	1.0 - 1.5

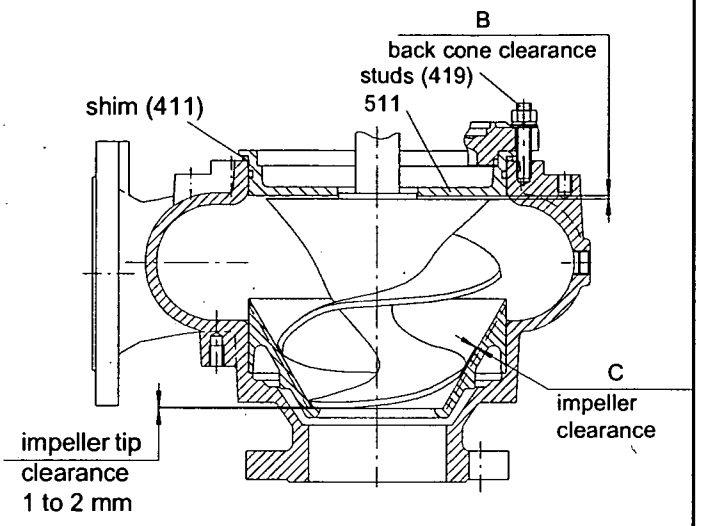


Fig. 3

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

3.3 DISASSEMBLY OF HYDRAULIC PARTS

3.3.1 DISASSEMBLY FOR INSPECTION

Casing-suction cover assembly should be placed with the suction flange flat on the floor or workbench, and the drive unit-impeller assembly removed or lowered into place from above by a suitable hoist.

Remove nuts (419) around the flange. Lift the rotating assembly including impeller from the pump casing. 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 be compensated by re-shimming or adjusting according to Section 3.2. However, excessive or uneven wear will require replacement of the wom parts.

3.3.2 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 into the impeller bolt (415) and with a hammer, tap the wrench counterclockwise to loosen the bolt.

FACTORY FITTED IMPELLER BOLTS		
SIZE	HEXAGON SW	TORQUE Nm
M8	6	17.5
M10	8	35.5
M12	10	61.5
M16	14	147.0
M27	19	380.0
M36	24	970.0

3.3.3 REMOVAL OF IMPELLER FLANGE (if existing)

If existing, disengage tabs on locking washer (167) and remove impeller nut (166) with coupling end of shaft secured from rotation. Remove impeller flange (165) by either levering with two screw drivers between impeller flange and back cover (507) or seal plate (511) or tapping with a rubber mallet at 90° intervals. Or, it may be required to use a gear puller. Remove Woodruff key (112).

Hydraulic size	Cone size	Impeller nut size	Impeller nut wrench size	Thread size "M"
E	28	-	-	M12
E	38	M28	41 mm	M12
F	50	M35	46 mm	M12
H	50	M35	46 mm	M16
H/I/L	75	M56	70 mm	M16
I/L	100	-	-	M16

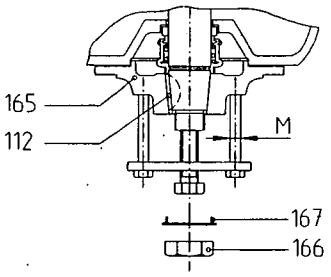


Fig. 4

3.3.4 REMOVAL OF LINER OR SUCTION COVER

a) For D03K / D04K

These pumps have a non-adjustable liner (421) held in a fixed position inside a one-piece volute casing. It can be pressed out of the casing after loosening of fastening set (418) (Fig. 5).

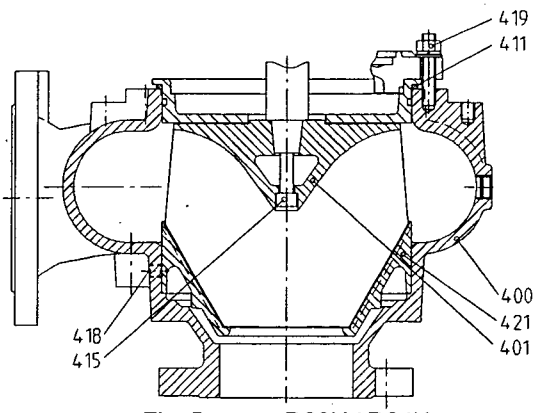


Fig. 5: D03K / D04K

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 drive unit.

NOTE:
Certain models may have 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 (Fig. 6).

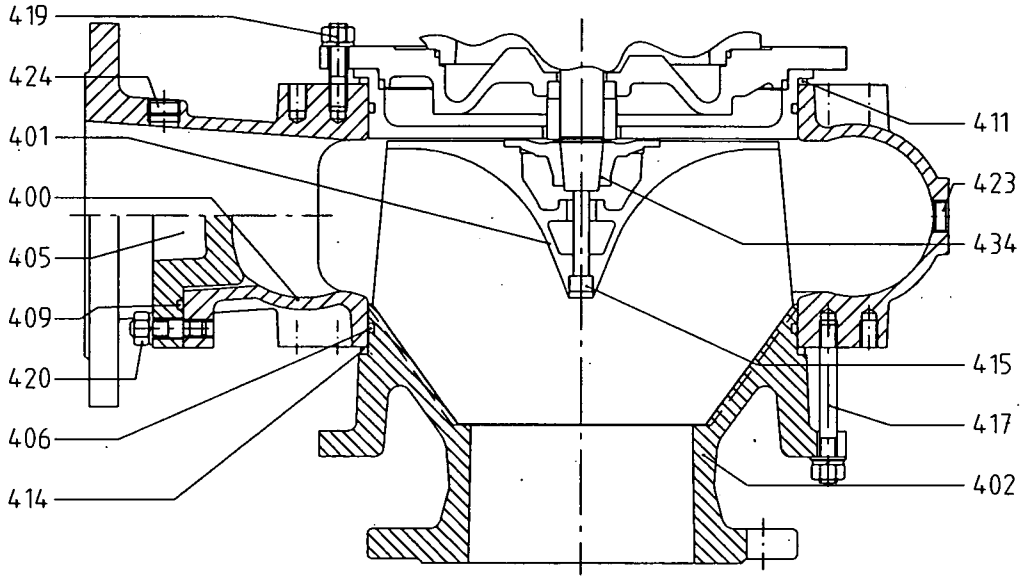


Fig. 6: E05K - L20K

c) For all other pumps with "regulable" feature

These pumps have an externally-adjustable liner (421), held in place by the volute casing (400) or the 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 (422).

If the conical surface is worn, the liner need be replaced. It can be removed while the volute casing or suction casing remain attached to the piping. Alternately, the suction casing may be removed by removing nuts (417).

Removing of liner: completely remove nuts (413). To force the liner out, push the three studs through the holes in the large regulator nuts (422), or the large regulator nuts can be turned all the way into the casing. **Do not yet disassemble the regulator studs (412)! They are loctited in place, and must be heated with a torch to break the locktite bond after removing of the liner.**

The wear ring (408) should only be removed from suction casing or volute casing if badly damaged. Therefore 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 (Fig. 7).

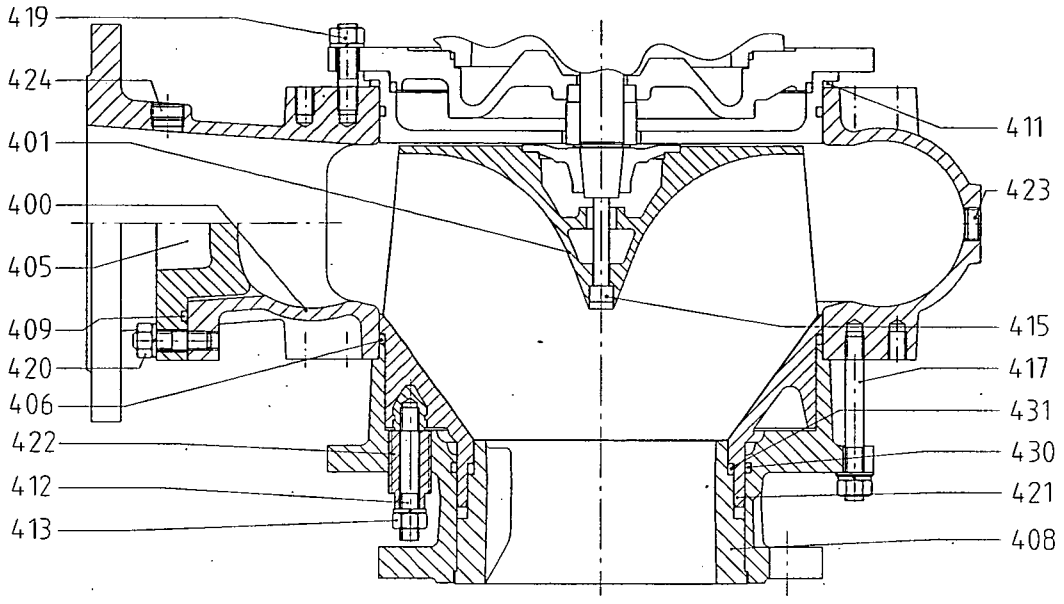


Fig. 7: E05K - L20K regulable

3.4 ASSEMBLY OF HYDRAULIC PARTS

3.4.1 ASSEMBLY OF IMPELLER FLANGE (if existing)

If existing, 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 nut must be tightened to 120 Nm (90 ft-lbs) by using torque wrench. Bend over locking washer tab.

3.4.2 ASSEMBLY OF IMPELLER

If impeller (401) with impeller flange (165) is used, mount it so that the pin (410) on back of impeller will fit in the corresponding hole on flange. Before fitting a new impeller or a new impeller bolt, length "L" of impeller bolt should be checked as follows:

By measuring of the impeller and the impeller bolt, it must be secured that:

1. thread reach "L" is 1.25 x thread diameter, e.g. M16:
   16 x 1.25 = 20 mm.

2. end of thread "G1" on impeller bolt is sufficient (re-cut the thread).

3. end of thread "G2" in the shaft is sufficient (shorten impeller bolt, see point 1.).

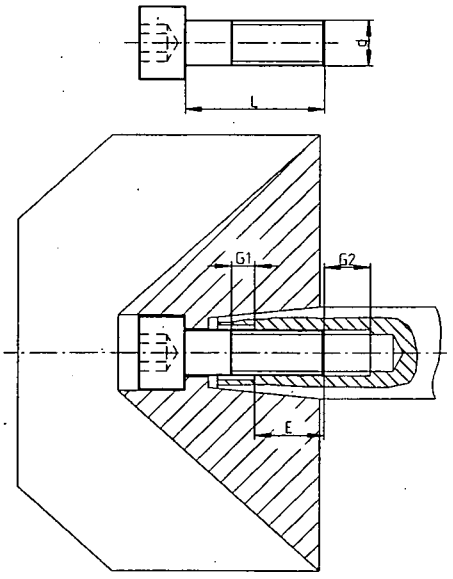


Fig. 8

ATTENTION:
Oil shaft taper slightly with a shred. **NEVER use thick oil, grease or anti-size compound!** Install impeller directly onto shaft. Coat the impeller bolt thread with grease or anti-size compound. Tighten screw with torque according table 3.3.2.

NOTE:
If torque wrench not available, torque can be approximated with an extension pipe and weight.

3.4.3 ASSEMBLY OF LINER OR SUCTION COVER

a) For D03K / D04K (Fig. 5)

Carefully position liner (421) into one-piece casing (400); tap into place with lead hammer, and fix it with screws (418). Seal the thread to avoid a possible leakage (no O-rings are used between liner and casing).

b) For all other pumps without "regulable" feature (Fig. 6)

Place spacer ring (414) over spigot of suction cover (402), then grease and install O-ring (406) into groove on suction cover.

Install suction cover into down side of the volute casing with fastening set (417).

CAUTION:
Since up-side and down-side of the volute casing are machined identically in some models, it is potentially possible to assemble the pump in a wrong way. Form of the volute casing see Fig. 1.

c) For all other pumps with "regulable" feature (Fig. 7)

Glue three regulation screws (412) into liner (421).

Thoroughly grease O-ring (430) and install into grove in suction casing (416). This groove is nearly hidden by the wear ring in some pump models.

If wear ring (408) was removed, glue it firmly back into place. Tap wear ring into suction casing with a lead hammer, until wear ring is flush with flange surface.

Grease the external threaded portion of large regulator nuts (422), and install these into the suction casing (416), hex-side toward the outside, direction to the suction flange. Screw these into the suction casing until they are flush with the inside.

Now grease O-ring (431) and install it into groove of wear ring (408, if there is no wear ring, this O-ring is not used).

Now place liner into suction casing or volute casing, engaging the three stud bolts into the holes through the three regulator nuts.

NOTE:
The three stud bolts are not spaced evenly around the liner, so there is only one orientation of the liner where the bolts will correctly fit through the regulator nuts.

Install suction casing into down-side of the volute casing with fastening set (417).

CAUTION:
Since up-side and down-side of the volute casing are machined identically in some models, it is potentially possible to assemble the volute casing in a wrong way. Form of the volute casing see Fig. 1.

3.5 FINAL ASSEMBLY

When ONLY a new impeller is fitted, the following clearance check must be done: install drive unit-impeller assembly into volute casing.

If the tip of the impeller touches the wear ring (408) or the lip in the liner (or suction cover) or if there is less than 1 mm clearance between the tip and the lip (the spiral edge of the impeller is firmly seated against the conical taper inside the liner or suction cover), then the impeller tip must be ground off, parallel to the suction flange, until 1 to 2 mm clearance is obtained (Fig. 9).

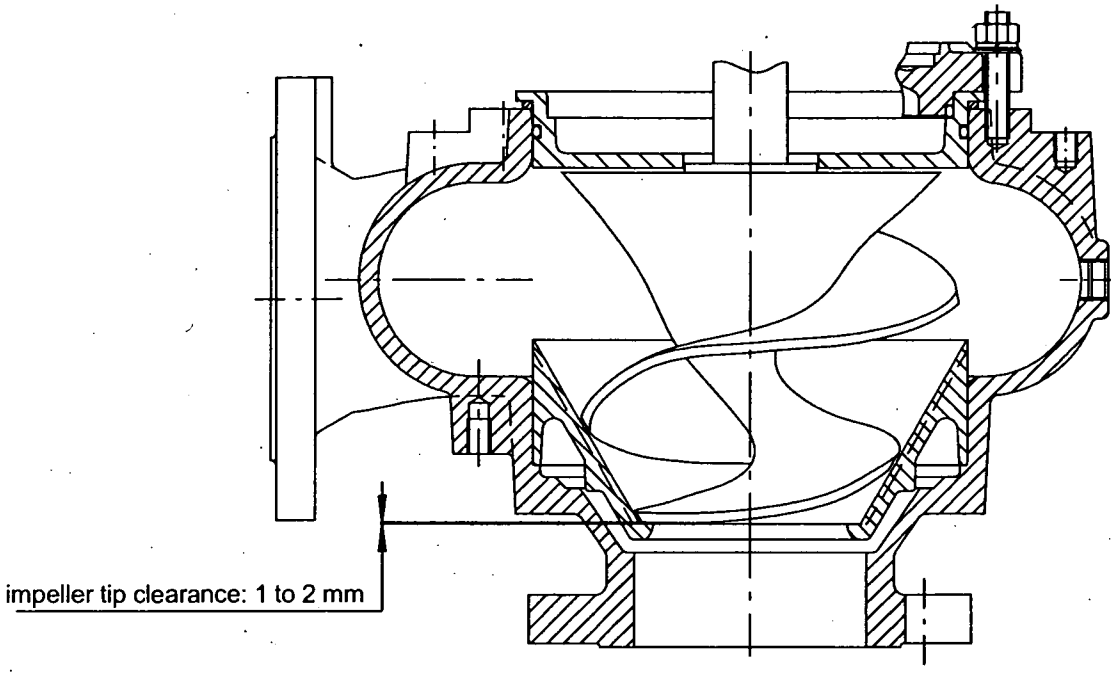


Fig. 9

If (411) is a spacer ring in lieu of shims place it over the spigot of the drive unit.

Grease O-ring (209) and place into groove on spigot of the drive unit.

Now install drive unit-impeller assembly into volute casing. Install and tighten nuts (419).

See Section 3.2 for correct setting of regulator nuts, or for placement of shims (411) for final adjustment of impeller clearance.

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2.0 USE

2.1 INTRODUCTION

Each pump unit is equipped with a nameplate attached to the motor, containing all motor and pump data (section 2.1.1). It is **essential** to give the complete data for any inquiry about parts or service.

a) For pumps in normal operation (Fig. 1)

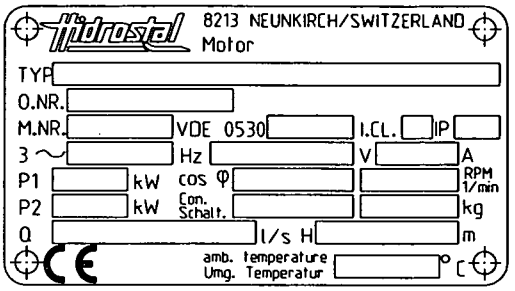

Fig. 1

b) Motors approved for **hazardous location** according norm 94/9/EG (ATEX 100)

- for online operation (Fig. 2).

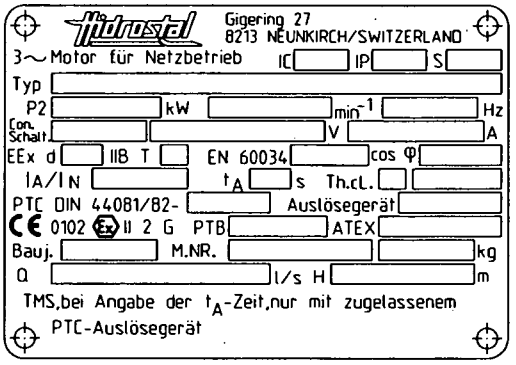

Fig. 2

- for variable frequency driver (Fig. 3).
  These motors are equipped with triple-thermistor according DIN - 44082 - S 150° C

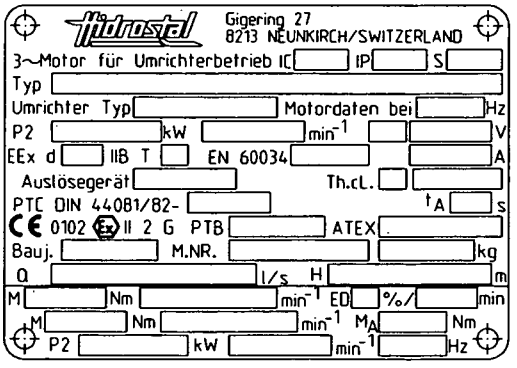

Fig. 3

The HIDROSTAL warranty is void unless the following requirements are met:

1. Temperature protection circuit is wired so as to positively disconnect power to the motor when excessive winding temperature is sensed (section 2.4.1.2f for wiring instructions).

2. Proper extra-quick-trip overload protectors M U S T be used on all three phases of each motor (section 2.4.1.2e).

3. Optional conductivity probe circuit is wired to a special relay for use with these motors. See section 2.4.1.3g 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 organisation. Use of any other parts 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. Disassembly of the pump by other than official HIDROSTAL service centers may cause loss of any remaining warranty.

2.1.1 TYPE CODE EXPLANATION

MOTOR CODE

E K Y A 6 - M N E Q

Identification letter of the hydraulic size to which this motor can be assembled.
The sizes are: B, C, 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 IEC-norms:

Size:	B/Z	2/Y	3/X	4/W	5/V	N	6/U	7/T
IEC:	90	100	132	180	225	250	280	315

Motor construction classification

Motor speed

			Nominal speed 50 Hz	Nominal speed 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

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MOTOR-CODE, continued:

E K Y A 6 - M N E Q 1

Pump side mechanical seal Pos. 515 type

C = Fitted with Carbon-ceramic seal faces. Recommended for handling water, activated sludge and non-abrasive liquids.
G = Silicon carbide seal faces, rubber bellows with external spring.
M = Tungsten carbide - silicon carbide seal faces, rubber bellows with internal spring. For sludges, slurries and abrasive liquids.
N = Fitted with converted carbon faces, rubber bellows, 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:

Standard				Ex-proof						
Motorsize			Additional elements	Motorsize						
	new	old		new					old	
W/V N/U/T	B/Z X/Y	X/4/5 6/7**		B	Z	Y	X	W/V N/U/T	X 4/5	
N	N	N	without monitoring elements	X	X	X	X	X	X	
M*	S	S	with internal moisture probe	-	I	I	I	Y*	-	
	F	-	with float switch	-	-	Z	Z			
	V	F	with internal moisture probe and float switch	-	-	U	U			
	-	-	with bearing temperature probe	-	-	-	-			
W*	W*	W	construction with flywheel	-						

* fitted additional elements are mentionned in the order
** Motorsize 6+7: always with SA1-.. (containing all above additional elements)

Voltage of winding (see nameplate):

A = 230/460 V 60 Hz
E = 400 V 50 Hz
G = 415 V 50 Hz
K = 575 V 60 Hz
S = special voltage

Q = Q-hydraulic
K = K-hydraulic

1 or blank = Material execution 1
5 = Material execution 5
6 = Material execution 6

CABLE CODE

N A A 1 - 1 0

factory code (not important for instruction)
length in metres

2.2 INSTALLATION

WET PIT PUMPS

All building and technical construction work must be finished before the pump will be installed. Make sure that length of cable supplied is sufficient for local conditions.

Attention: very important: For installation and servicing it is recommended to install a block and tackle or chain hoist over the pump sump (or at least make sure that it could be installed later on). The lifting capacity of the crane has to support at least double the weight of the pump. There should be a water supply of about 4 bar (70 psi) pressure to wash down the pump when removed from the sump.

⚠ During the installation of the pump make sure that the free ends of the cables **NEVER CONTACT WATER.**

2.2.1 INSTALLATION OF PUMP GUIDE SYSTEM (Fig. 4)

a) Fasten the upper guiderail bracket. Be sure to leave enough space for sliding shoe.

b) Sump floor where the discharge stand is to be placed must be even and level. Fasten the discharge stand to the sump floor with cast-in-place or expansion-type bolts and nuts so that the guide rail pins or recesses on the discharge stand are vertically in line with (i.e. directly below) the guide rail pins on the bracket.

c) The guide rails should be made from galvanized standard (or stainless steel) pipe. Cut pipe to the correct length. Put lower pipe ends in discharge stand guiderail pins or recesses. Unbolt upper guide rail bracket. Insert pins into upper pipe ends and re-bolt it. Check to see that the guide rails are exactly vertical and parallel.

d) The discharge pipe must be connected without stress or misalignment to the discharge stand.

If a check valve is installed close to the pump, air must be vented from the pump casing or discharge piping (before the check valve) during first start-up to ensure priming (Section 2.2.3, Fig. 5).

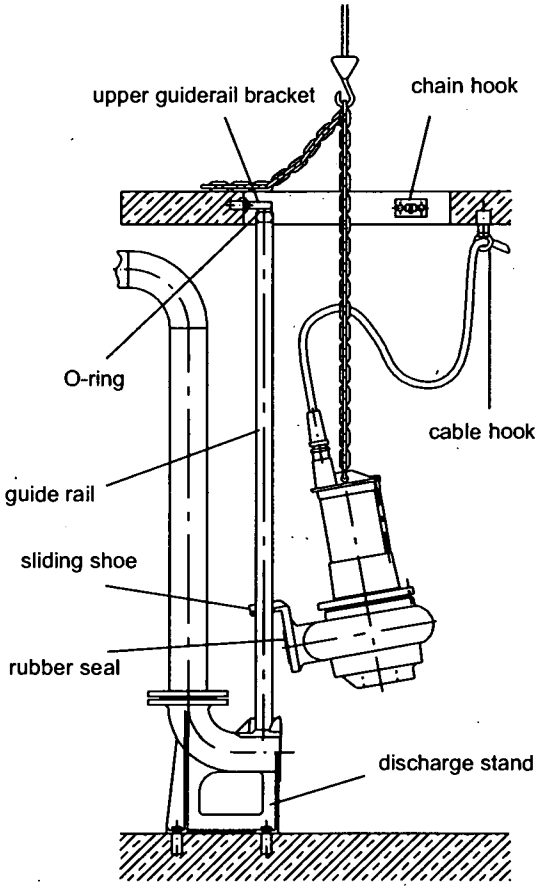


Fig. 4

2.2.2 PREPARATORY CHECKS

⚠ Before lowering the pump into the sump check to see that:

- The **lifting chain** or **steel lifting cable** is **correctly fastened** to the lifting eyes.
- The **cable entry assemblies** on motor have **not been damaged** or loosened and that the cables are firmly gripped by the cable entry assemblies.
- The **cables** have **not been damaged** during transportation or installation. Look especially for nicks and cuts on insulation; any damage penetrating through the outer layer of the cable will require replacement of them.
- The **cables** are **long enough** and that they can follow the pump unhindered.
- The **cable ends** have **never** come **in contact with water**.
- The rubber seal on the pump discharge is correctly seated in its groove, and is not damaged.
- The rubber seal is throughly greased.
- The **direction of rotation** is **correct** (Section 2.2.4, Fig. 6).

2.2.3 FLUSHING WATER CONNECTION

Pumps are supplied with a flushing water connection (service connection "F", Fig. 5).
For normal sewage application this connection is not used. However, in special cases when pumping high concentrations of sludge or mud, it should be connected. It will conduct cleaning water between impeller and pump side mechanical seal (515), providing periodic removal of accumulated solids.

Flushing water must be pressure-regulated between 0,5 to 1 bar (7 to 14 psi) above pump discharge pressure. 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.

The quantity of flushing water varies according to pumpsize and application: in most cases, flow rates of 6-8 litres per minute will be sufficient.

Connection "F" may be used to manually bleed the air from the casing prior to start-up (Section 2.2.1d), if there is no other place for air to escape through the discharge piping.

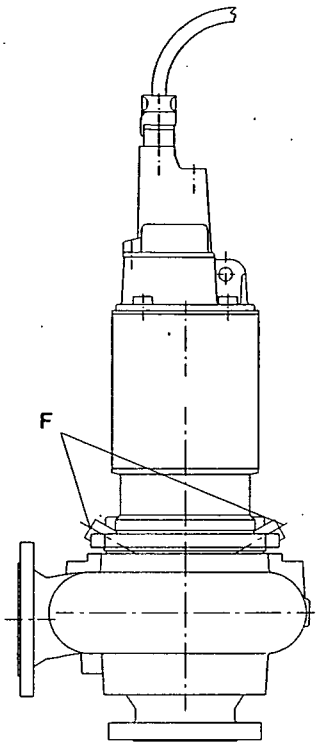


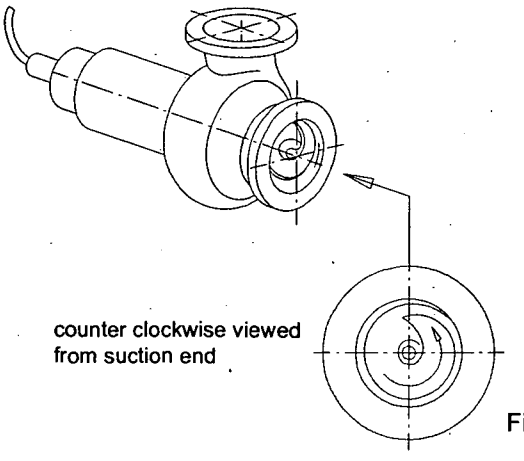
Fig. 5

2.2.4 DIRECTION OF ROTATION

Before lowering the pump into the sump, make electrical connections as indicated in Section 2.4.2 and check the direction of rotation. This must be counter-clockwise viewed from suction end. Check impeller rotation by suspending pump from the lifting eyes, resting inclined on the floor, and start up for one second. The starting jerk should be counter-clockwise viewed from driving side (Fig. 6).

This procedure must be repeated for each speed, if units are multi-speed pumps.

CAUTION:
If rotation is not correct on multi-speed or multi-pump installations, **only change the pump cable leads of the pump or speed with wrong rotation at its starter in the control panel. DO NOT** change the primary power leads coming into the control panel: This would change the rotation of all pumps or speeds.



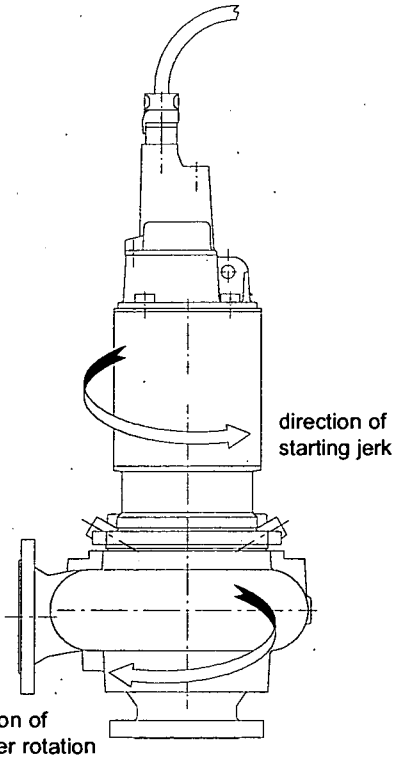


Fig. 6

2.2.5 LOWERING THE PUMP INTO THE SUMP

- **Clear the sump bottom** carefully of all **building debris** and other solid particles.
- **Lubricate** the **rubber seal** with grease.
- Lift and move the pump to a position directly over the guides until the sliding shoe fits correctly. Lower the pump steadily down to seat against the discharge stand. The sealing of mating faces is accomplished by the rubber seal that is incorporated in the sliding shoe attached to the pump discharge flange. This is pressed to the discharge stand (after the pump is in position) by the pump's own weight.
- When the chain is slack, unfasten it from the lifting device and fasten it to its retaining hook, so that there is as little slack as possible.

WARNING:
The **chain and cable** must be fastened **reliably** to their retaining hooks. **If they come loose** they **may be drawn into the pump suction** with severe **destructive consequences.**

2.2.6 DRY INSTALLED IMMERSIBLE PUMPS

HIDROSTAL immersible motors do not require submersion in liquid for cooling. They may be installed in dry locations. This is particularly advantageous for locations where occasional flooding may occur, as these motors will not be harmed thereby.

The electrical controls and pump power cable junction boxes must be placed above any expected water level. They should also be adequately sealed and/or vented to avoid internal condensation.

2.3 START-UP

The pump is ready to start when the following has been completed:

a) All construction debris has been removed from suction well.
b) Base plate or suction elbow is bolted to the foundation.
c) All rotating parts are found to turn freely by hand.
d) Motor has been checked for correct rotation, which is counter-clockwise viewed from suction end (section 2.2.4).
e) Suction and discharge gate valves are completely open.
f) All level controls are correctly set. The off-level is sufficiently high to prevent air entrance to the pump section.
g) Never run a pump dry, as the liquid in the pump serves as lubricant for close running surfaces. Damage may be caused to the pump if operated dry for extended period of time.
Note:
If installed with suction lift, the pump may be primed by using an ejector or vacuum pump. Vertically installed HIDROSTAL solids handling pumps will prime themselves if impeller tip is submerged in the pumping liquid, and an automatic air vent is connected to the pump casing or discharge pipe work (between pump and non-return valve).

STARTING OF PUMP

Never start pump **against closed valves** (except non-return valves).

Start the pump using manual operation. **Measure the amperage** drawn on each phase leg. Record and **verify** these **readings** with the **nameplate ratings**. If amperage is more than 5 % higher, stop pump and check probable causes according to "Operating Troubles" chart (Section 2.5.1).

Once preliminary checks are complete, place the pump into automatic operation. Cycle the system through several wetwell pumpdowns to observe that level controls are properly set and functioning correctly. **Observe** that the **alarm system** and change over switch (if included in control panel) **are working properly**.

Log date and hours meter reading, and set pump for automatic operation. Perform maintenance according to Section 2.6.

GENERAL OPERATING CONDITIONS

The pump should not be allowed to operate continuous-duty outside of performance curve: high discharge pressure with low flow or low discharge pressure with high flow. Bearing life is shortened and abrasive wear is accelerated in these operating conditions.

OPERATING TROUBLES
See chart, Section 2.5, maintenance.

2.4 ELECTRICAL CONNECTION

The motor winding leads will be factory-connected according specifications (see nameplate).

Make sure that the power supply to the control panel is the same as on the pump nameplates (tolerance +/- 5 %). 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 (motor overheating and considerable operating problems) can be expected. 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 electrical diagram.

2.4.1 PANEL CONTROLS

2.4.1.1 OPERATOR SAFETY

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

2.4.1.2 MINIMUM REQUIREMENTS

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 has to be sized **according to local electrical code requirements** based on motor power rating.

e) **Extra quick trip overload protectors**. They must be selected according to the amperage indicated on the nameplate. They must trip within 6 seconds 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 motor phases. Claims for warranty repair of motors must include documentation that proper overload protectors have been installed.

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f) **Temperature sensor circuit.** Each motor is manufactured with **temperature limit switches** in the winding-head (control leads 1 and 2). They are Bimetal type switches (similar to "Klixon"). They can be connected directly into the motor control circuit, as long as this circuit does not exceed 220/240 volts, 2,5 amps.

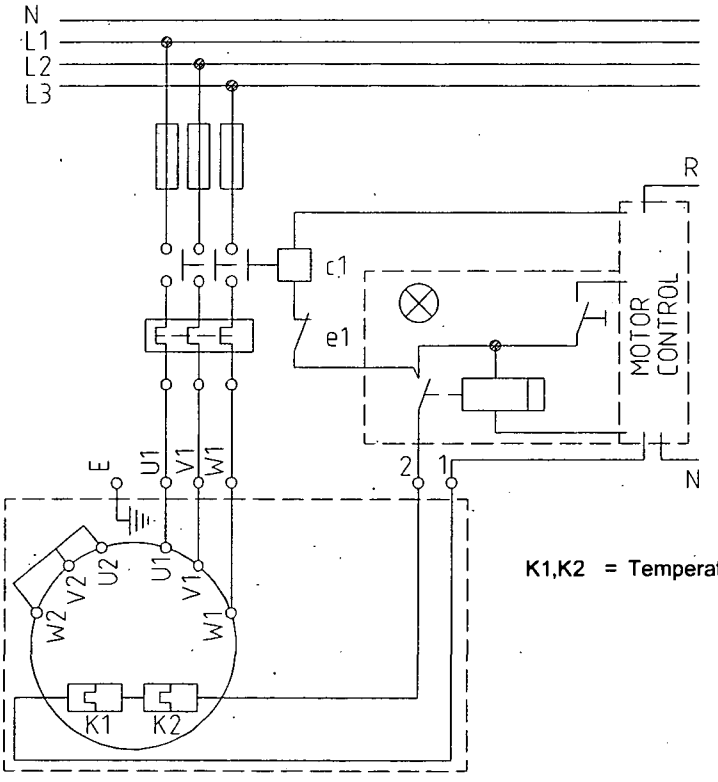
For variable frequency driver (Section 2.1) the motors must be equipped with triple-thermistor according DIN 44082-S 150° C. For Ex-proof motors this is prescribed and may only be used with thermistor control units type PTB 3.53-PTC/A.

As alternative (special order) thermistors can also be used for normal motors. All motors equipped with thermistor have a label at the end of the cable with the following words:

ATTENTION! Semiconductor switch! More than 2.5 Volt destroies the motor winding!

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.

g) **Connections of the motor**



K1,K2 = Temperature limit switches

The control leads 1 and 2 (**temperature limit sensor**) must be connected in such a way that the motor cannot automatically come on again, even after the temperature limit sensor have cooled and re-closed the circuit. The cause of overheating must be determined and corrected before the motor is put back into service.

ATTENTION:
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. They are **not** a sufficient substitute for the overload protectors specified in (e) above.

2.4.1.3 RECOMMENDED ADDITIONAL CONTROLS

a) **"Hand - Off - Automatic" switch.**

b) **Low voltage terminals for level switches.**

c) **Pump-on and pump-failure lamps.**

d) **Hours run meter:** Important to schedule service.

e) **Change-over switch** for multiple-pump stations.

f) **Alarm-system for high sump-level:** Preferably on a separate power supply, to ensure continued protection in the event of a main power supply failure.

g) **Moisture probe**

h) **Float switch**

i) **Bearing temperature probe**

2.4.2 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 motor to the power supply it is not necessary to open it. This should be avoided in order to retain the original factory-hermetic seal.**

If the sealing of the motor cover is disturbed, tightness tests must be performed as per Section 2.7.

Power leads of the motor are marked according to the following table:

MOTOR-TYPE	number of speeds	number of con-ductors (a)	speed (b)	winding connection (c)	markings on cable end, according DIN VDE 0530 norms
up to 4 kW, direct start	1	3+C+E		Y	U V W
over 4 kW star/delta start	1	6+C+E		Δ	U1 V1 W1 W2 U2 V2
two speed by Dahlander system Y/YY, direct start	2	6+C+E	N H	Y YY	1U 1V 1W 2U 2V 2W
pole change, each speed direct start	2	6+C+E	N H	Y Y	1U1 1V1 1W1 2U1 2V1 2W1
pole change, low speed: direct start, high speed: star/delta start	2	9+C+E	N H	Y 1) Δ	1U1 1V1 1W1 2U1 2V1 2W1 2U2 2V2 2W2
pole change, low and high speed with star/delta start	2	12+C+E	N H	Δ Δ	1U1 1V1 1W1 1U2 1V2 1W2 2U1 2V1 2W1 2U2 2V2 2W2

a) E = earth (yellow-green)
C = control leads

for normal motors: *		for EEx (explosion proof) motors, with two-level temperature protection circuits: *	
temperature protection circuit	1 to 2	lowest, temperature regulator	1 to 3
seal failure circuit (optional)	E to 4	highest, temperature limit switch	1 to 2
		seal failure circuit (optional)	see note

NOTE:
On EEx, seal failure circuit will always be in a separate cable originating near bottom of motor.
* If in doubt whether motor is normal or Ex-proof refer to Section 2.1.1.

b) N = low speed H = high speed

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

2.4.3 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.

2.4.4 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 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 excessive power consumption. The following formula will calculate the required minimum sump capacity:

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

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

2.4.5 REQUIRED SUBMERGENCE

HIDROSTAL immersible pumps can work continuously submerged or in a dry environment. 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.

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2.5 MAINTENANCE

2.5.1 OPERATING TROUBLES

POSSIBLE REASONS \ TROUBLE	No flow	Flow not sufficient	Head not sufficient	Reduction of flow or head after start up	Vibrations	Motor overload	Motor does not start	Noise
1. Pump not filled with water, not vented	X							
2. RPM too low	X		X					
3. RPM too high					X	X		X
4. Air entrance into suction line	X	X		X	X			X
5. Discharge line clogged / Valve closed	X				X	X		
6. Air or gas in pumped liquid	X	X	X	X	X			X
7. TDH too high (higher than calculated)	X	X			X			
8. Suction head too high				X	X			X
9. Insufficient suction head on hot liquids		X			X			X
10. Insufficient submergence of suction	X	X	X	X	X			X
11. Sludge concentration higher than assumed		X	X			X		
12. Specific weight of medium higher than assumed						X		
13. Impeller or suction line clogged	X	X			X			
14. Wrong direction of rotation	X	X	X					
15. Impeller clearances too high		X	X					
16. Damaged impeller		X	X		X			
17. Thermal overloads tripped; control switch off							X	
18. Motor damage					X	X	X	X
19. Low voltage		X	X			X	X	
20. Attachments loose					X			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		X
27. Thick sludge and tight impeller clearance						X		
28. Air or gas on impeller backside	X		X					

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2.6 MAINTENANCE AND SERVICE

2.6.1 GENERAL

Before doing any work on the pump unit, switch off main isolator switch and remove fuses from panel.

The following checks (Section 2.6.3) can be done in the field. When a repair is indicated, send the pump unit to the nearest authorized Hidrostal service station.

CAUTION:
When disconnecting the power cable at the control panel, take care that the cable ends **CANNOT** come in contact with water. Replace the plastic cable-end shipped with the pump (if this is no longer available, wrap the cable ends inside a plastic bag, and seal with tape) for water-tightness during handling and shipping.

2.6.2 COOLING TYPES

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

KEY FOR SYMBOLS ON FIG. 7,8,9

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

CONVECTION COOLING - Code "K"
(Fig. 7)

This type transfers motor heat directly through the stator housing to the surrounding ambient liquid (if submerged) or to the air (if not submerged).

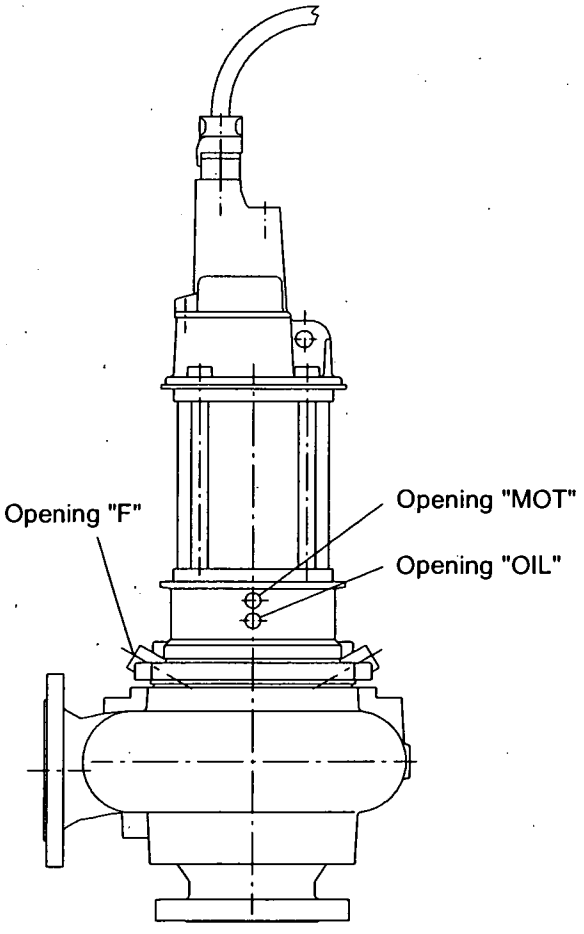

Fig. 7

Hidrostal	INSTRUCTION MANUAL IMMERSIBLE PUMPS	
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INTERNAL COOLING - Code "E"
(Fig. 8)

This type 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.

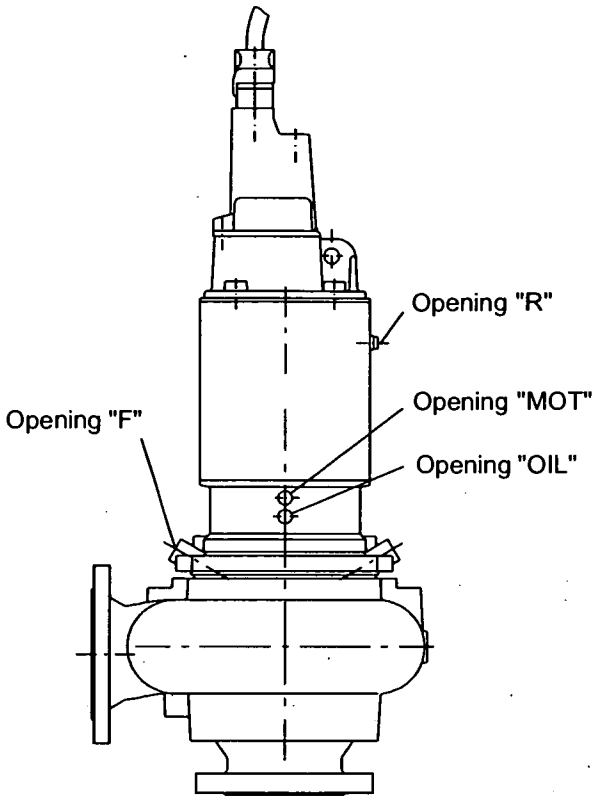

Fig. 8

EXTERNAL COOLING - Code "F"
(Fig. 9)

This type transfers motor heat from the stator into a coolant liquid circulating through a cooling jacket surrounding the stator housing. The coolant transfers this heat to an external heat exchanger, and it must be circulated by an external coolant pumping system.

This type is provided for cases where internal cooling is not sufficient, especially where the temperature of the pumped media is too high for effective cooling.

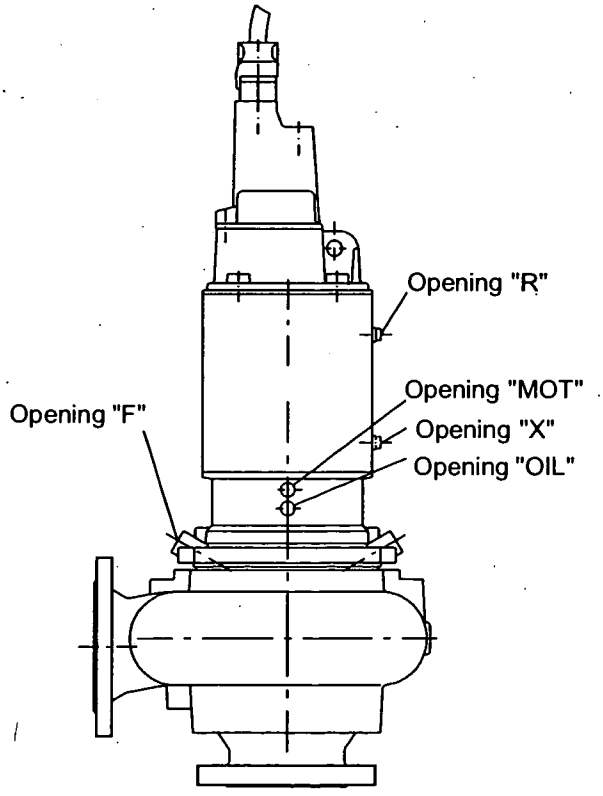

Fig. 9

2.6.3 FIELD TESTS

2.6.3.1 VISUAL CHECKS AFTER PULLING PUMP UNIT FROM SUMP

- Check pump and motor for possible mechanical damage. Pay attention to the cable.
- If pump volume or pressure are not acceptable, check impeller clearance (see manual for hydraulic).
- Check overload relay, fuses and time relays (if any) for correct setting.
- Check correct function of level control.
- 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 cable plus motor. A motor in the pit in reasonable 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 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, 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 repaired or the motor replaced. - The motor will probably not operate for long. - The motor will not run in this condition.	Less than 10'000 0	0 - 0.01 0

CAUTION:
Do **NOT** "Megger test" control leads when thermistors are fitted: Voltages over 2,5 V 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. If failure is indicated, remove pump with cable and proceed to Section 2.7 for further tests.

2.6.3.2 MOTOR HOUSING TEST

This test consists of a check on the condition of the motor side mechanical seal and/or motor housing "O"-rings.

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

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

CAUTION:
This screw plug must be completely watertight. 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 by Hidrostal are softened.

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2.6.3.3 OIL CHECKING ON IMMERSIBLE MOTORS

This is a check on the condition of the pump side mechanical seal. For pump units supplied with a moisture probe, total failure of the pump side seal will be indicated by activation of the resistance relay. A failure can be detected by the following oil check, even without this circuit.

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.

Oil level check

1. For pumps with cooling type "F" or "K" stand pump with shaft vertical and remove screw plug "OIL". Coolant level must be at the level of opening "OIL" (Fig 10).

2. For pumps with cooling type "E" stand pump with shaft vertical and remove screw plug "R". Oil level must be at the level of opening "R" (Fig. 11).

If coolant is far below this level, the pump side mechanical seal may have leaked and may require replacement (section 2.9.1). If oil level is only a small amount below this level, proceed with following test. Top-up with new oil and re-check in 200 to 500 hours.

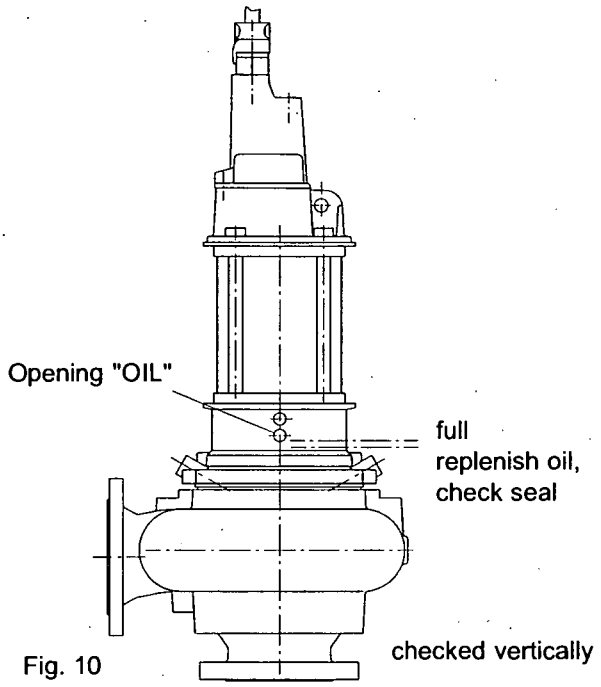

Fig. 10

Oil quality check

Lay pump down horizontally with opening "OIL" (536a) upwards. Remove screw plug "OIL". Insert a tube or rubber hose, place a finger over top of tube and remove it with a small sample. Repeat until a sufficient quantity has been collected for observation. Evaluation will show one of three conditions:

a) If oil is clear there are no problems with the pump side seal. Top up with oil and close opening "OIL" with screw plug and a new softened copper seal ring.

b) If there is just a little water in the oil but the oil is clear, repair of the pump is not necessary. Remove oil and separate water from oil (Section 2.6.3.4 or 2.6.3.5).

   Pour back the clean oil into the mechanical seal housing and close opening with screw plug "OIL" and softened copper seal ring (536). However, check oil quality again after 500 hours of operation.

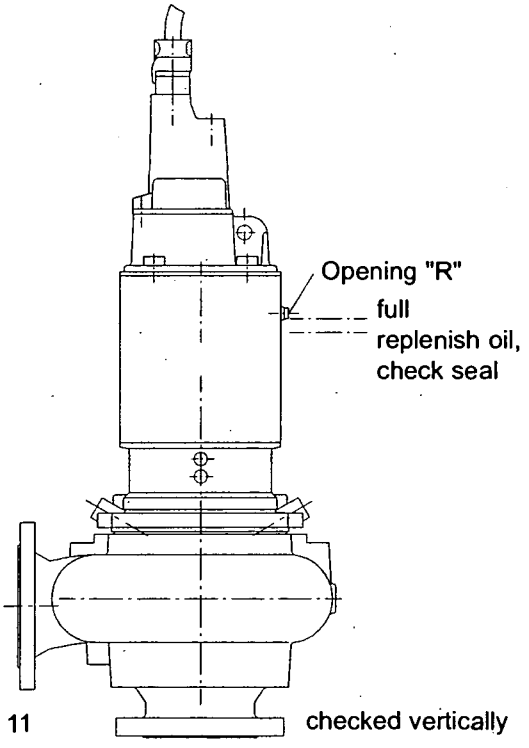

Fig. 11

With a new mechanical seal (515) it is possible that during the run-in period a small amount 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 small amount 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 sludge or sewage smell are detected in the oil, the pump side mechanical seal (515) must be repaired or replaced.

For oil removal as indicated in (b) above or for prior to a major repair, refer to Section 2.6.3.4 for all motors with 2nd letter in motor code "K" or "F". Refer to Section 2.6.3.5 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:

Specific gravity at 20° C	0.812	g/ml
Viscosity at 20° C	6.75	mm2/s (cst)
Viscosity at 40° C	3.52	mm2/s (cst)
Solidification point	-38.0	° C
Flash point	132.0	° C
Burning point	142.0	° C
Evaporation energy	251.0	kJ/kg
Solubility in water	none	

Other recommended 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.

2.6.3.4 OIL CHANGE FOR CONVECTION OR EXTERNAL COOLED MOTORS TYPES "K" AND "F" (second letter of motor code)

Remove screw plug "OIL" (536a) and drain oil chamber casing (504) completely, by turning the pump around slowly until opening "OIL" is upside down (Fig. 12). On larger motor sizes there may be another screw plug directly below the opening "OIL" on the back cover (507). Removing this screw plug will help remove the last bit of oil.

When the oil chamber casing is completly empty stand pump vertically on suction flange and refill with separated oil or new oil. The correct level is reached when the oil is at the bottom of opening "OIL".

Re-install screw plug "OIL" with softened copper seal ring.

2.6.3.5 OIL CHANGE FOR INTERNAL COOLED MOTORS TYPE "E" (second letter of motor code)

Remove screw plugs "OIL" and "R" (Fig. 13) and drain oil chamber casing and cooling jacket completely by turning the pump around slowly, until openings "OIL" and "R" are upside down (Fig. 13). When oil has completely drained, re-install screw plug "OIL" with softened copper seal ring. Place pump vertically.

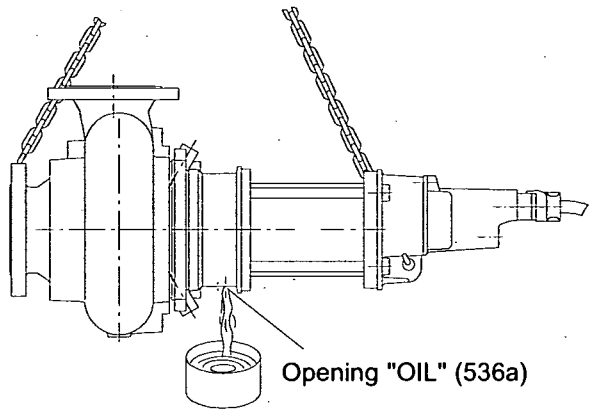

Fig. 12

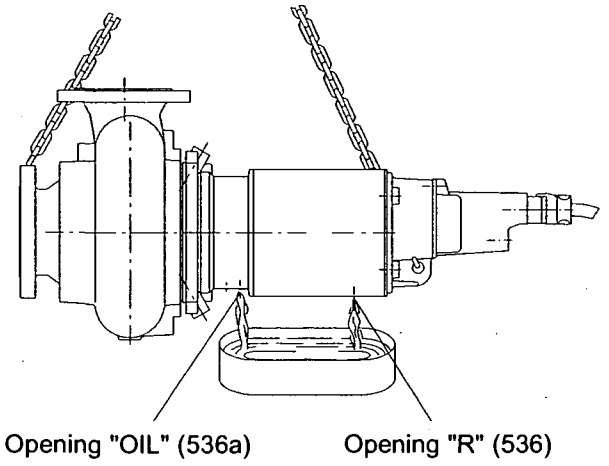

Fig. 13

Refill 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 screw plug "R", with softened copper seal ring.

2.6.4 GREASING INSTRUCTIONS

Hidrostal motors use 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 ("Overhaul Chart", Section 2.8). The overhaul should be done by an authorized Hidrostal service center.

CAUTION:
The overhaul of Ex-proof-motors must be done in the factory or in an authorized Hidrostal service center, otherwise the Ex-certification will be invalidated.

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

For regreasing we recommend:

STABURAGS NBU 8 EP by Kluber-Lubrication.

This grease is of a mineral oil base containing a barium complex as thickener.

Typical characteristics:

Colour	beige	
Apparent dynamic visco. (approx.)	6000	mPas
Operating temperature range	-30..150	° C
Max. temperature (short time)	170	° C
Consistency class (NLGI)	2	
Penetration DIN ISO 2137 (0.1 mm)	280	
Dropping point DIN ISO 2176	> 220	° C
Corrosion protection DIN 51802	0	
RPM-parameter (n x d m)	5×10^5	

2.7 MOTOR CABLES

Whenever opening motor housing, it is imperative that all O-rings have to be replaced with new items supplied from HIDROSTAL. O-rings glued-up from bulk stock are totally unsatisfactory for this critical application; the glued joint will inevitably leak water into the motor after a short time.

If tests conducted through the cables in the field (Section 2.6.3.1) 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" test on cable and winding. If windings are at fault, send the entire motor to the nearest authorized Hidrostal service station. If cable is at fault, a new cable set can be installed.

2.7.1 RE-CONNECTION OF CABLE

Place 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.

2.7.2 TEST FOR LEAKS

Before putting the pump back into operation after opening of the motor (as when changing cables), a test for leaks 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). Air pressure should be a maximum of 0.5 bar (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.

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2.8 OVERHAUL CHART

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 lit.	Hours between regreasing
BKBA2	25	20	0.8	20'000
BKZR2 / BKZY2	25	20	1.2	30'000
BEZR2	25	20	2.8	30'000
BEZY2	25	20	3	30'000
CEZR2	25	20	2.8	30'000
CEZY2	25	20	3	30'000
CEYR2 / CEYS2	1 1/2	1 1/8	2	30'000
CEYT2	1 1/2	1 1/8	2	30'000
DEYT2	1 1/2	1 1/8	2	20'000
DEXB2 / DEXBT	1 1/2	1 1/8	8	25'000
DEXL2	1 1/2	1 1/8	8	25'000
DEXQ2	2	1 1/2	10	25'000
DEXT2	2	1 1/2	10	25'000
DEXZ2 / DEXW2	2	1 1/2	11	25'000
EEWS2	2 1/2	1 1/2	24	15'000
EE5S2 / EEVS2	3	2	31	20'000
BKBA4	25	20	0.8	30'000
BKZR4	25	20	1.2	50'000
CKBA4	25	20	0.8	30'000
CKZR4 / CKZY4	25	20	1.2	50'000
CEZY4	25	20	3	50'000
CKYT4	1 1/2	1 1/8	1	40'000
DKYT4	1 1/2	1 1/8	1	35'000
DEYS4 / DEYT4	1 1/2	1 1/8	2	35'000
DEXA4 / DEXA5	1 1/2	1 1/8	8	45'000
DKXA4	1 1/2	1 1/8	4	45'000
EEXA4 / EEXA5	1 1/2	1 1/2	9	45'000
EEXAU	1 1/2	1 1/2	9	45'000
EEXK4	1 1/2	1 1/2	9	45'000
EEXO4 / EEXR4	1 1/2	1 1/2	10	45'000
EEXV4	1 1/2	1 1/2	11	45'000
EEXR5	1 1/2	1 1/2	10	45'000
EEXW4	2	1 1/2	14	40'000
EEXY4	1 1/2	1 1/2	11	40'000
EEXY5	1 1/2	1 1/2	11	40'000
EE4B4 / EEWB4	2 1/2	2	24	40'000
EE4B5	2 1/2	2	24	40'000
EE4S4 / EEWS4	2 1/2	2	28	40'000
EEWS5	2 1/2	2	24	40'000
FEXT4	2	2	13	40'000
FEXW4 / FEXZ4	2	2	14	40'000
FE4B4 / FE4B5	2 1/2	2	24	40'000
FE4BU	2 1/2	2	24	40'000
FE4C4	2 1/2	2	28	40'000
FE4S4 / FEWS4	2 1/2	2	28	40'000
FE4S5 / FE4T4	2 1/2	2	28	40'000
FE5B4 / FE5B5	3	2	38	35'000
FEVB4 / FEVB5	3	2	38	35'000
FE5BU	3	2	38	35'000
FE5S5	3	2	38	35'000
HE5C4/HE5T4	3	3	44	35'000
HE5S5	3	3	44	35'000
HE6S4	95	3	42	20'000
HE6S5 / HE6SU	95	3	42	20'000
HEUC4	95	3	60	20'000

Motor type	motor-side seal	pump-side seal	seal oil lit.	Hours between regreasing
IE7C4	100	100	94	18'000
IE7T4 / IETT4	100	100	94	18'000
IETT5	100	100	106	18'000
IETZ4 / IETZ5	100	100	106	18'000
DKYT6 / DEYS6	1 1/2	1 1/8	2	35'000
EEYS6 / EEYT6	1 1/2	1 1/8	2	35'000
EKXA6	1 1/2	1 1/2	5	50'000
EKXR7	1 1/2	1 1/2	5	50'000
EEXA6 / EEXK6	1 1/2	1 1/2	9	50'000
EEXR6 / EEXR7	1 1/2	1 1/2	10	50'000
FEXQ6	2	2	13	50'000
FEXT6	2	2	13	50'000
FEXT7	2	2	13	50'000
FEXW6	2	2	14	50'000
FEXZ6 / FEXZ7	2	2	14	50'000
FE4A6 / FE4A7	2	2	23	50'000
FE4S7	2 1/2	2	28	50'000
HE4B6	2 1/2	2	28	50'000
HE4S6 / HEWS6	2 1/2	2	32	50'000
HE4S7 / HEWS7	2 1/2	2	32	50'000
HE5B6 / HE5B7	3	3	44	45'000
HE5S6 / HE5S7	3	3	44	45'000
HE6S7	95	3	42	35'000
IE5S6	3	3	47	45'000
IENT6	3	3	47	45'000
IE6S6 / IE6SV	95	3	68	35'000
IE6S7	95	3	68	35'000
IE7C6	100	100	94	35'000
IETT6 / IETT7	100	100	106	35'000
IETZ7	100	100	106	35'000
LE7T6	100	100	106	35'000
LETZ6	100	100	106	35'000
DKYT8	1 1/2	1 1/8	1	35'000
DEYS8	1 1/2	1 1/8	2	35'000
EEYT8	1 1/2	1 1/8	2	35'000
EEXR9	1 1/2	1 1/2	10	50'000
FEXQ8	2	2	13	50'000
FEXT8 / FEXTW	2	2	13	50'000
FEXZ8 / FEXZ9	2	2	14	50'000
HE4B8 / HE4B9	2 1/2	2	28	50'000
HE4S8 / HEWS8	2 1/2	2	32	50'000
HE4S9	2 1/2	2	32	50'000
HE5B8	3	3	44	45'000
HE5B9 / HE5S9	3	3	44	45'000
HENT4	3	3	45	35'000
HEUC7	95	3	60	35'000
IE5S8 / IEVS8	3	3	47	45'000
IE6S9	95	3	68	30'000
IE6S8 / IE6SW	95	3	68	30'000
IETT9	100	100	106	30'000
LE7C8	100	100	106	30'000
LE7T8 / LETT8	100	100	106	30'000
LETZ8	100	100	106	30'000
LETZ9	100	100	106	30'000

2.9 ASSEMBLY / DISASSEMBLY

2.9.1 REPLACEMENT OF MECHANICAL SEAL

2.9.1.1 REMOVAL OF PUMP SIDE MECHANICAL SEAL (515)

a) Exposed-spring seal - type "C"
(Fig. 14)

Remove snap ring (Seeger, 546), then remove spring. Make sure that the shaft is free of burrs and has no sharp edges so that the rubber parts of the seal cannot be damaged as they are removed. Oil the shaft for ease of disassembly. Now the seal rotating parts can be pulled off the shaft by hand.

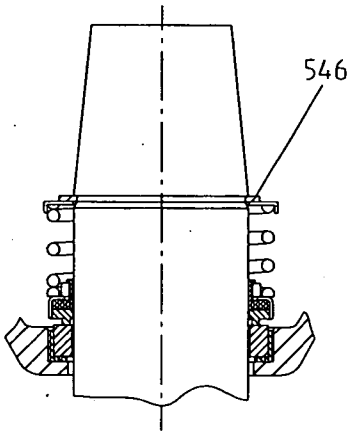

Fig. 14

b) Rubber-bellows seal, with internal spring - type "M"
(Fig. 15)

Remove retaining ring "A" from the rubber bellows of the seal by gently prying with two screwdrivers on opposite sides, between the rubber bellows and the retaining ring (Fig. 16).

CAUTION:
Use only dull-edged screwdrivers since sharp edges could cut the rubber bellows. Do not twist screwdriver, as this can puncture rubber bellows.

Rather, lay some convenient object onto back cover or seal plate, to act as a fulcrum for each screwdriver, and pry ring directly up away from rubber bellows (Fig. 16).

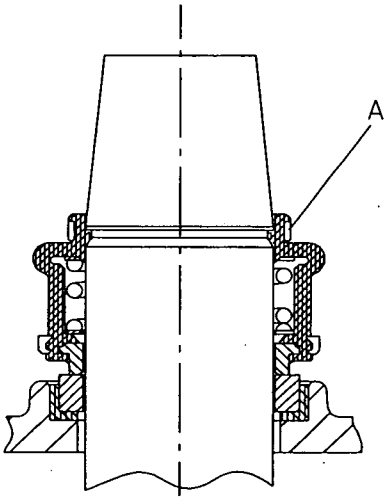

Fig. 15

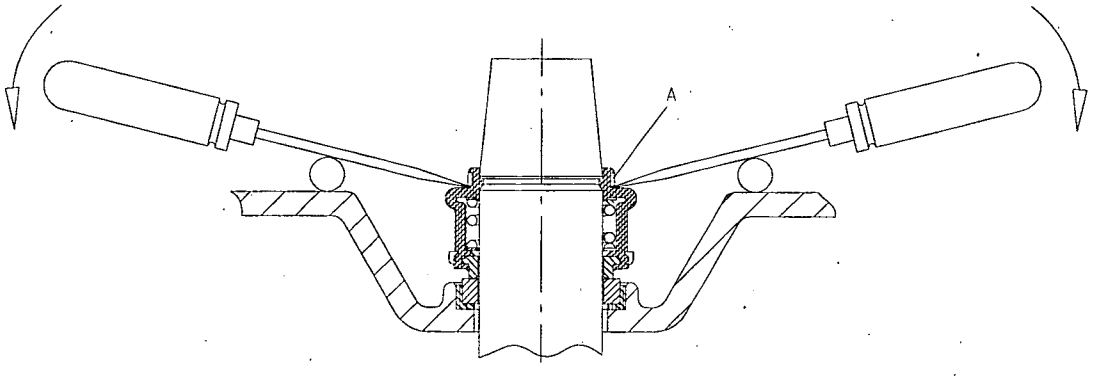

Fig. 16

Make sure that the shaft is free of burrs and has no sharp edges so that the rubber parts of the seal cannot be damaged as they are removed. Oil shaft and bellows for ease of disassembly. Gently insert a screwdriver between the shaft and the rubber bellows.

By lifting and turning the screwdriver around the shaft, the lip of the rubber bellows can be lifted out of the shaft groove. Once the bellows is free of the groove, the entire rotating part of the seal with bellows can be pulled off the shaft. If necessary, use two screwdrivers deep into the seal to pry the seal face loose (Fig. 17).

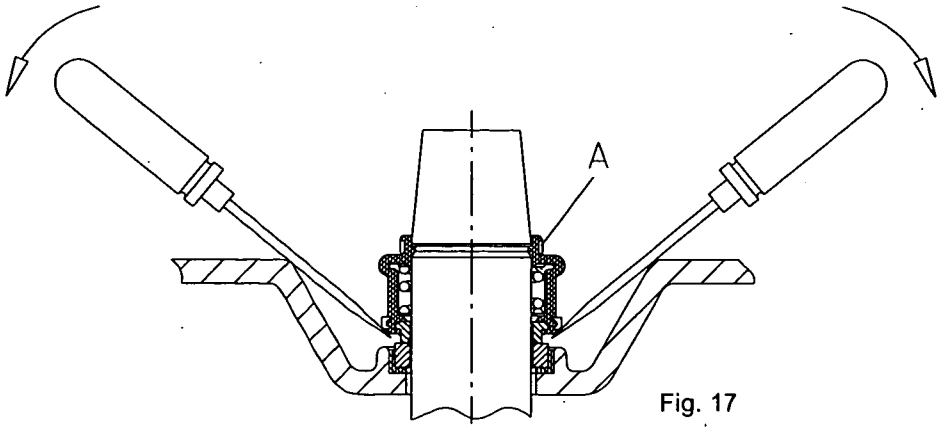

Fig. 17

c) Rubber-bellows seal - type "N" (Fig. 18)

Pull out the removable part (A) by hand.

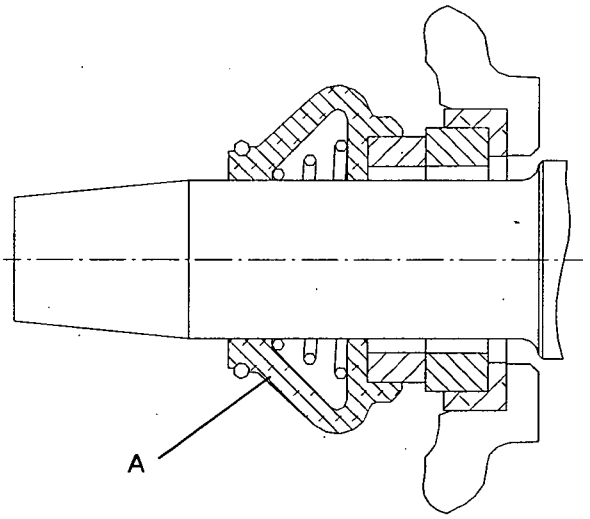

Fig. 18

d) Rubber-bellows seal, external spring - type "G" (Fig. 19)

Remove snap ring (546), if existing.
Pull out the removable part (A) by hand.

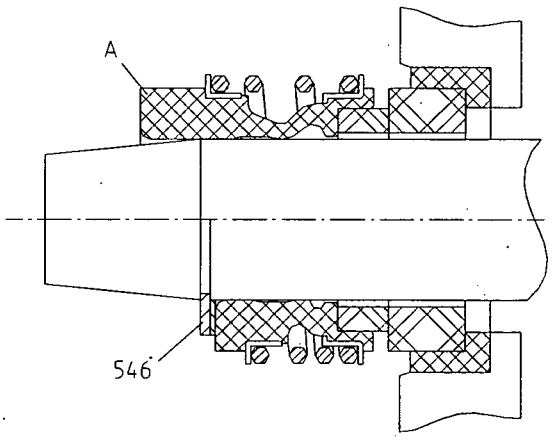

Fig. 19

e) Stainless-steel-shroud seal - type "X" (Fig. 20)

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.

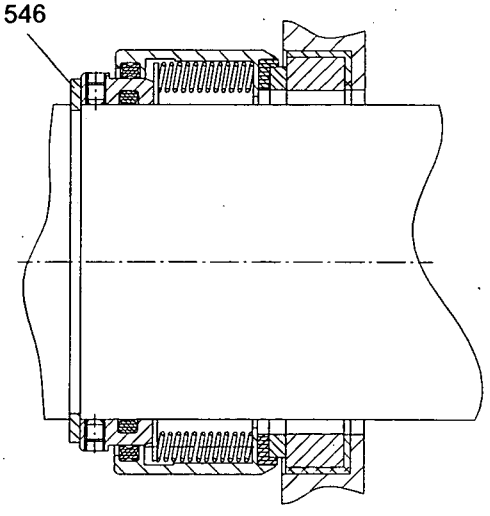

Fig. 20

f) Stationary seat (all types)
(Fig. 21 and 22)

Remove static part of the mechanical seal as follows:

Unfasten nuts (534) and carefully remove back cover or mechanical seal plate (507) from oil chamber casing. Make sure that the static part of the seal (515) does not hit the shaft so that the ring can't be damaged.

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

Some HIDROSTAL seals can be repolished or repaired (Consult nearest service center). When sending a seal for inspection or repair, it is important to thoroughly protect the seal faces to prevent damage during transportation.

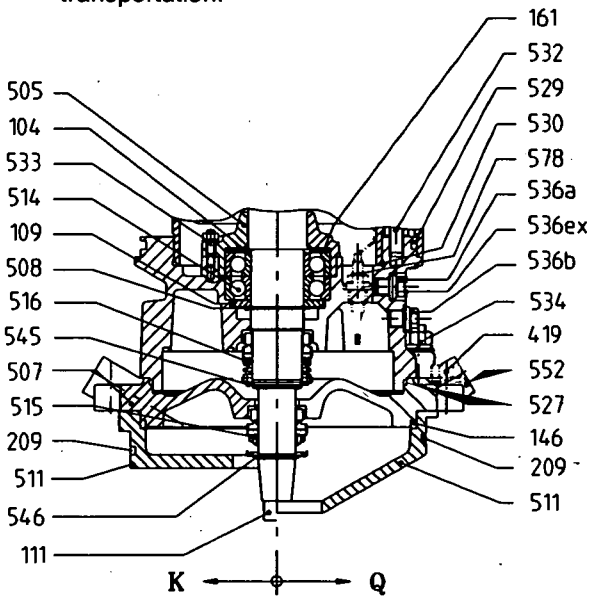

Fig. 21

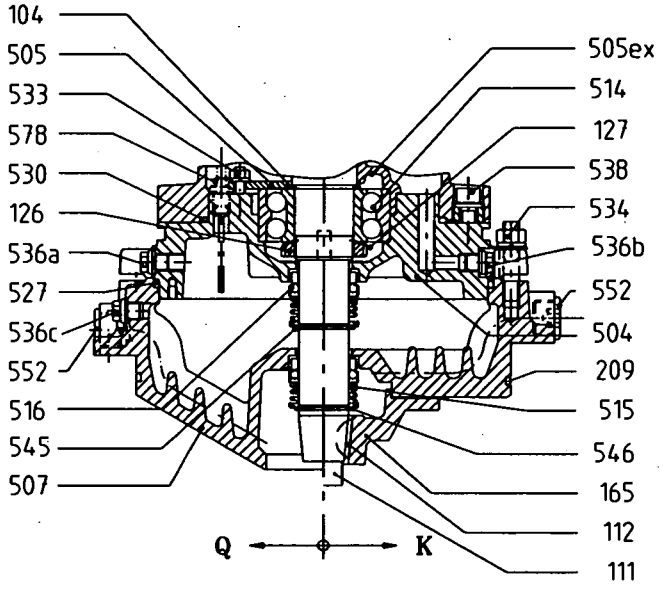

Fig. 22

2.9.1.2 MAINTENANCE OF MOTOR SIDE 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 motor housing test as described in Section 2.6.3.2, the entire motor should be sent to the nearest authorized HIDROSTAL service center for a complete inspection.

2.9.1.3 ASSEMBLY OF BACK COVER

⚠ **Cleanliness is of utmost importance for this assembly work!** All parts must be washed in solvent before assembly. All machined mating surfaces must be clean and free from burrs. All grooves and seatings for "O"-rings and other static seals must be 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 assembly.**

⚠ **WARNING:**
Never use "O"-rings glued from "O"-ring stock. Our experience is that this glue joint will inevitably leak.

Place a new "O"-ring (527) on the oil chamber casing (504). Carefully assemble back cover or mechanical seal plate (507) to the oil chamber casing and fasten with fastening set (534).

2.9.1.4 ASSEMBLY OF PUMP SIDE MECHANICAL SEAL

a) Stationary seat (all types)

Lubricate the rubber circumference of the static mechanical seal part and carefully press all the way into its seat in the back cover or mechanical seal plate (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 (Fig. 23).

Make sure that the shaft is free of burrs and has no sharp edges, so that the rubber part or the mechanical seal cannot be damaged. File groove edges if necessary.

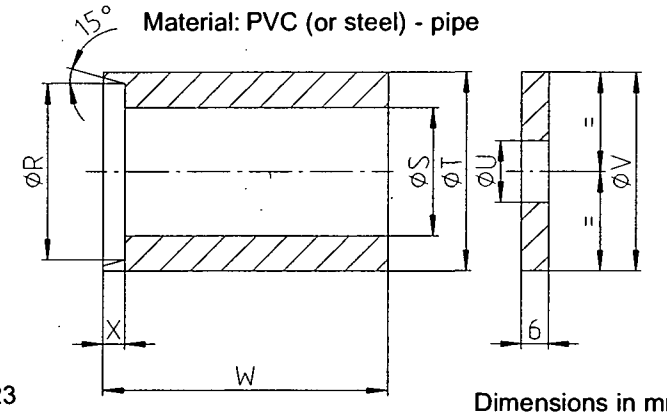

Fig. 23 Dimensions in mm

Seal size	ϕ R	ϕ S	ϕ T	ϕ U "Q"	ϕ U "K"	ϕ V	W	X	Bolt size "Q"	Bolt size "K"
20	32 +/-1	21 +1/-0	38 +/-1	12	-	40	60	5	M10	-
1 1/8"	40 +/-1	29 +1/-0	45 +/-1	14	12	50	65	5	M12	M10
1 1/2"	50 +/-1	39 +1/-0	55 +/-1	18	14	60	75	5	M16	M12
2"	65 +/-1	51 +1/-0	70 +/-1	22	18	80	95	5	M20	M16
2 1/2"	80 +/-1	64 +1/-0	85 +/-1	29	-	90	150	5	M27	-
3"	92 +/-1	77 +1/-0	100+/-1	28	29	110	170	5	M33	M27
100	110+/-1	102+1/-0	120+/-1	44	38	130	350	5	M42	M36

b) Exposed-spring seal - type "C"

Remove spring and spring retaining ring of mechanical seal. **Seal surfaces must be absolutely clean!** 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 a plastic pipe mandrel only slightly larger than shaft diameter, to push directly on the rubber part of the seal (Fig. 23). 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 (Seeger, 546) and turn shaft by hand to check for free running.

c) Rubber-bellows seal - type "N"

Lubricate the rotating part of the mechanical seal, put the ring "B" on the rubber bellows (Fig. 24). Push the whole assembly by hand over the shaft as far as possible. Mount the distance ring (546, Fig. 25). Final assembly by installing of impeller.

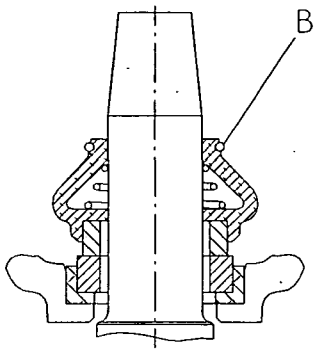

Fig. 24

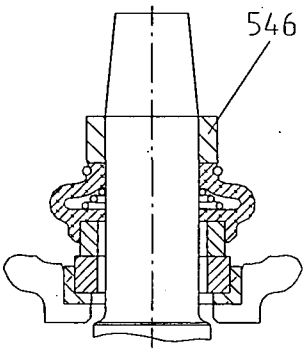

Fig. 25

d) Rubber-bellows seal, external spring - type "G"

Wet the rotating part of the mechanical seal with soap water. Push the whole assembly by hand over the shaft as far as possible. On size 20 mm (Fig. 26) final assembly by installing of impeller. On other sizes (Fig. 27) secure with snap ring (546).

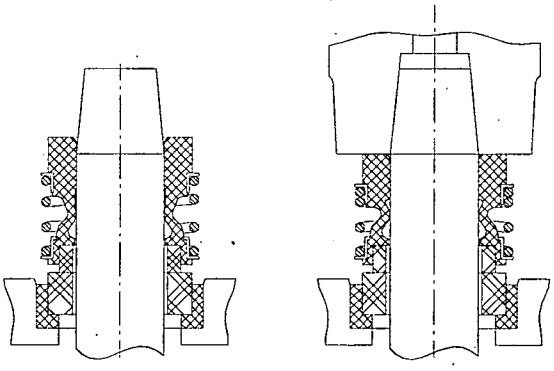

Fig. 26

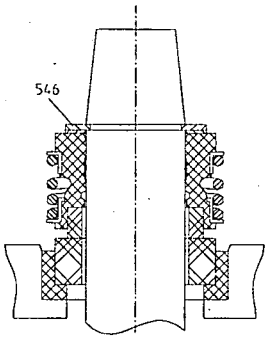

Fig. 27

e) Rubber-bellows seal, internal spring - type "M"

Lubricate the rotating part of the mechanical seal, position the retaining ring "A" on the rubber bellows (Fig. 28). Push the whole assembly by hand over the shaft as far as possible. Mount the special tool over the shaft tip (Fig. 29), and compress the mechanical seal until the lip of the rubber bellows 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 bellows and that it is not cocked. Then try to pull the rubber bellows off shaft by hand to make sure that the lip has reliably engaged in the shaft groove.

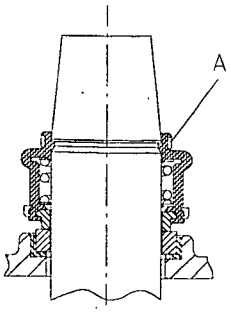

Fig. 28

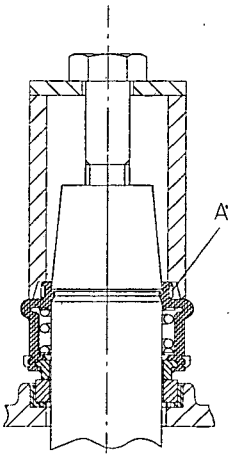

Fig. 29

f) Stainless-steel-shroud seal - type "X"

Lubricate inner rubber O-rings of seal 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 until it snaps into its groove. If necessary use the special tool (Fig. 23). Then re-install the three small setscrews into the seal rotating part, and tighten firmly.

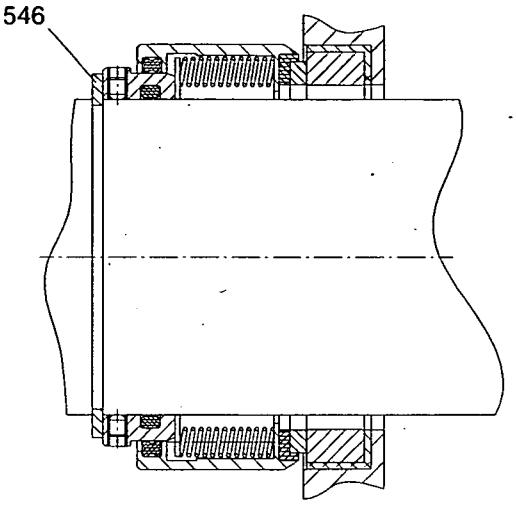

Fig. 30

2.9.1.5 LEAKAGE TEST FOR PUMP SIDE MECHANICAL SEAL (All Types)

Remove screw plug "OIL" (536) and drain the oil 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 0.5 bar (7 psi).

WARNING:
- Make sure that the pressure never exceeds 1 bar. This could displace the seal.
- 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.
- **Do not immerse end of cable!**
- Correct failure if leakage has been found. After finishing tightness test remove pressure connection hose and fill with oil according to Section 2.6.3.4.

Excellent
Engineering
Solutions

WEIR SERVICES

Installation and Operating Instructions

Hidrostal Pump
H05K-S04R+HEVT4-GMSK+NDB6-25

Client: Brisbane City Council
Site: -

Job No.: 208737
Hidrostal Fab No.: 132146
Hidrostal Serial No: H3034

Prepared by:

WEIR SERVICES
15 Gindurra Road
SOMERSBY NSW 2250
Australia

Phone:(02) 4349 2999
Fax: (02) 4349 2802

Hidrostal	INSTRUCTION MANUAL GENERAL USE	
Dat.: 14.07.99	No: 94-BA 5030E/1c	File: ALLG_E

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Part 0

Part I

Hidrostal	INSTRUCTION MANUAL GENERAL USE	
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0. GENERAL DIRECTIONS

0.1 GENERAL SAFETY DIRECTIONS

0.1.1 SAFETY AND WARNING DIRECTIONS

The following symbols and names will be used in this manual as safety and warning directions:

WARNING!
If the handling instructions, with this symbol, are not strictly adhered to then serious injuries or even fatal accidents could occur.

Warning symbols have to be kept **strictly**.

ATTENTION!
If the handling instructions, with this symbol, are not strictly adhered to then serious damage to the machine and/or other equipment could occur.

Directions marked with "Attention" have to be kept **exactly**.

DIRECTION!
If the handling instructions with this symbol will be observed the consequence will be more effective work. Directions make the work easier.

PARTICULAR INFORMATIONS

LEGAL DIRECTIONS

Hidrostal	INSTRUCTION MANUAL GENERAL USE	
Dat.: 14.07.99	No: 94-BA 5030E/3b	File: ALLG_E

1.0 PUMP CODE EXPLANATION

The pump-code is a combination of joined-together in series construction groups. The **"plus sign"** is the separation between these groups, and the **"dash"** is the separation between general and specific description of each construction group.

PUMP CODE

CONSTRUCTION GROUPS

	Group 1		Group 2		Group 3
EXAMPLES:	F10K-HD1R	+	FE4S4-MNGK	+	N3B4-10
	D04Q-L010E	+	DNXT2-MXEQ	+	X2B1-15
	F10D-L01	+	FE3Z7-CNEK	+	N2E1-10
			A2QR2-CC3	+	A01-10
	F150-S03R	+	FFM1O-XM.Q		
	H06F-M01	+	H2S10-L		
	E05K-M01	+	EDM1F-MM.K		
	Hydraulic		Hidrostal-Motor or Bearing Frame		Cable Set

1.1 DELIVERY

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

1.1.1 RECEPTION OF PUMP UNIT

Inspect the shipment for shortages or damage. Report any discrepancies to the carrier, note them on the shipping documents and sign them with date together with the carrier.

1.1.2 NAMEPLATE DATA

i Each pump is equipped with a nameplate showing all technical data of the pump. It is essential to give the complete data when enquiring about parts or service.

An explanation of the meaning of this code can be found under Section 1.0 "Pump Code Explanation".

1.1.3 STORAGE

If the unit is not to be installed immediately, note:
- Store in a dry and clean place without extreme changes in temperature (storage room temperature -10° to +40°C (14° to 104°F).
- Rotate the shaft 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 brinelling of the bearings could occur.

1.2 INSTALLATION

The pump should be placed as near to the liquid source as possible, and as low as possible, to provide the maximum possible suction head, avoiding elbows and excessive pipe lengths wherever possible.

Provide adequate ventilation of pump room.

WARNING:
If the pump can be exposed to temperatures at or below the freezing point of the media, the pump should be drained when not in use (formation of ice within the pump can cause cracking and other damage to the construction.

1.2.1 MOUNTING

- General:
  The pump can be mounted in a horizontal or vertical position.

- Fastenings:
  When mounted horizontally pumps should be mounted using the feet provided on the volute or use a bracket attached to the rear of the volute.

  When mounted vertically the pump can be stood using a special suction elbow on its suction flange or using a bracket bolted to the volute casing.

1.3 PIPING

The suction and discharge piping should be independently supported near the pump and be installed in such a manner so as not to impose stresses and strains on the pump casing.

1.3.1 SUCTION PIPING

To obtain maximum available suction head, the suction line should be as direct and as short as possible, avoiding elbows. If elbows must be used, a long radius type is preferred. It is important to avoid any sagging in a suction line in which air may accumulate and cause loss of prime. For the same reason, it is important to have the suction line airtight when suction lift exists.

The suction pipe must be such that no air pockets can form, and must slope upward to the pump intake.

Hidrostal	INSTRUCTION MANUAL GENERAL USE	
Dat.: 14.07.99	No: 94-BA 5030E/5c	File: ALLG_E

1.3.2 SIZING OF SUCTION PIPEWORK

The losses of the suction side should be kept to a minimum, the pipework should never be less than the suction diameter of the pump and preferably be one pipe size larger. When larger diameter pipework is required the transition should be made close to the pump using flat-topped tapers (Fig. 1 + 3). Concentric tapers should never be used, as air pockets could result (Fig. 2 + 4).

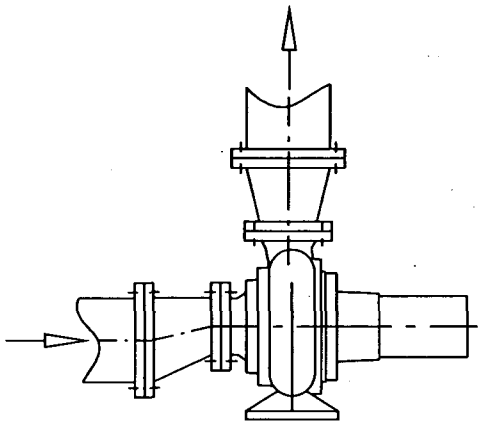

Fig. 1

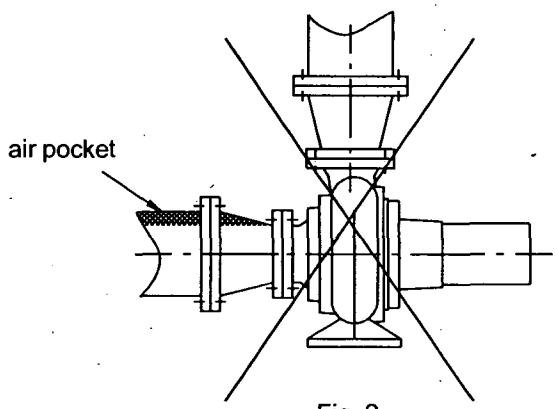

Fig. 2

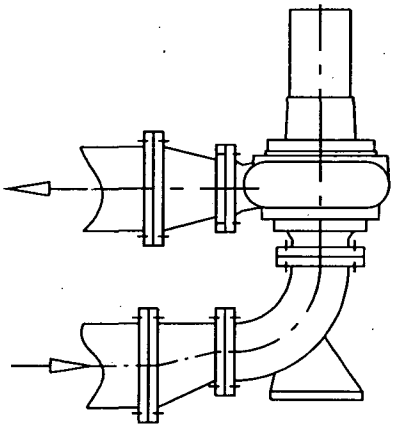

Fig. 3

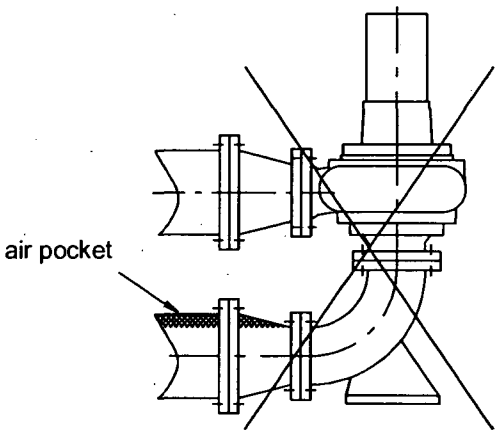

Fig. 4

Unusual suction conditions such as high liquid temperature, altitude above sea level and high specific gravity or viscous liquids should be compensated for, by proper engineering of a sufficiently sized suction pipe.

WARNING:
The pump should not operate on a suction lift when pumping liquids with entrained air or gas. Non-return valves should not be used in the suction line. Gate valves should preferably be installed with the spindle horizontal to prevent trapping air or gas. Suction valves must be fully open during operation.

1.3.3 DISCHARGE PIPING

Use as few fittings as possible and when elevating to any height, go vertically upward from the pump, **then** horizontal to the point of discharge.

When using non return valves in the discharge line it is important the maximum permitted velocity specified by the manufacturer is not exceeded. For single-flap valves operating on dirty liquids a typical maximum velocity is 3.5 m/second.

If these values are exceeded shock waves can result when the valve closes, which may cause the face of mechanical seals to open and allow material to become trapped between the faces resulting in premature seal failure and contamination/loss of the seal oil.

WARNING:
Does the pump work with closed or blocked up suction or discharge piping, there is a danger of overheating in the volute casing. It is possible to dry out the medium occluding gas bubbles. They could cause damages on person or machine if they will be eliminated inexpert.

1.3.4 CONNECTION OF PIPING

This should only be undertaken after the grout (if used) has thorough set and holding down bolts have been tightened.

The pipework should be connected to the pump flanges with gaskets in place and the bolts properly tightened. Make sure the pipe flanges are parallel and in line.

WARNING:
For all pumps in cast iron, great care must be used in connecting these flanges. Tighten evenly and adjust to a snug fit. Under no circumstances should the casing be subjected to piping strains. Such strains could result in structural failure leading to operator injury.

1.4 SPECIAL APPLICATIONS

If the pump is used for production or further processing of **food**, please check the following points:

- Observe the relevant guidelines.
- Replace the coolant and sealing liquids mentionned in the manuals by a media, allowable with the requested characteristics for food.
  (e.g. vegetable oil)
- Pay attention to extremely cleanness.
  (Evacuating and cleaning of pump and systems)
- After cleaning pay attention to the correct mounting of pump and systems.

Hidrostal	INSTRUCTION MANUAL K-HYDRAULIC	
Dat: 30.05.00	No: 94-BA 5074E/1a	File: K_HYD_E

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Part III

Hidrostal	INSTRUCTION MANUAL K-HYDRAULIC	
Dat: 30.05.00	No: 94-BA 5074E/2a	File: K_HYD_E

3.0 TYPE CODE EXPLANATION

The type code is found on the first line of the pump name plate.

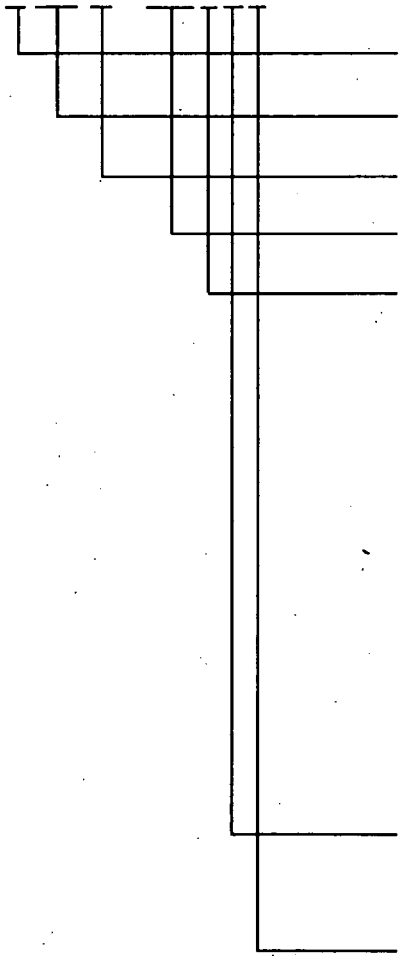
Example:

E05K-M010D

hydraulic code

HYDRAULIC CODE:

D 0 4 K - L 0 3 0 E
E 0 5 K - M L 3 R S
F 1 0 K - L L 3 R



hydraulic size (C,D,E,F,H,I,L)

discharge flange size (in inches)

impeller type (K)

impeller size

material:

1 = standard pump: all castings of grey iron (GG20), except impeller of nodular iron (GGG60).

2 = Advanced wear resistance: liner of Hi-chrome, other parts as 1.

3 = for improved wear resistance: casing and suction casing same as 1, impeller of stainless steel, liner and wear-ring of Hi-chrome.

4 = for improved wear and corrosion resistance: same as 3, except with Hi-chrome impeller.

5 = corrosion resistance: all wetted parts of stainless steel.

R = "regulable" construction: impeller clearance adjustable by three external screws (Absence of "R" in code implies impeller clearance is adjustable by shims).

S = special execution

D = bigger or smaller cone size than standard (first digit of code) D < E etc.
C = 20, D = 28, E = 38, F = 50 etc.

3.1 SERVICE CONNECTIONS

On Volute

These comprise of a gauge connection (424) on the discharge flange (see table).

When the pump is mounted horizontally with the discharge flange vertical, and drain plug (423) is provided at the lowest part of the volute casing.

When the pump is mounted horizontally with the discharge flange horizonal, additional drain plugs are possible on position "D".

Pos Type	423	424	D mm
C0CK	-	-	-
C03K	R 1/2"	R 1/4"	-
D0DK	-	-	-
D03K/D04K	R 1/2"	R 1/4"	35
E05K/E08K	R 1/2"	R 1/2"	50
F04K/F06K	R 1/2"	R 1/2"	50
F10K	R 1/2"	R 1/2"	35
H05K/H08K	R 1/2"	R 1/2"	35
H12K	R 1"	R 1/2"	60
I06K/I10K	R 1"	R 1/2"	60
I16K	R 1"	R 1/2"	60
L12K/L20K	R 1"	R 1/2"	60

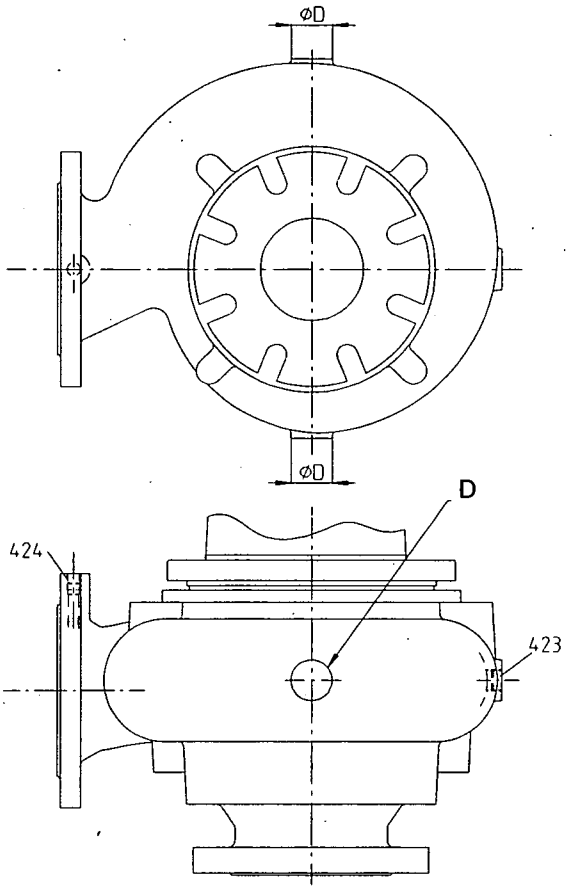


Fig. 1

3.2 IMPELLER CLEARANCE ADJUSTMENT FOR WEAR

- The impeller gap should be checked and readjusted whenever a significant decrease in pump performance is noticed, or at least once every year (until experience indicates how often this will be required).
- Excessive clearance can cause a drop in performance.
- Less clearance than the minimum listed can overload the motor and/or cause vibration due to a too great friction.
- When pumping thick sludges or high consistency material, it may be necessary to double the clearances in Figure 3.
- Regulable pumps are adjusted by means of a movable liner (421); its position is regulated by three external regulator nuts (422) found on the suction casing (416) or volute casing (400). These pumps include the letter "R" in the pump code (Section 3.0).
- Other pumps have a one-piece suction cover (402), or in pumps D03K and D04K, a fixed liner (421). These pumps are adjusted by changing the thickness of the shims (411) between the drive unit and the volute casing (400).

3.2.1 IMPELLER CLEARANCE ADJUSTMENT FOR "REGULABLE" PUMPS

Loosen and back off hex nuts (413) on end of each regulator nut (422). 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, see section 3.5.

Now back off the threaded regulator nut a bit. Holding each threaded regulator nut from turning, tighten the three hex nuts (413) (this pulls liner (421) away from impeller (401) 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 suction of the pump). If the clearance "C" is significantly different to the table (Fig. 3), it is possible that the wear is excessive or not uniform: disassembly and inspection is recommended.

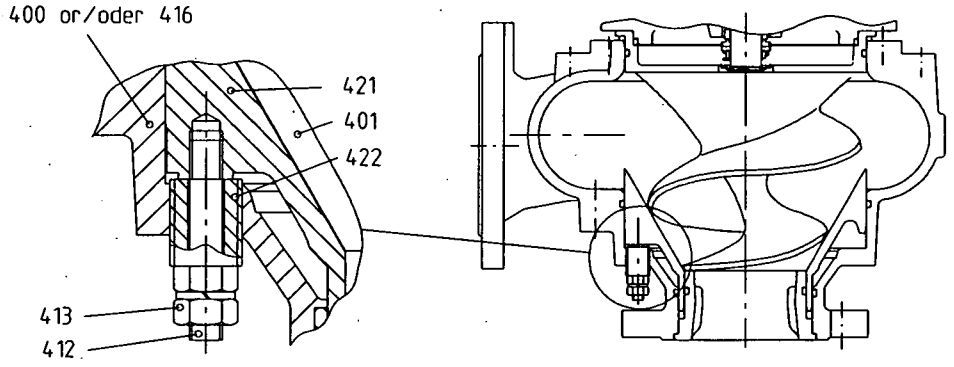


Fig. 2

3.2.2 IMPELLER CLEARANCE ADJUSTMENT FOR "NON-REGULABLE" PUMPS

For final assembly: Place the hydraulic (already built together) with the suction flange on a flat and hard underground. Lower the drive unit - impeller assembly into casing (400) by a suitable hoist.
For wear adjustment: Loosen all fasteners (419) between drive unit and volute casing. Remove shims.

General: To **estimate correct shim** (411) **thickness**, lower drive unit into casing just until impeller cannot be turned. Measure gap between drive unit and volute casing at several places and take average. Now add the distance "B" (Fig. 3) to the average gap measured; this will be approximate shim thickness required to obtain correct clearance "C" (Fig. 3).

NOTE: If impeller tip is binding, see section 3.5.

If necessary, loosen fasteners (419) again, lift drive unit as much as required to place shims of calculated thickness between drive unit and volute casing. Use 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 = calculated thickness) wrapped all the way around drive unit, 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 suction of the pump). If the clearance "C" is significantly different to the table (Fig. 3), 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, examine wear on impeller or suction cover/liner, and replace worn parts as necessary.

Pump size	Clearance	
	"C" mm	"B" mm
C	0.3	0.3 - 0.5
D	0.3	0.3 - 0.5
E	0.4	0.3 - 0.5
F	0.5	0.4 - 0.6
H	0.6	0.4 - 0.6
I	0.7	0.6 - 1.0
L	0.9	0.6 - 1.0
M	1.2	1.0 - 1.5

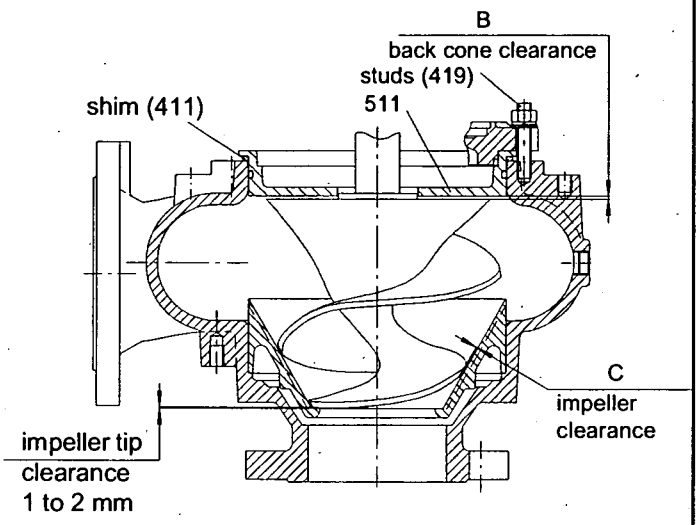


Fig. 3

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

3.3 DISASSEMBLY OF HYDRAULIC PARTS

3.3.1 DISASSEMBLY FOR INSPECTION

Casing-suction cover assembly should be placed with the suction flange flat on the floor or workbench, and the drive unit-impeller assembly removed or lowered into place from above by a suitable hoist.

Remove nuts (419) around the flange. Lift the rotating assembly including impeller from the pump casing. 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 be compensated by re-shimming or adjusting according to Section 3.2. However, excessive or uneven wear will require replacement of the worn parts.

3.3.2 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 into the impeller bolt (415) and with a hammer, tap the wrench counterclockwise to loosen the bolt.

FACTORY FITTED IMPELLER BOLTS		
SIZE	HEXAGON SW	TORQUE Nm
M8	6	17.5
M10	8	35.5
M12	10	61.5
M16	14	147.0
M27	19	380.0
M36	24	970.0

3.3.3 REMOVAL OF IMPELLER FLANGE (if existing)

If existing, disengage tabs on locking washer (167) and remove impeller nut (166) with coupling end of shaft secured from rotation. Remove impeller flange (165) by either levering with two screw drivers between impeller flange and back cover (507) or seal plate (511) or tapping with a rubber mallet at 90° intervals. Or, it may be required to use a gear puller. Remove Woodruff key (112).

Hydraulic size	Cone size	Impeller nut size	wrench size	Thread size "M"
E	28	-	-	M12
E	38	M28	41 mm	M12
F	50	M35	46 mm	M12
H	50	M35	46 mm	M16
H/I/L	75	M56	70 mm	M16
I/L	100	-	-	M16

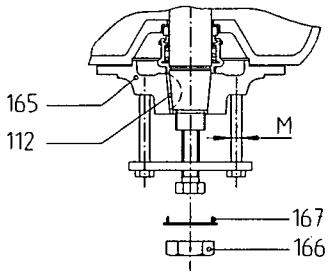


Fig. 4

3.3.4 REMOVAL OF LINER OR SUCTION COVER

a) For D03K / D04K

These pumps have a non-adjustable liner (421) held in a fixed position inside a one-piece volute casing. It can be pressed out of the casing after loosening of fastening set (418) (Fig. 5).

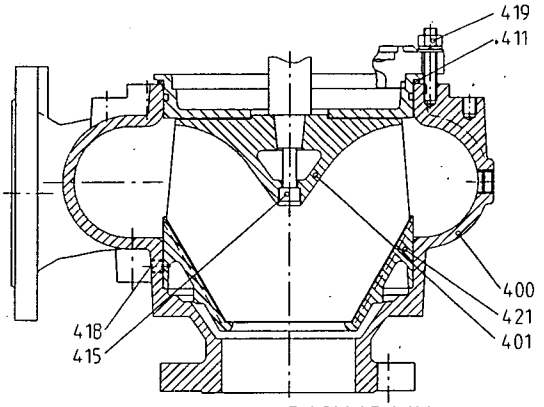


Fig. 5: D03K / D04K

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 drive unit.

NOTE:
Certain models may have 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 (Fig. 6).

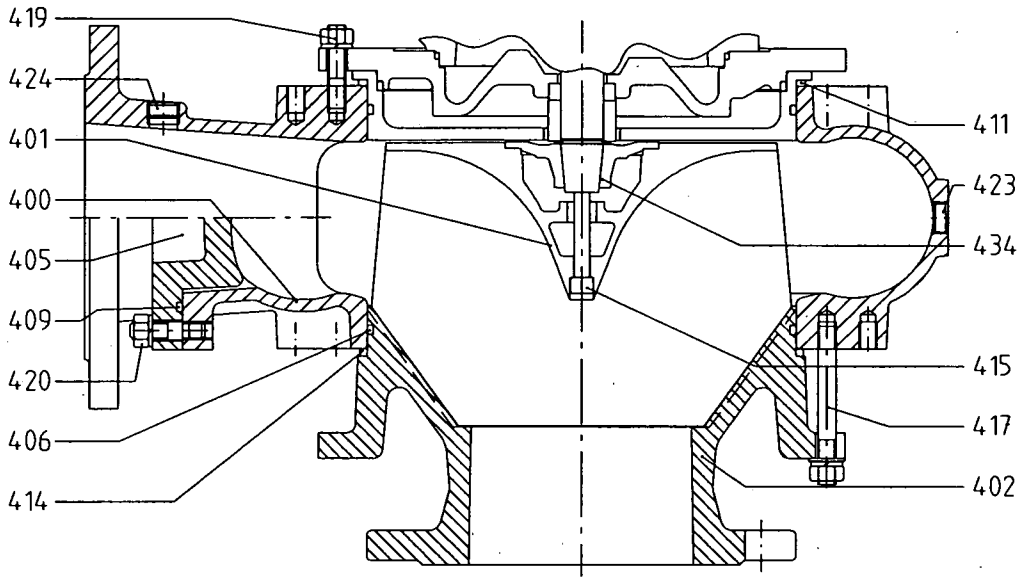


Fig. 6: E05K - L20K

c) For all other pumps with "regulable" feature

These pumps have an externally-adjustable liner (421), held in place by the volute casing (400) or the 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 (422).

If the conical surface is worn, the liner need be replaced. It can be removed while the volute casing or suction casing remain attached to the piping. Alternately, the suction casing may be removed by removing nuts (417).

Removing of liner: completely remove nuts (413). To force the liner out, push the three studs through the holes in the large regulator nuts (422), or the large regulator nuts can be turned all the way into the casing. **Do not yet disassemble the regulator studs (412)! They are loctited in place, and must be heated with a torch to break the locktite bond after removing of the liner.**

The wear ring (408) should only be removed from suction casing or volute casing if badly damaged. Therefore 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 (Fig. 7).

Hidrostal	INSTRUCTION MANUAL K-HYDRAULIC	
Dat: 09.01.01	No: 94-BA 5074E/ 8b	File: K_HYD_E

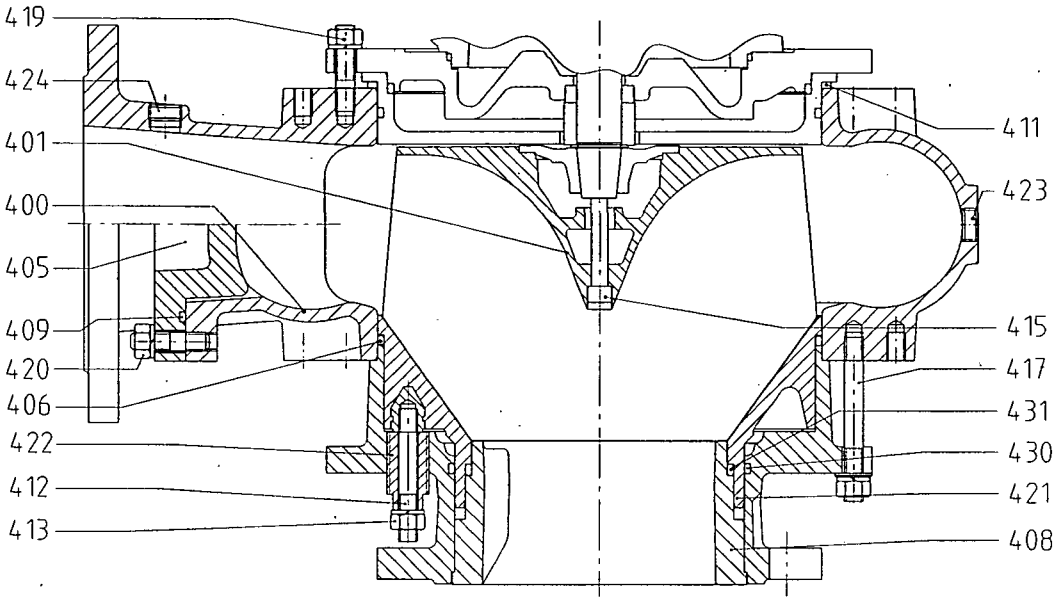


Fig. 7: E05K - L20K regulable

3.4 ASSEMBLY OF HYDRAULIC PARTS

3.4.1 ASSEMBLY OF IMPELLER FLANGE (if existing)

If existing, 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 nut must be tightened to 120 Nm (90 ft-lbs) by using torque wrench. Bend over locking washer tab.

3.4.2 ASSEMBLY OF IMPELLER

If impeller (401) with impeller flange (165) is used, mount it so that the pin (410) on back of impeller will fit in the corresponding hole on flange. Before fitting a new impeller or a new impeller bolt, length "L" of impeller bolt should be checked as follows:

By measuring of the impeller and the impeller bolt, it must be secured that:

1. thread reach "L" is 1.25 x thread diameter, e.g. M16:
   16 x 1.25 = 20 mm.

2. end of thread "G1" on impeller bolt is sufficient (re-cut the thread).

3. end of thread "G2" in the shaft is sufficient (shorten impeller bolt, see point 1.).

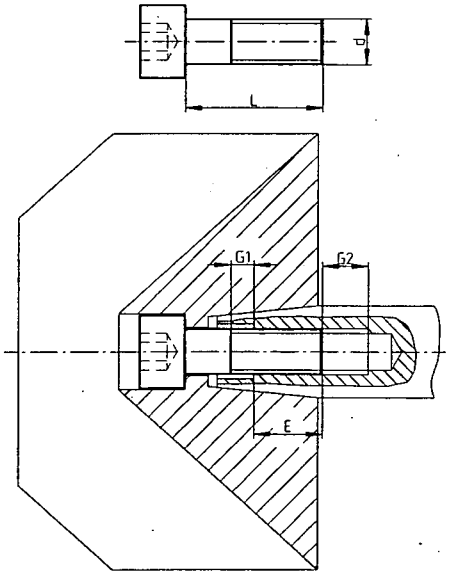


Fig. 8

ATTENTION:
Oil shaft taper slightly with a shred. **NEVER use thick oil, grease or anti-size compound!** Install impeller directly onto shaft. Coat the impeller bolt thread with grease or anti-size compound. Tighten screw with torque according table 3.3.2.

NOTE:
If torque wrench not available, torque can be approximated with an extension pipe and weight.

3.4.3 ASSEMBLY OF LINER OR SUCTION COVER

a) For D03K / D04K (Fig. 5)

Carefully position liner (421) into one-piece casing (400); tap into place with lead hammer, and fix it with screws (418). Seal the thread to avoid a possible leakage (no O-rings are used between liner and casing).

b) For all other pumps without "regulable" feature (Fig. 6)

Place spacer ring (414) over spigot of suction cover (402), then grease and install O-ring (406) into groove on suction cover.

Install suction cover into down side of the volute casing with fastening set (417).

CAUTION:
Since up-side and down-side of the volute casing are machined identically in some models, it is potentially possible to assemble the pump in a wrong way. Form of the volute casing see Fig. 1.

c) For all other pumps with "regulable" feature (Fig. 7)

Glue three regulation screws (412) into liner (421).

Thoroughly grease O-ring (430) and install into grove in suction casing (416). This groove is nearly hidden by the wear ring in some pump models.

If wear ring (408) was removed, glue it firmly back into place. Tap wear ring into suction casing with a lead hammer, until wear ring is flush with flange surface.

Grease the external threaded portion of large regulator nuts (422), and install these into the suction casing (416), hex-side toward the outside, direction to the suction flange. Screw these into the suction casing until they are flush with the inside.

Now grease O-ring (431) and install it into groove of wear ring (408, if there is no wear ring, this O-ring is not used).

Now place liner into suction casing or volute casing, engaging the three stud bolts into the holes through the three regulator nuts.

NOTE:
The three stud bolts are not spaced evenly around the liner, so there is only one orientation of the liner where the bolts will correctly fit through the regulator nuts.

Install suction casing into down-side of the volute casing with fastening set (417).

CAUTION:
Since up-side and down-side of the volute casing are machined identically in some models, it is potentially possible to assemble the volute casing in a wrong way. Form of the volute casing see Fig. 1.

3.5 FINAL ASSEMBLY

When ONLY a new impeller is fitted, the following clearance check must be done: install drive unit-impeller assembly into volute casing.

If the tip of the impeller touches the wear ring (408) or the lip in the liner (or suction cover) or if there is less than 1 mm clearance between the tip and the lip (the spiral edge of the impeller is firmly seated against the conical taper inside the liner or suction cover), then the impeller tip must be ground off, parallel to the suction flange, until 1 to 2 mm clearance is obtained (Fig. 9).

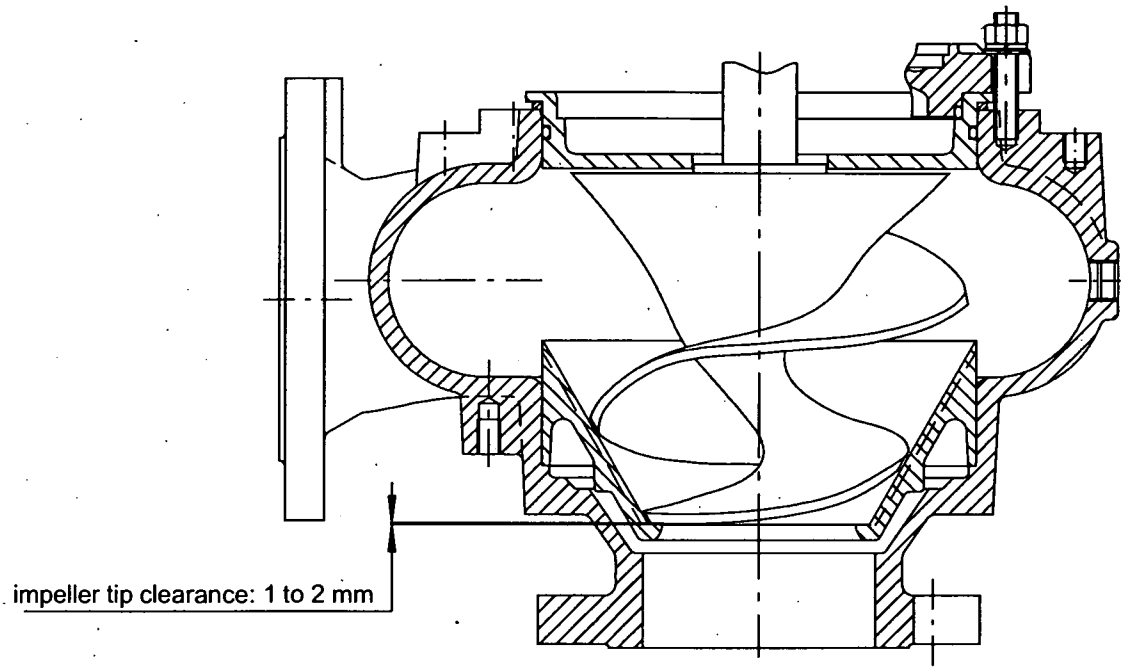


Fig. 9

If (411) is a spacer ring in lieu of shims place it over the spigot of the drive unit.

Grease O-ring (209) and place into groove on spigot of the drive unit.

Now install drive unit-impeller assembly into volute casing. Install and tighten nuts (419).

See Section 3.2 for correct setting of regulator nuts, or for placement of shims (411) for final adjustment of impeller clearance.

Hidrostal	INSTRUCTION MANUAL IMMERSIBLE PUMPS	
Dat: 28.07.00	No: 94-BA 5080E/1c	File: Q_UEBE_E

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Part II

Hidrostal	INSTRUCTION MANUAL IMMERSIBLE PUMPS	
Dat: 12.08.99	No: 94-BA 5080E/ 2c	File: Q_UEBE_E

2.0 USE

2.1 INTRODUCTION

Each pump unit is equipped with a nameplate attached to the motor, containing all motor and pump data (section 2.1.1). It is **essential** to give the complete data for any inquiry about parts or service.

a) For pumps in normal operation (Fig. 1)

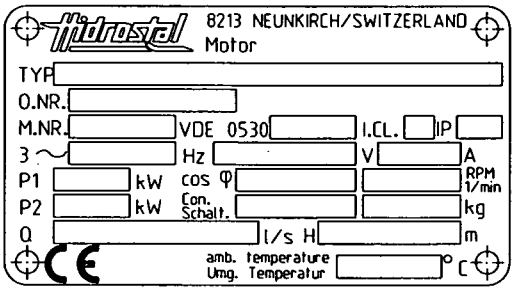

Fig. 1

b) Motors approved for **hazardous location** according norm 94/9/EG (ATEX 100)

- for online operation (Fig. 2).

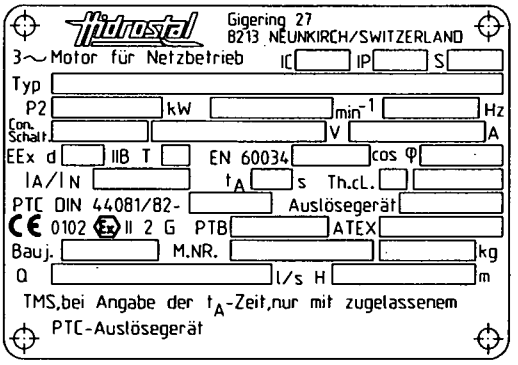

Fig. 2

- for variable frequency driver (Fig. 3).

These motors are equipped with triple-thermistor according DIN - 44082 - S 150° C

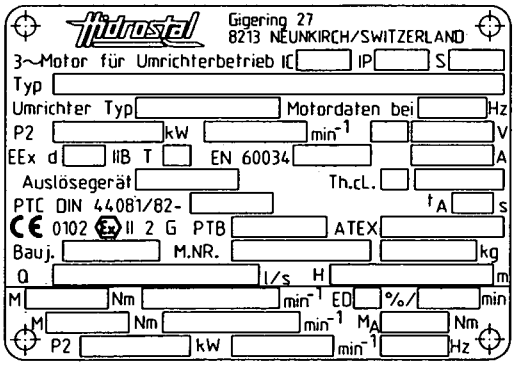

Fig. 3

The HIDROSTAL warranty is void unless the following requirements are met:

1. Temperature protection circuit is wired so as to positively disconnect power to the motor when excessive winding temperature is sensed (section 2.4.1.2f for wiring instructions).

2. Proper extra-quick-trip overload protectors M U S T be used on all three phases of each motor (section 2.4.1.2e).

3. Optional conductivity probe circuit is wired to a special relay for use with these motors. See section 2.4.1.3g 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 organisation. Use of any other parts 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. Disassembly of the pump by other than official HIDROSTAL service centers may cause loss of any remaining warranty.

2.1.1 TYPE CODE EXPLANATION

MOTOR CODE

E K Y A 6 - M N E Q

Identification letter of the hydraulic size to which this motor can be assembled.
The sizes are: B, C, 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 IEC-norms:

Size:	B/Z	2/Y	3/X	4/W	5/V	N	6/U	7/T
IEC:	90	100	132	180	225	250	280	315

Motor construction classification

Motor speed

			Nominal speed 50 Hz	Nominal speed 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

Hidrostal	INSTRUCTION MANUAL IMMERSIBLE PUMPS	
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MOTOR-CODE, continued:

E K Y A 6 - M N E Q 1

Pump side mechanical seal Pos. 515 type

C = Fitted with Carbon-ceramic seal faces. Recommended for handling water, activated sludge and non-abrasive liquids.
G = Silicon carbide seal faces, rubber bellows with external spring.
M = Tungsten carbide - silicon carbide seal faces, rubber bellows with internal spring. For sludges, slurries and abrasive liquids.
N = Fitted with converted carbon faces, rubber bellows, 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:

Standard				Ex-proof					
Motorsize			Additional elements	Motorsize					
	new	old		new					old
W/V N/U/T	B/Z X/Y	X/4/5 6/7**		B	Z	Y	X	W/V N/U/T	X 4/5
N	N	N	without monitoring elements	X	X	X	X	X	X
M*	S	S	with internal moisture probe	-	I	I	I	Y*	-
	F	-	with float switch	-	-	Z	Z		
	V	F	with internal moisture probe and float switch	-	-	U	U		
	-	-	with bearing temperature probe	-	-	-	-		
W*	W*	W	construction with flywheel	-					

* fitted additional elements are mentionned in the order
** Motorsize 6+7: always with SA1-.. (containing all above additional elements)

Voltage of winding (see nameplate):

A = 230/460 V 60 Hz
E = 400 V 50 Hz
G = 415 V 50 Hz
K = 575 V 60 Hz
S = special voltage

Q = Q-hydraulic
K = K-hydraulic

1 or blank = Material execution 1
5 = Material execution 5
6 = Material execution 6

CABLE CODE

N A A 1 - 1 0

factory code (not important for instruction)
length in metres

2.2 INSTALLATION

WET PIT PUMPS

All building and technical construction work must be finished before the pump will be installed. Make sure that length of cable supplied is sufficient for local conditions.

Attention: very important: For installation and servicing it is recommended to install a block and tackle or chain hoist over the pump sump (or at least make sure that it could be installed later on). The lifting capacity of the crane has to support at least double the weight of the pump. There should be a water supply of about 4 bar (70 psi) pressure to wash down the pump when removed from the sump.

⚠ During the installation of the pump make sure that the free ends of the cables **NEVER CONTACT WATER.**

2.2.1 INSTALLATION OF PUMP GUIDE SYSTEM (Fig. 4)

a) Fasten the upper guiderail bracket. Be sure to leave enough space for sliding shoe.

b) Sump floor where the discharge stand is to be placed must be even and level. Fasten the discharge stand to the sump floor with cast-in-place or expansion-type bolts and nuts so that the guide rail pins or recesses on the discharge stand are vertically in line with (i.e. directly below) the guide rail pins on the bracket.

c) The guide rails should be made from galvanized standard (or stainless steel) pipe. Cut pipe to the correct length. Put lower pipe ends in discharge stand guiderail pins or recesses. Unbolt upper guide rail bracket. Insert pins into upper pipe ends and re-bolt it. Check to see that the guide rails are exactly vertical and parallel.

d) The discharge pipe must be connected without stress or misalignment to the discharge stand.

If a check valve is installed close to the pump, air must be vented from the pump casing or discharge piping (before the check valve) during first start-up to ensure priming (Section 2.2.3, Fig. 5).

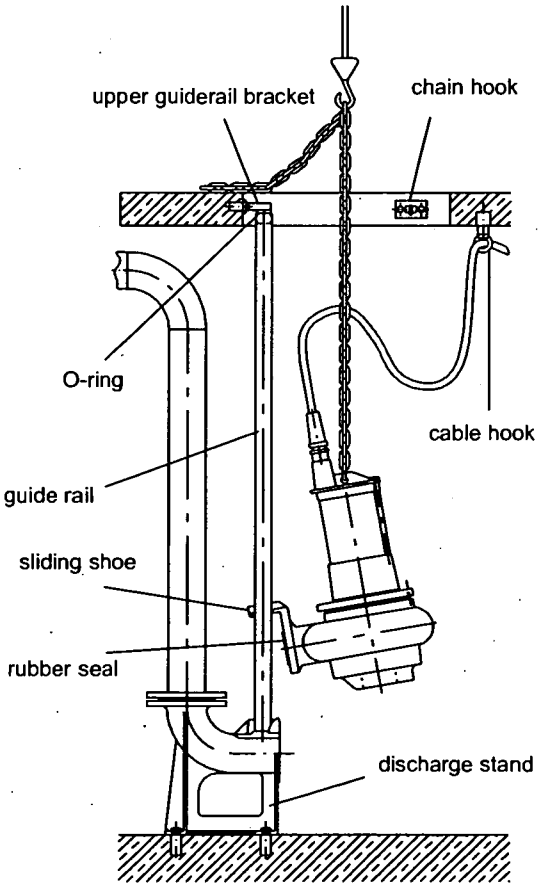


Fig. 4

2.2.2 PREPARATORY CHECKS

⚠ Before lowering the pump into the sump check to see that:

- The **lifting chain** or **steel lifting cable** is **correctly fastened** to the lifting eyes.
- The **cable entry assemblies** on motor have **not been damaged** or loosened and that the cables are firmly gripped by the cable entry assemblies.
- The **cables** have **not been damaged** during transportation or installation. Look especially for nicks and cuts on insulation; any damage penetrating through the outer layer of the cable will require replacement of them.
- The **cables** are **long enough** and that they can follow the pump unhindered.
- The **cable ends** have **never** come **in contact with water**.
- The rubber seal on the pump discharge is correctly seated in its groove, and is not damaged.
- The rubber seal is throughly greased.
- The **direction of rotation** is **correct** (Section 2.2.4, Fig. 6).

2.2.3 FLUSHING WATER CONNECTION

Pumps are supplied with a flushing water connection (service connection "F", Fig. 5).
For normal sewage application this connection is not used. However, in special cases when pumping high concentrations of sludge or mud, it should be connected. It will conduct cleaning water between impeller and pump side mechanical seal (515), providing periodic removal of accumulated solids.

Flushing water must be pressure-regulated between 0,5 to 1 bar (7 to 14 psi) above pump discharge pressure. 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.

The quantity of flushing water varies according to pumpsize and application: in most cases, flow rates of 6-8 litres per minute will be sufficient.

Connection "F" may be used to manually bleed the air from the casing prior to start-up (Section 2.2.1d), if there is no other place for air to escape through the discharge piping.

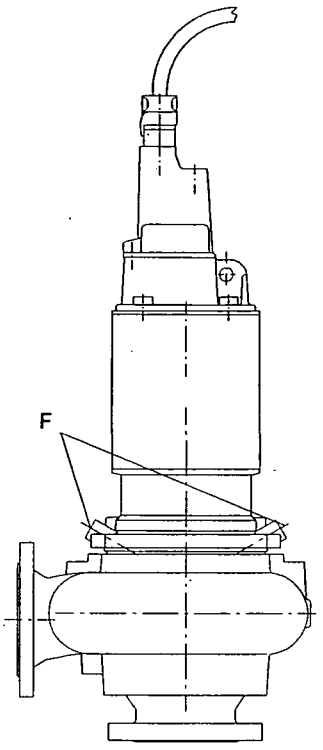


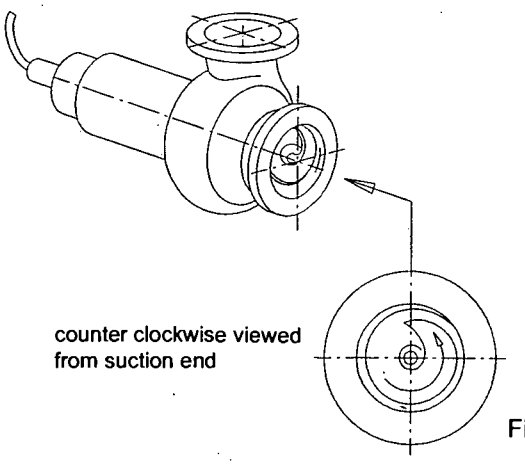
Fig. 5

2.2.4 DIRECTION OF ROTATION

Before lowering the pump into the sump, make electrical connections as indicated in Section 2.4.2 and check the direction of rotation. This must be counter-clockwise viewed from suction end. Check impeller rotation by suspending pump from the lifting eyes, resting inclined on the floor, and start up for one second. The starting jerk should be counter-clockwise viewed from driving side (Fig. 6).

This procedure must be repeated for each speed, if units are multi-speed pumps.

CAUTION:
If rotation is not correct on multi-speed or multi-pump installations, **only change the pump cable leads of the pump or speed with wrong rotation at its starter in the control panel. DO NOT** change the primary power leads coming into the control panel: This would change the rotation of all pumps or speeds.



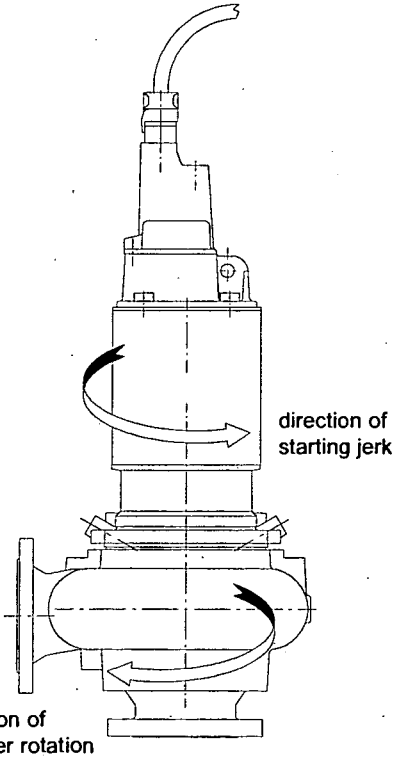


Fig. 6

2.2.5 LOWERING THE PUMP INTO THE SUMP

- **Clear the sump bottom** carefully of all **building debris** and other solid particles.
- **Lubricate** the **rubber seal** with grease.
- Lift and move the pump to a position directly over the guides until the sliding shoe fits correctly. Lower the pump steadily down to seat against the discharge stand. The sealing of mating faces is accomplished by the rubber seal that is incorporated in the sliding shoe attached to the pump discharge flange. This is pressed to the discharge stand (after the pump is in position) by the pump's own weight.
- When the chain is slack, unfasten it from the lifting device and fasten it to its retaining hook, so that there is as little slack as possible.

WARNING:
The **chain and cable** must be fastened **reliably** to their retaining hooks. **If they come loose** they **may be drawn into the pump suction** with severe **destructive consequences.**

2.2.6 DRY INSTALLED IMMERSIBLE PUMPS

HIDROSTAL immersible motors do not require submersion in liquid for cooling. They may be installed in dry locations. This is particularly advantageous for locations where occasional flooding may occur, as these motors will not be harmed thereby.

The electrical controls and pump power cable junction boxes must be placed above any expected water level. They should also be adequately sealed and/or vented to avoid internal condensation.

2.3 START-UP

The pump is ready to start when the following has been completed:

a) All construction debris has been removed from suction well.
b) Base plate or suction elbow is bolted to the foundation.
c) All rotating parts are found to turn freely by hand.
d) Motor has been checked for correct rotation, which is counter-clockwise viewed from suction end (section 2.2.4).
e) Suction and discharge gate valves are completely open.
f) All level controls are correctly set. The off-level is sufficiently high to prevent air entrance to the pump section.
g) Never run a pump dry, as the liquid in the pump serves as lubricant for close running surfaces. Damage may be caused to the pump if operated dry for extended period of time.
Note:
If installed with suction lift, the pump may be primed by using an ejector or vacuum pump. Vertically installed HIDROSTAL solids handling pumps will prime themselves if impeller tip is submerged in the pumping liquid, and an automatic air vent is connected to the pump casing or discharge pipe work (between pump and non-return valve).

STARTING OF PUMP

Never start pump **against closed valves** (except non-return valves).

Start the pump using manual operation. **Measure the amperage** drawn on each phase leg. Record and **verify** these **readings** with the **nameplate ratings**. If amperage is more than 5 % higher, stop pump and check probable causes according to "Operating Troubles" chart (Section 2.5.1).

Once preliminary checks are complete, place the pump into automatic operation. Cycle the system through several wetwell pumpdowns to observe that level controls are properly set and functioning correctly. **Observe** that the **alarm system** and change over switch (if included in control panel) **are working properly**.

Log date and hours meter reading, and set pump for automatic operation. Perform maintenance according to Section 2.6.

GENERAL OPERATING CONDITIONS

The pump should not be allowed to operate continuous-duty outside of performance curve: high discharge pressure with low flow or low discharge pressure with high flow. Bearing life is shortened and abrasive wear is accelerated in these operating conditions.

OPERATING TROUBLES
See chart, Section 2.5, maintenance.

2.4 ELECTRICAL CONNECTION

The motor winding leads will be factory-connected according specifications (see nameplate).

Make sure that the power supply to the control panel is the same as on the pump nameplates (tolerance +/- 5 %). 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 (motor overheating and considerable operating problems) can be expected. 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 electrical diagram.

2.4.1 PANEL CONTROLS

2.4.1.1 OPERATOR SAFETY

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

2.4.1.2 MINIMUM REQUIREMENTS

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 has to be sized **according to local electrical code requirements** based on motor power rating.

e) **Extra quick trip overload protectors**. They must be selected according to the amperage indicated on the nameplate. They must trip within 6 seconds 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 motor phases. Claims for warranty repair of motors must include documentation that proper overload protectors have been installed.

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f) **Temperature sensor circuit**. Each motor is manufactured with **temperature limit switches** in the winding-head (control leads 1 and 2). They are Bimetal type switches (similar to "Klixon"). They can be connected directly into the motor control circuit, as long as this circuit does not exceed 220/240 volts, 2,5 amps.

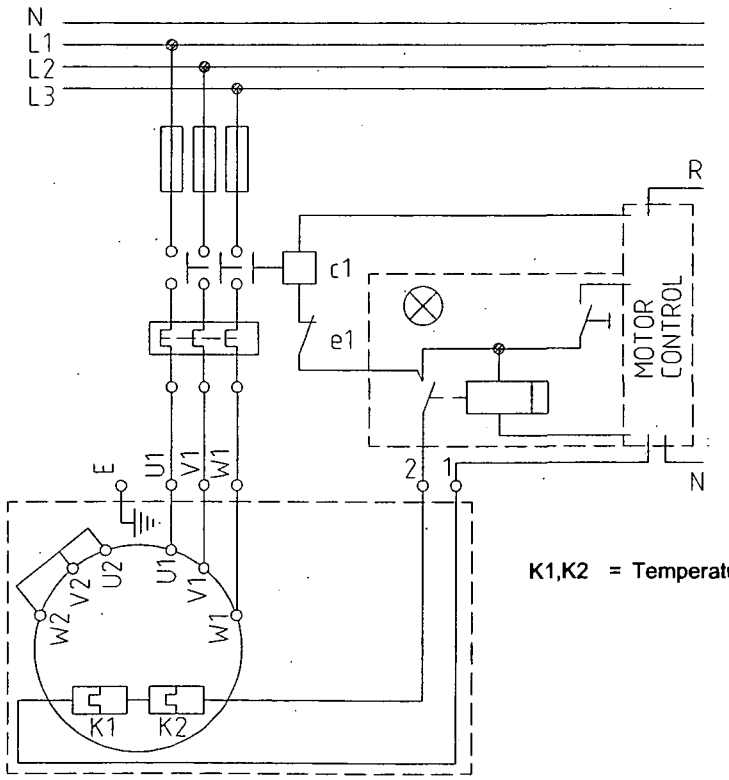
For variable frequency driver (Section 2.1) the motors must be equipped with triple-thermistor according DIN 44082-S 150° C. For Ex-proof motors this is prescribed and may only be used with thermistor control units type PTB 3.53-PTC/A.

As alternative (special order) thermistors can also be used for normal motors. All motors equipped with thermistor have a label at the end of the cable with the following words:

ATTENTION! Semiconductor switch! More than 2.5 Volt destroies the motor winding!

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.

g) **Connections of the motor**



K1,K2 = Temperature limit switches

The control leads 1 and 2 (**temperature limit sensor**) must be connected in such a way that the motor cannot automatically come on again, even after the temperature limit sensor have cooled and re-closed the circuit. The cause of overheating must be determined and corrected before the motor is put back into service.

ATTENTION:
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. They are **not** a sufficient substitute for the overload protectors specified in (e) above.

2.4.1.3 RECOMMENDED ADDITIONAL CONTROLS

a) **"Hand - Off - Automatic" switch.**

b) **Low voltage terminals for level switches.**

c) **Pump-on and pump-failure lamps.**

d) **Hours run meter:** Important to schedule service.

e) **Change-over switch** for multiple-pump stations.

f) **Alarm-system for high sump-level:** Preferably on a separate power supply, to ensure continued protection in the event of a main power supply failure.

g) **Moisture probe**

h) **Float switch**

i) **Bearing temperature probe**

2.4.2 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 motor to the power supply it is not necessary to open it. This should be avoided in order to retain the original factory-hermetic seal.**

If the sealing of the motor cover is disturbed, tightness tests must be performed as per Section 2.7.

Power leads of the motor are marked according to the following table:

MOTOR-TYPE	number of speeds	number of con-ductors (a)	speed (b)	winding connection (c)	markings on cable end, according DIN VDE 0530 norms
up to 4 kW, direct start	1	3+C+E		Y	U V W
over 4 kW star/delta start	1	6+C+E		Δ	U1 V1 W1 W2 U2 V2
two speed by Dahlander system Y/YY, direct start	2	6+C+E	N H	Y YY	1U 1V 1W 2U 2V 2W
pole change, each speed direct start	2	6+C+E	N H	Y Y	1U1 1V1 1W1 2U1 2V1 2W1
pole change, low speed: direct start, high speed: star/delta start	2	9+C+E	N H	Y 1) Δ	1U1 1V1 1W1 2U1 2V1 2W1 2U2 2V2 2W2
pole change, low and high speed with star/delta start	2	12+C+E	N H	Δ Δ	1U1 1V1 1W1 1U2 1V2 1W2 2U1 2V1 2W1 2U2 2V2 2W2

a) E = earth (yellow-green)
C = control leads

for normal motors: *		for EEx (explosion proof) motors, with two-level temperature protection circuits: *	
temperature protection circuit	1 to 2	lowest, temperature regulator	1 to 3
seal failure circuit (optional)	E to 4	highest, temperature limit switch	1 to 2
		seal failure circuit (optional)	see note

NOTE:
On EEx, seal failure circuit will always be in a separate cable originating near bottom of motor.
* If in doubt whether motor is normal or Ex-proof refer to Section 2.1.1.

b) N = low speed H = high speed

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

2.4.3 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.

2.4.4 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 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 excessive power consumption. The following formula will calculate the required minimum sump capacity:

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

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

2.4.5 REQUIRED SUBMERGENCE

HIDROSTAL immersible pumps can work continuously submerged or in a dry environment. 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.

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2.5 MAINTENANCE

2.5.1 OPERATING TROUBLES

POSSIBLE REASONS \ TROUBLE	No flow	Flow not sufficient	Head not sufficient	Reduction of flow or head after start up	Vibrations	Motor overload	Motor does not start	Noise
1. Pump not filled with water, not vented	X							
2. RPM too low	X		X					
3. RPM too high					X	X		X
4. Air entrance into suction line	X	X		X	X			X
5. Discharge line clogged / Valve closed	X				X	X		
6. Air or gas in pumped liquid	X	X	X	X	X			X
7. TDH too high (higher than calculated)	X	X			X			
8. Suction head too high				X	X			X
9. Insufficient suction head on hot liquids		X			X			X
10. Insufficient submergence of suction	X	X	X	X	X			X
11. Sludge concentration higher than assumed		X	X			X		
12. Specific weight of medium higher than assumed						X		
13. Impeller or suction line clogged	X	X			X			
14. Wrong direction of rotation	X	X	X					
15. Impeller clearances too high		X	X					
16. Damaged impeller		X	X		X			
17. Thermal overloads tripped; control switch off							X	
18. Motor damage					X	X	X	X
19. Low voltage		X	X			X	X	
20. Attachments loose					X			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		X
27. Thick sludge and tight impeller clearance						X		
28. Air or gas on impeller backside	X		X					

2.6 MAINTENANCE AND SERVICE

2.6.1 GENERAL

Before doing any work on the pump unit, switch off main isolator switch and remove fuses from panel.

The following checks (Section 2.6.3) can be done in the field. When a repair is indicated, send the pump unit to the nearest authorized Hidrostal service station.

CAUTION:
When disconnecting the power cable at the control panel, take care that the cable ends **CANNOT** come in contact with water. Replace the plastic cable-end shipped with the pump (if this is no longer available, wrap the cable ends inside a plastic bag, and seal with tape) for water-tightness during handling and shipping.

2.6.2 COOLING TYPES

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

KEY FOR SYMBOLS ON FIG. 7,8,9

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

CONVECTION COOLING - Code "K"
(Fig. 7)

This type transfers motor heat directly through the stator housing to the surrounding ambient liquid (if submerged) or to the air (if not submerged).

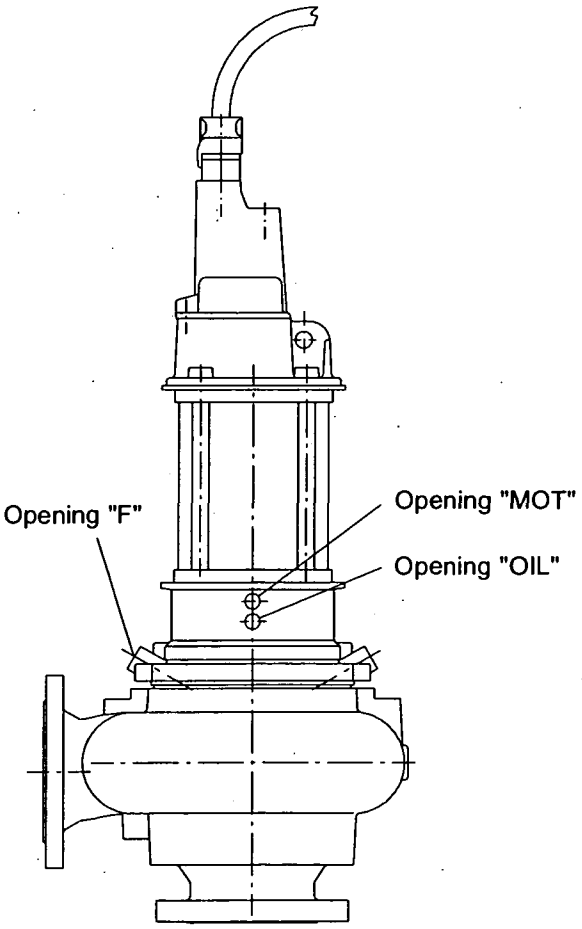

Fig. 7

Hidrostal	INSTRUCTION MANUAL IMMERSIBLE PUMPS	
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INTERNAL COOLING - Code "E"
(Fig. 8)

This type 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.

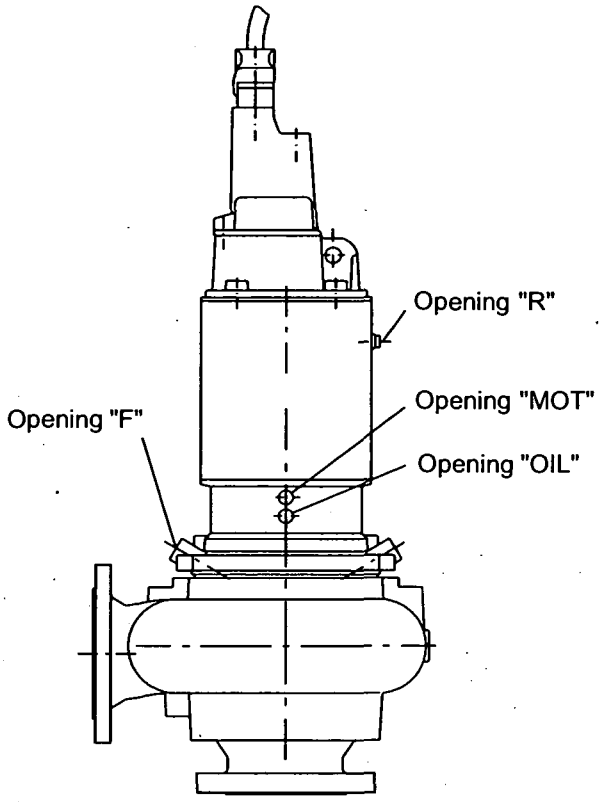

Fig. 8

EXTERNAL COOLING - Code "F"
(Fig. 9)

This type transfers motor heat from the stator into a coolant liquid circulating through a cooling jacket surrounding the stator housing. The coolant transfers this heat to an external heat exchanger, and it must be circulated by an external coolant pumping system.

This type is provided for cases where internal cooling is not sufficient, especially where the temperature of the pumped media is too high for effective cooling.

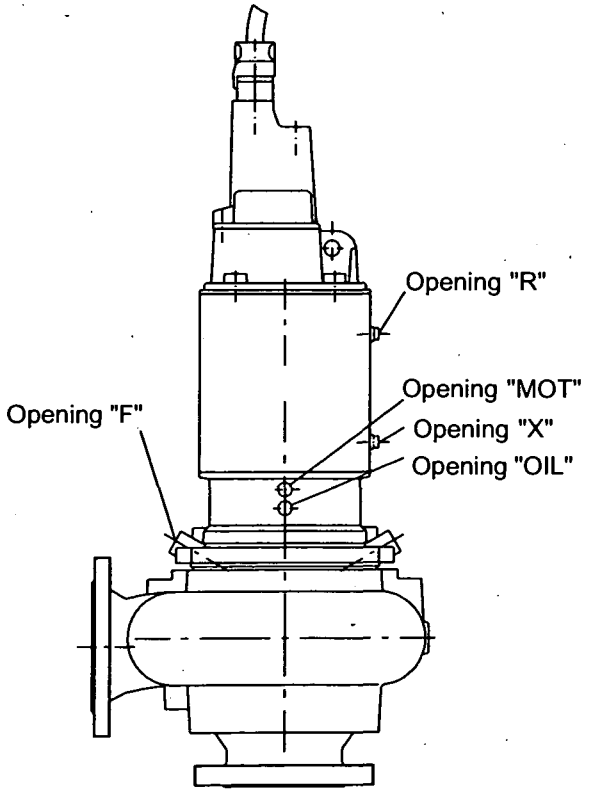

Fig. 9

2.6.3 FIELD TESTS

2.6.3.1 VISUAL CHECKS AFTER PULLING PUMP UNIT FROM SUMP

- Check pump and motor for possible mechanical damage. Pay attention to the cable.
- If pump volume or pressure are not acceptable, check impeller clearance (see manual for hydraulic).
- Check overload relay, fuses and time relays (if any) for correct setting.
- Check correct function of level control.
- 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 cable plus motor. A motor in the pit in reasonable 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 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, 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 repaired or the motor replaced. - The motor will probably not operate for long. - The motor will not run in this condition.	Less than 10'000 0	0 - 0.01 0

CAUTION:
Do **NOT** "Megger test" control leads when thermistors are fitted: Voltages over 2,5 V 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. If failure is indicated, remove pump with cable and proceed to Section 2.7 for further tests.

2.6.3.2 MOTOR HOUSING TEST

This test consists of a check on the condition of the motor side mechanical seal and/or motor housing "O"-rings.

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

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

CAUTION:
This screw plug must be completely watertight. 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 by Hidrostal are softened.

2.6.3.3 OIL CHECKING ON IMMERSIBLE MOTORS

This is a check on the condition of the pump side mechanical seal. For pump units supplied with a moisture probe, total failure of the pump side seal will be indicated by activation of the resistance relay. A failure can be detected by the following oil check, even without this circuit.

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.

Oil level check

1. For pumps with cooling type "F" or "K" stand pump with shaft vertical and remove screw plug "OIL". Coolant level must be at the level of opening "OIL" (Fig 10).

2. For pumps with cooling type "E" stand pump with shaft vertical and remove screw plug "R". Oil level must be at the level of opening "R" (Fig. 11).

If coolant is far below this level, the pump side mechanical seal may have leaked and may require replacement (section 2.9.1). If oil level is only a small amount below this level, proceed with following test. Top-up with new oil and re-check in 200 to 500 hours.

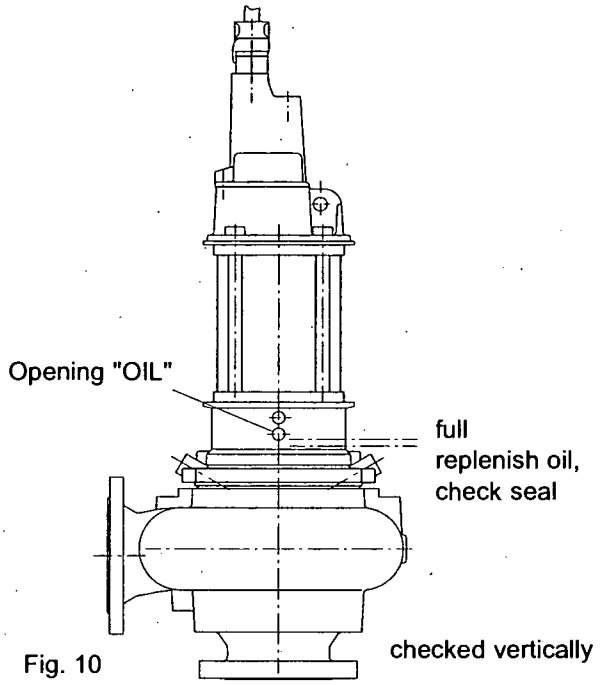

Fig. 10

Oil quality check

Lay pump down horizontally with opening "OIL" (536a) upwards. Remove screw plug "OIL". Insert a tube or rubber hose, place a finger over top of tube and remove it with a small sample. Repeat until a sufficient quantity has been collected for observation. Evaluation will show one of three conditions:

a) If oil is clear there are no problems with the pump side seal. Top up with oil and close opening "OIL" with screw plug and a new softened copper seal ring.

b) If there is just a little water in the oil but the oil is clear, repair of the pump is not necessary. Remove oil and separate water from oil (Section 2.6.3.4 or 2.6.3.5).

   Pour back the clean oil into the mechanical seal housing and close opening with screw plug "OIL" and softened copper seal ring (536). However, check oil quality again after 500 hours of operation.

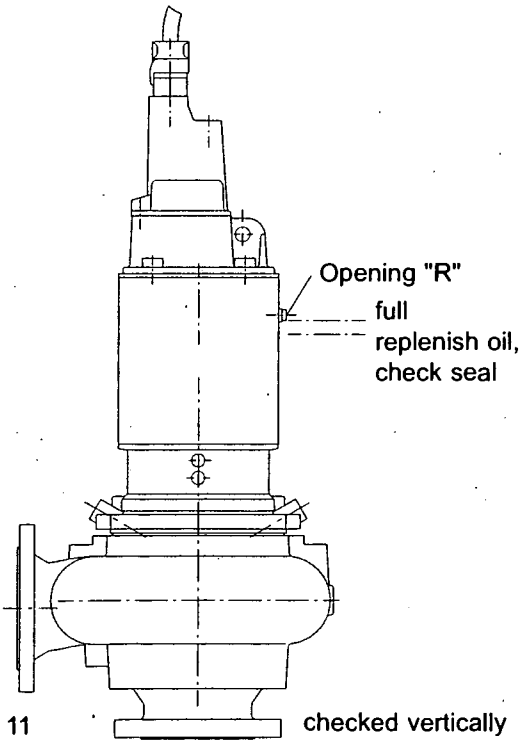

Fig. 11

With a new mechanical seal (515) it is possible that during the run-in period a small amount 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 small amount 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 sludge or sewage smell are detected in the oil, the pump side mechanical seal (515) must be repaired or replaced.

For oil removal as indicated in (b) above or for prior to a major repair, refer to Section 2.6.3.4 for all motors with 2nd letter in motor code "K" or "F". Refer to Section 2.6.3.5 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:

Specific gravity at 20° C	0.812	g/ml
Viscosity at 20° C	6.75	mm2/s (cst)
Viscosity at 40° C	3.52	mm2/s (cst)
Solidification point	-38.0	° C
Flash point	132.0	° C
Burning point	142.0	° C
Evaporation energy	251.0	kJ/kg
Solubility in water	none	

Other recommended 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.

2.6.3.4 OIL CHANGE FOR CONVECTION OR EXTERNAL COOLED MOTORS TYPES "K" AND "F" (second letter of motor code)

Remove screw plug "OIL" (536a) and drain oil chamber casing (504) completely, by turning the pump around slowly until opening "OIL" is upside down (Fig. 12). On larger motor sizes there may be another screw plug directly below the opening "OIL" on the back cover (507). Removing this screw plug will help remove the last bit of oil.

When the oil chamber casing is completly empty stand pump vertically on suction flange and refill with separated oil or new oil. The correct level is reached when the oil is at the bottom of opening "OIL".

Re-install screw plug "OIL" with softened copper seal ring.

2.6.3.5 OIL CHANGE FOR INTERNAL COOLED MOTORS TYPE "E" (second letter of motor code)

Remove screw plugs "OIL" and "R" (Fig. 13) and drain oil chamber casing and cooling jacket completely by turning the pump around slowly, until openings "OIL" and "R" are upside down (Fig. 13). When oil has completely drained, re-install screw plug "OIL" with softened copper seal ring. Place pump vertically.

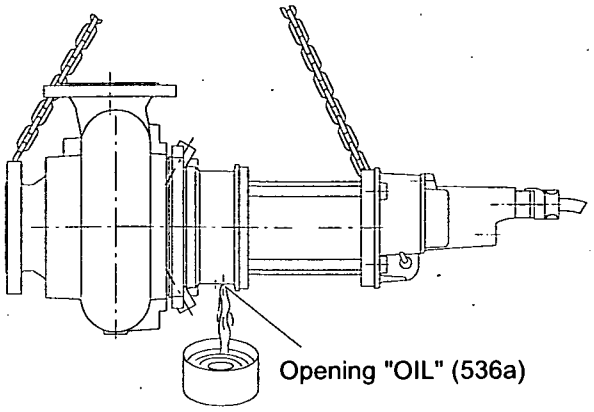

Fig. 12

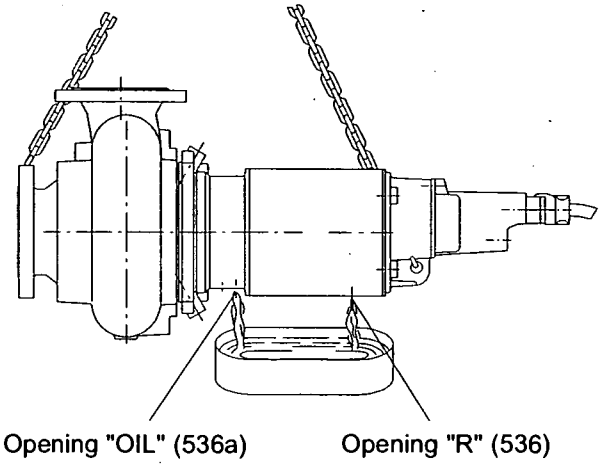

Fig. 13

Refill 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 screw plug "R", with softened copper seal ring.

2.6.4 GREASING INSTRUCTIONS

Hidrostal motors use 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 ("Overhaul Chart", Section 2.8). The overhaul should be done by an authorized Hidrostal service center.

CAUTION:
The overhaul of Ex-proof-motors must be done in the factory or in an authorized Hidrostal service center, otherwise the Ex-certification will be invalidated.

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

For regreasing we recommend:

STABURAGS NBU 8 EP by Kluber-Lubrication.

This grease is of a mineral oil base containing a barium complex as thickener.

Typical characteristics:

Colour	beige	
Apparent dynamic visco. (approx.)	6000	mPas
Operating temperature range	-30..150	° C
Max. temperature (short time)	170	° C
Consistency class (NLGI)	2	
Penetration DIN ISO 2137 (0.1 mm)	280	
Dropping point DIN ISO 2176	> 220	° C
Corrosion protection DIN 51802	0	
RPM-parameter (n x d m)	5×10^5	

2.7 MOTOR CABLES

Whenever opening motor housing, it is imperative that all O-rings have to be replaced with new items supplied from HIDROSTAL. O-rings glued-up from bulk stock are totally unsatisfactory for this critical application; the glued joint will inevitably leak water into the motor after a short time.

If tests conducted through the cables in the field (Section 2.6.3.1) 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" test on cable and winding. If windings are at fault, send the entire motor to the nearest authorized Hidrostal service station. If cable is at fault, a new cable set can be installed.

2.7.1 RE-CONNECTION OF CABLE

Place 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.

2.7.2 TEST FOR LEAKS

Before putting the pump back into operation after opening of the motor (as when changing cables), a test for leaks 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). Air pressure should be a maximum of 0.5 bar (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.

Hidrostal	INSTRUCTION MANUAL IMMERSIBLE PUMPS	
Dat: 28.07.00	No: 94-BA 5080E/ 20d	File: Q_UEBE_E

2.8 OVERHAUL CHART

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 lit.	Hours between regreasing
BKBA2	25	20	0.8	20'000
BKZR2 / BKZY2	25	20	1.2	30'000
BEZR2	25	20	2.8	30'000
BEZY2	25	20	3	30'000
CEZR2	25	20	2.8	30'000
CEZY2	25	20	3	30'000
CEYR2 / CEYS2	1 1/2	1 1/8	2	30'000
CEYT2	1 1/2	1 1/8	2	30'000
DEYT2	1 1/2	1 1/8	2	20'000
DEXB2 / DEXBT	1 1/2	1 1/8	8	25'000
DEXL2	1 1/2	1 1/8	8	25'000
DEXQ2	2	1 1/2	10	25'000
DEXT2	2	1 1/2	10	25'000
DEXZ2 / DEXW2	2	1 1/2	11	25'000
EEWS2	2 1/2	1 1/2	24	15'000
EE5S2 / EEVS2	3	2	31	20'000
BKBA4	25	20	0.8	30'000
BKZR4	25	20	1.2	50'000
CKBA4	25	20	0.8	30'000
CKZR4 / CKZY4	25	20	1.2	50'000
CEZY4	25	20	3	50'000
CKYT4	1 1/2	1 1/8	1	40'000
DKYT4	1 1/2	1 1/8	1	35'000
DEYS4 / DEYT4	1 1/2	1 1/8	2	35'000
DEXA4 / DEXA5	1 1/2	1 1/8	8	45'000
DKXA4	1 1/2	1 1/8	4	45'000
EEXA4 / EEXA5	1 1/2	1 1/2	9	45'000
EEXAU	1 1/2	1 1/2	9	45'000
EEXK4	1 1/2	1 1/2	9	45'000
EEXO4 / EEXR4	1 1/2	1 1/2	10	45'000
EEXV4	1 1/2	1 1/2	11	45'000
EEXR5	1 1/2	1 1/2	10	45'000
EEXW4	2	1 1/2	14	40'000
EEXY4	1 1/2	1 1/2	11	40'000
EEXY5	1 1/2	1 1/2	11	40'000
EE4B4 / EEWB4	2 1/2	2	24	40'000
EE4B5	2 1/2	2	24	40'000
EE4S4 / EEWS4	2 1/2	2	28	40'000
EEWS5	2 1/2	2	24	40'000
FEXT4	2	2	13	40'000
FEXW4 / FEXZ4	2	2	14	40'000
FE4B4 / FE4B5	2 1/2	2	24	40'000
FE4BU	2 1/2	2	24	40'000
FE4C4	2 1/2	2	28	40'000
FE4S4 / FEWS4	2 1/2	2	28	40'000
FE4S5 / FE4T4	2 1/2	2	28	40'000
FE5B4 / FE5B5	3	2	38	35'000
FEVB4 / FEVB5	3	2	38	35'000
FE5BU	3	2	38	35'000
FE5S5	3	2	38	35'000
HE5C4/HE5T4	3	3	44	35'000
HE5S5	3	3	44	35'000
HE6S4	95	3	42	20'000
HE6S5 / HE6SU	95	3	42	20'000
HEUC4	95	3	60	20'000

Motor type	motor-side seal	pump-side seal	seal oil lit.	Hours between regreasing
IE7C4	100	100	94	18'000
IE7T4 / IETT4	100	100	94	18'000
IETT5	100	100	106	18'000
IETZ4 / IETZ5	100	100	106	18'000
DKYT6 / DEYS6	1 1/2	1 1/8	2	35'000
EEYS6 / EEYT6	1 1/2	1 1/8	2	35'000
EKXA6	1 1/2	1 1/2	5	50'000
EKXR7	1 1/2	1 1/2	5	50'000
EEXA6 / EEXK6	1 1/2	1 1/2	9	50'000
EEXR6 / EEXR7	1 1/2	1 1/2	10	50'000
FEXQ6	2	2	13	50'000
FEXT6	2	2	13	50'000
FEXT7	2	2	13	50'000
FEXW6	2	2	14	50'000
FEXZ6 / FEXZ7	2	2	14	50'000
FE4A6 / FE4A7	2	2	23	50'000
FE4S7	2 1/2	2	28	50'000
HE4B6	2 1/2	2	28	50'000
HE4S6 / HEWS6	2 1/2	2	32	50'000
HE4S7 / HEWS7	2 1/2	2	32	50'000
HE5B6 / HE5B7	3	3	44	45'000
HE5S6 / HE5S7	3	3	44	45'000
HE6S7	95	3	42	35'000
IE5S6	3	3	47	45'000
IENT6	3	3	47	45'000
IE6S6 / IE6SV	95	3	68	35'000
IE6S7	95	3	68	35'000
IE7C6	100	100	94	35'000
IETT6 / IETT7	100	100	106	35'000
IETZ7	100	100	106	35'000
LE7T6	100	100	106	35'000
LETZ6	100	100	106	35'000
DKYT8	1 1/2	1 1/8	1	35'000
DEYS8	1 1/2	1 1/8	2	35'000
EEYT8	1 1/2	1 1/8	2	35'000
EEXR9	1 1/2	1 1/2	10	50'000
FEXQ8	2	2	13	50'000
FEXT8 / FEXTW	2	2	13	50'000
FEXZ8 / FEXZ9	2	2	14	50'000
HE4B8 / HE4B9	2 1/2	2	28	50'000
HE4S8 / HEWS8	2 1/2	2	32	50'000
HE4S9	2 1/2	2	32	50'000
HE5B8	3	3	44	45'000
HE5B9 / HE5S9	3	3	44	45'000
HENT4	3	3	45	35'000
HEUC7	95	3	60	35'000
IE5S8 / IEVS8	3	3	47	45'000
IE6S9	95	3	68	30'000
IE6S8 / IE6SW	95	3	68	30'000
IETT9	100	100	106	30'000
LE7C8	100	100	106	30'000
LE7T8 / LETT8	100	100	106	30'000
LETZ8	100	100	106	30'000
LETZ9	100	100	106	30'000

2.9 ASSEMBLY / DISASSEMBLY

2.9.1 REPLACEMENT OF MECHANICAL SEAL

2.9.1.1 REMOVAL OF PUMP SIDE MECHANICAL SEAL (515)

a) Exposed-spring seal - type "C"
(Fig. 14)

Remove snap ring (Seeger, 546), then remove spring. Make sure that the shaft is free of burrs and has no sharp edges so that the rubber parts of the seal cannot be damaged as they are removed. Oil the shaft for ease of disassembly. Now the seal rotating parts can be pulled off the shaft by hand.

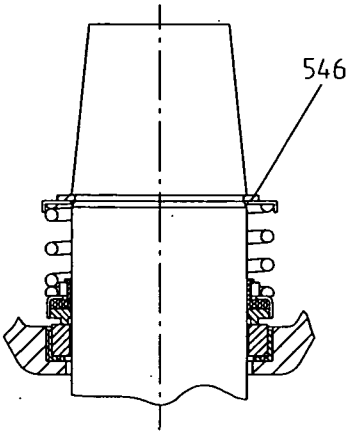

Fig. 14

b) Rubber-bellows seal, with internal spring - type "M"
(Fig. 15)

Remove retaining ring "A" from the rubber bellows of the seal by gently prying with two screwdrivers on opposite sides, between the rubber bellows and the retaining ring (Fig. 16).

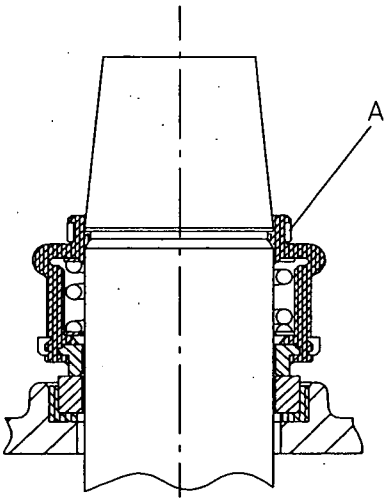

Fig. 15

CAUTION:
Use only dull-edged screwdrivers since sharp edges could cut the rubber bellows. Do not twist screwdriver, as this can puncture rubber bellows.

Rather, lay some convenient object onto back cover or seal plate, to act as a fulcrum for each screwdriver, and pry ring directly up away from rubber bellows (Fig. 16).

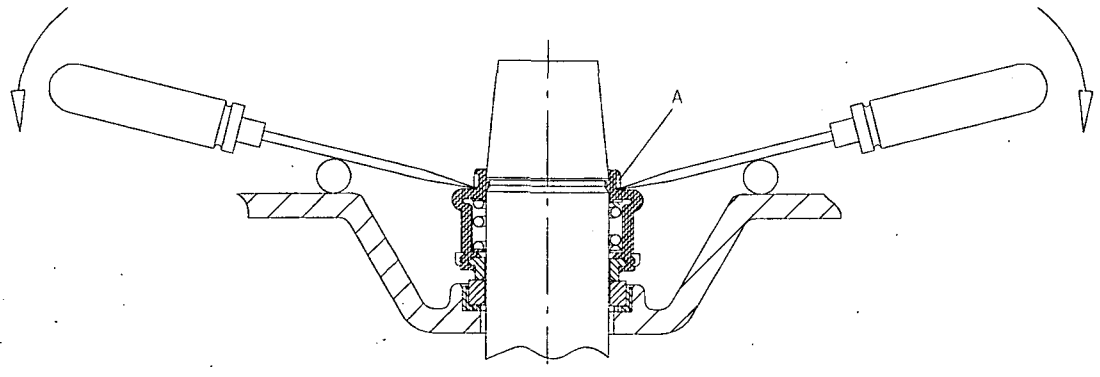

Fig. 16

Make sure that the shaft is free of burrs and has no sharp edges so that the rubber parts of the seal cannot be damaged as they are removed. Oil shaft and bellows for ease of disassembly. Gently insert a screwdriver between the shaft and the rubber bellows.

By lifting and turning the screwdriver around the shaft, the lip of the rubber bellows can be lifted out of the shaft groove. Once the bellows is free of the groove, the entire rotating part of the seal with bellows can be pulled off the shaft. If necessary, use two screwdrivers deep into the seal to pry the seal face loose (Fig. 17).

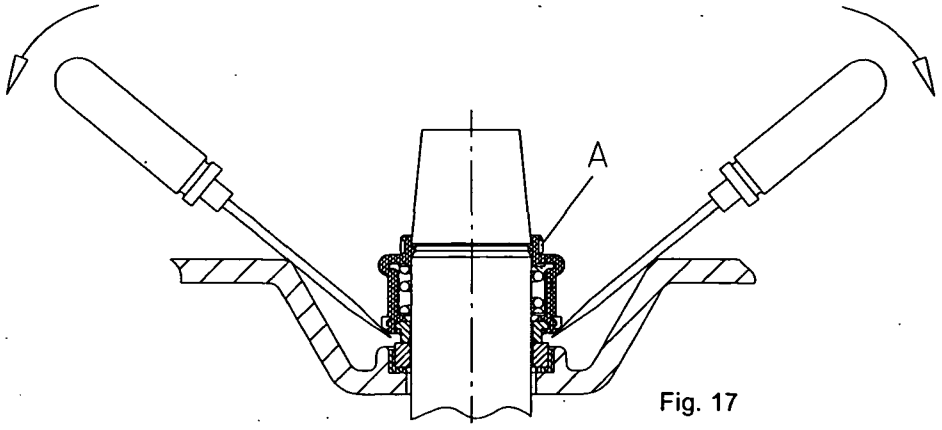

Fig. 17

c) Rubber-bellows seal - type "N" (Fig. 18)

Pull out the removable part (A) by hand.

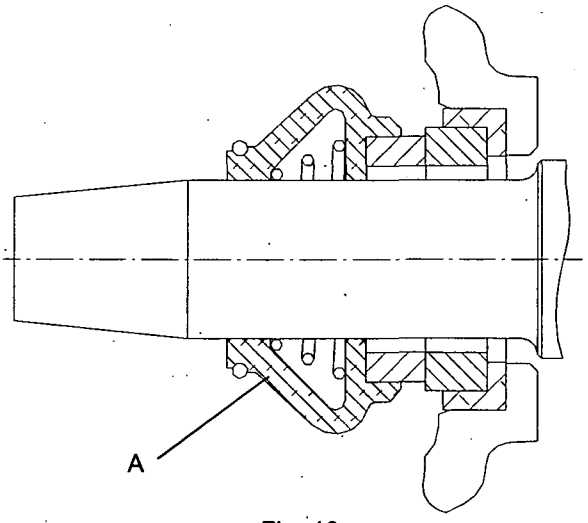

Fig. 18

d) Rubber-bellows seal, external spring - type "G" (Fig. 19)

Remove snap ring (546), if existing.
Pull out the removable part (A) by hand.

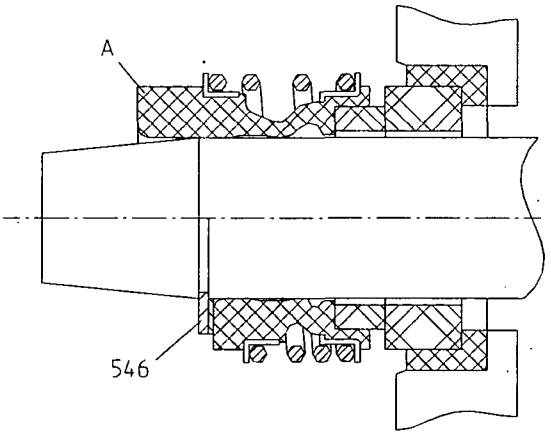

Fig. 19

e) Stainless-steel-shroud seal - type "X" (Fig. 20)

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.

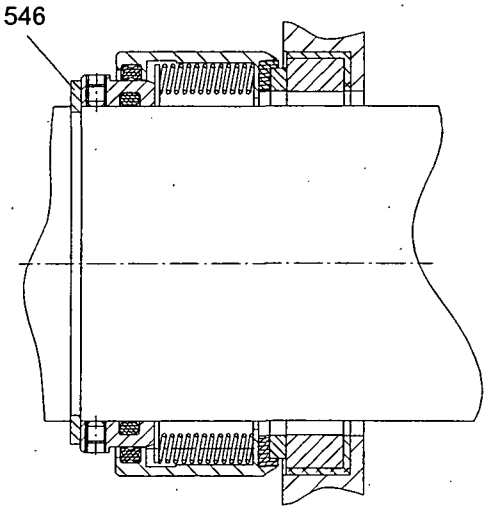

Fig. 20

f) Stationary seat (all types)
(Fig. 21 and 22)

Remove static part of the mechanical seal as follows:

Unfasten nuts (534) and carefully remove back cover or mechanical seal plate (507) from oil chamber casing. Make sure that the static part of the seal (515) does not hit the shaft so that the ring can't be damaged.

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

Some HIDROSTAL seals can be repolished or repaired (Consult nearest service center). When sending a seal for inspection or repair, it is important to thoroughly protect the seal faces to prevent damage during transportation.

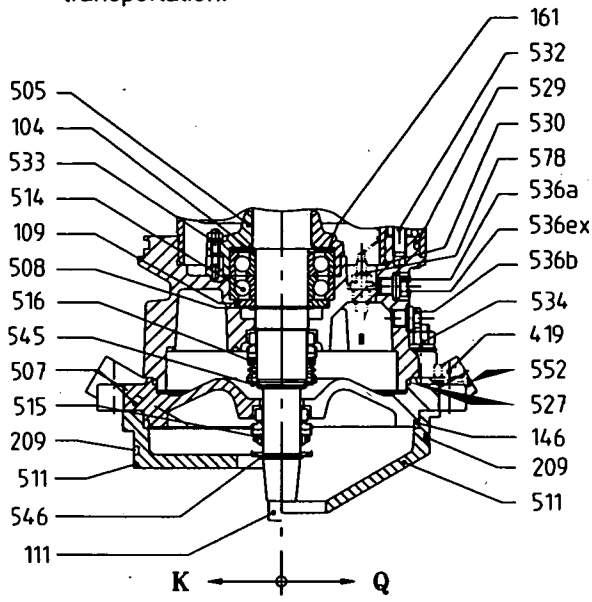

Fig. 21

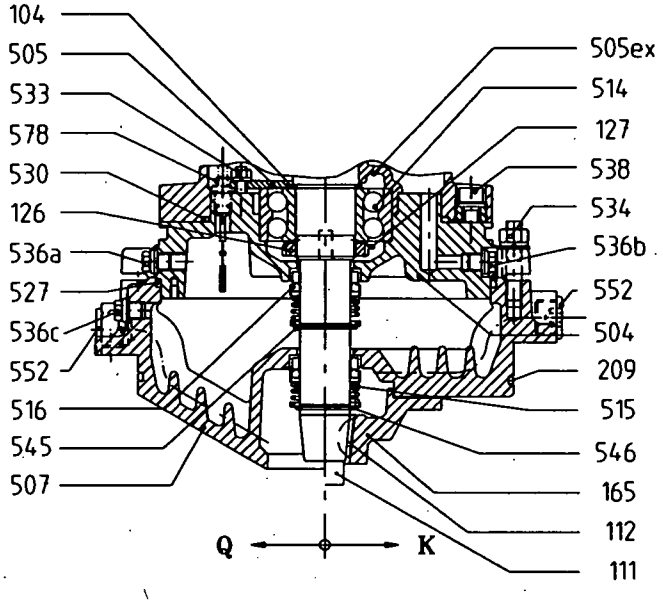

Fig. 22

2.9.1.2 MAINTENANCE OF MOTOR SIDE 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 motor housing test as described in Section 2.6.3.2, the entire motor should be sent to the nearest authorized HIDROSTAL service center for a complete inspection.

2.9.1.3 ASSEMBLY OF BACK COVER

⚠ **Cleanliness is of utmost importance for this assembly work!** All parts must be washed in solvent before assembly. All machined mating surfaces must be clean and free from burrs. All grooves and seatings for "O"-rings and other static seals must be 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 assembly.**

⚠ **WARNING:**
Never use "O"-rings glued from "O"-ring stock. Our experience is that this glue joint will inevitably leak.

Place a new "O"-ring (527) on the oil chamber casing (504). Carefully assemble back cover or mechanical seal plate (507) to the oil chamber casing and fasten with fastening set (534).

2.9.1.4 ASSEMBLY OF PUMP SIDE MECHANICAL SEAL

a) Stationary seat (all types)

Lubricate the rubber circumference of the static mechanical seal part and carefully press all the way into its seat in the back cover or mechanical seal plate (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 (Fig. 23).

Make sure that the shaft is free of burrs and has no sharp edges, so that the rubber part or the mechanical seal cannot be damaged. File groove edges if necessary.

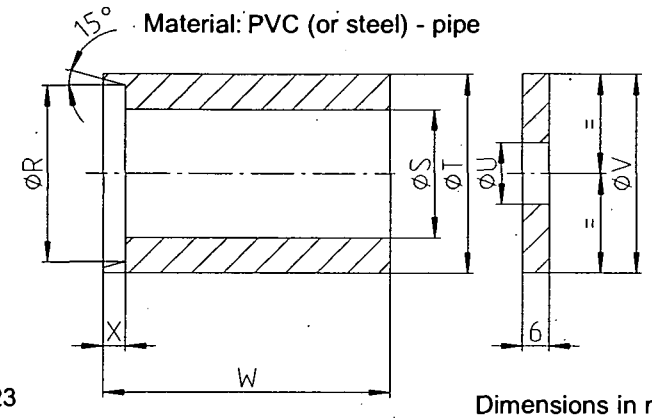

Fig. 23

Dimensions in mm

Seal size	ϕ R	ϕ S	ϕ T	ϕ U "Q"	ϕ U "K"	ϕ V	W	X	Bolt size "Q"	Bolt size "K"
20	32 +/-1	21 +1/-0	38 +/-1	12	-	40	60	5	M10	-
1 1/8"	40 +/-1	29 +1/-0	45 +/-1	14	12	50	65	5	M12	M10
1 1/2"	50 +/-1	39 +1/-0	55 +/-1	18	14	60	75	5	M16	M12
2"	65 +/-1	51 +1/-0	70 +/-1	22	18	80	95	5	M20	M16
2 1/2"	80 +/-1	64 +1/-0	85 +/-1	29	-	90	150	5	M27	-
3"	92 +/-1	77 +1/-0	100+/-1	28	29	110	170	5	M33	M27
100	110+/-1	102+1/-0	120+/-1	44	38	130	350	5	M42	M36

b) Exposed-spring seal - type "C"

Remove spring and spring retaining ring of mechanical seal. **Seal surfaces must be absolutely clean!** 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 a plastic pipe mandrel only slightly larger than shaft diameter, to push directly on the rubber part of the seal (Fig. 23). 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 (Seeger, 546) and turn shaft by hand to check for free running.

c) Rubber-bellows seal - type "N"

Lubricate the rotating part of the mechanical seal, put the ring "B" on the rubber bellows (Fig. 24). Push the whole assembly by hand over the shaft as far as possible. Mount the distance ring (546, Fig. 25). Final assembly by installing of impeller.

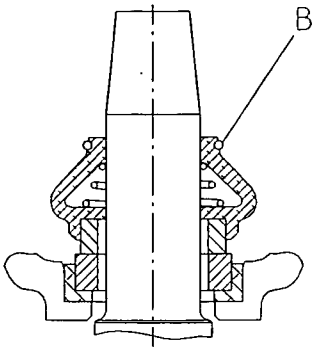

Fig. 24

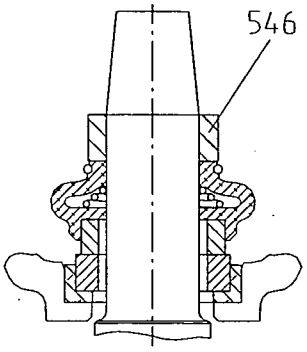

Fig. 25

d) Rubber-bellows seal, external spring - type "G"

Wet the rotating part of the mechanical seal with soap water. Push the whole assembly by hand over the shaft as far as possible. On size 20 mm (Fig. 26) final assembly by installing of impeller. On other sizes (Fig. 27) secure with snap ring (546).

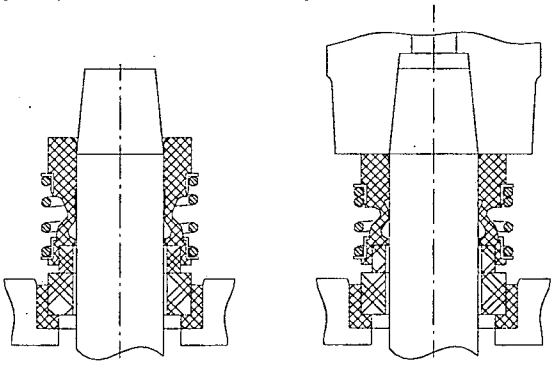

Fig. 26

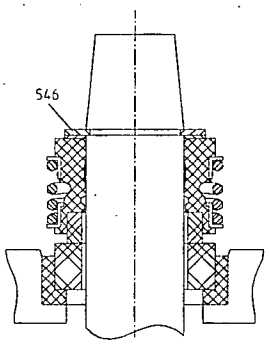

Fig. 27

e) Rubber-bellows seal, internal spring - type "M"

Lubricate the rotating part of the mechanical seal, position the retaining ring "A" on the rubber bellows (Fig. 28). Push the whole assembly by hand over the shaft as far as possible. Mount the special tool over the shaft tip (Fig. 29), and compress the mechanical seal until the lip of the rubber bellows 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 bellows and that it is not cocked. Then try to pull the rubber bellows off shaft by hand to make sure that the lip has reliably engaged in the shaft groove.

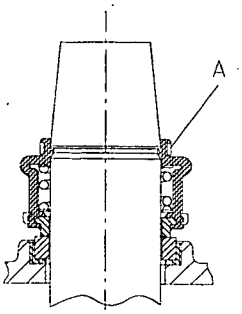

Fig. 28

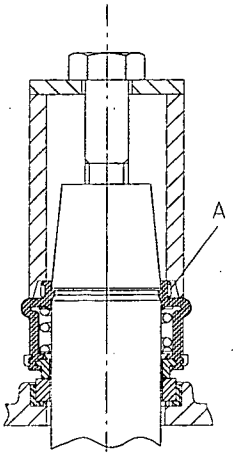

Fig. 29

f) Stainless-steel-shroud seal - type "X"

Lubricate inner rubber O-rings of seal 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 until it snaps into its groove. If necessary use the special tool (Fig. 23). Then re-install the three small setscrews into the seal rotating part, and tighten firmly.

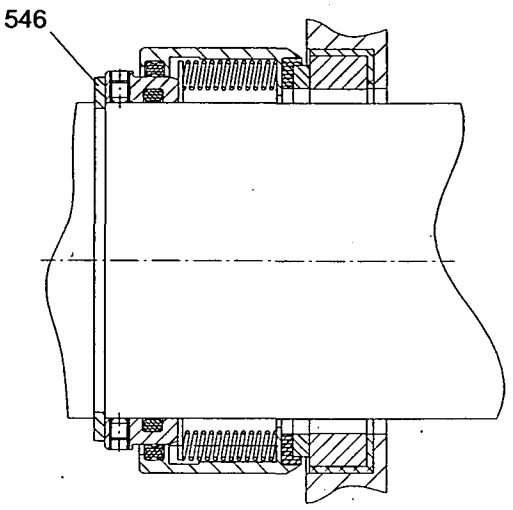

Fig. 30

2.9.1.5 LEAKAGE TEST FOR PUMP SIDE MECHANICAL SEAL (All Types)

Remove screw plug "OIL" (536) and drain the oil 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 0.5 bar (7 psi).

WARNING:
- Make sure that the pressure never exceeds 1 bar. This could displace the seal.
- 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.
- **Do not immerse end of cable!**
- Correct failure if leakage has been found. After finishing tightness test remove pressure connection hose and fill with oil according to Section 2.6.3.4.

240V AC
AUX. SUPPLY FROM
DISTRIBUTION BOARD
CIRCUIT BREAKER
REF DWG:-
486/5/7-HG001

REF DWG:-
486/5/7-HG001

E N R W B

TL1
TEST
LINKS

CT1
5A

250A

(NOTE 2)

149 682 N17 (18) IT1

148 154 682 N17 (16) (17) KWT1

150 151 4 - 20mA → 7+ 7- PUMP No 1 KILOWATTS CHANNEL 7

REF DWG:-
486/5/7-HG005

145 146 147 IF1

2A 2A 2A

(15) (13) (14)

C13

156

(37) 6A (NOTE 6)

(06) DANFOSS VLT6100
V.F. DRIVE No 1

91 L1
92 L2
93 L3
94 ⏚

U 96
V 97
W 98
⏚ 99

(NOTE 1)

MAIN PUMP No.1
63kW
FLC=115A

RP14-1 136 THR1-1 135

3 → 18 RUN/STOP
27
2 → 16 RESET
1 → 12 COMMON
32 SELECT SET UP 2

RP13-1 138
139

SMC
REMOTE LOCAL
140
4

(55) REF DWG:-
486/5/7-HG004
LINE No 13

CABLE C18
(10 CORE)

CABLE C12 (71)

50 3W PR+
53 3Bk PR-

652

MANUAL SPEED CONTROL
1K POTENTIOMETER

60 2W 651 0+ 0- VFD 1 SPEED CONTROL CHANNEL 0
55 2Bk 652
45 1W 642 11+ 11- VFD 1 RUNNING SPEED CHANNEL 11
39 1Bk 641
5Bk 641 8- 8+ VFD 1 MOTOR AMPS CHANNEL 8
42 5W 153 A 152

REF DWG:-
486/5/7-HG005

(16) 0-115A ANALOG AMMETER (4-20mA)

VFD1W-1
9A
9B
10 → 121+ V.F. DRIVE WARNING
REF DIM2 R.T.U.
INPUT CHANNEL 11

RS485 CONNECTOR
MOUNTED IN THE
MAIN SWITCHBOARD

RELAY 06
VFD1A-1
6A
6B
9 → 120+ V.F. DRIVE IN AUTO
REF DIM2 R.T.U.
INPUT CHANNEL 10

68
69
61

V.F.D. 2
RS485 TERM'LS
REF DWG:-
486/5/7-HG003

RELAY 07
VFD1R-1
7A
7B
7 → 118- V.F. DRIVE RUNNING
8 → 118+ REF DIM2 R.T.U.
INPUT CHANNEL 8

CABLE C18

RELAY 08
VFD1R-2
8A
8B

B 126 (38) h HOURS RUN

125 R 1 READY 2 W 141 RL11 (42) V.F. DRIVE No 1 READY RELAY

CABLE C14

PUMP No 1 - DANFOSS VLT6100
VARIABLE FREQUENCY DRIVE CABINET

N1
MAIN PUMP No.1

MI01 MOISTURE IN OIL RELAY (ZIEHL NSIF)

103 CABLE C21 104 PROBES 3 4 135 136

THR1 (39) THERMISTOR RELAY (AUTO RESET)

125 133

TO DIM2 CHANNEL 4
REFER RTU INPUT MODULE
114+
114-

CABLE C21 MOTOR THERMISTOR CABLE C21 134
101 1 2 102

125 129 ON OFF (NOTE 5) 130 RP12-1 132 C13 (07) LINE CONTACTOR
PR1 (41) CONTROL CIRCUIT POWER ON

EMERGENCY STOP

CABLE C10
2 CORE

RTU INPUTS MODULE [DIM2]

24N1 — R.T.U. 24V DC [REF 486/5/7-HG010] — DIM2+

2 CORE CABLE C8 (NOTE 4)

110-	110+ 0	REFLUX MICRO SWITCH	CHANNEL 0
111- PR1-1	111+ 1	POWER ON	CHANNEL 1
112- MI01-1	112+ 2	MOISTURE IN OIL	CHANNEL 2
113- (47)	113+ 3	LOCAL START	CHANNEL 3
114- (48)	114+ 4	EMERGENCY STOP	CHANNEL 4
115- THR1-2	115+ 5	THERMISTOR TRIP	CHANNEL 5
116- RL11-1	116+ 6	V.F.D. No 1 READY	CHANNEL 6
117- (49)	117+ 7	LOCAL RESET	CHANNEL 7
118- VFD1R-1 (7A 7B)	118+ 8	VFD No 1 RUNNING	CHANNEL 8
119- C13-2	119+ 9	CONTACTOR CLOSE	CHANNEL 9
VFD1A-1 (6A 6B)	120+ 10	VFD No 1 AUTO SEL'D	CHANNEL 10
VFD1W-1 (9A 9B)	121+ 11	V.F.D. No 1 WARNING	CHANNEL 11
SPARES	122+ 12	SPARE	CHANNEL 12
	123+ 13	SPARE	CHANNEL 13
	124+ 14	SPARE	CHANNEL 14
	125+ 15	SPARE	CHANNEL 15

REFERENCE LINE 30

RTU OUTPUTS MODULE [DOM1]

DOM1+ — R.T.U. 24V DC [REF 486/5/7-HG010] — DOM1-

(NOTE 4)

SITE ALARM ATTENTION IND'RS	0	606+ (A) 59 606- (W) 60	CHANNEL 0
CONNECT REF. ELECTRODES	1		CHANNEL 1
CATHODIC PROTECTION DE-ENERG. RECTIFIER	2		CHANNEL 2
CLOSE LINE CONT'R	3	123+ (44) RP12 123- 123-	CHANNEL 3
PUMP STATUS	4	122+ (46) R 122-	CHANNEL 4
RUN/STOP VFD No 1	5	140+ (40) RP14 140- 140-	CHANNEL 5
VFD 1 FAULT RESET	6	124+ (45) RP13 124-	CHANNEL 6
CATHODIC PROTECTION ALARM INDICATOR	7		CHANNEL 7
SPARE	8		CHANNEL 8
SPARE	9		CHANNEL 9
SPARE	10		CHANNEL 10
SPARE	11		CHANNEL 11
SPARE	12		CHANNEL 12
SPARE	13		CHANNEL 13
SPARE	14		CHANNEL 14
SPARE	15		CHANNEL 15

SPARES

LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- FUNCTION / ADDRESS — RTU DIGITAL INPUT
- FUNCTION / ADDRESS — RTU DIGITAL OUTPUT
- FUNCTION / ADDRESS — RTU ANALOG INPUT
- FUNCTION / ADDRESS — RTU ANALOG OUTPUT
- (00) EQUIPMENT ITEM No.
- ---6--- CABLE CORE NUMBER

NOTES:

1. MAIN PUMP DECONTACTORS ARE LOCATED IN UPPER SECTION OF PUMP WELL.
2. CIRCUIT BREAKERS RATINGS TO SUIT LOAD & ENSURE TYPE 2 COORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.
3. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST COMPATIBLE LABELLING.
   THE FOLLOWING PREFIXES ARE USED:
   MAIN PUMP No. 1 = 1
   MAIN PUMP No. 2 = 2
   MAIN PUMP No. 3 = 3
   SUMP PUMP = 5
   COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE)
   OXYGEN PUMP No. 1 = 7
   OXYGEN PUMP No. 2 = 8
4. 24V DC INPUT/OUTPUT INDIVIDUAL PROTECTION FUSES NOT SHOWN. (i.e. PART OF INTERFACE TERMINAL STRIP)
5. ON / OFF ISOLATOR SWITCHES LOCATED ADJACENT TO MOTORS IN PUMP WELL.
6. PUMP CONTROL CIRCUIT BREAKERS RATED AT 9KA FOR 1 SEC.
7. THE VARIABLE FREQUENCY SPEED CONTROLLERS SHALL BE LOCATED EXTERNALLY TO THE SWITCHBOARD IN WALL MOUNTED CABINETS IN THE UPPER SECTION OF THE PUMP WELL.
8. THIS DRAWING HAS BEEN PRODUCED FROM DRAWING No:- E94-BM6000/A0 & A2 REVISION E.
9. ALL ITEMS IN THE AREAS DELINEATED BY THE REVISION CLOUDS ARE NEW REVISIONS.

AS CONSTRUCTED
PLOTTED _____ DATE _____
CHECKED _____ DATE _____

NO.	DATE	AMENDMENT	INITIALS
B	2-7-04	CONTROLS REVISED	CJ
A	8/00	AS CONSTRUCTED ISSUE.	--
0	01/00	ORIGINAL ISSUE.	RFW

DIRECTOR OF P.D. & P.S. — DATE
ENGINEER IN CHARGE — R. BOWRING — 21/12/99 — DATE
SUPERVISING ENGINEER — NOTE 8 — R.P.E.Q. NO. — DATE

	NAME	DATE
DESIGN	NOTE 8 R.I.	3-12-99
DRAWN	NOTE 8	3-12-99
CHECKED		

Brisbane City

JOB FILE			
ACAD FILE	S7HG002-RevB	SHEET SIZE	A1
SURVEY No.		FIELD BOOK	
SURVEYED		A.H. DATUM	

Brisbane Water — Professional Services in Engineering

PROJECT
CENTENARY HIGHWAY
SEWAGE PUMP STATION SP19

TITLE
SEWAGE PUMP No 1
POWER & CONTROL
SCHEMATIC DIAGRAM

SCALE NTS — N° 2 OF 8 SHEETS
DRAWING N° 486/5/7-HG002 — AMEND. B

Q:\PSEDRAWING2\SEWERAGE\INFRASTR\Centenary Hwy Sp19\S7HG002-RevB.dwg, 01/06/2004 02:54:06 PM

240V AC
AUX. SUPPLY FROM
DISTRIBUTION BOARD
CIRCUIT BREAKER
REF DWG:-
486/5/7-HG001

REF DWG:-
486/5/7-HG001

E N R W B

TL2
TEST
LINKS

CT2
5A

250A

(NOTE 2)

IT1

KWT1

PUMP No 2 KILOWATTS
CHANNEL 9

4 - 20mA

REF DWG:-
486/5/7-HG005

IF2

DANFOSS VLT6100
V.F. DRIVE No 1

MAIN PUMP No.2
63kW
FLC=115A

(NOTE 1)

RUN/
STOP

RESET

COMMON

SELECT
SET UP 2

SMC
REMOTE LOCAL

REF DWG:-
486/5/7-HG004
LINE No 13

CABLE C20
(10 CORE)

(NOTE 6)

6A

CABLE C13

MANUAL SPEED CONTROL
1K POTENTIOMETER

VFD 2 SPEED CONTROL
CHANNEL 1

VFD 2 RUNNING SPEED
CHANNEL 12

VFD 2 MOTOR AMPS
CHANNEL 10

REF DWG:-
486/5/7-HG005

0-115A ANALOG AMMETER (4-20mA)

V.F.D. 1
RS485 TERM'LS
REF DWG:-
486/5/7-HG002

V.F. DRIVE
WARNING
REF DIM2 R.T.U.
INPUT CHANNEL 11

RELAY 06
VFD2A-1

V.F. DRIVE
IN AUTO
REF DIM2 R.T.U.
INPUT CHANNEL 10

RELAY 07
VFD2R-1

V.F. DRIVE
RUNNING
REF DIM2 R.T.U.
INPUT CHANNEL 8

CABLE C20

RELAY 08
VFD2R-2

PUMP No 2 - DANFOSS VLT6100
VARIABLE FREQUENCY DRIVE CABINET

CABLE C15

READY

MAIN PUMP No.2

HOURS RUN

V.F. DRIVE No 2
READY RELAY

MOISTURE IN OIL RELAY
(ZIEHL NSIF)

CABLE C22

PROBES

THERMISTOR RELAY
(AUTO RESET)

TO DIM3 CHANNEL 4
REFER RTU INPUT MODULE

MOTOR
THERMISTOR

EMERGENCY
STOP

ON OFF
(NOTE 5)

CABLE C11
2 CORE

LINE CONTACTOR

CONTROL CIRCUIT
POWER ON

REFERENCE
LINE 30

RTU INPUTS MODULE [DIM3]

24N1 — R.T.U. 24V DC [REF 486/5/7-HG010] — DIM3+

2 CORE
CABLE C9

(NOTE 4)

0	REFLUX MICRO SWITCH CHANNEL 0	210-	210+
1	POWER ON CHANNEL 1	PR2-1	211+
2	MOISTURE IN OIL CHANNEL 2	MI02-1	212+
3	LOCAL START CHANNEL 3	(47)	213+
4	EMERGENCY STOP CHANNEL 4	(48)	214+
5	THERMISTOR TRIP CHANNEL 5	THR2-2	215+
6	V.F.D. No 2 READY CHANNEL 6	RL21-1	216+
7	LOCAL RESET CHANNEL 7	(49)	217+
8	VFD No 2 RUNNING CHANNEL 8	VFD2R-1 (7A / 7B)	218+
9	CONTACTOR CLOSE CHANNEL 9	C23-2	219+
10	VFD No 2 AUTO SEL'D CHANNEL 10	VFD2A-1 (6A / 6B)	220+
11	V.F.D. No 2 WARNING CHANNEL 11	VFD2W-1 (9A / 9B)	221+
12	SPARE CHANNEL 12		222+
13	SPARE CHANNEL 13		223+
14	SPARE CHANNEL 14		224+
15	SPARE CHANNEL 15		225+

SPARES

RTU OUTPUTS MODULE [DOM2]

DOM2+ — R.T.U. 24V DC [REF 486/5/7-HG010] — DOM2-

(NOTE 4)

0	CLOSE LINE CONT'R CHANNEL 0	223+ (44)	RP22 223-
1	PUMP STATUS CHANNEL 1	222+ (46) R	222-
2	RUN/STOP VFD No 2 CHANNEL 2	240+ (40)	RP24 240-
3	VFD 2 FAULT RESET CHANNEL 3	224+ (45)	RP23 224-
4	SPARE CHANNEL 4		
5	SPARE CHANNEL 5		
6	CENTENARY HIGHWAY DOSING P1 RUN/STOP CHANNEL 7	721+ (54)	RP71 721-
7	FORTROSE STREET DOSING P2 RUN/STOP CHANNEL 7	821+ (55)	RP81 821-
8	SPARE CHANNEL 8		
9	SPARE CHANNEL 9		
10	SPARE CHANNEL 10		
11	SPARE CHANNEL 11		
12	SPARE CHANNEL 12		
13	SPARE CHANNEL 13		
14	SPARE CHANNEL 14		
15	SPARE CHANNEL 15		

SPARES

SPARES

LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- FUNCTION / ADDRESS — RTU DIGITAL INPUT
- FUNCTION / ADDRESS — RTU DIGITAL OUTPUT
- FUNCTION / ADDRESS — RTU ANALOG INPUT
- FUNCTION / ADDRESS — RTU ANALOG OUTPUT
- (00) — EQUIPMENT ITEM No.
- ---6--- — CABLE CORE NUMBER

NOTES:

1. MAIN PUMP DECONTACTORS ARE LOCATED IN UPPER SECTION OF PUMP WELL.
2. CIRCUIT BREAKERS RATINGS TO SUIT LOAD & ENSURE TYPE 2 COORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.
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   MAIN PUMP No. 3 = 3
   SUMP PUMP = 5
   COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE)
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8. THIS DRAWING HAS BEEN PRODUCED FROM DRAWING No:- E94-BM6000/A0 & A2 REVISION E.
9. ALL ITEMS IN THE AREAS DELINEATED BY THE REVISION CLOUDS ARE NEW REVISIONS.

AS CONSTRUCTED
PLOTTED _____ DATE _____
CHECKED _____ DATE _____

NO.	DATE	AMENDMENT	INITIALS
B	2-7-03	CONTROLS REVISED	CJ
A	06/00	AS CONSTRUCTED ISSUE.	--
0	01/00	ORIGINAL ISSUE.	RFW

DIRECTOR OF P.D. & P.S. — DATE
ENGINEER IN CHARGE — R. BOWRING — 21/12/99 — DATE
SUPERVISING ENGINEER — NOTE 8 — R.P.E.Q. NO. — DATE

	NAME	DATE
DESIGN	NOTE 8 R.J.	3-12-99
DRAWN	NOTE 8	3-12-99
CHECKED		

Brisbane City

JOB FILE			
ACAD FILE	S7HG003-RevB	SHEET SIZE	A1
SURVEY No.		FIELD BOOK	
SURVEYED		A.H. DATUM	

Brisbane Water

PROJECT
CENTENARY HIGHWAY
SEWAGE PUMP STATION SP19

TITLE
SEWAGE PUMP No 2
POWER & CONTROL
SCHEMATIC DIAGRAM

SCALE NTS — N° 3 OF 8 SHEETS
DRAWING N° 486/5/7-HG003 — AMEND. B

Q:\PSEDRAWING2\SEWERAGE\RASTR\Centenary Hwy Sp19\57HG003-RevB.dwg, 01/06/2004 02:56:11 PM

NEW "HERCUS SYT4" 2:1 GEARBOX FITTED WITH STAINLESS STEEL RISING STEM COVER AND VALVE SPINDLE CAP TO BCC STANDARD AND WITH S.K.F. "V" SEAL TO SUIT 1Y" THREAD SIZE 5 TEETH/INCH LEFT HAND STUB ACME PITCH DIA. 26.83 mm. SEE NOTE B1

NEW STAINLESS STEEL PEDESTAL SEE DETAIL SHOWN ON DWG. NO. 3052/9/6

NON SHRINK EPOXY GROUT UNDER PEDESTAL TO PROVIDE GAS TIGHT SEAL

NEW 4 NO. OF STAINLESS STEEL M16 CHEMICAL ANCHORS WITH 130 EMBEDMENT LENGTH

CORE NEW Ø125 HOLE IN TOP SLAB AND INSERT DN100 UPVC PIPE AS SHOWN ON DRAWING NO. 3052/9/6

NEW DN40 STAINLESS STEEL PIPE RISING SPINDLE REFER TO STANDARD DWG. NO. 486/S/25-S48

NEW 3 NO. OFF EVENLY SPACED PLUMMER BLOCKS AND STAINLESS STEEL SUPPORTS FOR DETAILS REFER TO STANDARD DWG. NO. 486/S/25-S49

EXISTING 2 NO. OFF DN300 FLANGED INLET SLUICE VALVES

EXISTING SCREEN BASKET TO BE REMOVED

NEW STAINLESS STEEL SPOOL PIECE SEE DETAIL SHOWN ON DWG. NO. 3052/9/5

EXISTING DN300 INLET PIPE IL1.908

NEW DN300 FULL STAINLESS STEEL KNIFE GATE VALVE "KEYSTONE F9S2 170 ACD" WITH RISING SPINDLE SHAFT

IL-1.064

EXISTING DRY WELL SUMP

NOMINAL S96

25

RL9.223

74

RL9.985

FSL9.528

991

675

RL7.736

EXISTING 1219 X 914 OPENING WITH ACCESS HATCH

EXISTING DN300 DELIVERY ISOLATING SLUICE VALVE

EXISTING DN300 RISER PIPES

PS EXISTING DN300 FLANGE TO BE REMOVED AND REPLACED WITH NEW 60 THICK FLANGE TO SUIT LOWERED AND ROTATED DUCK FOOT BEND

NEW DN200 SWING CHECK VALVE WITH ADJUSTABLE COUNTER WEIGHTS AND POSITION SWITCHES AND TO BE PROVIDED IF REQUIRED WITH TUNDISH PLUMBED TO EXISTING FLOOR DRAIN

NEW DN50 FULL BORE STAINLESS STEEL BALL VALVE FOR AIR BLEED TO BE PLUMBED WITH COPPER PIPE TO EXISTING FLOOR TUNDISH

P3 NEW DN200 TO DN125 REDUCING BEND WITH DN50 BSP TREADED SOCKET BRANCH

NEW SCREW CENTRIFUGAL DRY WELL SUBMERSIBLE PUMP "HYDROSTAL H05K-S01R+HE5T4-G5SK+ND86-10" WITH 4 POLE SPEED, 68 kW MOTORS.

NEW NON SHRINK CEMENTIOUS GROUT UNDER NEW PUMP FEET

RL0.066

520

RL-0.454

NEW GALVANISED MOUNTING PLATE 20MM THICK MILD STEEL

RL-1.241

RL-1.774

4 NO. OFF PER PUMP M36 STAINLESS STEEL CHEMICAL ANCHORS WITH 330 MIN. EMBEDMENT LENGTH

RL-0.783 AT CENTER OF WELL WITH FALL TO SUMP

P1 NEW DN300 MSCL INLET 5° BEND PIPE WITH DN80 FLANGED SCOUR BRANCH

EXISTING DUCK FOOT BEND SUPPORT TO BE CUT AND TOP PORTION ROTATED AS SHOWN ON PLAN AND LOWERED 230 TO SUIT NEW PUMP DISCHARGE CENTER LINE. SUPPORT THEN TO BE WELDED IN NEW POSITION

20°

SECTIONAL ELEVATION B/1

SCALE 1 : 50 FULL SIZE A1 SHEET

EXISTING ACCESS LADDER

EXISTING 2 NO. OFF DN200 DUCK FOOT BENDS TO BE ROTATED AS SHOWN

EXISTING 2 NO. OFF DN300 FLANGED INLET SLUICE VALVES

EXISTING DRY WELL SUMP

EXISTING 2 NO. OFF DN300 SUCTION INLET PIPES

EXISTING CONCRETE PLATFORM

EXISTING SCREEN BASKET TO BE REMOVED

NEW DN300 FULL STAINLESS STEEL KNIFE GATE VALVE WITH RISING SPINDLE SHAFT

NEW STAINLESS STEEL SPOOL PIECE SEE DETAIL SHOWN ON DWG. NO. 3052/9/5

EXISTING DN300 INLET PIPE

305 Ø3962 305

1299 675 Ø3962

286 686 386 386 286

11.1° 17.2° 59° 5° 5°

111 675 675 111

616 640 1895 256

991 675 1090

P1 NEW DN300 MSCL INLET 5° BEND PIPE WITH DN80 FLANGED SCOUR BRANCH

NEW DN80 DOUBLE FLANGED SLUICE VALVE SCOUR

NEW DN200 SWING CHECK VALVE WITH ADJUSTABLE COUNTER WEIGHTS AND POSITION SWITCHES AND TO BE PROVIDED IF REQUIRED WITH TUNDISH PLUMBED TO EXISTING FLOOR DRAIN

P3 NEW DN200 TO DN125 REDUCING 20° BEND WITH DN50 BSP TREADED SOCKET BRANCH

NEW 2 NO. OFF SCREW CENTRIFUGAL DRY WELL SUBMERSIBLE PUMP "HYDROSTAL H05K-S01R+HE5T4-G5SK+ND86-10" WITH 4 POLE SPEED, 68 kW MOTORS.

P4 NEW DN200 TO DN125 REDUCING 15° BEND WITH DN50 BSP TREADED SOCKET BRANCH

NEW DN80 DOUBLE FLANGED SLUICE VALVE SCOUR

NEW DN200 SWING CHECK VALVE WITH ADJUSTABLE COUNTER WEIGHTS AND POSITION SWITCHES AND TO BE PROVIDED IF REQUIRED WITH TUNDISH PLUMBED TO EXISTING FLOOR DRAIN

P2 NEW DN300 MSCL INLET 5° BEND PIPE WITH DN80 FLANGED SCOUR BRANCH

SECTIONAL PLAN A/-

SCALE 1 : 50
FULL SIZE A1 SHEET

GENERAL NOTES

G1 ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE CURRENT S.A.A. CODES AND THE BY-LAWS OF THE RELEVANT BUILDING AUTHORITY.

G2 DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METRES TO A.H.D. UNLESS NOTED OTHERWISE.

GEARBOX

B1 STANDARD DRAWING NO. 486/S/25-S47 (GRIT COLLECTOR MAINTENANCE HOLE INLET VALVE GENERAL ARRANGEMENT) SHOWS THE GEARBOX LOCATED WITHIN THE MAINTENANCE HOLE. THE GEAR BOX SHOWN ON THIS DRAWING IS INSTALLED ABOVE GROUND

500 0 500 1000 1500 2000 2500

SCALE OF MILLIMETRES
1 : 50 FULL SIZE A1 SHEET

DESIGN CHARGE Nº	
STFW	AENA
CONSTRUCTION PROJECT Nº	

AS BUILT RECEIVED	
BY	
OFFICER CODE	
DATE	
ON MAINTENANCE DETAILS	
START	FINISH
D.R.S. COMMENTS	
FUNDING	
PRIVATE BOOSTER REQUIRED?	YES / NO
FUNDED BY BCC (✓)	DEVELOPER ( )
FED. GOV'T ( )	STATE ( ) OTHER ( )
DRS OFFICER	
DATE RELEASED	
PLAN CUSTODIAN	
OFFICER/RECD	
DATE RELEASED	
LIVE CONNECTION(S) / PASSED(W)	
REFERENCE	
DATE	
BMAP CAPTURE	
JOB NUMBER	
OFFICER CODE	
DATE	
BMAP COMMENTS	

NO	DATE	AMENDMENT	INITIALS
A	5.10.03	NOTATION ALTERED WHERE INDICATED	

PRINCIPAL ENGINEER	ORIGINAL SIGNED H. LAI 4650	RPEQ NO.	DATE 8/03
MANAGER ENGINEERING	ORIGINAL SIGNED H. LAI		DATE 25/8/03
PRODUCTION / NETWORK DELEGATE			DATE

CADD FILE	305293.DTA		
FILE NO.	705/5(1900)		
SURVEYED			
SURVEY NO.		FIELD BOOK	

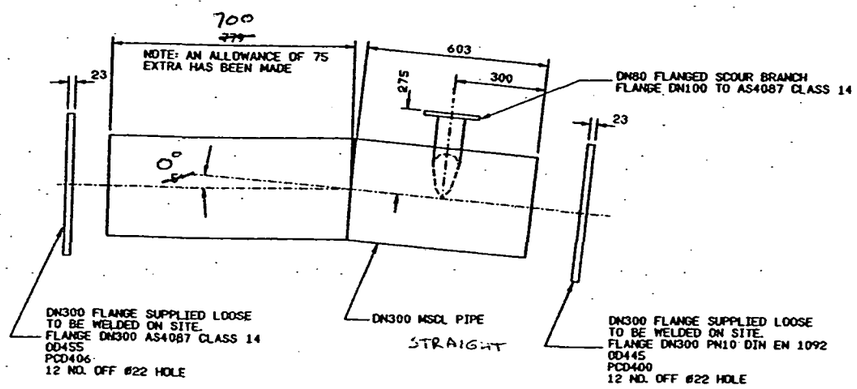
DESIGN	I.G.B.	JULY 2003
DESIGN CHECK	ORIG. SIGNED J.W.	15/08/03
DRAWN	I.G.B.	JULY 2003
DRAFTING CHECK	B.O.B.	AUG. 2003

Brisbane Water

PROJECT
CENTENARY HIGHWAY SP19
(CENTENARY ESTATE)
SEWERAGE PUMPING STATION

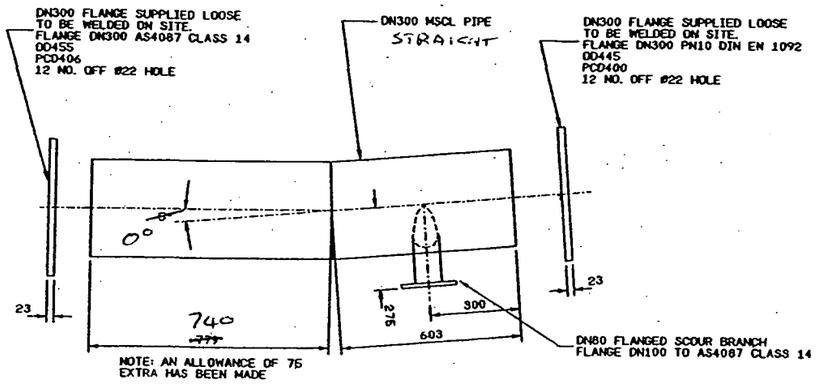
TITLE
PUMP STATION UPGRADE
GENERAL ARRANGEMENT

SCALE AS SHOWN	A.H. DATUM
DRAWING Nº 3052/9/3	Nº 1 OF 4 SHEETS
	AMEND. A



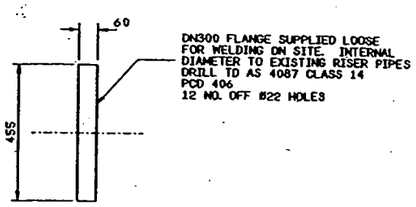
PIPE NO. 1

MATERIAL: MILD STEEL CEMENT LINED WITH EXTERNAL COATING AS PER NOTE C1 AND C2



PIPE NO. 2

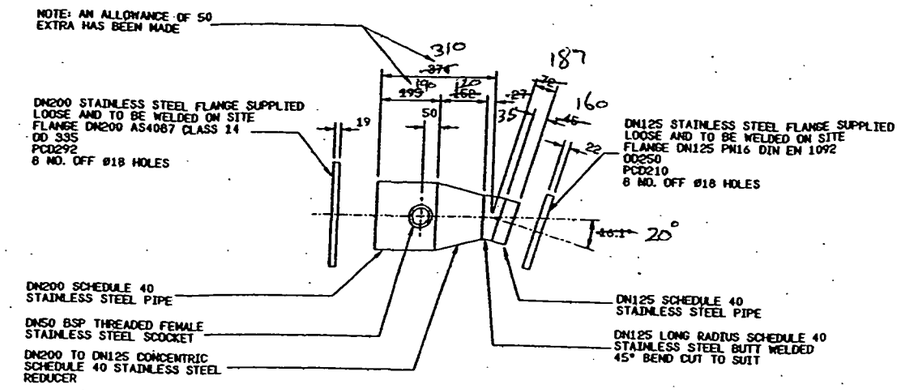
MATERIAL: MILD STEEL CEMENT LINED WITH EXTERNAL COATING AS PER NOTE C1 AND C2



PIPE NOS. 5 AND 6

2 NO. OFF TOTAL REQUIRED

MATERIAL: MILD STEEL WITH EXTERNAL COATING AS PER NOTES C1 AND C2



PIPE NO. 3

MATERIAL: TYPE 316 STAINLESS STEEL

PIPE NO. 4

MATERIAL: TYPE 316 STAINLESS STEEL

NOTES

EXTERNAL COATING

C1. SURFACE PREPARATION: THE SURFACE SHALL BE CLEANED AND DEGREASED TO AS1627.1 AND ABRASIVE BLAST CLEANED TO AS1627.4 CLASS 2½

C2. METHOD:

- FIRST COAT: (SHOP COAT) POLYAMIDE CURED EPOXY PRIMER CONTAINING ZINC PHOSPHATE, TO MINIMUN DRY THICKNESS OF 57μm (EG. DULUX AMERCOAT 385P)
- SECOND COAT: (SHOP COAT) POLYAMIDE CURED EPOXY TO A MINIMUM THICKNESS OF 75 μm (EG. DULUX AMERCOAT 385)
- THIRD COAT: (SITE COAT) POLYAMIDE CURED EPOXY TO A MINIMUM THICKNESS OF 75 μm (EG. DULUX AMERCOAT 385)

NO	DATE	AMENDMENT	INITIALS

PRINCIPAL ENGINEER — RPEQ NO. 4650 — DATE 8/03
MANAGER ENGINEERING — DATE 25/8/03
PRODUCTION / NETWORK DELEGATE — DATE

CADD FILE	305294.DTA	DESIGN	I.G.B.	JULY 2003
FILE NO.	705/5(1900)	DESIGN CHECK		15/8/03
SURVEYED		DRAWN	I.G.B.	JULY 2003
SURVEY NO.	FIELD BOOK	DRAFTING CHECK	B.O.B.	AUG. 2003

Brisbane Water

PROJECT: CENTENARY HIGHWAY SP19 (CENTENARY ESTATE) SEWERAGE PUMPING STATION

TITLE: PUMP STATION UPGRADE PIPE DETAILS

DESIGN CHARGE NA
STEM AENA
CONSTRUCTION PROJECT NA

AS BUILT RECEIVED	
BY	
OFFICER CODE	
DATE	

ON MAINTENANCE DETAILS — START — FINISH

D.R.S. COMMENTS

FUNDING
PRIVATE BOOSTER REQUIRED? YES / NO
FUNDED BY B.C.C. (✓) DEVELOPER ( )
FED. GOV'T ( ) STATE ( ) OTHER ( )
DRS OFFICER
DATE RELEASED

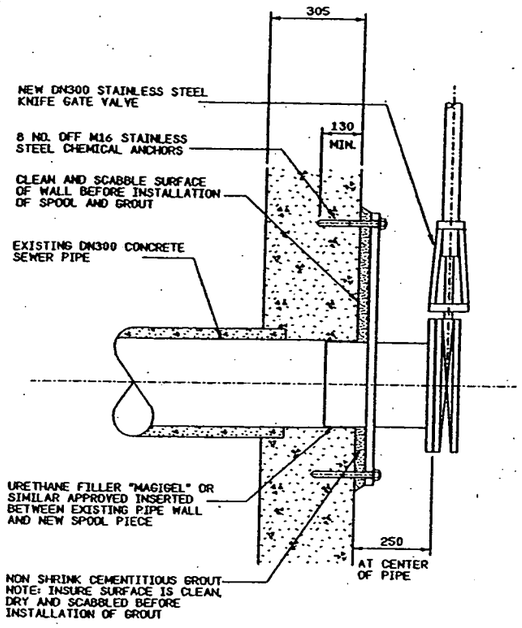
PLAN CUSTODIAN	
OFFICER/RECD	
DATE RELEASED	

LIVE CONNECTION(S) / PASSED(W)	
REFERENCE	
DATE	

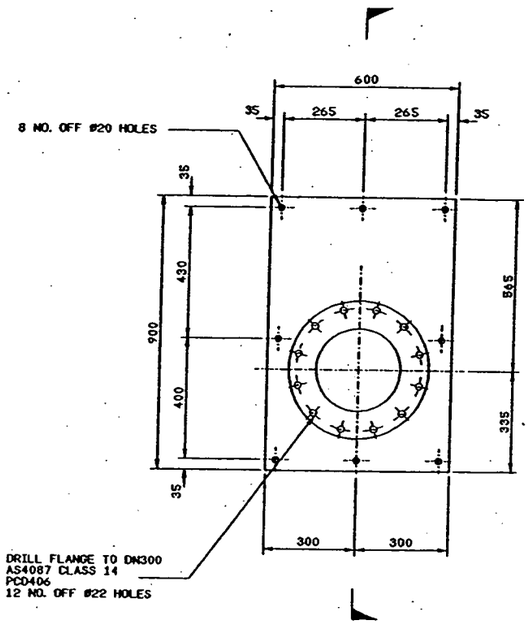
BMAP CAPTURE	
JOB NUMBER	
OFFICER CODE	
DATE	

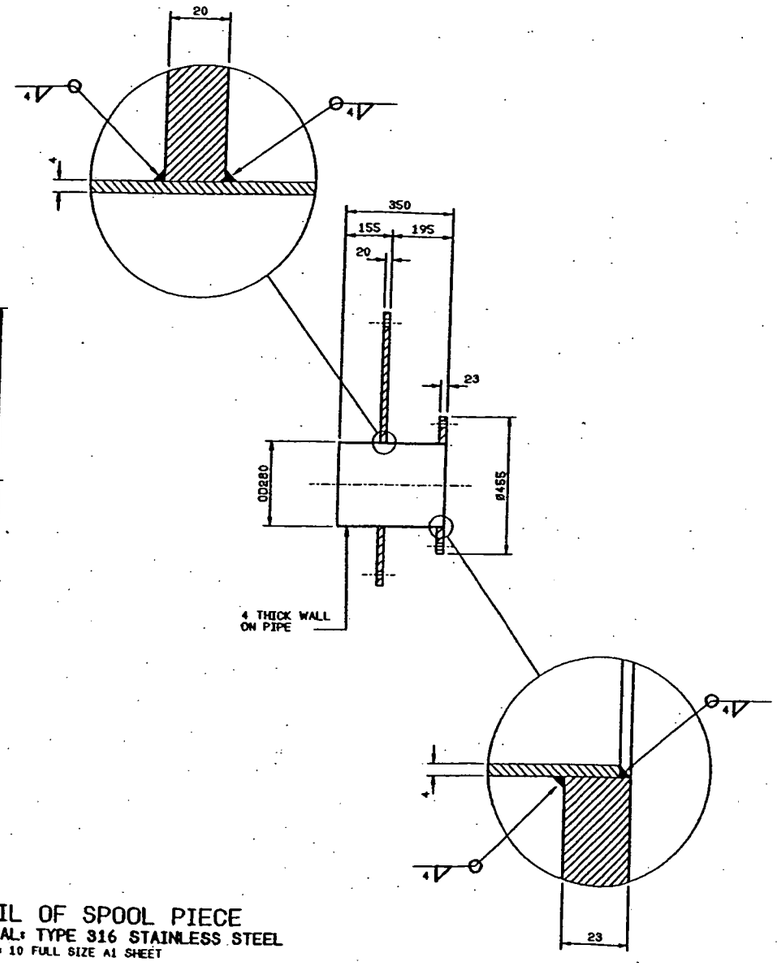
BMAP COMMENTS

SCALE: NOT TO SCALE — A.H. DATUM — Nº 2 OF 4 SHEETS
DRAWING Nº: 3052/9/4 — AMEND. 0



INSTALLATION DETAIL
SCALE 1 : 10 FULL SIZE A1 SHEET





DETAIL OF SPOOL PIECE
MATERIAL: TYPE 316 STAINLESS STEEL
SCALE 1 : 10 FULL SIZE A1 SHEET

100 0 100 200 300 400 500
SCALE OF MILLIMETRES
1 : 10 FULL SIZE A1 SHEET

NO	DATE	AMENDMENT	INITIALS

PRINCIPAL ENGINEER	RPEQ NO. 4250	DATE 29/8/03	
MANAGER ENGINEERING		DATE	
PRODUCTION / NETWORK DELEGATE		29/8/03 DATE	

CADD FILE	305295.DTA		
FILE NO.	70S/S(1900)		
SURVEYED			
SURVEY NO.		FIELD BOOK	

DESIGN	I.G.B.	JULY 2003
DESIGN CHECK		15/08/03
DRAWN	I.G.B.	JULY 2003
DRAFTING CHECK	B.O.B.	AUG. 2003

Brisbane Water

PROJECT
CENTENARY HIGHWAY SP19
(CENTENARY ESTATE)
SEWERAGE PUMPING STATION

TITLE
PUMP STATION UPGRADE
WET WELL
INLET VALVE SPOOL PIECE
INSTALLATION AND DETAILS

DESIGN CHARGE N^
STFM AEMA
CONSTRUCTION PROJECT N^

AS BUILT RECEIVED
BY
ORDER CODE
DATE

ON MAINTENANCE DETAILS
START FINISH

DRS COMMENTS

FUNDING
PRIVATE BOOSTER REQUIRED? YES / NO
FUNDED BY BCC (✓) DEVELOPER ( )
FED. GOV'T ( ) STATE ( ) OTHER ( )
DRS ORDER
DATE RELEASED

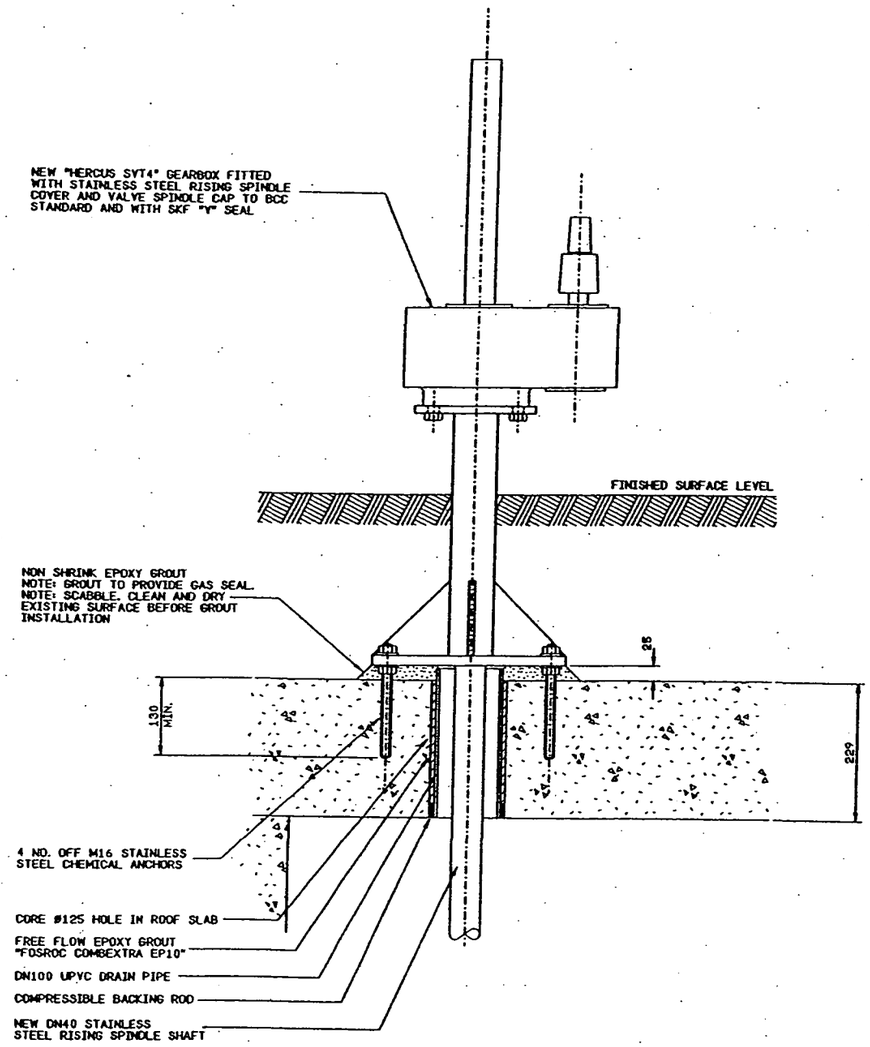
PLAN CUSTODIAN
ORDER/REC'D
DATE RELEASED

LIVE CONNECTION(S) / PASSED(W)
REFERENCE
DATE

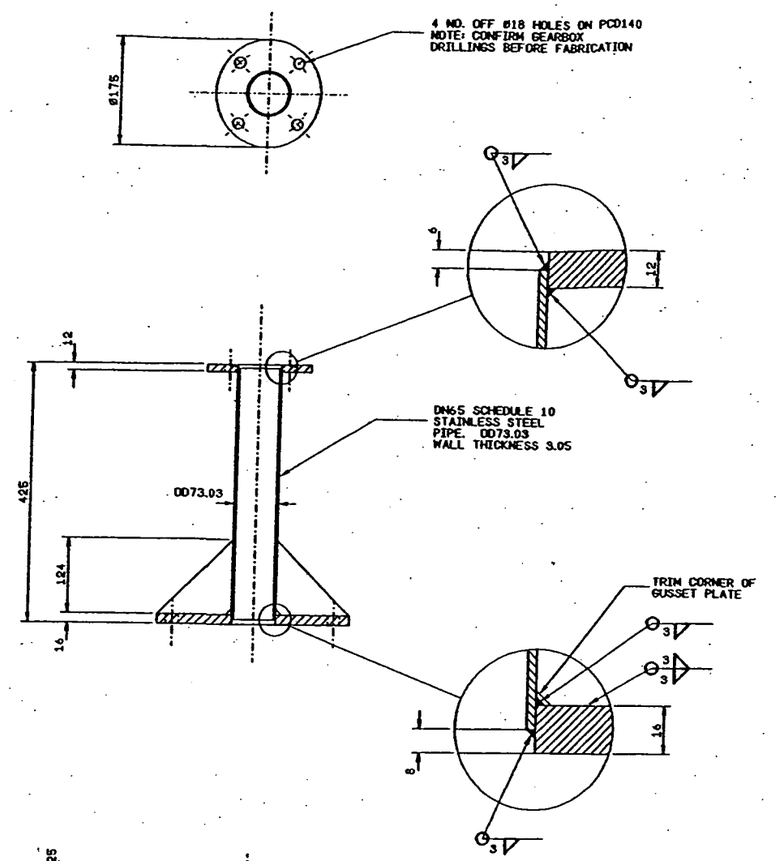
BMAP CAPTURE
JOB NUMBER
ORDER CODE
DATE

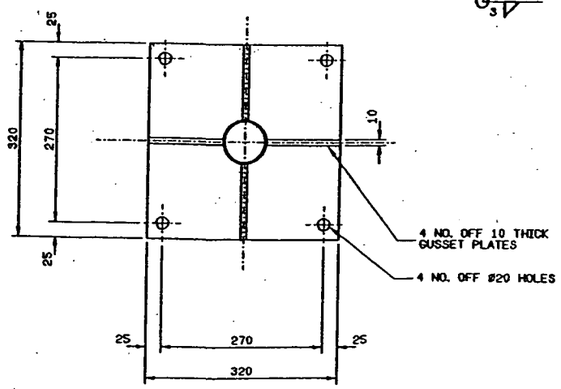
BMAP COMMENTS

SCALE AS SHOWN
A.H. DATUM
N^ 3 OF 4 SHEETS
DRAWING N^ 3052/9/5
AMEND. 0



INSTALLATION DETAIL
SCALE 1 : 5 FULL SIZE A1 SHEET





DETAIL OF GEARBOX PESESTAL
MATERIAL: TYPE 316 STAINLESS STEEL
SCALE 1 : 5 FULL SIZE A1 SHEET

50 0 50 100 150 200 250
SCALE OF MILLIMETRES
1 : 5 FULL SIZE A1 SHEET

DESIGN CHARGE NO
STFW AENA
CONSTRUCTION PROJECT NO

AS BUILT RECEIVED
BY
ORDER CODE
DATE

ON MAINTENANCE DETAILS
START FINISH

D.R.S. COMMENTS

FUNDING
PRIVATE BOOSTER REQUIRED? YES / NO
FUNDED BY BCC (✓) DEVELOPER ( )
FED. GOV'T ( ) STATE ( ) OTHER ( )
DRS OFFICER
DATE RELEASED

PLAN CUSTODIAN
ORDER/RECD
DATE RELEASED

LIVE CONNECTION(S) / PASSED(W)
REFERENCE
DATE

BMAP CAPTURE
JOB NUMBER
ORDER CODE
DATE

BMAP COMMENTS

NO	DATE	AMENDMENT	INITIALS

		RPEQ NO	DATE
PRINCIPAL ENGINEER		4019	8/03
MANAGER ENGINEERING			DATE
PRODUCTION / NETWORK DELEGATE			28/08/03 DATE

CADD FILE	305296.DTA
FILE NO.	70S/S(1900)
SURVEYED	
SURVEY NO.	FIELD BOOK

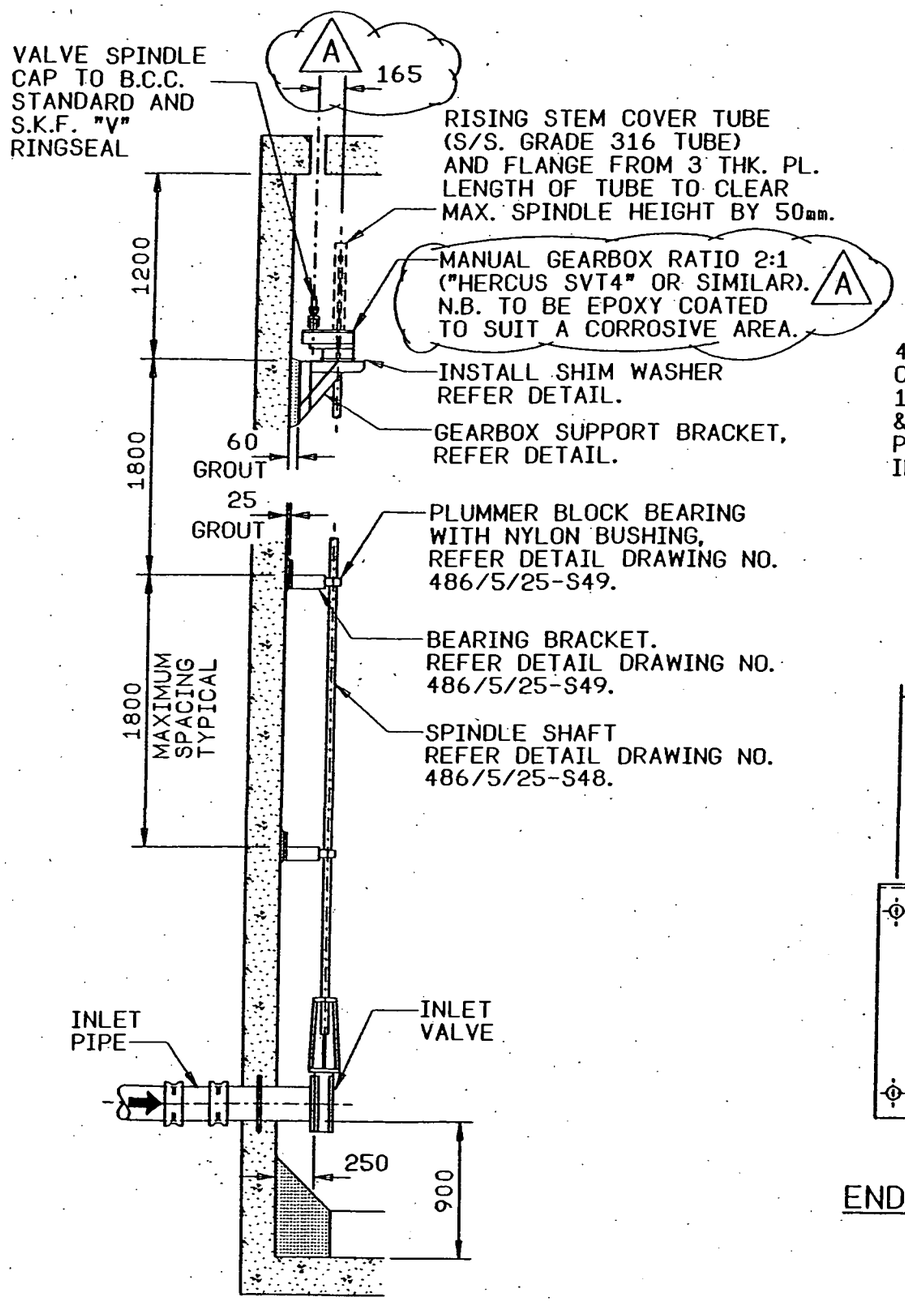
DESIGN	I.G.B.	JULY 2003
DESIGN CHECK		15/08/03
DRAWN	I.G.B.	JULY 2003
DRAFTING CHECK	B.O.B.	AUG. 2003

Brisbane Water

PROJECT
CENTENARY HIGHWAY SP19
(CENTENARY ESTATE)
SEWERAGE PUMPING STATION

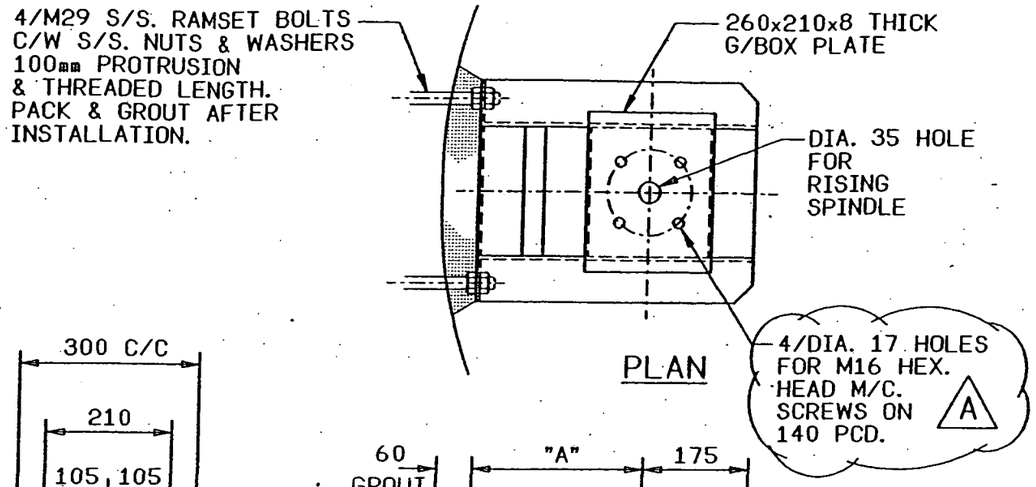
TITLE
PUMP STATION UPGRADE
WET WELL
INLET VALVE GEARBOX PEDESTAL
INSTALLATION AND DETAILS

SCALE AS SHOWN | A.H. DATUM
DRAWING No 3052/9/6 | Nº 4 OF 4 SHEETS | AMEND. 0

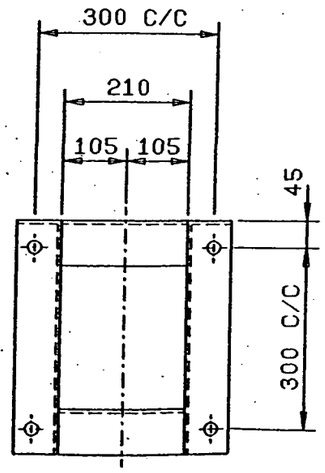


GENERAL ARRANGEMENT

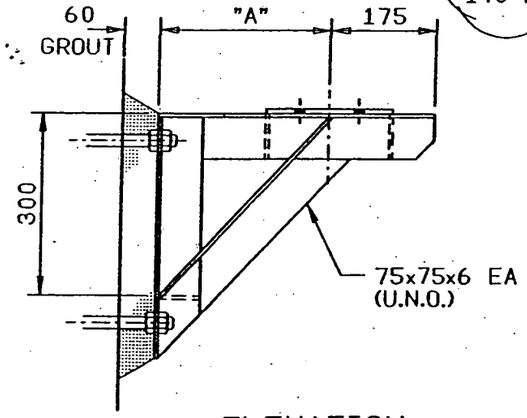
NOTE: GEARBOX DIMENSION SHOWN ARE FOR "HERCUS SVT4" ONLY (A)



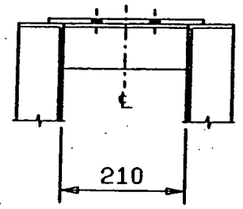
PLAN



END ELEVATION

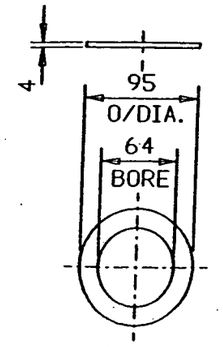


ELEVATION



END ELEVATION

DIA. VALVE	DIMN. "A"
150	219
225	225
300	228



GEARBOX SHIM WASHER

SCALE 1:5

1 NO. OFF REQUIRED.
INSERT BETWEEN GEARBOX & SUPPORT BRACKET/STOOL.

STAINLESS STEEL GRADE 316

GEARBOX SUPPORT BRACKET

1 NO. OFF REQUIRED

STAINLESS STEEL GRADE 316

STANDARD DRG.

NO	DATE	AMEND.	INITIALS
A	6.10.03	GEARBOX DETAILS ALTERED	

ORIGINAL SIGNED
HENRI LAI 25/7/02
PRINCIPAL MECHANICAL ENGINEER DATE

ORIGINAL SIGNED
S. MOBBS 9/8/02
PRINCIPAL CIVIL & STRUCTURAL ENGINEER DATE

N/A
PRINCIPAL ELECTRICAL ENGINEER DATE

APPROVED
ORIGINAL SIGNED
A. KRUMINS 16/8/02
FOR BRISBANE WATER DATE

ORIGINAL SIGNED
B. BALL 19/9/02
FOR URBAN MANAGEMENT DATE

NO 1 OF 3 SHEETS

CADD FILE: O:\STANDARDS\DRAWINGS\BWSTANDARDS\525S47.DTA

Brisbane Water

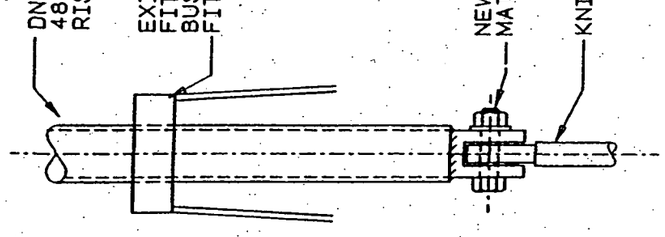
TITLE GRIT COLLECTOR MAINTENANCE HOLE INLET VALVE GENERAL ARRANGEMENT

DRAWING NO. 486/5/25-S47 AMEND. A

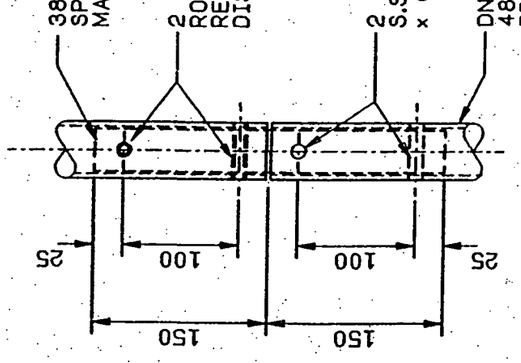
STANDARD DRG.

SPINDLE SHAFT DETAILS

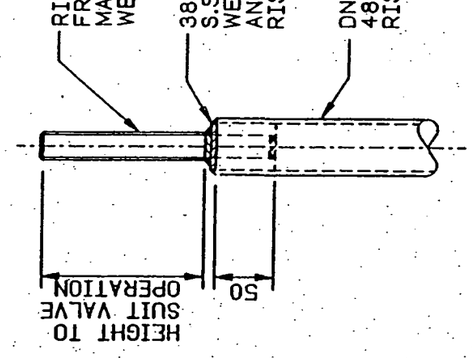
VALVE CONNECTION



SPLICE DETAIL (As Required)



GEARBOX CONNECTION



NO	DATE	AMEND.	INITIALS

PRINCIPAL MECHANICAL ENGINEER — DATE 21/7/02

PRINCIPAL CIVIL & STRUCTURAL ENGINEER — DATE 19/9/02

PRINCIPAL ELECTRICAL ENGINEER N/A — DATE

APPROVED — 16/8/02
FOR BRISBANE WATER — DATE

19/9/02
FOR URBAN MANAGEMENT — DATE

NO 2 OF 3 SHEETS

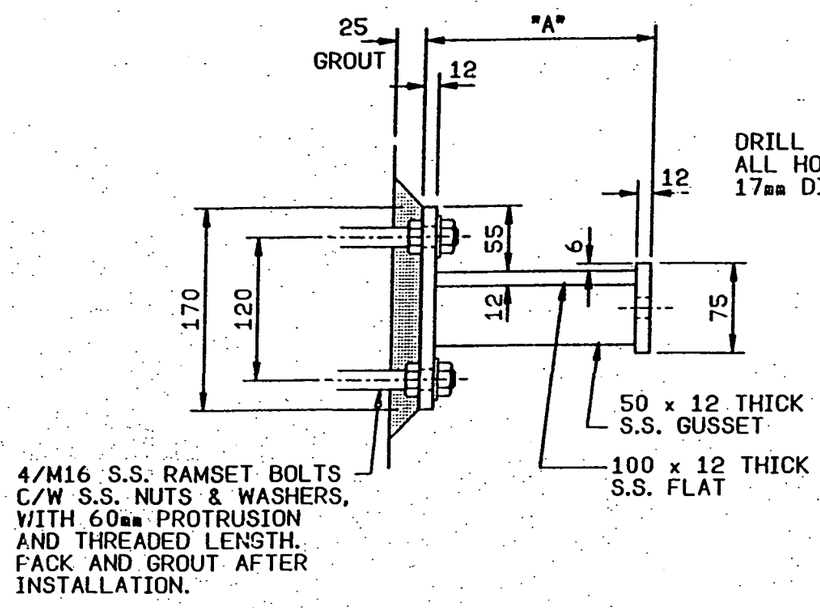
CADD FILE: Q:\STANDARDS\DRAWINGS\BWSTANDARDS\525S48.DTA

Brisbane Water

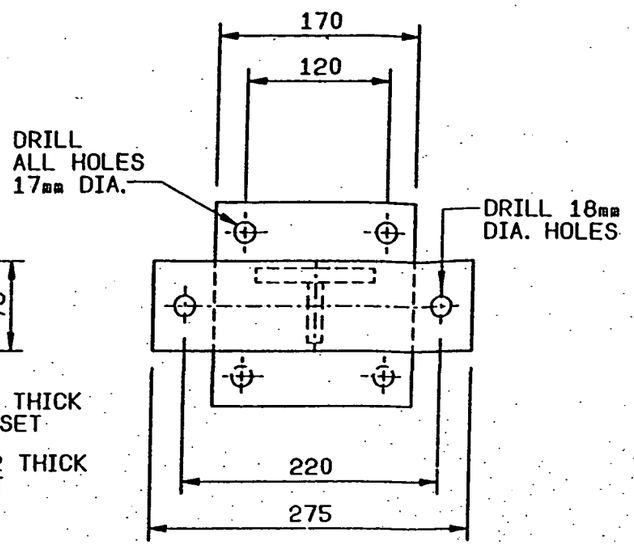
TITLE GRIT COLLECTOR MAINTENANCE HOLE INLET VALVE SPINDLE SHAFT DETAILS

DRAWING NO. 486/5/25-S48 — AMEND. 0

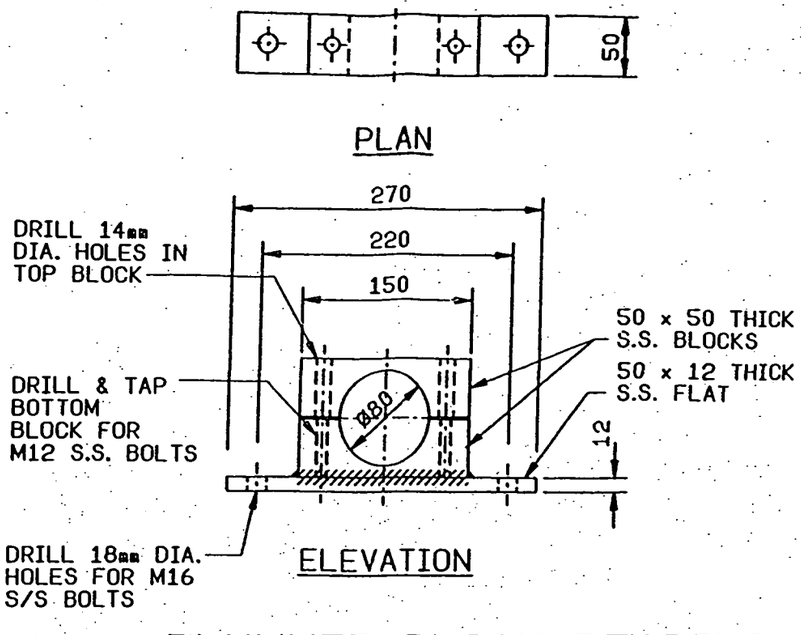
STANDARD DRG.



ELEVATION



END ELEVATION

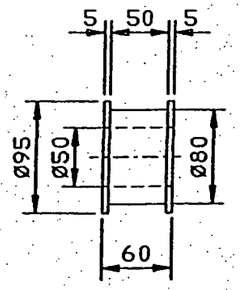


PLUMMER BLOCK BEARING

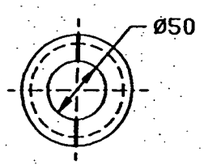
BEARING BRACKET

NO. OFF REQUIRED - DEPENDS ON MH DEPTH
STAINLESS STEEL GRADE 316

DIA. VALVE	DIMN. "A"
150	192
225	198
300	201



SIDE ELEVATION



END ELEVATION

TO SUIT 50mm SHAFT

PLUMMER BLOCK BUSH

N.B.: NYLON BUSHING
MATERIAL TO BE USED.

NO	DATE	AMEND.	INITIALS

PRINCIPAL MECHANICAL ENGINEER — 25/7/02 DATE
PRINCIPAL CIVIL & STRUCTURAL ENGINEER — 9/8/02 DATE
N/A
PRINCIPAL ELECTRICAL ENGINEER — DATE

APPROVED
FOR BRISBANE WATER — 16/8/02 DATE
FOR URBAN MANAGEMENT — 19/9/02 DATE
NO 3 OF 3 SHEETS

BRISBANE CITY
Brisbane Water

CADD FILE: Q:\STANDARDS\DRAWINGS\BWSTANDARDS\525S49.DTA

TITLE GRIT COLLECTOR MAINTENANCE HOLE INLET VALVE BEARING SUPPORT DETAILS

DRAWING NO. 486/5/25-S49 — AMEND. 0