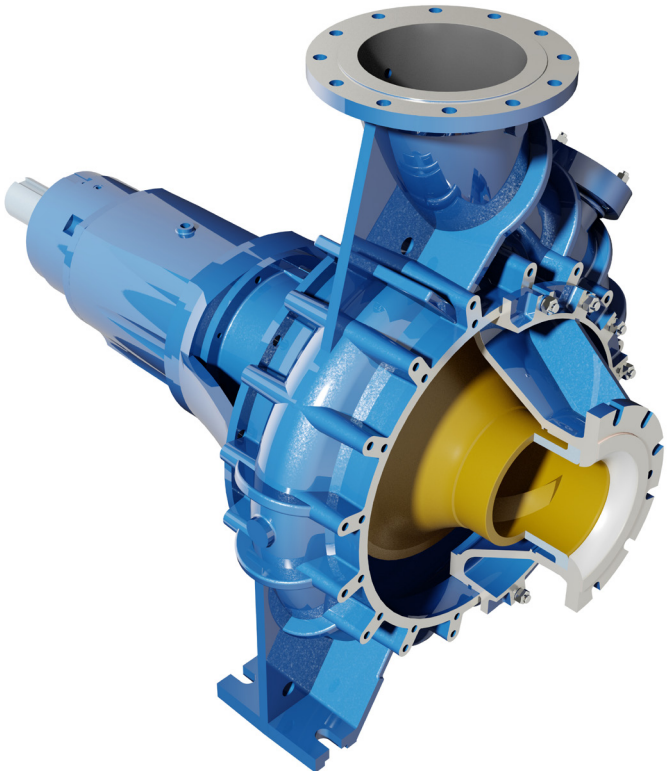
MANUAL DEL USUARIO

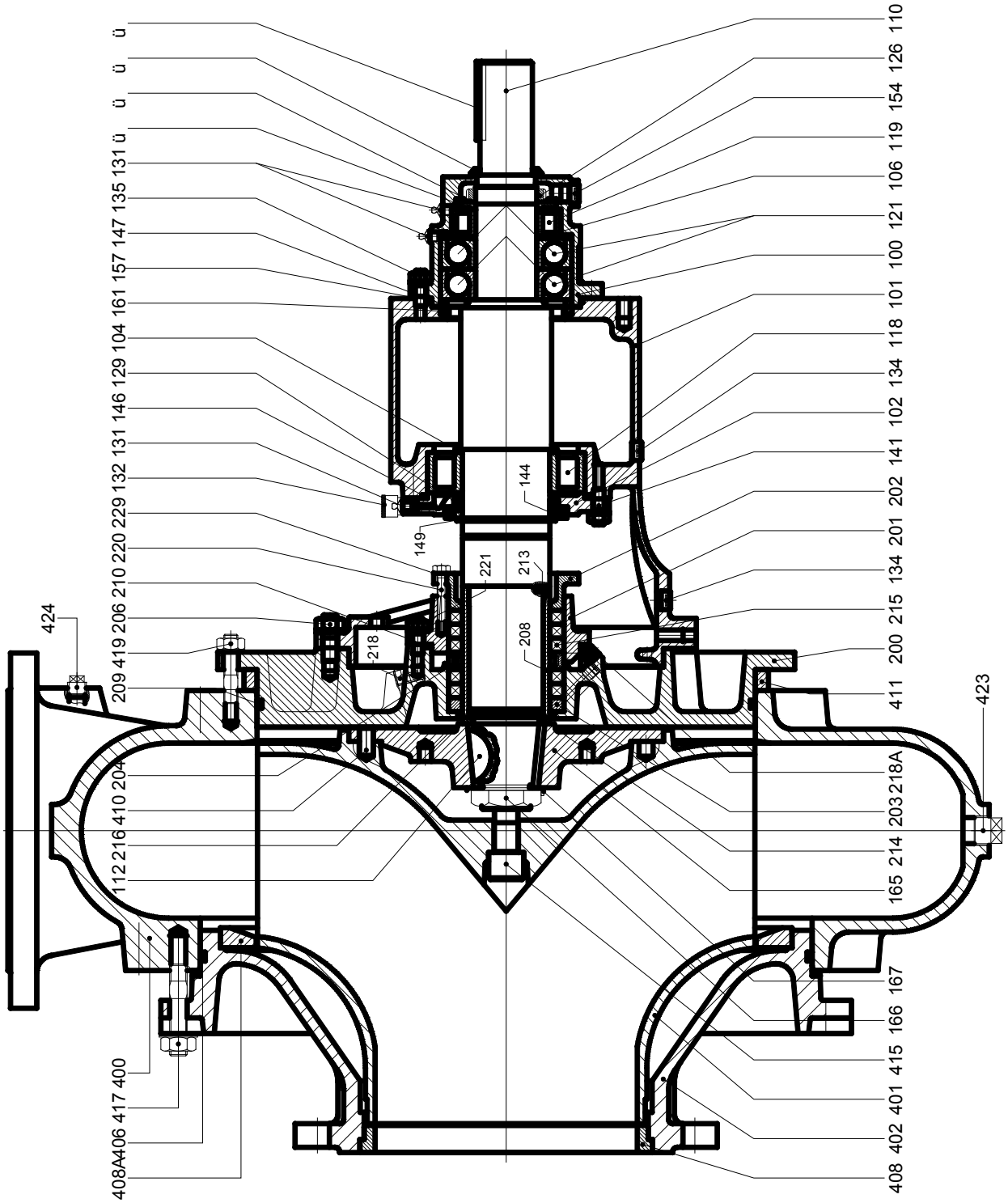
INSTALACIÓN OPERACIÓN Y MANTENIMIENTO



PUMP FOR SOLIDS TYPE F

INDEX

“F” TYPE PUMP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1 GENERAL INFORMATION

Introduction

You have acquired a valuable equipment. Pay attention and be careful with your Hidrostal pump in order to obtain excellent results.

Your pump has been designed and constructed in order to render years of constant service, as long as the user stricly follows these instructions must be fully understood before starting the pump.

Identification Plate

Transcribe the data filled in the pump identification plate to this manual and mention it when you refer to us for any consultation.

Warranty

As you can notice in the instructions we offer a warranty over the pump according to our purchase general conditions. However the warranty stops if the pump is used to pump other liquids, concentrations, temperatures and characteristics that differ from the ones indicated in our order acknowledgment, likewise by failures originated by wrong maintenance, inadequate use, non appropriate service, deficient emplacement or incorrect installation

1.1 Description

1.1.1 Casing (Part 400)

Vertical split volute casing with axial suction; radial discharge and back pull out design, which allows a fast bearing frame and impeller service without dismantling any pipe fastened to the casing. If the pump coupling used is a flexible extended type or cardan type. The motor can also stand fixed to the base. The casing has been hydrostatically tested.

1.1.2 Impeller (Part 401)

Closed type impeller, its hydraulic design provides a gentle handing of the solids in suspension avoiding rough changes in direction and acceleration. The impeller is firmly mounted on the impeller flange fastened to the pump shaft by a central bolt. This design allows a quick mounting and dismantling of the impeller even in pumps with many years of running.

1.1.3 Wear Rings (Part 408)

The wear ring has been designed to be easily replaced, allowing to maintain the original efficiency with a low maintenance cost.

1.1.4 Shaft (Part 110)

Carbon steel shaft C-1045 or stainless steel mounted on grease lubricated bearings. Replaceable stainless steel shaft sleeve to avoid any damage due to the stuffing box packing friction.

1.1.5 Bearing Frame

Widely sized bearing frame, back pull out design allows the pump to be dismantled without the removal of any pipe fastened to the casing. The grease lubricated bearing frame has been designed for a 50,000 hour of operation rate, when the pump runs on its best efficiency point.

1.1.6 Stuffing Box

Splitted stuffing box type, which allows an easy access to the stuffing box packing for its replacement. The external connection (3) is to perform the shaft sealing in the stuffing box. Normally the equipment is provided by free asbestos packing.

1.2 Installation

The pump installation should allow the direct connectation of the suction and discharge pipe with their accessories (valves and fittings) properly supported. The connection should be in an independed way to avoid the transmission of any strength and tension to the pump. Pipe tensions generally cause misalignments, vibrations, coupling breaking and wheels damage. The pipe flanges before being adjusted with the bolts.

Project the pipe so that a minimum of curves, elbows and accessories would be used. Install the pipe the nearest possible to the water supply or the liquid being held. Remember that if the length of the pipe increases, the loss of capacity of the pump by friction increases as well, thus the cost of the equipment operation.

Leave enough space in the installation to allow an easy access for the inspection job, dismantling and maintenance of the pump and the auxiliary equipment. If the pumps are placed in pits, they must be protected against floods.

1.2.1 Foundation

It is great importance to mount the pumps on solid foundations, preferently on concrete bases. It is normally satisfactory to build a concrete base using a 1-3-5 mix (cement, sand, and gravel) with a thickness according to the basement characteristic The foundation anchor bolts should be fixed to the concrete as showed in (Fig. 1).
The diameter of the pipe placed around the anchor foundation bolt should exceed two or three times this last, allowing the anchor foundation bolt to be freely removed to its final position.

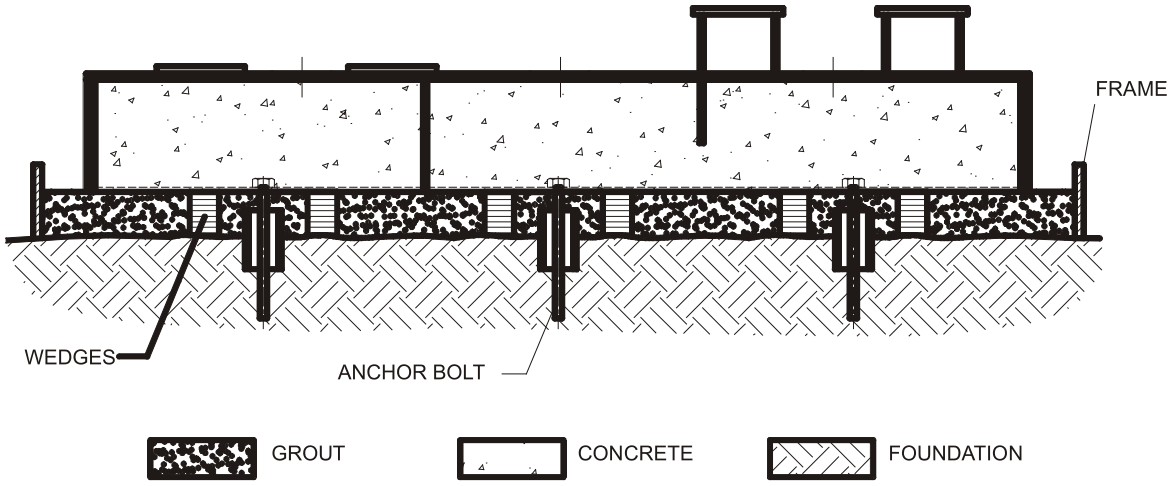

Fig. 1

1.2.2 Alignment

The pumping units is correctly aligned in the factory, however the experience has demonstrated that flexing and bending could happen during transportation in spite of the tough construction of the bases, in consequence an alignment re-check is needed after the complete pump installation.

1.2.3 Leveling

When the unit is received with the pump and the motor placed on their common base, this unit should be mounted on its foundation base. The couplings should be disconnected, leaving a 3/4" and 1.1/2" space between the top face of the foundation block and the bottom face of the pump base, interlocking it with a thin wedge in order to count with a convenient space.

The flexible couplings should not be used to compensate the pump and motor shaft misalignment. The flexible coupling allows only absorbing the misalignment produced by temperature changes.

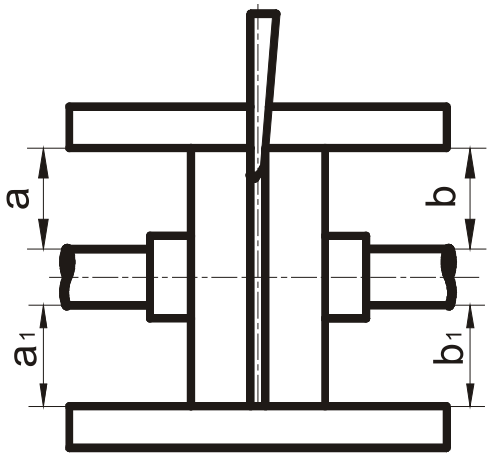

Fig. 1

1.2.4 Alignment

1.2.4.1 Flexible Disk Coupling (Fig. 2)

In order to align the shafts, the two halves of the coupling should have the distance recommended by its manufacturer. The distance must be: $a=a_1$ and $b=b_1$, it can be verified through a gage and a rule. The axial distance has to be the same in the whole coupling circumference; this distance can be measured by introducing a gage between the two halves of the coupling. (in different parts of the circumference).
The coupling alignment is considered correct whenever being measured in four positions with 90º rotation each time, a play no major of 0.05 mm. does not appear, in axial or radial direction.

1.2.4.2 Cardan Joint (Fig. 3)

If the pump uses a cardan joint, the motor and pump shafts have to be parallel. The angel between cardan shaft and pump shaft, and the angle between cardan shaft and motor shaft must be equal, a difference major of 1º between this angles is not allowed. It the difference exceeds 1º a decrease of the universal joint life happens.
If for any reason the cardan joint is dismantled, make sure to mount it with the ribbed shaft on its original position.

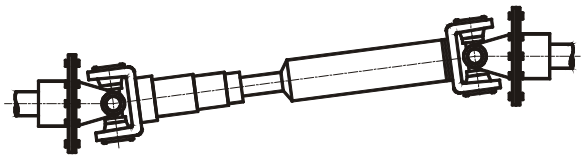

Fig. 1.3

1.2.4.3 Belt Transmission

If the pump uses a belt transmission or a chain transmission, V-belts should not be over-tensiond. The tension over the V-belts must be enough to avoid the slipping between belts and pulleys. Make sure that the belts are similar in length, tolerance and dynamically measured during its confection. Each belt will take belts comply with these conditions.

Note: It is very important to remember that the alignment in one direction could vary the alignments already performed in other directions, therefore an accurate final inspection is needed.

If the pumps or motors heat due to the operation conditions, alignment has to be done in these normal thermal conditions, so that contraction and expansion due to temperature changes are compensated. Do not forget that a wrong alignment produces vibrations, shafts bending and excessive bearing wear.

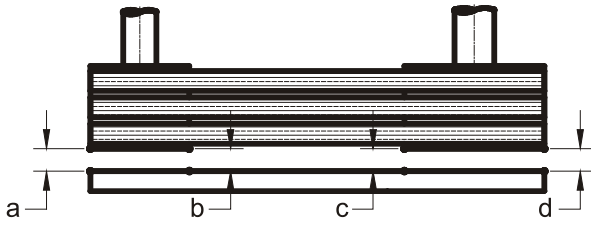

Fig. 1.4

1.2.5 Foundation Finishing (Fig. 4)

When alignment is completed foundation bolts have to be handadjusted and the base grouted (mix of one part of cement for two parts of sand), in order to get a strong pump base support. (See Fig. 1).
The grouting has to be done with a support under the pump base and over the wet foundation until the surface support is completely covered.
The metallic base interior cavities must be filled with concrete avoiding air bubbles. Once thefoundation base is ready, the foundation bolts must be tightened.

Note: The equipment last depends in great deal on a correct alignment and grouting. We do not assume any warranty if these recommendations are not followed.

1.2.6 Suction (Fig. 5)

The suction pipe must be direct and short, sized according to the pump flow. The suction pipe size is greater or equal than the suction pump size.
The flow velocity in the suction pipe must not exceed 2 Mts./sec. Avoid to place any portion of the suction pipe over the pump suction centerline, because an air pocket could appear in this area

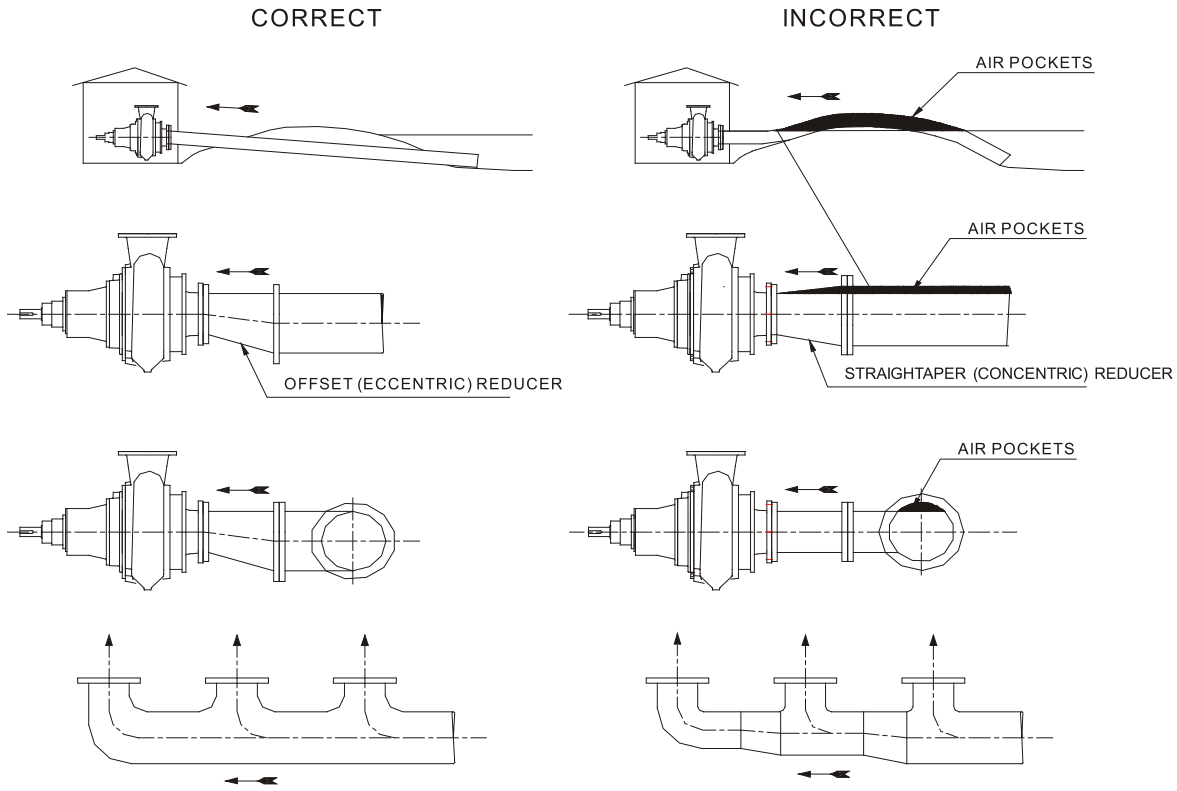

Fig. 1.5

and an erratic pump function could be generated by this condition.

If a reduction is needed to assemble the suction pipe to the pump suction, eccentrical reduction is required.

If the suction is negative a foot value must be installed in the suction entrance. The foot valve must be placed under the fluid lowest level to avoid any air bubbled inlet and at a convenient distance from reservoir bottom to avoid sludge or sand inlet.

If a foot valve installation is not possible due to (pump size or short space), other system like injectors or vacuum pumps could be used for pump priming. For more specific information, contact Hidrostal engineering department or your Hidrostal local distributor.

If the pump suction is positive it is convenient to install a gate valve in the suction pipe in order to allow an easier inspection job and maintenance.

If the installation contemplates the use of multiple pumps using the same source (reservoir), each pump should have its own suction pipe.

If this is not possible, the common suction pipe must be calculated to obtain low flow velocity.

1.2.7 Discharge

Discharge pipe must include a gate valve, which allows the operation and the pump control. If the installation has a long discharge pipe or a high major than 15 Mts. it is necessary to install a quick closing check valve to avoid the water hammer in the pump.
For lower highs a standard check valve could be used. If it is possible, elbows must be avoided and replaced by long radius curves. The discharge pipe must be sized according to the pump flow

rate, avoiding any flow velocity over 3 Mts./sec. The pump discharge size must not be a conditional for pipe discharge sizing. Remember to prevent the connection for pump priming.

Sometimes it is convenient to install an expansion joint to avoid the transmission of any discharge pipe stress over the pump. (Due to thermal expansion, piping misalignment or due to any other reason).

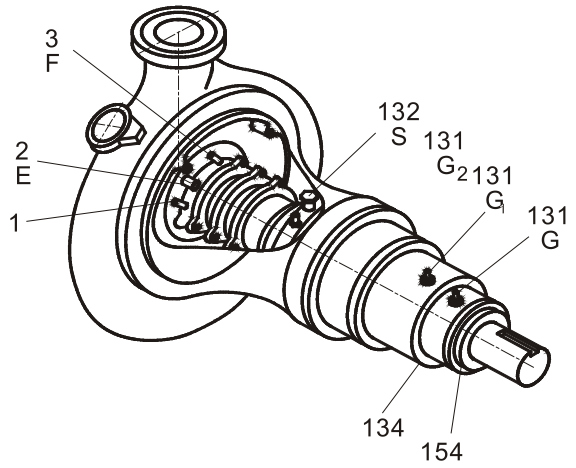

Fig. 6

1.2.8 Sealing System (Fig. 6)

Hidrostal pumps have a special connection to perform a shaft liquid sealing in the stuffing box.

If the pumped fluid is clean and contains no abrasive particles, the connection can be performed from the pump discharge.
If the fluid contains abrasive particles another source of clean fluid must be slightly higher than the pump discharge pressure. In this case, you should take in account that a portion of this fluid enters the pump and the balance evacuates through part (101).

1.2.9 Service Connection (Fig. 7)

Hidrostal pumps are supplied with the possibility of various service connections. These connections should be applied according to the pump service.

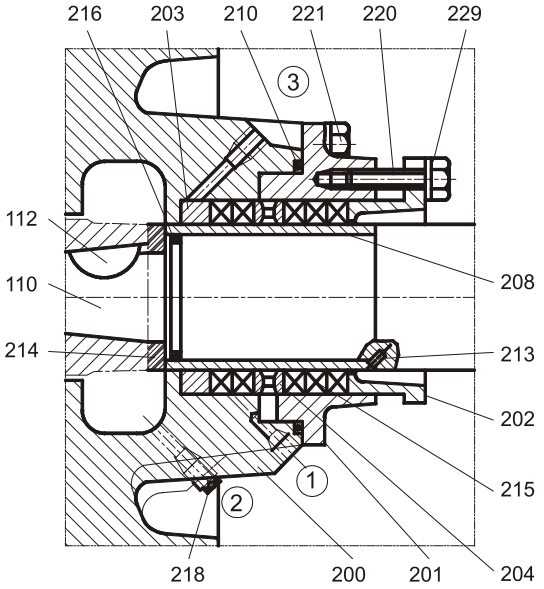

Fig. 7

Service Connection Nº. 1
This connection is used to introduce sealing water to the lantern ring (204). The water introduced to this zone, seals, cools and lubricates the stuffing box zone. This connection should be used if the

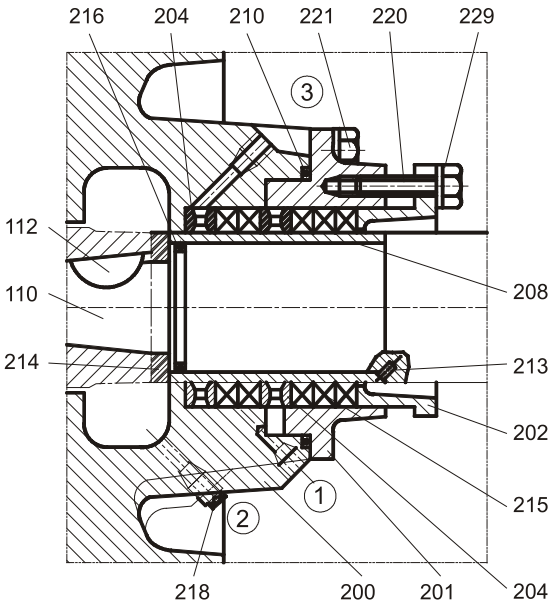

Fig. 8

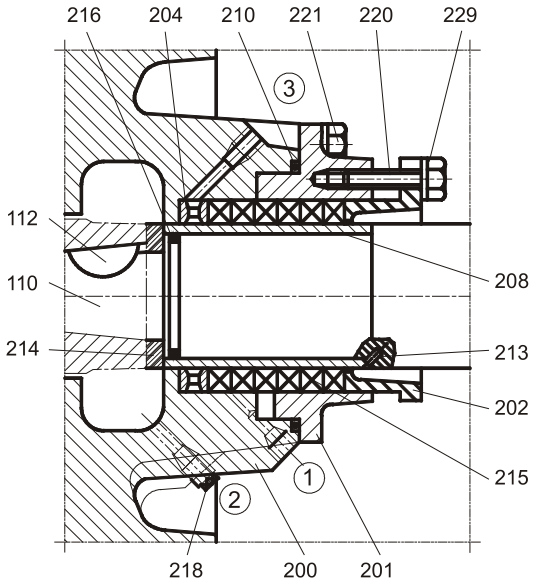

Fig. 9

fluid to be pumped is sewage water or water with solids in suspension (Fig. 7).

If the fluid to be pumped contains small quantities of solids, this connection could be relaced by a grease cup in order to introduce grease once in a while to keep the stuffing box packing lubricated. Use yellow grease ALVANIA Nº. 3 (Shell), MOBILLUX M-2 (Mobiloil) or its equivalent.

Service Connection Nº 2 (E)
Used to introduce water inside the chamber formed by the back part of the impeller (401) and the back cover (200), in order to Clean solids accumulations in this area.
Normally solids accumulatios occur when the liquid to be pumped contains high solids concentrations with dehydration tendency. This service connection uses a solenoid valve with a timer to inject the water during 60 seconds from time to time. This water injection must be done as frequent as needed.
In vertical pumps this connection could be used to evacuate the air accumulated in this area, especially when the fluid to be pumped has a tendence to gasify.

Service Connection Nº 3 (F)
This is not a standard conection. It is used when abrasive liquids or liquids with a crystallize tendency are pumped. This connection can be done replacing the last packing ring (205) by another lantern ring (204) Fig. 8.
Sometimes the lantern ring position change is enough, depending on the pumped fluid characteristic (204) Fig. 9.
The water introduced to this connection goes directly to the shaft sleeve surface (208), near the impeller, avoiding the inlet of abrasive materials and lubricating the stuffing box.

1.2.10 Instrumentation
To verify the functioning and the pump running conditions, a vacuumpressure gage in the suction and a pressure gage in the discharge should be connected.
The pressure gages have to be mounted in a convenient place for easy checking. A shut off device must be placed before the pressure gauge. If the pump is driven by an electrical motor, voltmeter, ampmeter and protection elements must be placed in the switchboard.

1.2.11 Final verification
When the pipe installation is finished, check the alignment one more time; proceed according to the ruler and gage method above mentioned.
After the stuffing box adjusting and alignment checking, the pump shaft should be hand rotated (free and soft rotation).

1.3 Starting

1.3.1 Priming
Priming shoul be done before starting the pump, the suction pipes and the casing will be filled with liquid. Remember that a prolonged functioning of the pump without liquid, produces serious damage to the shaft or stuffing box.

1.3.1.1 Positive Suction Pumps
Close the discharge valve and open the suction valve so that the liquid fills the pump. Open the drain valve or drain plug located on the top of the pump and release air until the pump is completely filled with the liquid and air free. Finally close the drain valve or screw the drain plug (424).

1.3.1.2 Negative Suction Pumps

Close the discharge valve, open the priming connection and fill the pump casing completely (drain plug) (424). Once the pump is primed, wait 5 minutes observing the liquid level inside the pump, the level should not vary. If the level tends to diminish, proceed with the foot valve revision and repair it if necessary.

1.3.2 Rotation

The pump should rotate in the direction indicated by the arrow in the casing. The rotation is in clockwise direction, observing the pump from the driver side.

1.3.3 Stuffing Box

In the pumps supplied with stuffing box, the packing material has been selected to a determinate application. Prior to the pump starting, verify the packing conditions, removing the stuffing box gland (202) (Figs. 7, 8 and 9). If the pump is not going to be used within the first 60 days after its dispatch, a packing inspection is needed. If the period of disuse is longer, the packing should be checked and replaced when its lubricant properties are lost or dryness occurs. In all cases it is important to remember to inspect the packings before pump starting.
Dryness in packings is the main cause of excessive leakage and eventually the cause of shaft sleeve damages (208). An extra torque is needed in the packing bolts in order to avoid an excessive **leakage**.
Once the packings conditions have been verified, start the pump as indicated in (1.3.4.) and adjust the stuffing box as follows:

1. Make sure that the bolts in the stuffing box gland are hand adjusted. In the first 10 min. of operation, plenty filtration should appear.
2. Adjust carefully the stuffing box gland bolts (202) half turn every 10 min. until the spurt turns into a constant dropping, approximately 20 drops/min.
3. The stuffing box condition should be periodically verified during the first week of operation and be adjusted up to 20 drops/min.

1.3.4 Starting

Open the admission and discharge valves. Check if the pump rotates hand free. Start the electrical motor and check the current with an ammeter in order to avoid any overcharge.

In the case that the pressure does not increase after pump start, it is a sign that air remains in the suction. In such case, stop the pump immediately and prime the pump again.
The pump operation without water is harmful and could damage the pump in a short time.

1.3.5 Stopping

If the installation has a water hammer prevention valve or if its T.D.H. is no major than 15 Mts., the detention of the motor is enough. In installations where the T.D.H. is major than the indicated, proceed with the partial closing of the discharge valve, before the pump stopping. This is necessary to avoid the reverse rotation of the pump.

In automatic installations, if the detention is produced by electrical energy failures, a new manual starting is needed.

1.3.6 Initial and Periodical Checking

1. The pump starting should be soft and vibrations free.
2. Check the bearings temperature. Normally the temperature must be constant (maximun 70º). If the temperature starts to rise, check the bearings immediately.
3. Check the stuffing box for leaking according to point 2 of 1.3.3 and for any overheating sign.
4. When an external source for sealing refrigeration is needed, check that the difference between refrigeration water temperature of the outlet side and the inlet side is no major than 10ºC.
5. Avoid any pump or motor overcharge.
6. When the pump works with negative suction, check that the NPSH available in the installation is major than the NPSH required by the pump. The reservoir must be always full and free of materials that could cause pump obstruction.
7. The T.D.H. specified in the quotation must not differ the installation T.D.H. In that case pump failure could occur.
8. When a stand-by pump is available, it is convenient to use it in an alternate way.

1.3.7 Service Characteristic

The Hidrostal pump has been designed to operate with a determinate speed, T.D.H. and flow,

according to the given information. If the T.D.H. is different than the one indicated in he order, a motor overcharging could occur. It is necessary to fix this condition in order to obtain a good equipment operation. Due to its special design the solids handling Hidrostal pumps cannot be throttled to reduce the motor charge as standard centrifugal pumps. To reduce the motor overcharge a new impeller must be placed in the pump according to the new hydraulic conditions. In any case consult our engineering department or your nearest Hidrostal local distributor.

1.3.8 NPSH (Net Positive Suction Head)

If the pump does not comply with the specified flow rate, a variation in the NPSH available could be attributed to this condition. Each pump has its own NPSH requirement curve as showed in the characteristics pump curves. If the NPSH available is less than the NPSH required by the pump, the pump is cavitating. Pump cavitation generates noises, vibrations, motor overcharge and flow rate decrease).

The liquid temperature and the altitude of the installation also affect the NPSH available. (Remember that the atmosphere pressure varies with the altitude). An accurate calculation of NPSH available must be done when these conditions appear. If the liquid to be pumped has a tendence to gasify a positve suction pump is required.

1.3.9 Corrosion and abrasion

When the fluid to be pumped has abrasive or corrosive properties a correct pump material selection must be done. In this way costly pump failures could be avoided. If the fluid to be pumped is corrosive or abrasive you must contact our engineering department or your Hidrostal local distributor.

1.4 Periodical Maintenance

1.4.1 Lubrication

The bearings must be regularly lubricated. Use good quality lithium soap grease, water resistant and appropriate for service temperatures between -25ºC and 110ºC.

Apply only the necessary amount of grease (0.025 kg. per bearing). Excessive grease application could cause bearing overheating and failures. Use multi-purpose grease Shell Alvania EP-2, Mobiloil Multiplex 48 or equivalents.

The bearings temperature measured in the bearing frame external side should not exceed 70ºC.

Procedure

Before lubricating, establish the discharge of grease amount of your gun grease per each shooting as follows:

1. Weight the grease amount obtained after 10 shootings.
2. Calculate the weight in grams per each shooting and mark this data on your gun grease.

Proceed to lubricate as follows:

a) Remove 134 and 154 plugs and start the pump for at least 10 minutes in order to evacuate the old remaining grease from the equipment by bearing heating. (Fig. 1.7)

b) Set back 134 and 154 plugs.

c) Clean up the lubricating points (G, G1 and G2).

Note: Bearing frame E2S does not have lubricating point G.

d) The necessary grease amount in grams must be injected in each lubricating point as indicated in the table 1.4.1.2.

1.4.2 Labyrinth seal

The pumps sealed with stuffing box have a labyrinth seal in order to avoid water inlet to the bearings. This seal must be lubricated by a grease cup (132), using the same bearing grease according to the stuffing box conditions. The grease cup must be adjusted until the grease appears through the labyrinth seal. (Fig. 6).

1.4.3 Sealing shaft system

It is necessary to check periodically that the stuffing box dropping rate is in between 20 to 30 drops/min., allowing lubrication and refrigeration of the stuffing box packing.

When the stuffing box gland (202) is being adjusted in order to regulate the dropping rate; make sure to do a half turn per time bolts adjustment.

The stuffing box packing must be replaced, when due to packing wear, the gland reaches the maximun adjustment.
Verify periodically that the liquid sealing connection complies with the descriptions in chapter 1.2.8.

The pumps are supplied with the rings quantities described in the table 2.

1.1.4 Stuffing Box Packing Replace (Fig.10)

1. Loose and take away the stuffing box gland bolts (220) and slip it towards the support.
2. Take away the stuffing box (201) bolts (221) adjusted to the back cover (200) and slip is towards the bearing frame. take away the packing ring (215) from the stuffing box.
3. Slip the lantern rings (204) along the shaft towards the support and take away the packing rings (215) placed inside the back cover (200).
4. Clean up and lubricate with waterproof grease the stuffing box cavities. Use yellow grease ALVANIA Nº. 3, MOBIL-LUX Nº. 2 or its equivalent.
5. Cut the packing rings according to the shaft diameters (rolling the packing around a cylinder with the same diameter than the pump shaft). Avoid overtensioning the packings (around the pump shaft) because leakage among free spaces could occur, due to cut failures (Fig. 11).

   It is convenient to effectuate the cut in 45º degrees way so that the packings will overlap.
6. Place the packing rings (215) inside the stuffing

Table 2: Packing Rings Quantity

Bearing frame model	Ring Qty.	Ring Thickness Inch. mm.	Ring Length mm.
D	5	5/16 8.0	150
E	5	3/8 10.0	188
F	5	1/2 12.2	292
H	5	5/8 16.0	365
I	5	5/8 16.0	427
L	5	5/8 16.0	477

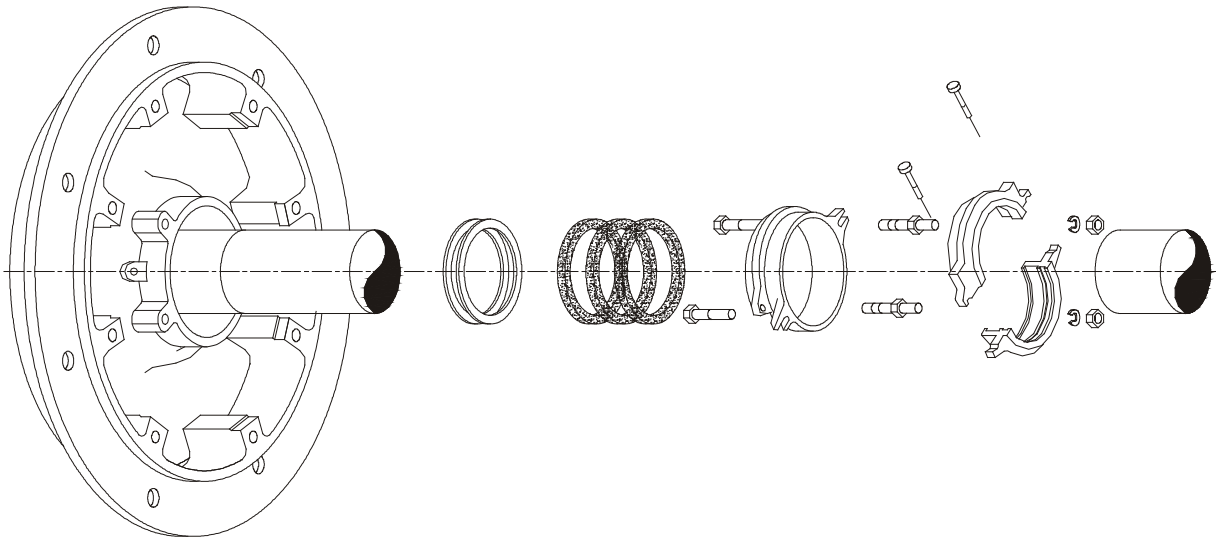

Fig. 1.10

box cavity in the back cover (200).

Use the latern ring (204) to push and introduce the packing rings (215).

Place the packing rings 90º rotated (from the cut). Install only the quantity of packing rings needed in order to place the latern ring exactly in the water inlet drill hole (Nº. 1) (Fig. 7).

7. Place again the stuffing box (201) and fix it with the stuffing box bolts (221). Do not forget to verify the packing (210) condition and location.
8. Place the missing rings (215) inside the stuffling box cavity pushing it with the stuffing box gland (202). The packing ring ends (215) must be placed at 90º from the other one. A special care should be taken in order to avoid the last packing ring to overhang from the stuffing box, allowing in this way the correct placing of the stuffing box gland (202).

   The lock nut should be tightened by hand.
9. Before pump starting, proceed as 1.3.3.

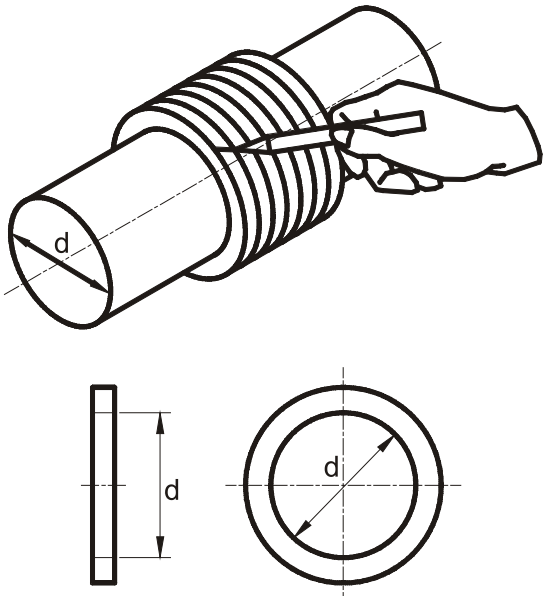

Fig. 11

1.4.5 Impeller Clearance Adjustment

Check the clearence C between impeller and suction casing must be 0.4-0.7 mm (see fig. 12)

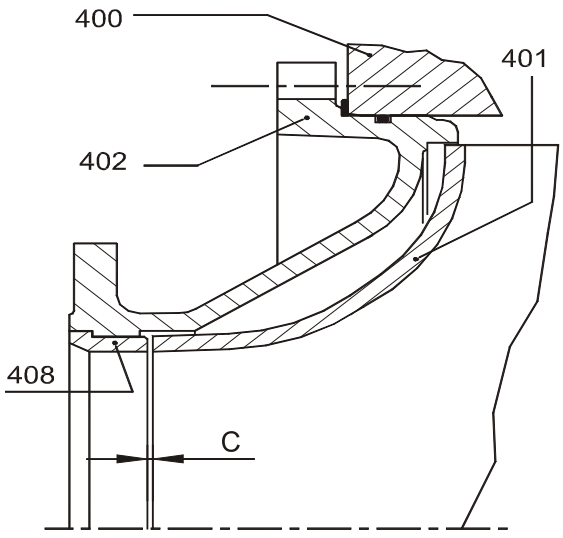

Fig. 12

1.5 Recycling and end of product life:

At the end of the working life of the equipment or its parts, the materials must be recycled whenever possible. If it is not, it should be eliminated in an environmentally acceptable way and in accordance with applicable local regulations. If the equipment contains harmful substances to the environment, they should be discarded in accordance with the regulations of each country. It is important to ensure that harmful substances or toxic fluids are safely disposed of and your staff wears suitable protective equipment.

Table 1: Grease quantity according to bearing frames requirement

Bearing Frame	R.P.M	Lubrication Cycle (hours)	Lubricating Point "G"	Lubricating Point "G1"	Lubricating Point "G2"
D2S	1800	3400	-	25	10
E2S	1500 1800	2800 2300	-	25	15
F2S	1100 1800	1300 650	40	40	40
H1S	1000 1200	5000 3500	23	23	31
H2S	1200 1800	3500 1600	40	40	42
H4S	890 1800	530 380	95	95	42
I1S	890 1000	5000 4000	43	43	43
I2S	890 1200	5000 4000	95	95	63
I4S	890 1200	1440 770	40	40	30
L2S	800 900	1200 1070	73	95	85

1.4.6 Failure Causes

Failures	Failure Causes (Refer to the explanation below)
Pump does not deliver water	1-2-3-4-6-7-9-10-15-16-33
Low flow	1-2-3-4-6-7-10-13-15-16-21-22-32-35
Low Pressure	3-7-9-10-13-15-16-21-22-35
Pump priming loose after starting the pump.	1-3-4-5-6-35
Excessive pump power requirements.	8-9-10-11-12-13-16-17-18-19-20-21-24-25-27
Excessive stuffing box dropping.	17-18-23-24-25-26
Excessive packing ring wear.	17-18-23-24-25-26-27
Excessive pump vibrations or noises.	1-2-6-10-14-16-17-18-19-20 22-26-28-29-31-34-35
Pump clogging.	10-16-17-19-20-26
Bearing overheating (>70º)	10-17-18-24-26-27-28-30
Solids damage.	3-5-8-10-12-16-21-22-34-35

Explanation

1. Incorrect pump or suction pipe priming.
2. NPSH available minor than NPSH required.
3. Excessive amount of gas or air dissolved in the liquid.
4. Air pocket in suction pipe.
5. Suction pipe air filtration.
6. Pump suction inlet does not have enought submergence.
7. Low pump velocity.
8. High pump velocity.
9. Wrong pump shaft rotation.
10. System TDH major than pump TDH design.
11. System TDH minor than pump TDH design.
12. Pumped fluid densify differs from design fluid density.
13. Pumped fluid viscosity differs from design fluid viscosity.
14. Low flow pump operation.
15. Incorrect pumps engagement not designed to operate in parallel.
16. Impeller clogging by strange bodies presence.
17. Pump and motor misalignment.
18. Bended shaft.
19. Rotating part in contact with stationary part.
20. Clogged pump, sand, etc.
21. Wear rings excessive clearance.
22. Damaged impeller.
23. Shaft sleeve (208) wear in packing rings area.
24. Packing rings or mechanical seal incorrectly mounted.
25. Incorrect packing for operation conditions.
26. Misaligned pump shaft due to bearing wear.
27. Stuffing box gland bolts overtightened.
28. Poor lubrication.
29. Loose anchor of foundation bolts.
30. Wrong lubrication.
31. Unbalanced impeller.
32. Small sized impeller.
33. Pump has not been primed.
34. High solids concentration in relation with pump velocity.
35. Cavitation (fluid with gas or air in pump suction).

Be aware that the failure causes above mentioned do not necessarily correspond to the real failure reasons. Therefore we recommend checking the equipment by a pump equipment service expert.

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www.hidrostal.com.pe
HIDROSTAL S.A.
• LIMA Sede central, Portada del Sol 722 - Lima 36, ventas@hidrostal.com.pe
• LIMA Tienda, Paseo de la República 2500 - Lima 14, fax: 441-8560, lince@hidrostal.com.pe
• PIURA Zona industrial Mz 229 Lote 1E, Telf : (73) 331-031, piura@hidrostal com pe
• AREQUIPA Avenida Parra 306 - Cercado, Telf.: (54) 214-090, arequipa@hidrostal.com.pe