Centrifugal Pumps ETA - L

Works Serial No.

Preface

KSB machines are high quality products which will always give satisfactory service provided they are properly installed and maintained.

They will, however, only give trouble-free service if the recommendations and instructions contained in this manual are carefully observed. This booklet should therefore be available to every person intrusted with the erection, maintenance and operation of ETA pumps. We shall be glad to supply further copies on request.

If you require any expert advice please let us know. We shall be glad to oblige. This also applies to any repairs that may become necessary.

If the instructions contained in this manual are carefully observed you are covered by our guarantee in accordance with our conditions of supply.

This guarantee will become void, however,

- if the pump is used to handle media other than those specified in our confirmation of order or at temperatures other than those stated therein.

- if damage is caused to the pump as a result of improper handling, operation outside the operating range specified, improper erection, wrong or unworkmanlike laying of piping etc.

During the guarantee period the pump or individual parts of it must not be dismantled without our previous consent in writing.

Contents

2. Description

2.1 Pump

The general design of the pumps is shown in the sectional drawings at the end of this booklet.

For pumps up to size 100-33 as well as for sizes 125-20 and 125-26 the pump casing is overhung and flange-mounted on the bearing bracket. All other sizes of this type of pump are additionally supported by two heavy feet, and where the pump shaft passes through the stuffing box it is provided with a shaft protecting sleeve.

Some of the pumps are two-stage.

For liquids having temperatures in the range 220 to 285 °F (105 to 140 °C), – ductile iron pumps up to 320 °F (160 °C) the stuffing box is provided with a cooling-water jacket.

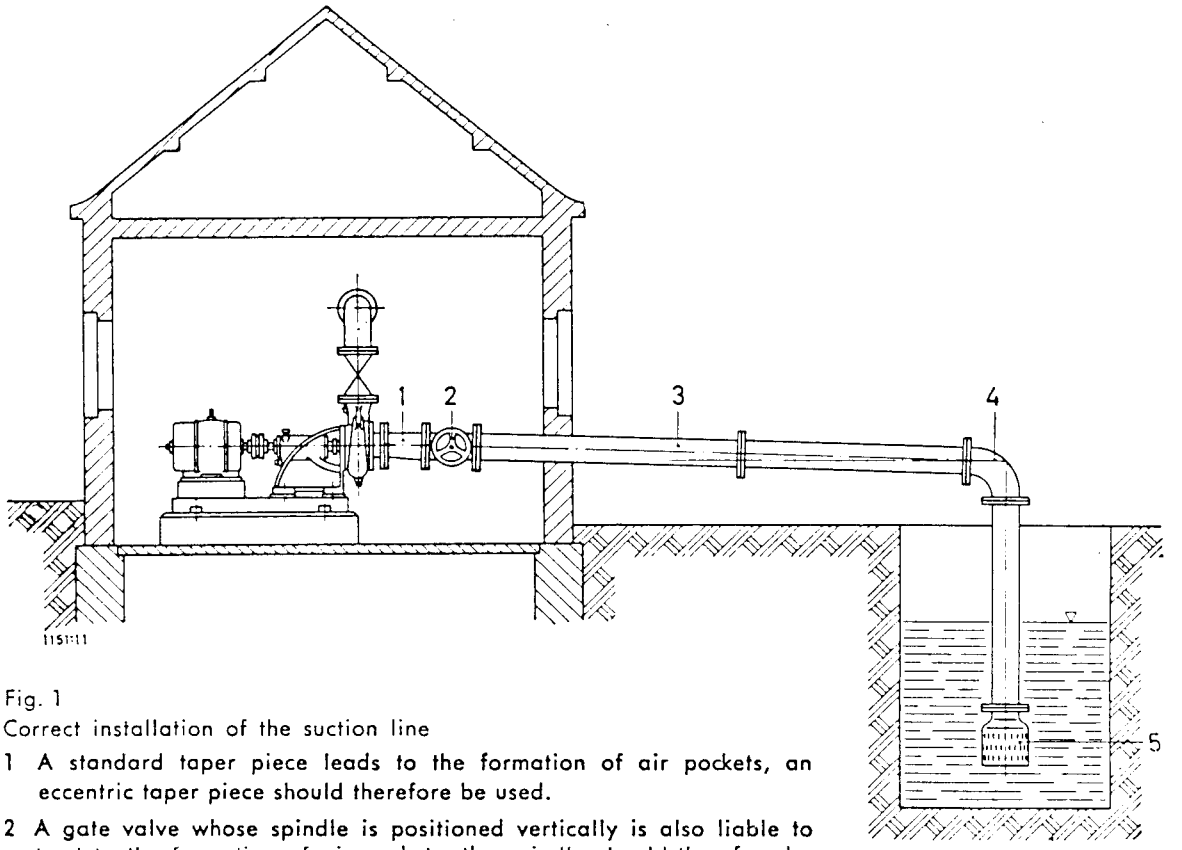


Fig. 1
Correct installation of the suction line

1 A standard taper piece leads to the formation of air pockets, an eccentric taper piece should therefore be used.

2 A gate valve whose spindle is positioned vertically is also liable to lead to the formation of air pockets, the spindle should therefore be positioned horizontally. The gate valve in the suction line must be wide open during operation.

3 The suction line must always rise towards the pump.

4 Pipe bends should be used where necessary, the use of elbows should be avoided.

5 The suction strainer should be installed at an adequate depth to prevent air entering the system even if the water level is low.

2.2 Piping

2.21 Suction and inlet piping

Reliable operation of the pump depends largely on the correct installation of the suction line. It is essential that this be **absolutely leakproof** and installed in such a way as to prevent the formation of air pockets. The suction line should therefore **always rise towards the pump.**

Suction branches and suction lines of different nominal bores should be connected by means of eccentric taper piece if the suction line is horizontal (fig. 1, item 1).

It is also essential to ensure that the suction opening (foot valve) is mounted in a position sufficiently below the lowest water level to prevent air from being sucked into the system. However, the suction opening should not be installed so close to the floor of the well as to cause agitation of the mud or sand which would lead to premature wear or clogging of the pump.

The nominal bore of the suction flange of the pump does not provide any criterion for the bore to be selected for the suction line. The flow velocity in the suction line should preferably be limited to 6 ft (2 m)/sec. Each pump should be provided with its own suction pipe. If this cannot be done for some special reason, the suction line should be dimensioned for a relatively low flow velocity; in this case the nominal bore of the common line should be maintained as far as the suction branch of the last pump (fig. 2a and 2b).

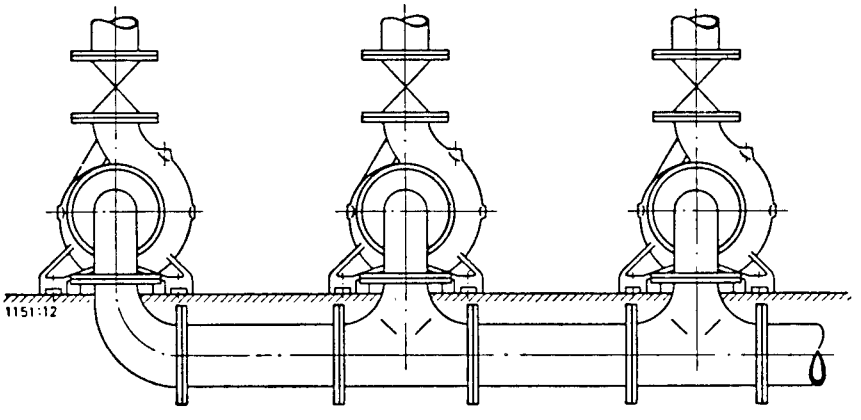


Fig. 2a correct

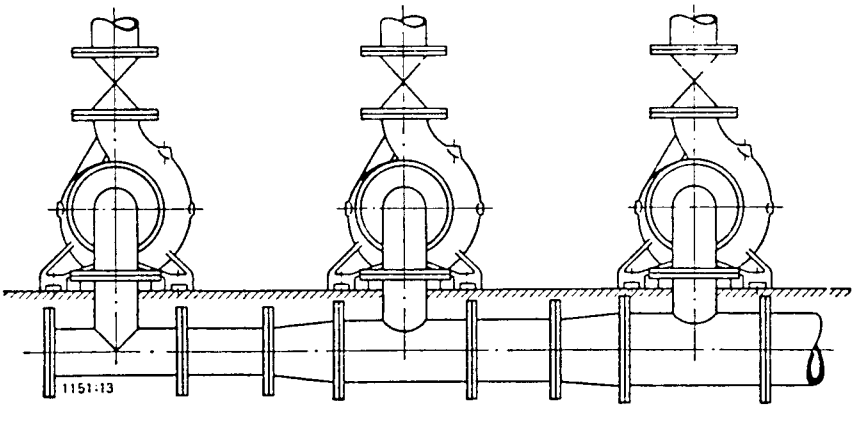


Fig. 2b incorrect
Connection of several pumps to a common suction line

The use of abrupt bends and sudden changes of cross-section and direction should always be avoided. Care should also be taken to ensure that gaskets between flanges do not project into the bore of the pipe.

Suction lines not equipped with priming pumps are generally closed by means of foot valves; these are usually provided with strainers to prevent foreign matter from entering the pump.

Buried suction lines should always be tested at a pressure of 40 to 60 PSIG (3–4 kp/cm³) before being covered. The **spindles of gate valves** in the suction line should be positioned either **horizontally or vertically downwards** to prevent the formation of air pockets. The use of water-sealed gate valves is strongly recommended.

If the pump operates with positive suction head (flooded suction) the suction line should be slightly inclined towards the pump to prevent the formation of air pockets. In other respects the principles outlined above for suction-lift lines also apply to lines from an overhead source of supply (flooded-suction operation).

The positive-suction line should be provided with a gate valve to facilitate inspection of the pump.

Stop valves in the suction-lift or positive-suction line are only intended to enable the line to be isolated when necessary for an inspection etc. Such valves must therefore be fully opened in operation.

2.22 Delivery

The bore of the delivery branch of the pump does not determine the size of the bore of the delivery line. The flow velocity in the delivery line should not exceed 10 ft (3 m)/sec. The use of elbows and T-pieces should also be avoided in the delivery line as far as possible. It is advisable to use a non-return valve if the delivery head exceeds 50 ft (15 m), or if a long delivery line is used. Non-return valves prevent large masses of water from falling back and damaging the pump and foot valve in the event of sudden stoppage of the pump. A gate valve may be inserted into the delivery line to control the discharge or to protect the power unit against overloads.

2.23 Vacuum compensating line

If the liquid entering the pump is under a vacuum (as is usually the case with condensates pumped from a closed vessel) a vacuum compensating line (fig. 3) must be provided to enable air or gas entrained in the liquid to be eliminated.

The line should be as close to the impeller as possible, and be taken to the top of the container. If the pump does not permit a direct connection, the compensating line is connected to the inlet pipe, as close to the pump as possible. Compensating lines are of a 1" to 2" size depending on the flow expected.

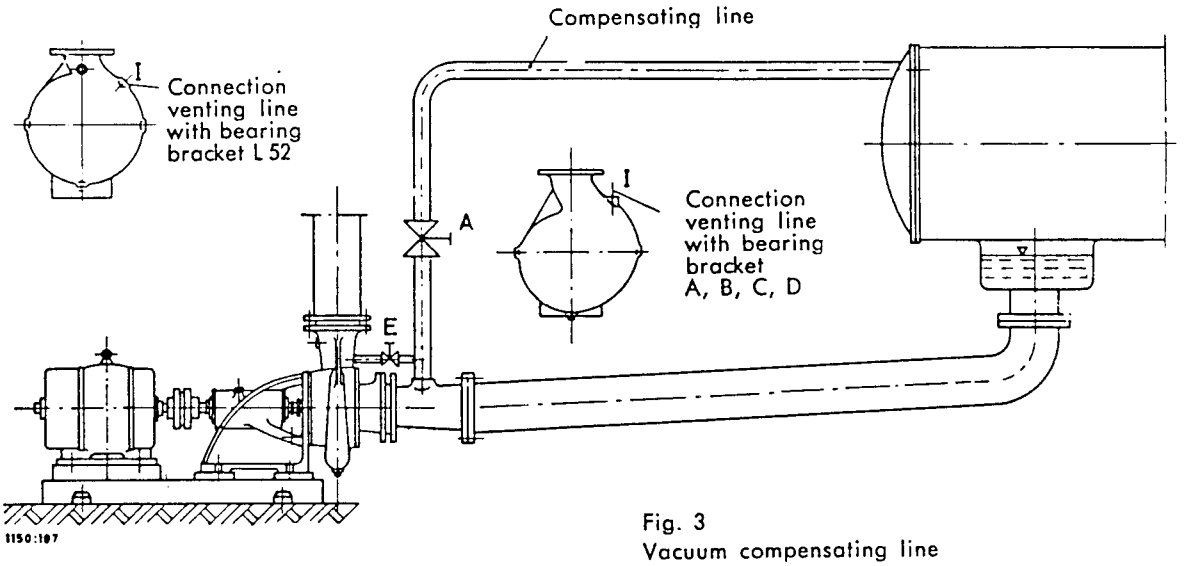


Fig. 3
Vacuum compensating line

A crossover from the highest point of the pump casing to the compensating line (cams available) will permit the pump to be vented prior to a startup. Valve E in this crossover line must be vacuum tight and closed again before the main run. Valve A in the vacuum compensating line is always open when the pump is in operation; it is closed when the pump is stopped.

3. Installation

3.1 Pump

If the motor and bedplate are supplied with the pump, the set leaves the works already mounted, with the motor dowelled in position.

The greatest care must be taken preparing the foundation, and mounting the set. Incorrect installation will result in premature wear of components, and breakdown of the pump. Concrete foundation beds should be allowed to set and dry thoroughly before the complete set is placed in position. The bedplate should be aligned with the aid of a spirit level and, if necessary, it should be packed with shims.

After alining, when it is a steel-welded construction the bedplate should be grouted in with a quick-setting cement mixture (1 : 2). Care should be taken to ensure that **no hollow spaces are left.** Base plates of cast iron need not being grouted in. The bedplate should not be finally bolted down on the bed until the cement is thoroughly set. **No undue force should be used when connecting the pipelines to the pump branches, and the pump must not be stressed.** On conclusion of this work **the coupling must be carefully** checked and the unit aligned accordingly (see 3.2). **Checking and alignment are also necessary when pump and motor are mounted on a common base plate since common base plates of normal construction material are never so rigidly fabricated that they cannot be distorted during transport or setting up on an uneven foundation.** The motor can then be pinned but this is not absolutely necessary. On coupling. **Bad direction very quickly makes itself evident in the form of operating troubles and premature wear on the internal components of the pump.** If the power unit is not provided by us its installation is proceeded as prescribed before.

The same degree of care must be exercised if the pump is driven by a belt*). The drive shaft and the pump shaft must be positioned accurately parallel to each other so that the belt does not run askew, and slip off the pulley. The belt tension should not be too slack, nor should it be too tight. Excessive belt tension is liable to overload the pump shaft and bearings, while a slack belt reduces the output of the pump. Only high-grade belts should be used; they should be fully stretched, thin, flexible and correctly jointed by cement. Other methods of connecting the ends of the belt, such as metal belt connectors, etc., result in poor running characteristics and lead to premature wear.

The transmission ratio should be as small as possible and should not exceed 1 : 6. Jockey pulleys must be used for transmission ratios of up to 1:20. The transmission ratio must not exceed 1 :10 if V-belts are used.

After the installation work is completed, the pump shaft should be checked for easy running by rotating the fast pulley. If necessary the holding-down bolt nuts should be alternately loosened and tightened until the desired easy-running characteristics are obtained. This test should be repeated after the pipelines are bolted in position, to make sure that the bearings do not bind on the shaft.

In order to minimize noise, and to avoid transmitting vibration and noise to the entire pipeline system, it may be necessary to place the foundation bed on anti-vibration mountings and to insert compensating joints between the pipelines and the suction and delivery branches of the pump.

*) Admissible only for pumps with bearing bracket AR and BR

3.2 Flexible coupling

In direct drives the pump and the power unit are connected by means of a flexible coupling (fig. 4).

It is essential that the pump shaft and the motor drive shaft be carefully aligned in relation to each other, since errors of alignment lead to destruction of the flexible transmitting elements of the coupling and subsequently to defects in the pump itself. The assembly is correctly aligned if a straight-edge placed across both halves of the coupling parallel to the shaft is equidistant from all points of the shaft.

The spacing between the periphery of each half of the coupling must be uniform. This should be checked by means of a feeler gauge (fig. 5). If desired we can supply on loan a special alignment gauge which facilitates accurate and rapid adjustment of the coupling (fig. 6).

If rubber cushions or rubber disks show signs of wear they should be renewed immediately.

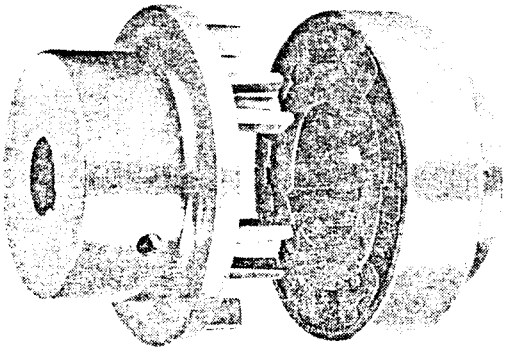


Fig. 4
Elastic coupling

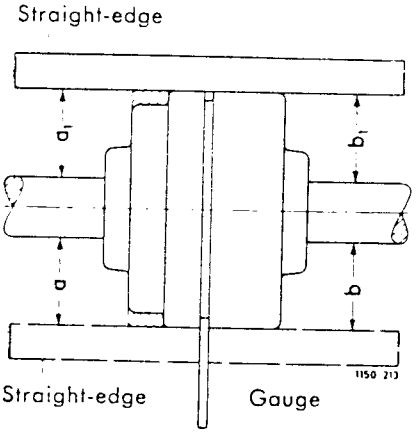


Fig. 5
Alignment of the coupling by means of a gauge and straight-edge

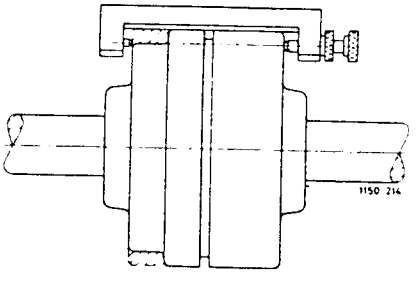


Fig. 6
Special alignment gauge

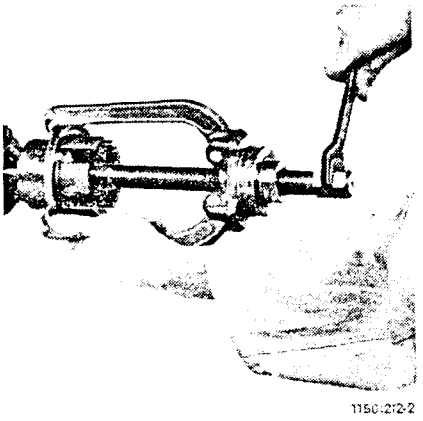


Fig. 7 Removing the coupling

To remove the coupling, the power unit or the pump must be removed from the bed plate. The coupling is removed most conveniently by means of one of the usual types of coupling drawer (fig. 7). The coupling must not be hammered off the shaft, since this will damage the bearings of the pump.

The elastic parts of the coupling must not be allowed to come into contact with oil or grease, as this will impair the rubber parts.

To check the direction of rotation of the motor the coupling must be disengaged.

3.3 Stuffing-box

The pumps are normally sent with the stuffing-box packed. In exceptional cases, dispatch with unpacked stuffing-box takes place and in this eventuality one stuffing-box packing is delivered with the pump. The stuffing-box design corresponds with the particular operating conditions prevailing (see section 8).

3.31 Packing the stuffing-box

The stuffing box can only function correctly if it is **carefully packed and properly maintained.** Before the packing rings are placed into position, the space in the stuffing box, the shaft and the shaft protecting sleeve should be thoroughly cleaned. The packing rings should be cut at an angle; this can be done most conveniently with the aid of the simple jig shown in fig.8b.The ends of the packing ring should just touch when the ring is placed around the shaft.

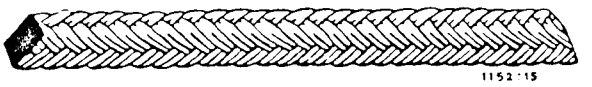


Fig. 8a

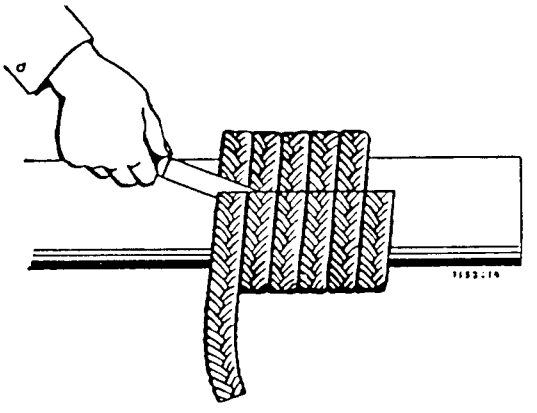


Fig. 8b

The packing rings should be well saturated with oil before being inserted in the stuffing box.

Each ring is pushed into the stuffing-box with the aid of the gland. The butts of each packing ring should be offset by 90 ° in relation to the adjoining packing ring (fig. 9). The position of the lantern ring in the stuffing-box is marked by a plate on the housing (see stuffing boxes, page 27), and the packing rings and lantern ring must be inserted in the order indicated in these instructions. Pumps not provided with a lantern ring do not carry a position-indicating plate. A space of at least 1/4 in. (5 mm) should be left as a lead for the gland, so that it cannot be located askew. The nuts of the gland should be lightly and uniformly tightened.

Pumps designed for operation with mechanical seals are supplied with the seal already mounted in position.

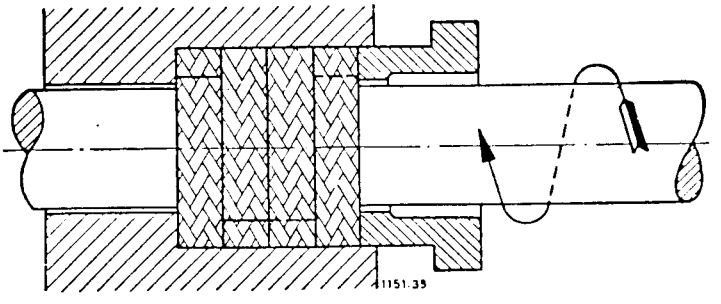


Fig. 9 Packing rings, showing the offset position of the joints

In general, the stuffing-box is connected with the delivery side of the pump by means of a small passage. If the pump operates with a small delivery head and a large suction lift, it may be possible that the sealing water pressure applied to the packing is inadequate to prevent the entry of air. If the delivery pressure is less than 7 PSIG (0.5 kp/cm²), it may then be necessary to feed an external supply of sealing water into the stuffing-box.

This can be effected by connecting a supply of fresh water to the screw plug 556 resp. 556a (see sectional drawings). The normal sealing water bore must be plugged by means of a threaded pin. This also applies if the pump is used to discharge water containing sand. To prevent rapid wear of the shaft or the shaft-protecting sleeve, the stuffing box must be supplied with clean sealing water whose pressure must be at least 7 PSI higher than the inlet pressure, the minimum pressure being at least 7 PSIG = 0.5 kp/cm². The pipelines should be connected to the points marked by the appropriate indicator plates. In pumps designed for hot-water operation, the cooling water inlet and outlet connections are also marked by appropriate plates.

3.4 Lubrication

The pump shaft runs in two oil-lubricated ball-bearings.

The bearing and the bearing bracket should be flushed with petrol or benzene while slowly rotating the shaft. After cleaning and complete removal of the cleaning agent, the bearing bracket should be filled with oil. Maximum and minimum oil level are indicated by marks on the dipstick. An overflow boring located on the stuffing-box side of the bearing cover prevents over-filling.

Only **high-grade branded** oils conforming to the following specifications should be used:

	Viscosity at 120° F = 50° C		Specific gravity (20° C)	Flash point minimum		Pour point below		Neutralization number	Ash content %	Bitumen content
	Centistokes	°Engler	max.	°F	°C	°F	°C	max.	max.	%
up to 1500 rev/min	30 – 45	4 – 6	0.9	380	195	40	+ 5	0.3	0.05	0
over 1500 rev/min	20 – 40	3 – 5	0.9	380	195	40	+ 5	0.3	0.05	0
at low ambient temperatures	15 – 30	2.5 – 4	0.9	380	195	40	+ 5	0.3	0.05	0

The above table shows that SAE 20 oils are suitable.
The required quantity of oil can be obtained from the table on page 26.

4. Operating instructions

4.1 Starting the pump

Before the pump is started for the first time, ensure that the stuffing-box is packed and that the bearing bracket is filled with oil. Should this not be the case, the instructions given in section 3.3 or 3.4 should be carried out.

The stuffing-box should be checked to ensure that it is lightly and uniformly tightened. **Excessive or uneven tightening causes the shaft to run hot, eventually leading to damage of the shaft and the shaft protecting sleeve.** In small pumps whose power consumption is comparatively low this may occasionally lead to over-loading of the power unit. **During operation the stuffing-box should show a slight leak,** since dry packing damages the shaft or the shaft protecting sleeve.

The shaft should be rotated by hand to ensure that the set runs easily.

The stop valve in the delivery line of the pump should be completely closed. The stop valve in the suction line (with lift or head) should be fully opened.

If the pump operates with positive suction head, the pressure in the flooded line should be checked.

The pump and the suction line (if with lift) must be filled with the pumping liquid. While the pump is being filled the shaft should be repeatedly turned by hand. Filling should be carried out either by means of the filling funnel valve, through the filling bore or with the aid of a special priming pump. It may also be possible to fill the pump with water from the delivery line after opening the by-pass pipe on the non-return valve. When using this method, care should be taken to ensure that neither the suction strainer nor the suction line are subjected to excessive pressure. The pump must also be vented in this case.

In pumps equipped with a cooled stuffing-box, the cooling water should be turned on and its free discharge verified.

In stuffing boxes fed with an external supply of sealing (or flushing) liquid, the control valve should be opened and the flow should be checked.

The pumping set should be started against a closed delivery valve. The correct direction of rotation should be observed (see arrow on casing). In plants with automatic control, the delivery valve need only be closed when the pump is started for the first time.

After the pump has run up to its full rated speed, the delivery valve should be gradually opened until the desired delivery pressure is obtained. Further opening of the delivery valve may lead to overloading of the power unit. To ensure that the maximum permissible current consumption is not exceeded, the load current should be checked while the discharge is being adjusted.

4.2 Stopping the pump

The delivery valve should first be closed.

The vacuum gauge cock (if any) on the suction side of the pump should also be closed.

The power unit should then be shut down and at the same time it should be verified that the rotor assembly comes smoothly to a stop.

The supply of cooling water (if any) may then be shut off.

Finally the supply of sealing or flushing liquid (if any) should be shut off.

Caution: Condensate pumps in which the liquid handled is fed under a vacuum must be supplied with sealing liquid even when the pump is at rest.

4.3 Supervision during operation

4.31 General

Every pump and its power unit must be carefully supervised during operation, in particular in respect of the following points, viz:

Operation of the pump should be smooth and free from vibration.

The water level in the well (suction lift) or in the tank (suction head) should be checked, and the pressure at the suction branch of the pump should be kept under observation.

The loading of the pumping set should be frequently checked by comparing delivery pressure or power consumption with the values quoted on the rating plates of the pump and motor.

The stuffing-boxes must be inspected frequently, particularly after they have been repacked (see section 4.33).

Free outlet of the cooling water must be provided for pumps equipped with cooled stuffing-boxes. A temperature difference of 50 °F (10 °C) between inlet and outlet is permissible.

If the installation includes stand-by pumps, these should be operated from time to time to ensure that they are ready for service when required. The shaft of such pumps should be rotated by hand at frequent intervals.

4.32 Servicing the bearings

The oil level should be checked during operation by means of the dipstick provided for this purpose. Fresh oil should be added if the oil level approaches the lower mark. A vent hole in the dipstick prevents the formation of condensed moisture and consequently prevents the oil from frothing. After 2000 operating hours, the oil

chamber in the bearing bracket and the bearings should be carefully cleaned (see section 3.4) and the oil should be changed.

The ball bearings are protected against the ingress of water and dirt by means of easily renewable felt rings. These rings must be changed if they become hardened or damaged. The butts should lie on the top of the shaft.

The temperature of the bearings may be up to 120 °F (50 °C) higher than the ambient temperature, but a maximum of 175 °F (80 °C) must not be exceeded.

4.33 Servicing the stuffing-boxes

The stuffing-box must be frequently inspected during a certain running-in period after fresh packing has been inserted. Only occasional inspection is required after the packing has seasoned. **During operation the stuffing-box should show a slight leak.** Should the stuffing-box seal completely or even start to smoke, the gland nuts should be eased off at once. When the packing is compressed by an amount equal to the width of one packing ring, the entire packing should be replaced. At the same time, the condition of the shaft surface and of the surface of the shaft protecting sleeve should be inspected for wear. The shaft or the shaft protecting sleeve should be renewed if the surface has become scored and rough. It is essential that the packing material used is of the correct size (see table page 26). An adequate reserve of packing material should always be kept in stock.

If a **mechanical seal** is fitted, it must be verified that it is sealing properly. Occasionally this seal shows a slight leak for a short period after the pump is started for the first time, but after the seal has run in, the leak will cease.

5. Troubles and their remedies

5.1 Delivery below rating

Possible causes:	Remedy:
The delivery head is too high.	The speed should be increased. If this is not possible in the case of electrically driven pumps, the works should be consulted with a view to fitting a larger impeller or another pump.
The pump is not correctly primed.	The pump and the pipelines should be completely filled.

Possible causes:	Remedy:
The suction line or an impeller is clogged.	The inlet should be cleaned and if necessary the impeller should be removed for cleaning.
Formation of air pockets in the pipelines.	The run of the pipelines should be altered and venting cocks fitted where necessary.
Inadequate positive suction head where the pump operates under flooded suction.	Check water level in the overhead supply tank; the pipeline system should be checked for points of excessive flow resistance. Stop valves in the suction line should be fully opened and locked in that position if they can be tampered with.
Suction lift too high when operating under normal suction conditions.	The suction strainer and the suction line should be cleaned; if necessary, a larger cross-section should be selected for the suction line. Verify that foot valve opens fully, and that there is enough water in the well.
Air is drawn into the pump through the stuffing box.	The pressure of the sealing liquid should be increased and the sealing liquid duct should be checked for possible blockages. If necessary, an external supply of sealing liquid should be fed to the stuffing box.
Incorrect direction of rotation.	Change leads of the electric motor. If the pump has already been run in the wrong direction, the impeller nut should be re-tightened if necessary.
The speed is too low.	If the pump does not provide the desired discharge at the full-load speed, the works should be consulted regarding the fitting of a larger impeller. Alternatively, a larger pump may have to be installed. The speed of pumps driven by internal combustion engines can be varied to some extent by regulating the fuel supply. A low speed in belt-driven pumps may be due to slipping belts which should therefore be tightened. If necessary, a different pulley should be used.

Possible causes:	Remedy:
Excessive wear of pump internals	a) Pumps with L 52 bearing bracket: Open up pump, check clearances of components subject to wear (impeller, gap between impeller neck and casing), and if necessary restore original clearance (0.3 mm on diameter) by fitting a new wear ring. b) Pumps with A, B, C or D bearing bracket: Open up pump, check clearances of components subject to wear (wear rings and impeller) and if necessary fit new components. The normal clearance between wear ring and impeller neck is 0.3 mm on the diameter.
5.2 The driver is overloaded	
The pump discharge pressure is lower than the figure stated on the order data sheet.	Throttle the valve in the discharge line until the pressure indicated on the pressure gauge on the pump discharge nozzle equals the pressure given on the data sheet. If the overloading of the driver still persists, trim the impeller after having consulted us first.
5.3 Pump discharge pressure is excessive	
Pump speed is too high.	Check pump speed accurately. If it is not possible to reduce it, the impeller must be trimmed, after having consulted us first.
5.4 The cooling jacket leaks	
a) Pumps with L 52 bearing bracket: The bolts fastening the discharge cover to the bearing bracket are loose, or the gasket is defective.	Stop the pump, relieve the internal pressure, and tighten the bolts really tight when the pump is cold. Check condition of gasket.
The O-rings on the cooling water cover are defective.	Fit new O-rings; to do this, dismantle volute casing, impeller and discharge cover.
b) Pumps with A, B, C or D bearing bracket: The bolts fastening the volute casing to the bearing bracket are loose.	Stop the pump, relieve the internal pressure, and tighten the bolts really tight when the pump is cold. Check condition of gasket.

Possible causes:	Remedy:
The fastening bolts on the cooling water cover are loose.	Disconnect pump from bearing bracket, tighten bolts on cooling water cover, and check condition of gasket between cooling water cover and bearing bracket.
5.5 The stuffing box leaks.	
Worn, unsuitable or badly fitted packing.	Repack the stuffing box and use a suitable packing.
The shaft, resp. the shaft protecting sleeve, has wear grooves because the gland has been tightened too hard or askew.	**The shaft or shaft protecting sleeve must be ground smooth or replaced by a new one.**
The pump runs rough, i. e. the shaft runs out of true.	No stuffing box can remain leaktight if the shaft runs out of true, therefore the shaft must be checked for true running.
5.6 Excessive bearing temperature.	
The set is misaligned.	Check alignment on the coupling.
The piping transmits stresses to the pump.	Modify the piping to obtain a stress-free connection to the pump. Re-align pumping set.
Excessive axial thrust	
a) on pumps with L 52 bearing bracket: Resulting from excessive clearance at impeller neck.	Restore normal clearance (0.3 mm on diameter) by fitting a new wear ring; if necessary fit a new impeller.
b) on pums with A, B, C or D bearing bracket:	
Resulting from plugging of the balance holes or excessive wear of the wear rings.	Clean the balance holes. Fit new wear rings.
Axial clearance on coupling is insufficient (motor shaft slides).	Restore required axial clearance on coupling (for measurements, see foundation drawing).
Insufficient lubricating oil, or deterioration of oil.	Top up oil, or if necessary renew oil fill.
5.7 Freezing up of pump	
Pump not protected from cold weather.	Protect pump from cold. Failing this, drain pump completely every time it is stopped. To do this, remove drain plug at bottom of volute casing.

6. Dismantling and reassembly

Always refer to the relevant cross-sectional drawing when dismantling and reassembling the pump.

The instructions in the following paragraphs relate to complete dismantling and reassembly of the pump. If a partial dismantling only is required, for inspection purposes or renewal of certain components, you should only proceed as far as required by the circumstances.

6.1 Dismantling of pumps with L 52 bearing bracket

The pump should first be disconnected from the baseplate, the driver, the main piping and auxiliary piping (if applicable).

Then proceed as follows:

1. Drain oil from bearing bracket.
   Undo the bolts fastening the volute casing (101) to the discharge cover (103a) – see fig. 10 – and pull off the volute casing.

2. Undo the impeller nut (217) – see fig. 11 – and remove the spring washer (222).

3. Push the impeller off the stub shaft – see fig. 12. Remove the key.
   After prolonged operation, it may prove difficult to remove the impeller from the shaft. In this case, use a proprietary rust solvent.

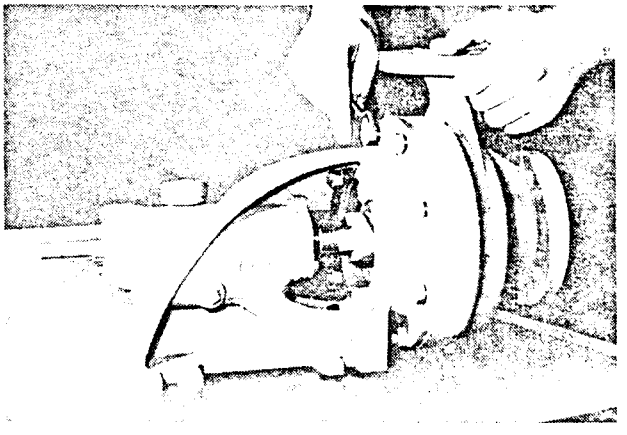


Fig. 10 Undoing the bolts fastening the volute casing to the discharge cover

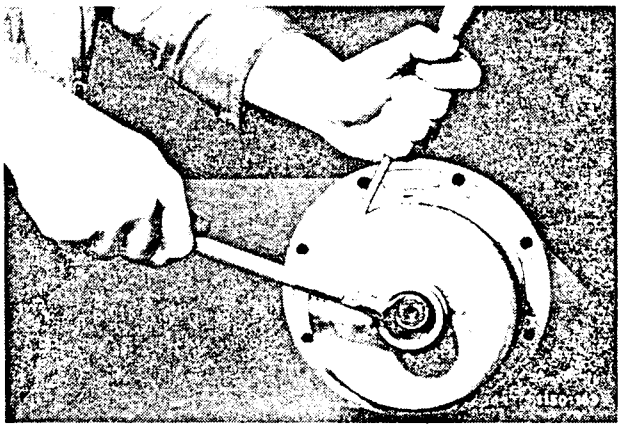


Fig. 11 Undoing the impeller nut

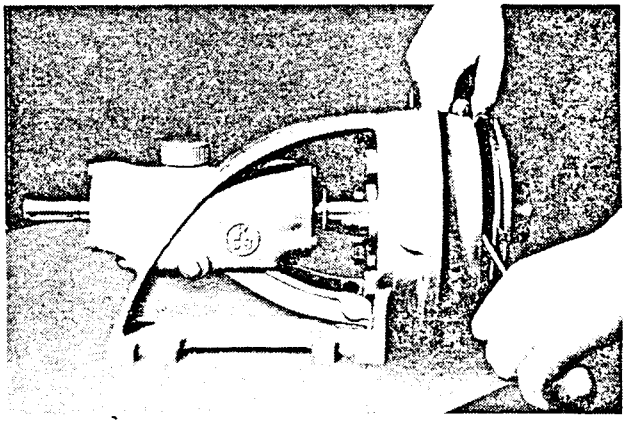


Fig. 12 Pushing off the impeller with the aid of two screw-drivers or other suitable tools

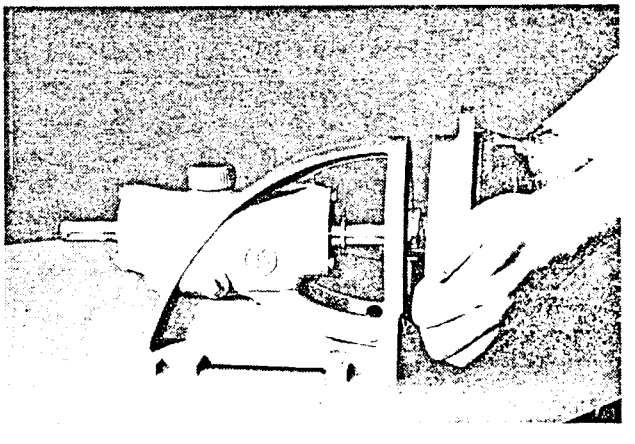


Fig. 13 Removing the discharge cover

4. Undo the bolts connecting the bearing bracket (115) to the discharge cover (103a) and loosen the gland (407). Pull off the discharge cover – see fig. 13.

   On pumps fitted with a cooling jacket to the stuffing box, push off the cooling water cover (301); avoid damaging the O-rings.

   Strip off the gland (407) and the flinger ring (241).

5. Undo bearing coverplate (426a) at stuffing box end.

6. Remove oil dipstick (f) from bearing bracket, remove coupling key, and carefully drive the shaft out of the bearing bracket with gentle taps on the coupling end of the shaft – see fig. 14 – and remove it from the bearing bracket.

7. Pull off the grooved ball bearings (409) from the shaft. To do this, first warm the ball bearings, keeping the shaft itself as cold as possible. Then drive the shaft out of the ball bearings with gentle taps – see fig. 15.

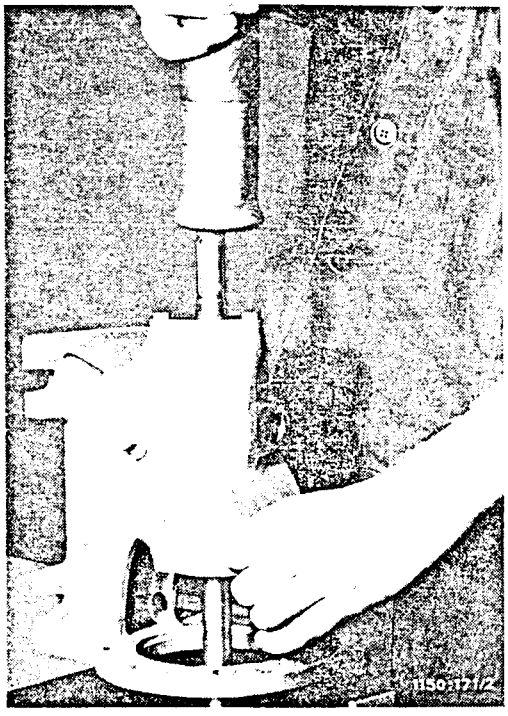


Fig. 14
Driving the shaft out of the bearing bracket

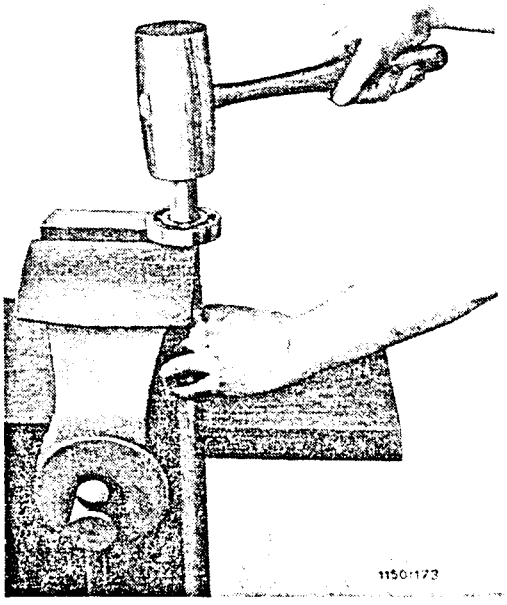


Fig. 15
Removing the ball bearing from the shaft

6.2 Dismantling of pumps with A, B, C or D bearing bracket

The pump should first be disconnected from the baseplate, the driver, the main piping and auxiliary piping (if applicable).

Then proceed as follows:

1. Drain oil from bearing bracket.
   Undo the bolts fastening the volute casing (101) to the suction cover (102a) and pull off suction cover – see fig. 16.
2. Undo the impeller nut (217) – see fig. 17 – and remove the spring washer (222).

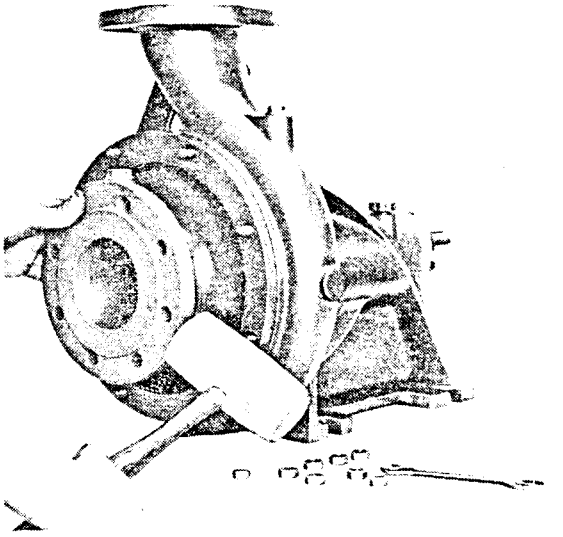


Fig. 16 Removing the suction cover

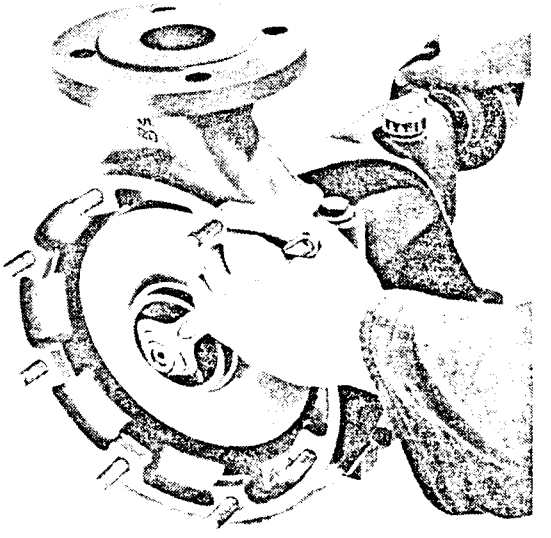


Fig. 17 Undoing the impeller nut

3. Undo the bearing coverplate (426) at the drive end, and drive the shaft off the impeller with gentle taps – see fig. 18. After prolonged operation, it may prove difficult to remove the impeller from the shaft. In this case, use a proprietary rust solvent.

4. Loosen gland (407), undo the bolts connecting the bearing bracket (115) to the volute casing (101), and withdraw the volute casing.
   On pumps fitted with a cooling jacket to the stuffing box, unscrew the cooling water jacket coverplate (301).

   Strip off gland (407) and flinger ring (241).

5. Remove oil dipstick (f) from bearing bracket, and carefully drive the shaft out of the bearing bracket with gentle taps – see fig. 19 – and remove it from the bearing bracket.

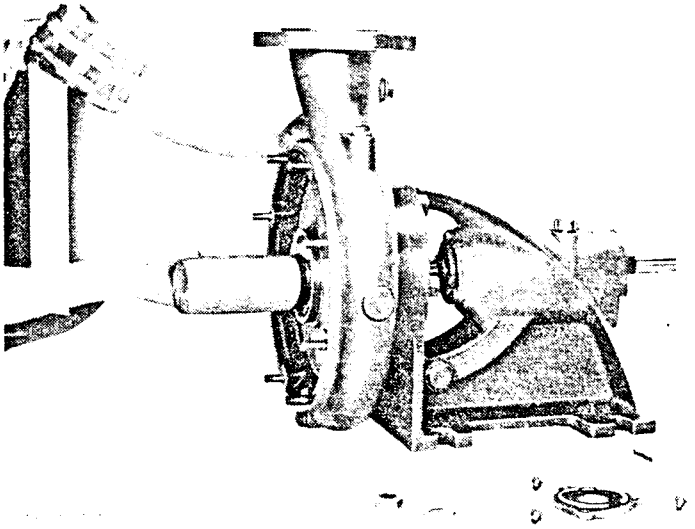


Fig. 18 Removing the impeller from the shaft

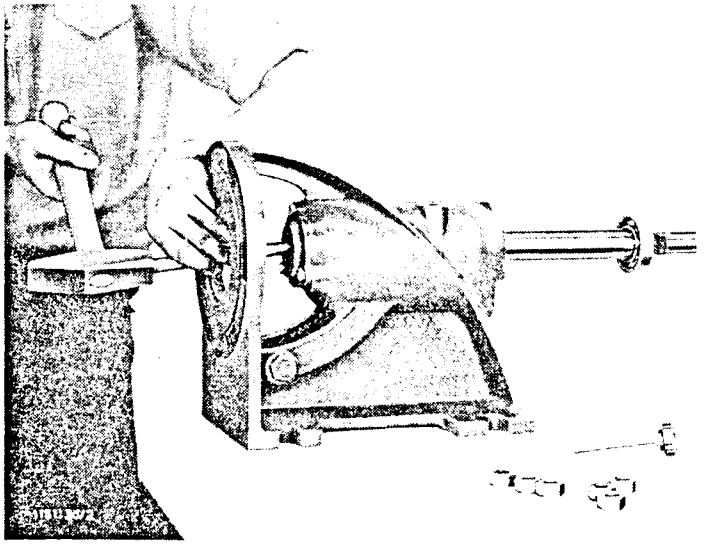


Fig. 19 Driving the shaft out of the bearing bracket

6. Undo the bearing coverplate (426a) at the stuffing box end.
7. Pull off the grooved ball bearings (409) from the shaft. To do this, first warm the ball bearings, keeping the shaft itself as cold as possible. Then drive the shaft out of the ball bearings with gentle taps – see fig. 15.

6.21 Two-stage pumps

On two-stage pumps (fig. 20), the suction cover should first be removed, then the first stage impeller, the diffuser (fig. 21), the spacer sleeve and the second stage impeller should successively be dismantled. Further dismantling as described in section 6.2.

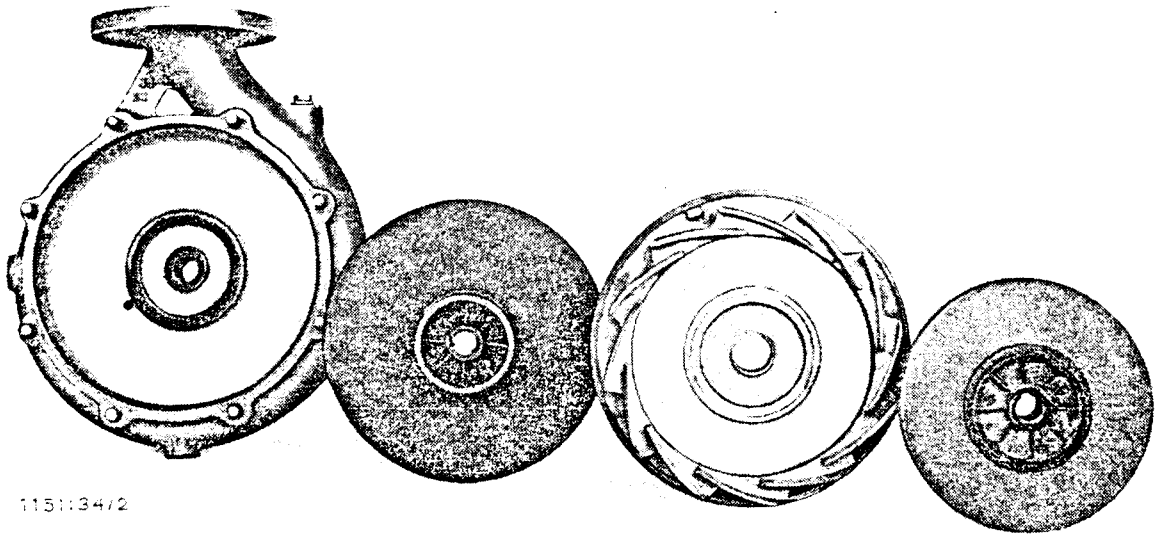


Fig. 20 Components of two-stage ETA pump

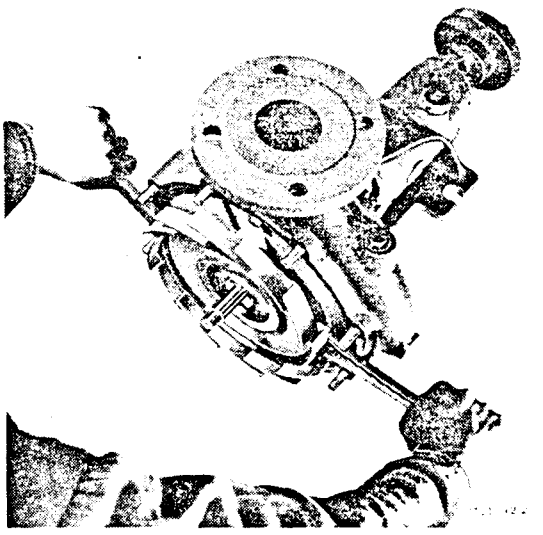


Fig. 21 Dismantling the diffuser

6.3 Reassembly

Reassembly of the pump is carried out in reverse sequence to dismantling. The following points should be watched:

All sealing elements (gaskets, O-rings, felt washers) should be replaced by new ones if damaged.

If new grooved ball bearings are fitted, they should first be heated in an oilbath to 80 ° C approx. (170 ° F) slipped onto the shaft, and if necessary driven up against the shaft shoulder with the aid of a piece of piping resting against the inner ball race – see fig. 22. The greatest possible cleanliness should be observed.

On pumps fitted with L 52 bearing bracket, should the sealing gap between impeller neck and volute casing have become too large, as a result of excessive wear, a wear ring can be fitted to the volute casing, after machining the impeller neck and volute casing. The correct clearance is 0.3 mm on the diameter.

On pumps fitted with A, B, C or D bearing bracket, should the sealing gap between impeller neck and case wear ring have become too large as a result of excessive wear, new case wear rings (122 resp. 122a) should be fitted to the volute casing and the suction cover.

Fig. 23 illustrates the fitting of a new case wear ring into a suction cover. If required, the impeller should be touched up, and in certain cases it may prove necessary to fit wear rings with an undersize bore. The correct clearance between wear ring and impeller is 0.3 mm on the diameter.

Please refer to preceding paragraphs of this publication as regards oil change, renewal of stuffing box packing and reassembly of the pumping set.

Fig. 22
Fitting a ball bearing

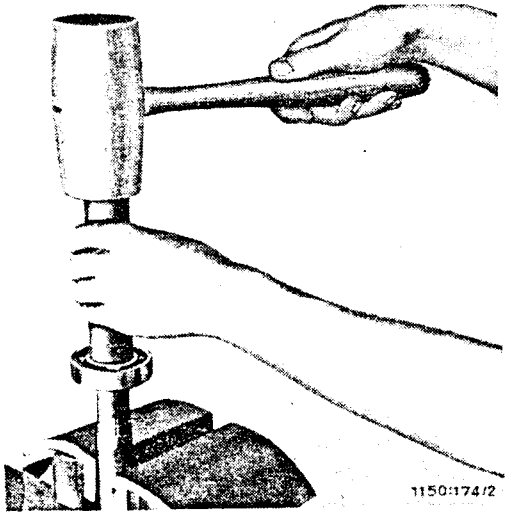
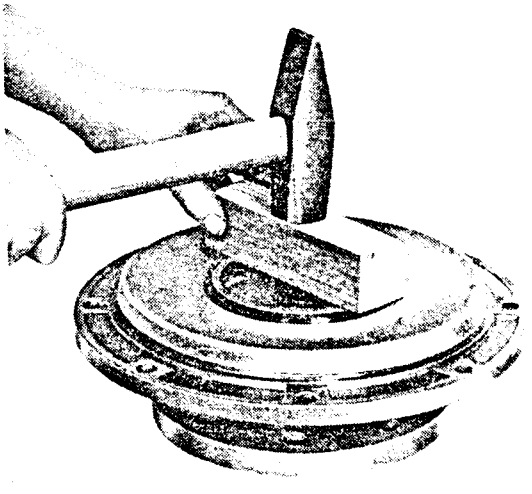
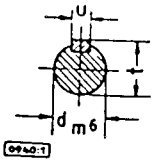


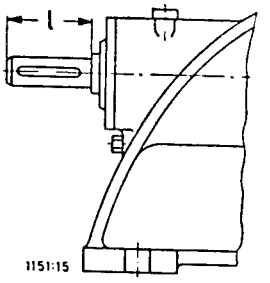
Fig. 23
Fitting a case wear ring in the suction cover

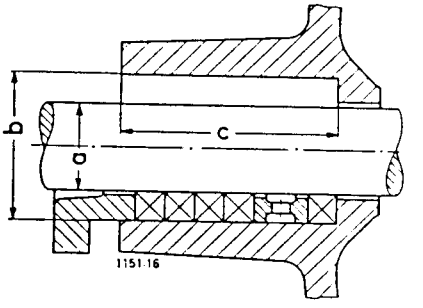


7. Dimensions of shaft and stuffing-box



Shaft end according to DIN 7160
Height of fitting key
according to DIN 6885





(see also paragraph 8)

Dimensions in mm.

Size of pump	Ball bearing DIN 625 (Part. No. 409)	Shaft extension				Stuffing-box			Oil[1]
		dia. m6	l	u	t	dia. a	dia. b	c	litres
32-12.1; 32-16.1 32-20.1; 40-12.1 40-16.1; 50-12.1 50-16.1; 65-12.1 65-16.1; 80-16.1	6304/C 3	18	45	6	20.5	20	36	46	0.175
40 – 16 40 – 20 40 – 26 40 – 33/2	6305/C 3	24	65	8	26.9	24	40	58	0.4
50 – 16 50 – 20 50 – 26 50 – 33/2	6305/C 3	24	65	8	26.9	24	40	58	0.4
65 – 16 65 – 20 65 – 26 65 – 33/2	6305/C 3	24	65	8	26.9	24	40	58	0.4
80 – 16 80 – 20	6305/C 3	24	65	8	26.9	24	40	58	0.4
80 – 26 80 – 33 80 – 40/2	6306/C 3	28			30.9	29	45		0.55
100 – 16	6305/C 3	24	65	8	26.9	24	40	58	0.4
100 – 20	6306/C 3	28	65	8	30.9	29	45	58	
100 – 26	6306/C 3	28	65	8	30.9	29	45	58	0.55
100 – 33	6306/C 3	28	65	8	30.9	29	45	58	
100 – 40	6409/C 3	42	105	12	45.1	45	65	75	1.2
100 – 50/2	6409/C 3	42	105	12	45.1	45	65	75	
125 – 20	6306/C 3	28	65	8	30.9	29	45	58	0.55
125 – 26	6306/C 3	28	65	8	30.9	29	45	58	
125 – 33	6409/C 3	42	105	12	45.1	45	65	75	1.2
125 – 40	6409/C 3	42	105	12	45.1	45	65	75	
125 – 50/2	6409/C 3	42	105	12	45.1	45	65	75	
150 – 20	6306/C 3	28	65	8	30.9	29	45	58	0.55
150 – 26	6409/C 3	42	105	12	45.1	45	65	75	1.2
150 – 33	6409/C 3	42	105	12	45.1	45	65	75	
150 – 40	6411/C 3	50	110	14	53.5	60	85	85	3.25
150 – 50	6411/C 3	50	110	14	53.5	60	85	85	
200 – 23	6409/C 3	42	105	12	45.1	45	65	75	1.2
200 – 33 200 – 40 200 – 50 DS[2]	6411/C 3	50	110	14	53.5	60	85	85	3.25
250 – 29 250 – 33 250 – 40 250 – 50 DS[2]	6411/C 3	50	110	14	53.5	60	85	85	3.25
300 – 35									

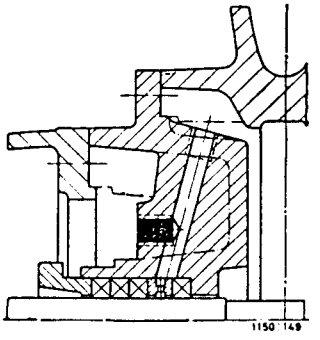
[1]) Standard values only, oil level according to marking on the dipstick
[2]) Bearing (stuffing box end) 6313/C 3 (DS – double spiral)

8. Stuffing-box executions

8.1 On pumps with L 52 bearing bracket

8.11 Standard stuffing box N

Design N/a

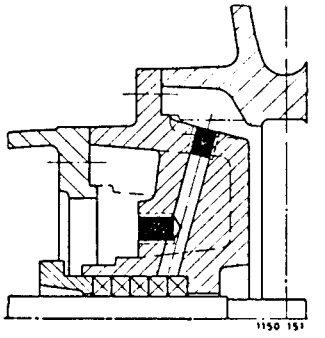


Applications:
Clean fluids, suction lift to pump, or positive suction pressure not exceeding 0.5 kp/cm² gauge.

Temperature range:
up to 105 °C (200 °F).

Sealing: fluid pumped used as sealing liquid

Design N/b

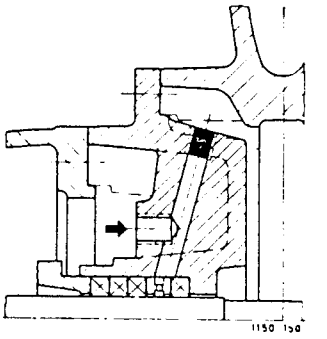


Applications:
Positive suction pressure on pump exceeding 0.5 kp/cm² gauge; also used for fluids having an unpleasant odour, such as ammonia solutions, and petrol, benzole and hydrocarbons having lubricating properties, providing the pump is located outdoors.

Temperature range:
up to 105 °C (200 °F).

Sealing:
no sealing liquid used.

Design N/c



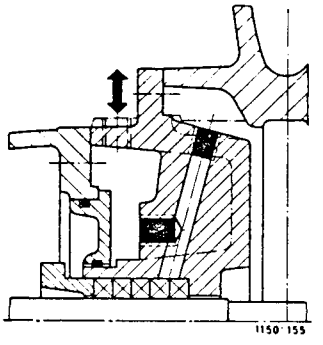
Applications:
For fluids pumped out of tanks under vacuum.

Temperature range:
up to 105 °C (200 °F).

Sealing: always by means of a liquid other than the fluid pumped.

8.12 Hot water stuffing box HW

Design HW



Applications:
Clean, hot fluids (e. g. hot water). The positive suction pressure must be at least equal to atmospheric pressure, or higher.

Temperature range:
105 to 140 °C (200 to 280 °F).
Ductile iron construction:
105 to 160 °C (200 to 320 °F)

Sealing:
No sealing liquid used.

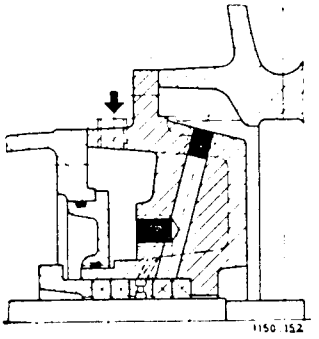
Cooling:
Cooling fluid must be provided.

Mechanical seal
For clean fluid applications, a mechanical seal can be fitted, provided a discharge cover of special design is also fitted. Two makes of seal – Flexibox or Pacific – can be accommodated, and up to now these mechanical seals have only been fitted for special applications or unusual operating conditions.

Temperature range: up to 140 °C (280 °F).

8.13 Extra deep stuffing box VSM and VSH

Design VSM/a

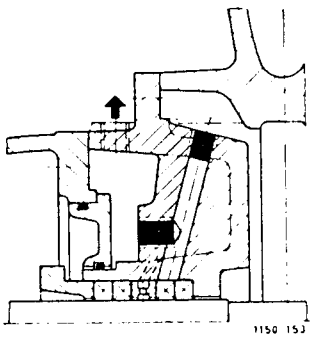


Applications:
Clean fluids and operation under vacuum, in those cases where the contamination of the liquid pumped by the sealing fluid must be reduced to an absolute minimum. This stuffing box design is also in standard use for pure sugar syrups.

Temperature range:
up to 105 °C (200 °F).

Sealing: A sealing liquid from an outside source is provided.

Design VSM/b

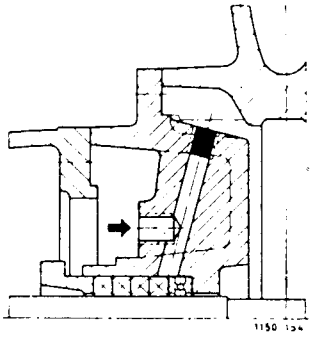


Applications:
Fluids with a suction pressure of at least 1 kp/cm² absolute, in cases where the stuffing box leakage must be trapped before it reaches the outlet of the stuffing box (various solvents, ammonia, petrol, hydrocarbons). The leakage from the stuffing box is led through the lantern ring to a closed vessel outside the pump.

Temperature range:
up to 105 °C (200 °F).

Sealing: Leakage fluid led away from stuffing box.

Design VSH



Applications:
Fluids containing abrasive particles, in cases where the shaft and stuffing box packing require protection against the abrasive action of the fluid pumped (e. g. raw river water).

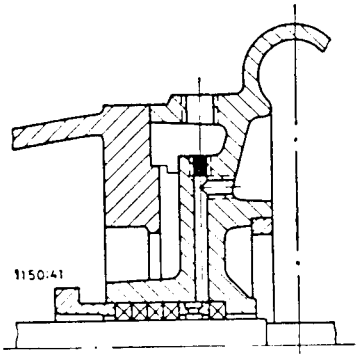
Temperature range:
up to 105 °C (200 °F)

Sealing: A flushing liquid from an outside source is provided.

8.2 On pump with A, B, C or D bearing bracket.

8.21 Standard stuffing box N

Design N/a

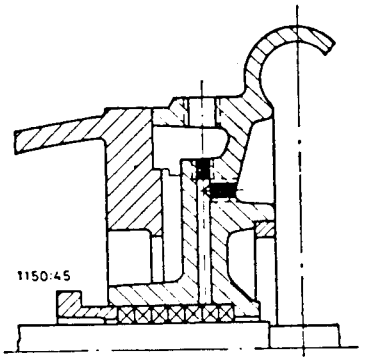


Applications:
Clean fluids, suction lift to pump, or positive suction pressure not exceeding 0.5 kp cm² gauge.

Temperature range:
up to 105 °C (200 °F).

Sealing: fluid pumped used as sealing liquid

Design N/b

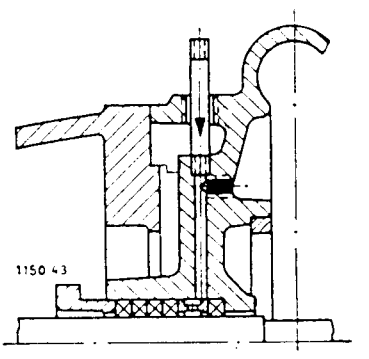


Applications:
Positive suction pressure on pump exceeding 0.5 kp/cm² gauge; also used for fluids having an unpleasant odour, such as ammonia solutions, and petrol, benzole and hydrocarbons having lubricating properties, providing the pump is located outdoors.

Temperature range:
up to 105 °C (200 °F)

Sealing:
no sealing liquid used

Design N/c



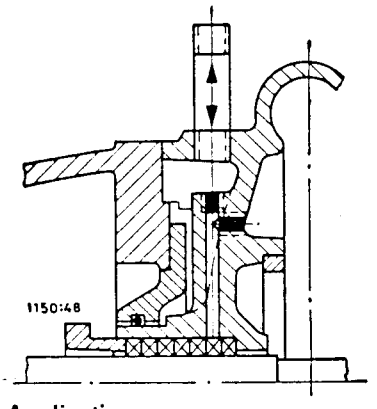
Applications:
For fluids pumped out of tanks under vacuum.

Temperature range:
up to 105 °C (200 °F)

Sealing: Always by means of a liquid other than the fluid pumped.

8.22 Hot water stuffing box HW

Design HW



Applications:
Clean, hot fluids (e.g. hot water). The positive suction pressure must be at least equal to atmospheric pressure, or higher.

Temperature range:
105 to 140 °C (200 to 280 °F)
Ductile iron construction:
105 to 160 °C (200 to 320 °F)

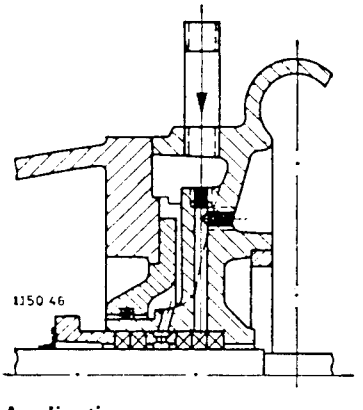
Sealing:
No sealing liquid used

Cooling:
Cooling fluid must be provided.

Mechanical seal
For clean fluid applications, a mechanical seal can be fitted without any modification to the pump.
According to the type and make of mechanical seal used, the housing may have to be machined and a special stuffing box gland fitted. Details provided on request to Head Office.

8.23 Extra deep stuffing box VSM and VSH

Design VSM/a

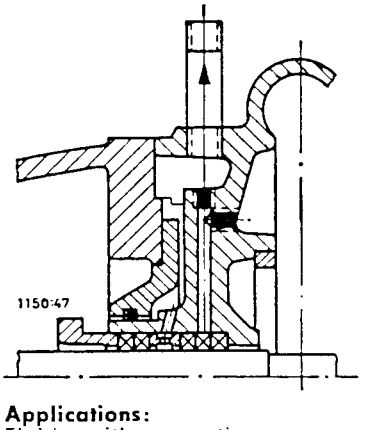


Applications:
Clean fluids and operation under vacuum, in those cases where the contamination of the liquid pumped by the sealing fluid must be reduced to an absolute minimum. This stuffing box design is also in standard use for pure sugar syrups.

Temperature range:
up to 105 °C (200 °F)

Sealing:
A sealing liquid from an outside source is provided

Design VSM/b

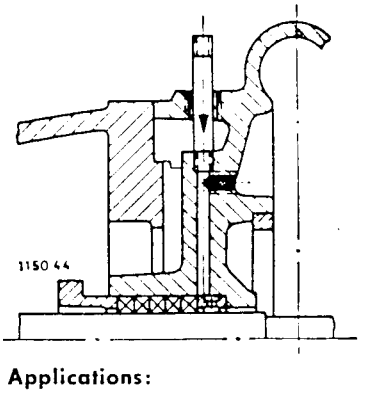


Applications:
Fluids with a suction pressure of at least 1 kp/cm² absolute, in cases where the stuffing box leakage must be trapped before it reaches the outlet of the stuffing box (various solvents, ammonia, petrol, hydrocarbons). The leakage from the stuffing box is led through the lantern ring to a closed vessel outside the pump.

Temperature range:
up to 105 °C (200 °F)

Sealing:
Leakage fluid led away from stuffing box.

Design VSH



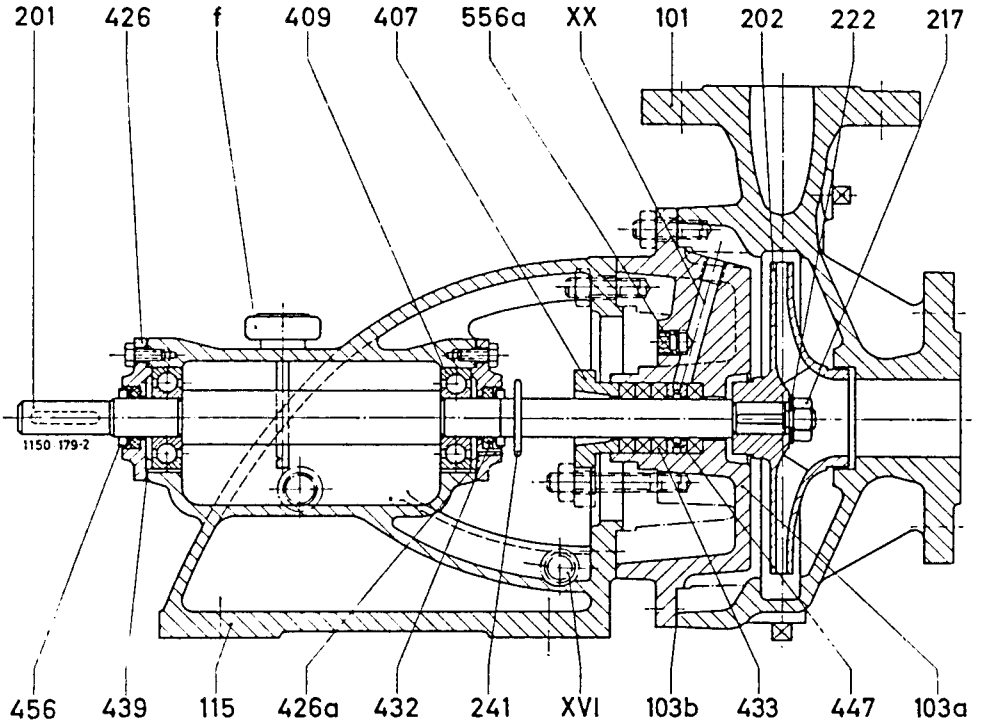
Applications:
Fluids containing abrasive particles, in cases where the shaft and stuffing box packing require protection against the abrasive action of the fluid pumped (e. g. raw river water).

Temperature range:
up to 105 °C (200 °F)

Sealing:
A flushing liquid from an out side source is provided.

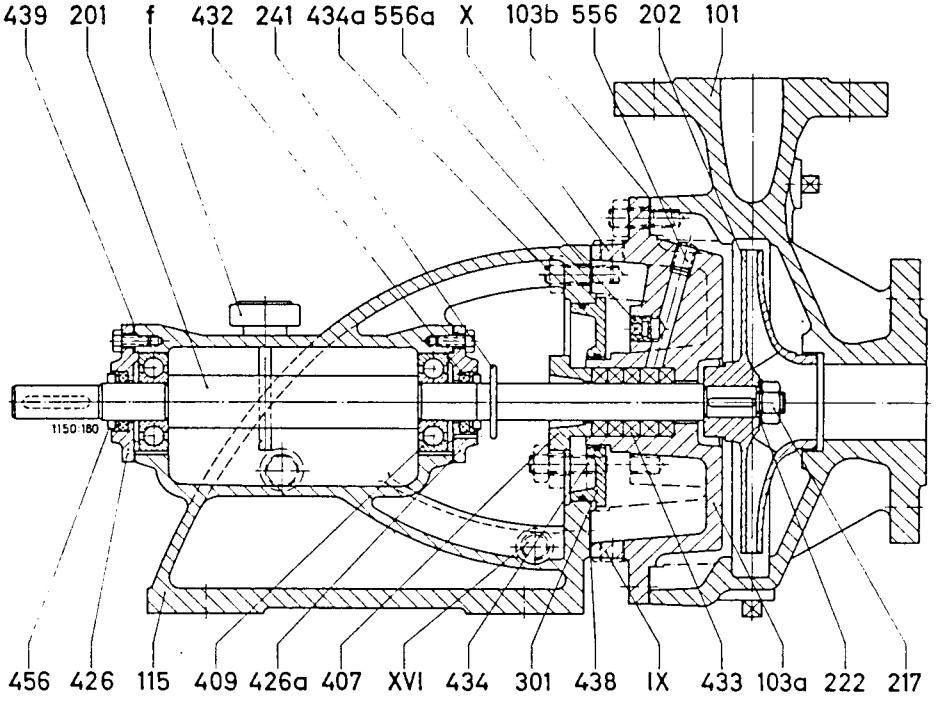
9. Sectional drawings and list of components

9.1 ETA centrifugal pumps with L 52 bearing bracket, model K



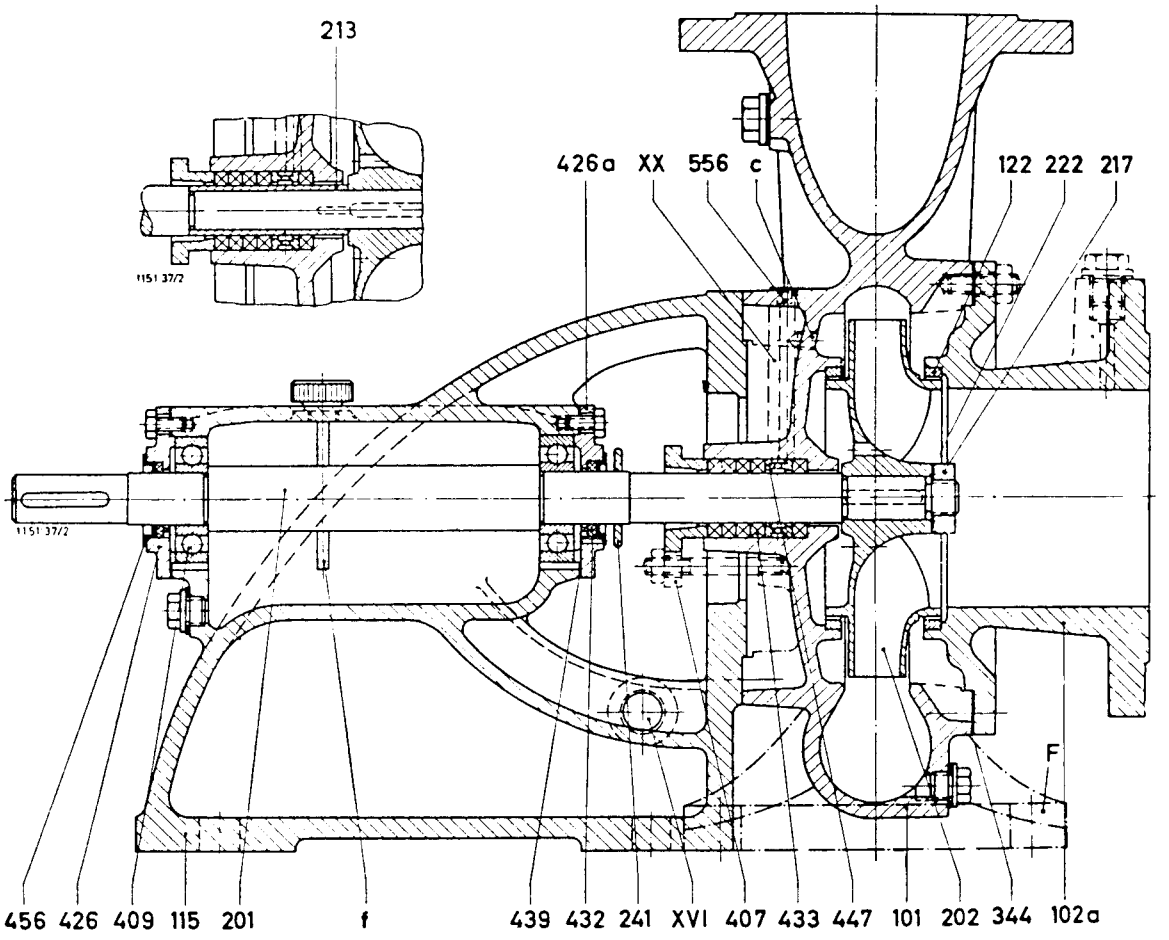
Part No.	Name	Part No.	Name
101	Volute casing	426a	Bearing cover / stuffing box end
103a	Discharge cover		
103b	Gasket	432	Felt ring
115	Bearing bracket	433	Stuffing box packing
201	Shaft	439	Gasket
202	Impeller	447	Lantern ring
217	Impeller nut	456	End ring
222	Spring washer	556a	Plug / sealing liquid
241	Splash ring		
407	Stuffing box gland	XVI	Leakage drain
409	Grooved ball bearing	XX	Sealing liquid inlet
426	Bearing cover / driven end	f	Dipstick

9.2 ETA centrifugal pumps with L 52 bearing bracket, model K, with cooled stuffing box



Part No.	Name	Part No.	Name
101	Volute casing	426a	Bearing cover / stuffing box end
103a	Discharge cover	432	Felt ring
103b	Gasket	433	Stuffing box packing
115	Bearing bracket	434	O-ring
201	Shaft	434a	O-ring
202	Impeller	438	Gasket
217	Impeller nut	439	Gasket
222	Spring washer	456	End ring
241	Splash ring	556	Plug
301	Cooling water cover plate	556a	Plug
407	Stuffing box gland	IX	Cooling water inlet
409	Grooved ball bearing	X	Cooling water outlet
426	Bearing cover / driven end	XVI	Leakage drain
		f	Dipstick

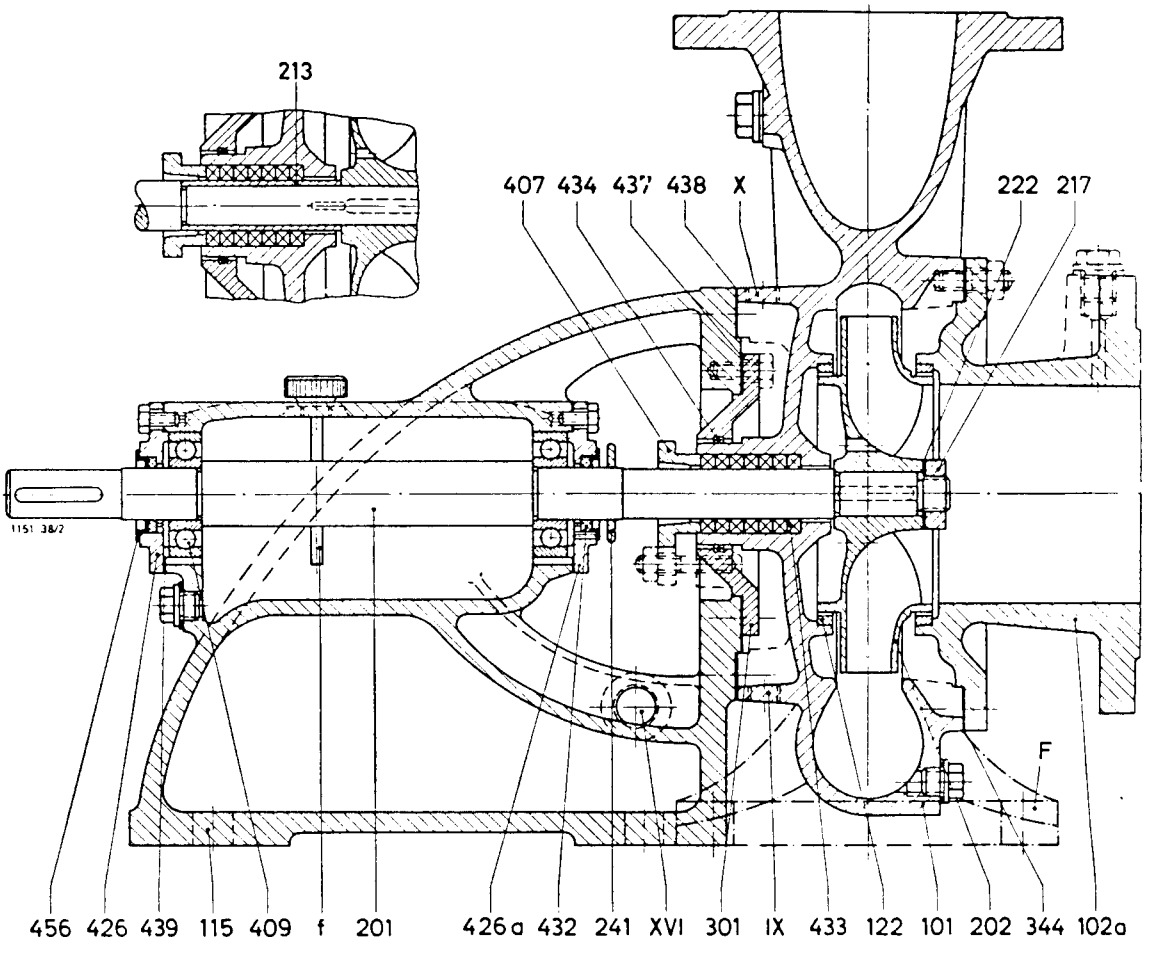
9.3 ETA centrifugal pumps with A, B, C or D bearing bracket, model K



Part No.	Name	Part No.	Name
101	Volute casing	426	Bearing cover
102a	Suction cover	426a	Bearing cover
115	Bearing bracket	432	Felt ring
122	Wear ring	433	Stuffing box packing
201	Shaft	439	Gasket
202	Impeller	447	Lantern ring
213	Shaft protecting sleeve *	456	Cover for 432
217	Impeller nut	556	Plug for Sealing liquid inlet
222	Locking plate	XVI	Leakage drain
241	Splash ring	XX	Sealing liquid inlet
344	Gasket	f	Dipstick
407	Stuffing box gland	c	Sealing liquid duct
409	Grooved ball bearing	F	Mounting feet (Integrally cast with the volute casing 101*)

* **Only in pumps equipped with a Type C or D bearing bracket** (the appropriate letter is cast on the bearing bracket)

9.4 ETA centrifugal pumps with A, B, C or D bearing bracket, model K equipped with cooled stuffing-box



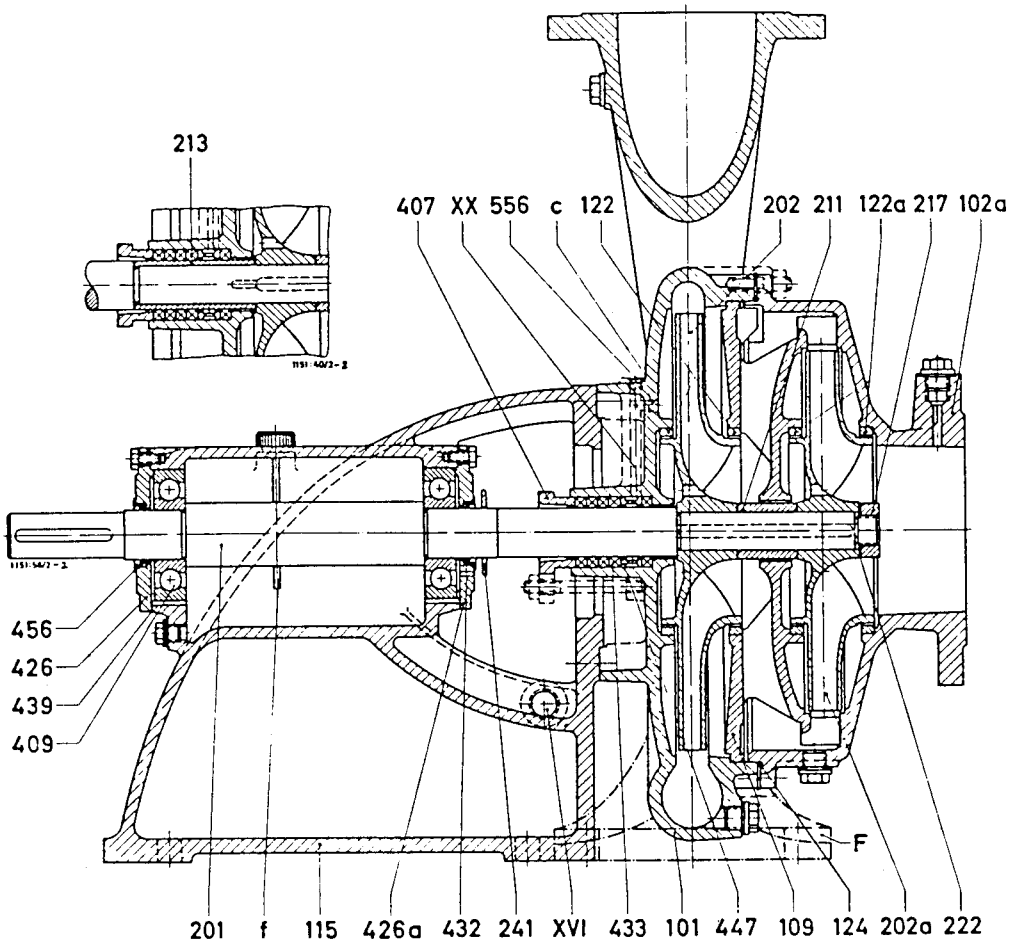
Part No.	Name
101	Volute casing
102a	Suction cover
115	Bearing bracket
122	Wear ring
201	Shaft
202	Impeller
213	Shaft protecting sleeve *
217	Impeller nut
222	Locking plate
241	Splash ring
301	Cooling-jacket cover
344	Gasket
407	Gland
409	Grooved ball bearing

PartNo.	Name
426	Bearing cover
426a	Bearing cover
432	Felt ring
433	Stuffing box packing
434	Rubber O-ring
437	Gasket
438	Gasket
439	Gasket
456	Cover for 432
IX	Cooling water inlet
X	Cooling water outlet
XVI	Leakage drain
f	Dipstick
F	Mounting feet (Integrally cast with the volute casing 101*)

* **Only in pumps equipped with a Type C or D bearing bracket** (the appropriate letter is cast on the bearing bracket)

9.5 ETA centrifugal pumps with A, B, C bearing bracket, Model K, two-stage design

(The corresponding sections of the drawing on page 33 apply to this pump type equipped with a cooled stuffing box

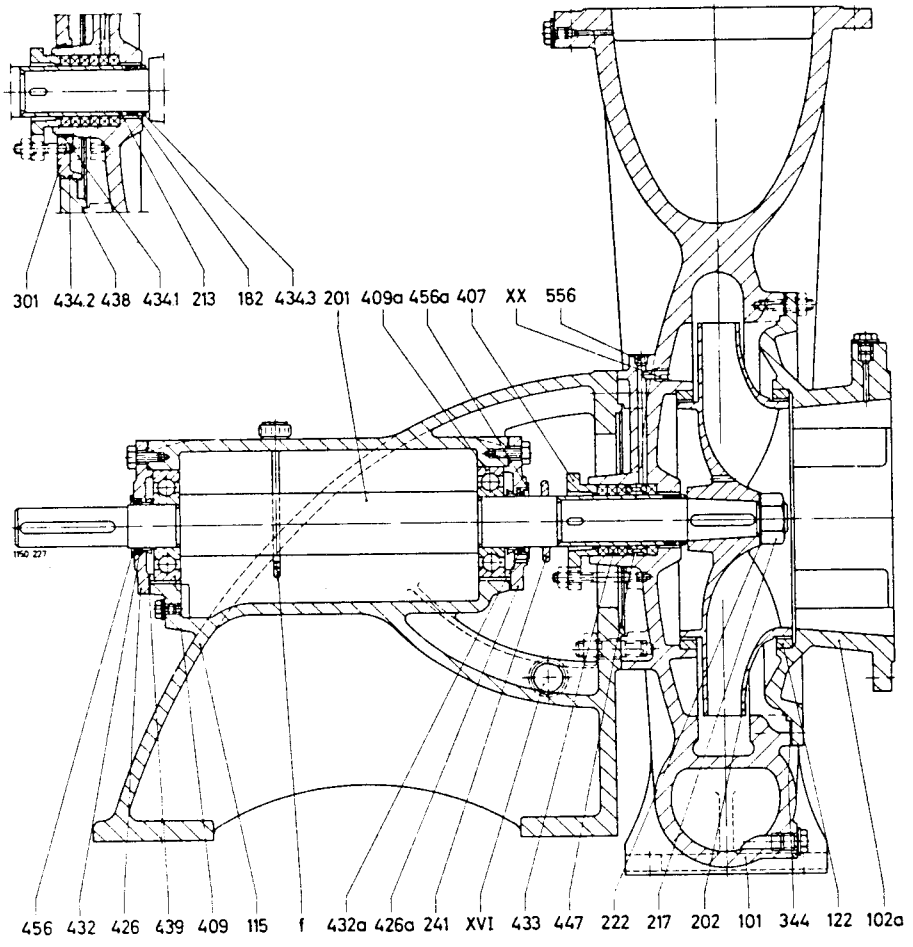


Part No.	Name
101	Volute casing
102a	Suction cover
109	Diffuser
115	Bearing bracket
122 and 122a	Wear ring
124	Rubber O-ring
201	Shaft
202	Large impeller
202a	Small impeller
211	Spacer sleeve
213	Shaft protecting sleeve *
217	Impeller nut
222	Locking plate
241	Splash ring
407	Stuffing box gland

Part No.	Name
409	Grooved ball bearing
426	Bearing cover
426a	Bearing cover
432	Felt ring
433	Stuffing box packing
439	Gasket
447	Lantern ring
456	Cover for 432
556	Plug, sealing liquid inlet
XVI	Leakage drain
XX	Sealing liquid inlet
f	Dipstick
c	Sealing liquid duct
F	Mounting feet (Integrally cast with the volute casing 101*)

* **Only in pumps equipped with a Type C bearing bracket** (the appropriate letter is cast on the bearing bracket)

9.6 ETA centrifugal pumps with D bearing bracket, Model K, with double spiral



Part. No	Name	Part. No	Name
101	Volute casing	426	Bearing cover
102	Suction cover	426a	Bearing cover
115	Bearing bracket	432	Felt ring
122	Wear ring	432a	Felt ring
182	Clearance ring	433	Stuffing box packing
201	Shaft	434.1	O-ring
202	Impeller	434.2	O-ring
213	Shaft protecting sleeve	434.3	O-ring
217	Impeller nut	438	Gasket
222	Locking plate	439	Gasket
241	Splash ring	447	Lantern ring
301	Cooling jacket cover	456	Cover for 432
344	Gasket	456a	Cover for 432
407	Stuffing box gland	556	Sealing liquid duct
409	Grooved ball bearing	XVI	Leakage drain
409a	Grooved ball bearing	XX	Sealing liquid inlet
		f	Dipstick

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