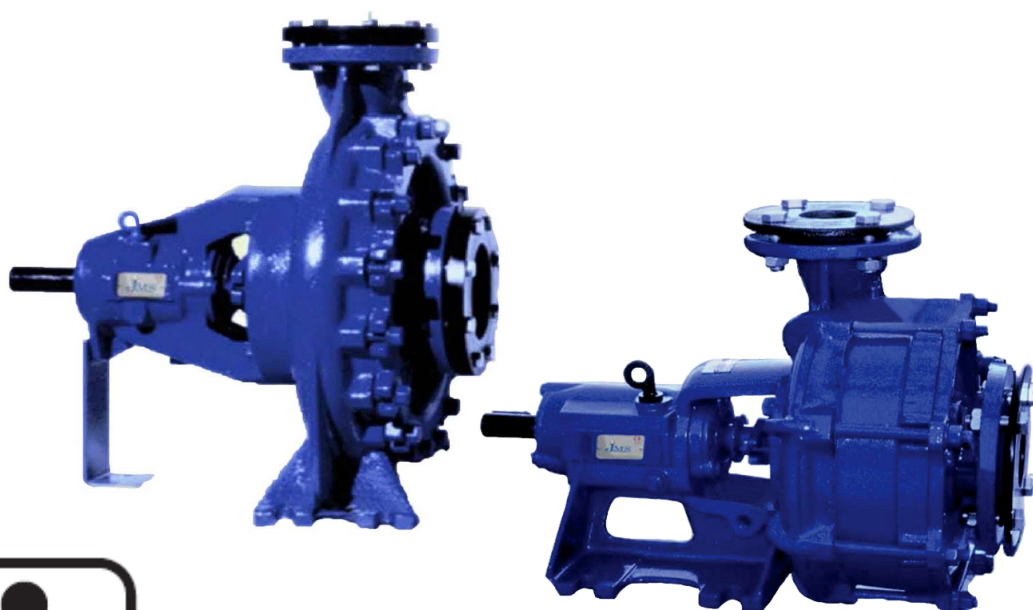




PUMPS SERIE:
JCS-M
JCS-P
JNCB
SPLIT CASE

CENTRIFUGAL PUMPS CARE
MANUAL INSTALLATION,
MAINTENANCE AND OPERATING
INSTRUCTIONS



READ THIS MANUAL CAREFULLY

CONTENTS

- 1) SAFETY
- 2) USER SAFETY REGULATIONS
- 3) TROUBLE SHOOTING
- 4) CARRIAGE AND STORAGE
- 5) PUMP FOUNDATION AND BASEPLATE
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- 9) PUMP ASSEMBLING AND DISMANTLING
- 10) SEALING
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- 21) LUBRICATION OIL LIST

NOTE:

CADOPPI reserves the right to make any changes in dimensions without prior notice.
Consult to CADOPPI for any issue not included in this manual

GETTING STARTED



PURPOSE OF SAFETY GUIDE

- In order to prevent incorrect operation of the pump and accidents, instructions of this manual have to be read and followed carefully. Manual should be kept in easy access.
- Installation, starting, maintenance and operation instruction for the pump included in this manual. These instruction must to be followed strictly in each phase of the operation.
- Pumps should never be operated on duty points (capacity and head) rather than that specified in purchase order. Cadoppi is not responsible for loss or damage of any kind resulted by operation of the pump on duty point rather than specified in order confirmation.
- This manual does not include working environment safety regulations and instructions.

Pump flange norm:

Standard manufacture according to PN10 DIN 2501 – ISO 7005/2

Operational conditions:

Do not operate the pump temperature values other than interval – 10°C + 20°C

1 – SAFETY

Pump installation to a system is governed by specific principals.

Principals concerning to the operation of the system that the pumps are installed in, are not covered within the contents of this manual.



ATTENTION: if warnings outlined in this manual and safety instructions provided separately are ignored, accidents involving people, environment and machinery will be inevitable.

2 – SAFETY WARNINGS FOR THE OPERATOR

- In pumps accidents that may be caused due to cold or hot machine parts must be reduced to safety level by taking pumped medium temperature into consideration.
- The coupling is protected by coupling guard.
- Never touch rotating components when pump operates.
- Cadoppi will be not responsible for any accidents caused especially from the coupling guard if only the bare-shaft pump is obtained from Cadoppi whereas electric motor and base plate are supplied from other resources.
- All rotating parts must be guarded.
- Electric motor cooling fan must be protected by guard.
- Necessary precautions must be taken in pump station for drainage and removal of the pumps against flooding.
- Pump should only be operated at intended duty point.
- Do not touch hot pumps or components which could possibly get hot due to operation such as bearings.
- Do not let pump undergo sudden temperature changes.
- Fluid density should not be higher than that specified in purchase order.
- Do not adjust flow rate by valve located at the suction side.
- Do not run pump dry. (without pumped medium)
- Do not put your hand or any other body part in holes or gaps of the pump.



ATTENTION: Assembly, commissioning, servicing and maintenance of the pumps must always be done by authorized Cadoppi services. All electrical works must be done by certified personnel. Cadoppi will not be responsible for any damages incurred by unauthorized or uncertified persons.

3 – PUMP TROUBLE SHOOTING

A proper careful mounting of the pump saves you from expenses and ensures trouble free operation. Most pump breakdowns result from the misalignment of the pump and driver at the time of installation. Pump and motor bearing failures and excessive coupling wear are the results of misalignment. To avoid pump problems and expensive maintenance, the instructions stated below should be strictly observed at the time of installation:

- 3.1) After the pump and driver are mounted on the foundation, check alignment. Level the unit and correct any angular and parallel misalignment by using wedges. These misalignment might be caused by distortion of bedplate during handling and shipping.
- 3.2) Before grouting in bedplate make sure that accurate alignment has been made.
- 3.3) After grouting and tightening of the hold-down bolts check alignment again.
- 3.4) Check alignment once more after suction and discharge pipes are connected.
- 3.5) After running the pump at the actual operating temperatures make a final check on alignment.
- 3.6) Make sure to correct any misalignment at the moment it is observed during the inspections stated above.



ATTENTION: Problems caused when original spare parts are not employed are to the user's account.

4 – STORAGE AND CARRIAGE



ATTENTION:

- Pumps volute must be emptied completely by draining pumped medium.
- Safety notes must be obeyed.
- While carrying do not leave load hanging idle, carry load with the right equipment.
- Carry load in appropriate quantities of weights and dimensions.
- Do not use flange holes and bolts of the pumps carriage.
- Pumps documents should be in easy access.

4.1) STORAGE

- If pump is not for immediate use, store in a dry and vibration free place. In case of storage in open area, cover the pump against atmospheric affects.
- While pump is in storage cover suction and discharge ends against entry of foreign objects.
- For long term storage of pumps with mechanical seals, rotate the shaft by hand once a week (2 – 3 turns) to prevent seal surface to stick each other and distortions.
- Do not leave fluid in the pump to prevent freezing.



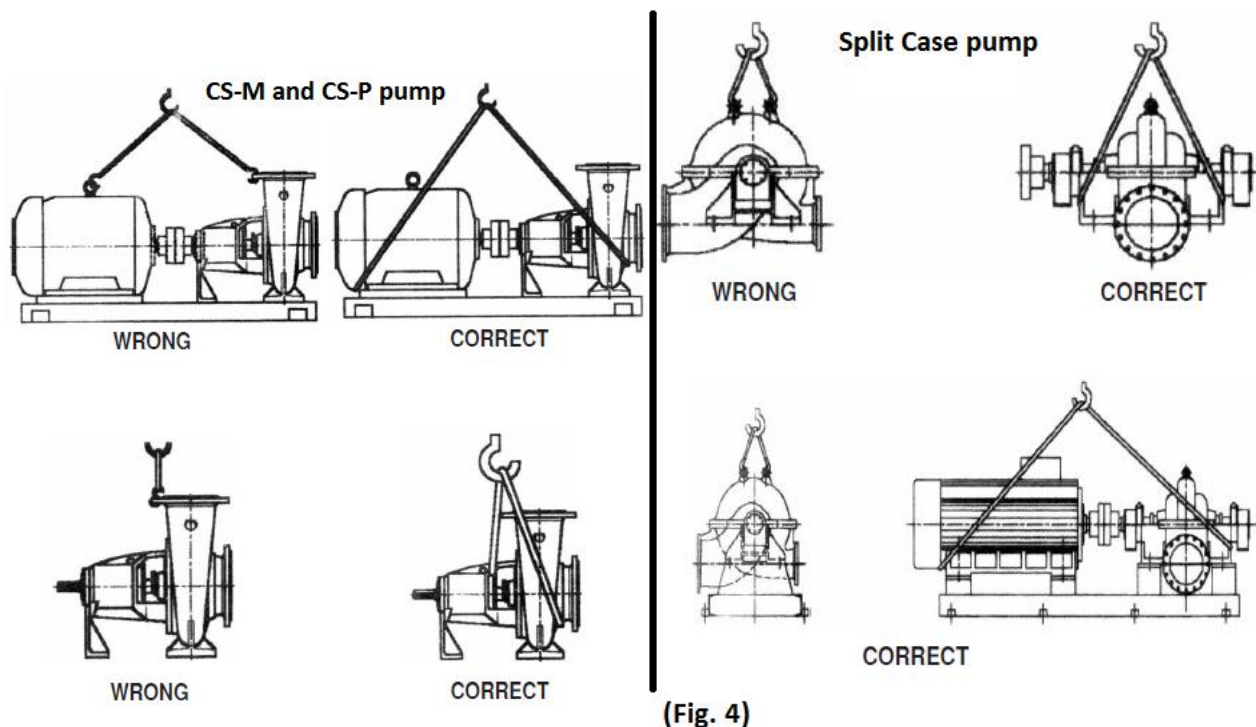
ATTENTION: Pumps must be protected against freezing.

4.2) CARRIAGE

- Cadoppi CS-M, CS-P and split case pumps should be carried as shown in the following figure (Fig. 4).

4.3) PROTECTING THE PUMP

- Pump should be kept in position suitable for easy carriage. Pump should never be moved by pushing or pulling.
- Pump should not be kept in environment with chemicals which may cause damage.



5 – PUMP FOUNDATION AND BASE PLATE

The pump is a machine manufactured with utmost care in precise dimensions to meet the required performance and operation conditions. When installed properly with appropriate pipe connections it provides year of trouble free service. For this purpose careful attention should be given to design and manufacturing of a sufficiently firm and strong bedplate and its proper connection to foundation.

The foundation should be heavy enough to increase rigidity of the system and absorb normal strains and shocks which might occur during operation. As far as rigidity and absorption of strains and shock are concerned, a concrete foundation based on solid ground gives the most satisfactory results. When the pump is to be placed in a building or on steel work it should be installed directly over a beam or as close to a main support or wall as possible. The usual sag of unsupported wooden floors causes baseplate distortion and consequently misalignment.



ATTENTION: Pump must be installed on a firm and vibration free base plate. In case of vibrations base plate must be fixed on vibration absorber feet.

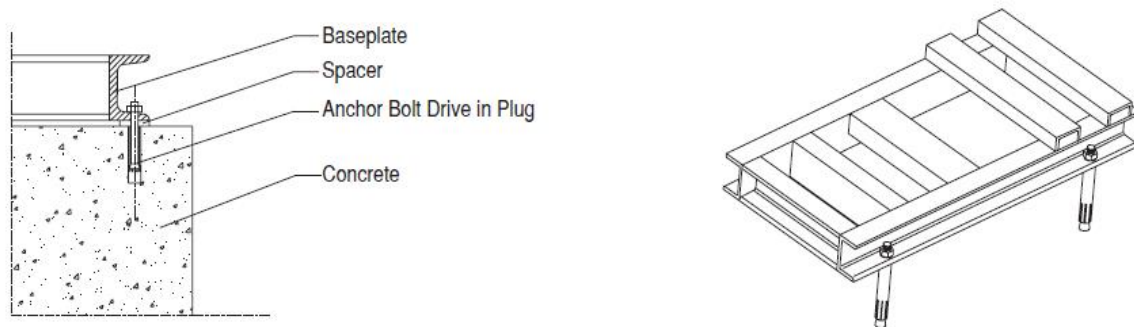
Strains in suction and delivery pipes to be connected to the pump give rise to distortion of the pump casing and bearing frame causing shaft rubbing and consequently excessive wear and shaft failure. To avoid this adequate number of pipes supports must be used.

Make sure that pump base is grouted before the suction and discharge pipes are connected to the pump. **Piping should be installed starting from the pump never vice-versa.**

Before grouting the base plate to the concrete foundation, pump is leveled and preliminary alignment is made. 48 hours after laying mortar and fixing bolts get tightened. Driver motor alignment can be made after that.

To prevent the bearings from being subject to undue loads, the pump must be leveled. The pump can be easily leveled by adjusting the position of the suction and discharge flanges in horizontal and vertical plane with aid of a small spirit level.

Leveling is also important for oil lubricated pumps to maintain equal lubrication to both bearings.

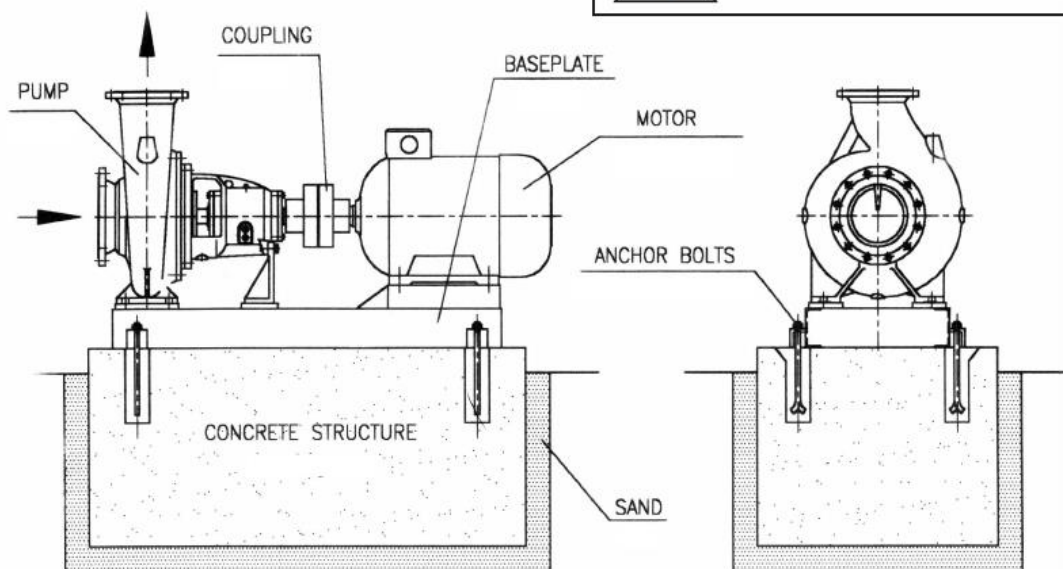


(fig). 5a. Baseplate foundation detail

ATTENTION



- In order to prevent vibrations fill base plate with concrete.



(fig). 5 Common Installation

5 – COUPLING ALIGNMENT

For trouble free operation of the pump, accurate alignment of the pumps and driver is essential. Misalignment may shorten bearing life and causes excessive coupling wear, noisy pump operation and loss of power. Because of this coupling alignment must be made properly and must be checked frequently.

Flexible coupling should never be considered as cure for misalignment. Flexible coupling does not compensate misalignment.

Coupling alignment is an adjustment to put pump and motor rotation axis on same line. If the pump is ordered from Cadoppi together with drive motor and base plate, coupling alignment get made by Cadoppi before delivery. However alignment made by Cadoppi may deviate during handling or transport, therefore pump and drive motor has to be realigned after installation.

Necessary tools for making coupling alignment are: straight metal bar (metal ruler) and caliper (if high accuracy is requested more accurate measuring devices must be used.)

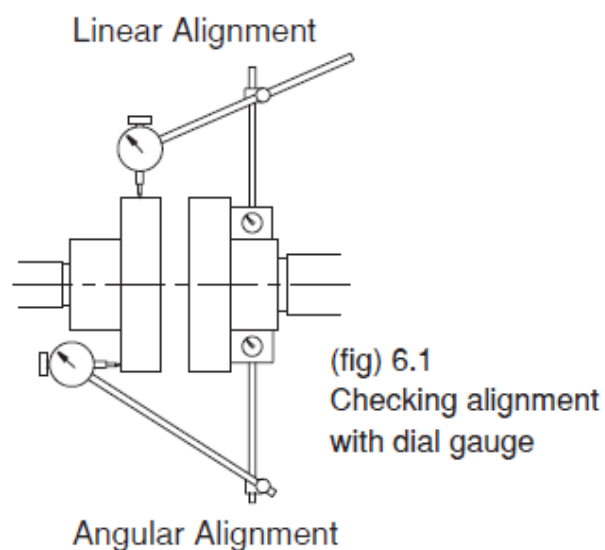
6.1) MAKING THE COUPLING ALIGNMENT:

a) Angular alignment

b) Linear alignment

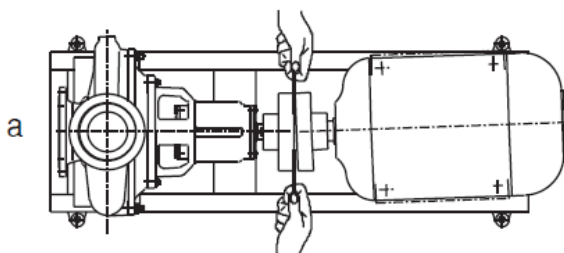
A) To check angular alignment; distance between both coupling pieces (motor side and pump side) get measured in vertical and horizontal plane. Readings taken on four opposite points must be equal. (Fig. 6a-b)

B) To check linear alignment a straight bar get placed on coupling touching both motor and pump side coupling pieces. Bar must be in contact with both coupling pieces all over their surface without making an angle. This check must be performed in both vertical and horizontal plane, in two different locations.

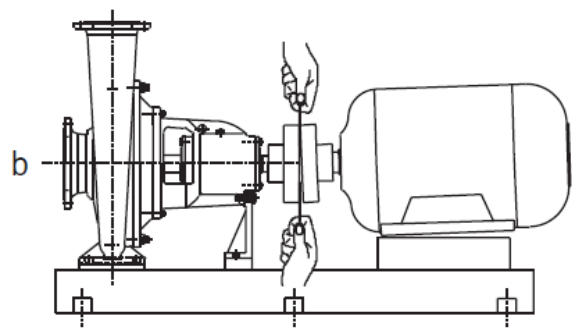


6.2) CORRECTING MISALIGNMENT:

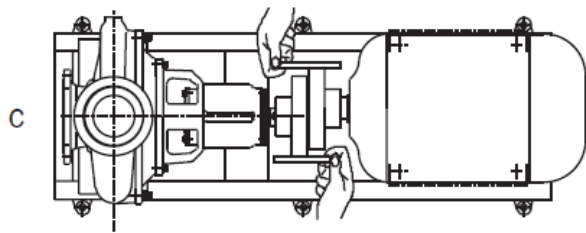
Misalignment may occur in horizontal and/or vertical plane. Correction in vertical plane can be made by placing thin sheet metal pieces under pump feet or motor feet. Correction in horizontal plane can be made moving pump or motor in horizontal plane as holes of pump and motor feet have allowance for such movement.



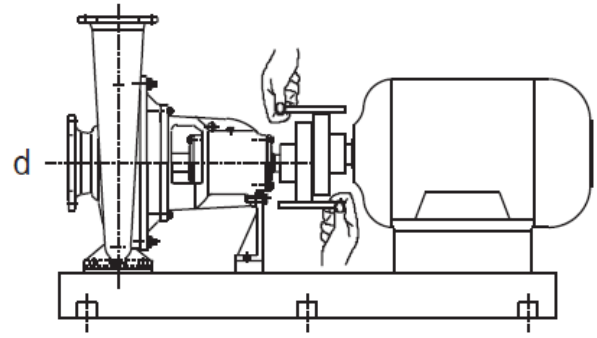
(fig.) 6.a Angular alignment in horizontal plane



(fig.) 6.b Angular alignment in vertical plane



(fig.) 6.c Linear alignment in horizontal plane



(fig.) 6.d Linear alignment in vertical plane

- Depending on coupling size distance between two coupling pieces (motor side piece and pump side piece) must be 2 – 6 mm.
- Couplings must be protected by means of coupling guard.
- After any installation change, all alignment checks must be made, since any position change may cause misalignment.
- Pump shaft end and motor shaft end should never be in contact.



ATTENTION:

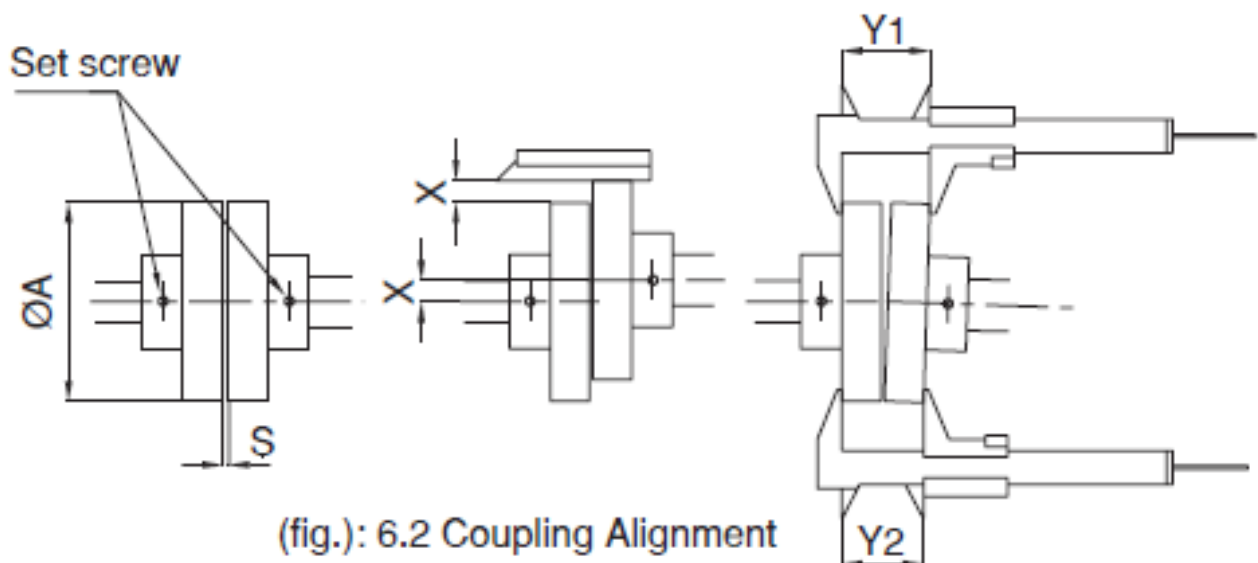
Rotation direction of the pump should always be taken into consideration.

Unless otherwise requested standard pump rotation direction is clockwise (viewed from motor end).



ATTENTION:

Never remove coupling guard while pump is running.



(fig.): 6.2 Coupling Alignment

Coupling alignment made by using a rules and caliper as seen in Fig. 6.2

COUPLING (Ø A mm.)	GAP (S mm.)	PARALLEL (X mm.)	ANGULAR (Y mm.) = Y1 – Y2
125 – 140	3 – 4	0.15	0.15
160 – 180	3 – 4	0.15	0.15
200 – 250	3 – 4	0.20	0.20
280 – 315	4 – 5	0.20	0.20
400	4 – 5	0.25	0.25

RECOMMENDED COUPLING ALIGNMENT MEASUREMENTS

7– PLANT DESIGN

7.1) PIPE LINE

- Pay attention to the direction of the flow.
- Pressure head should compensate for the loss due to friction in the design capacity of the pipe line and loss due to fittings.
- Pump connections must be well supported against any tension and the pump should not be exposed to pipe line load and tension.
- Precautions must be taken to eliminate tension may occur due to thermal expansion, expansion joints must be employed.
- Sudden crosssectional changes and directional changes must be avoided.
- Axial misalignment with the connection parts must be avoided.
- Maximum suction head of the installation must be calculated.
- In general flow velocity must not exceed 2 m/sec in suction line and 3,5 m/sec at discharge line.
- Air gap formation within the pipe line must be prevented. Flow must not be disturbed by misalignment connection parts.
- Pump should not be exposed to weight or tensional load of pipe line.

7.2) FLOW RATE REGULATION

Desired flow rate through pipe line can be regulated by means of valve fitted at discharge flange of the pump. When regulating the flow rate water hammer effect must be avoided, position of the valve should not be changed suddenly to avoid pressure fluctuations. Flow rate regulation should never be made by means of valve located at suction line / flange.

7.3) LEAKAGE

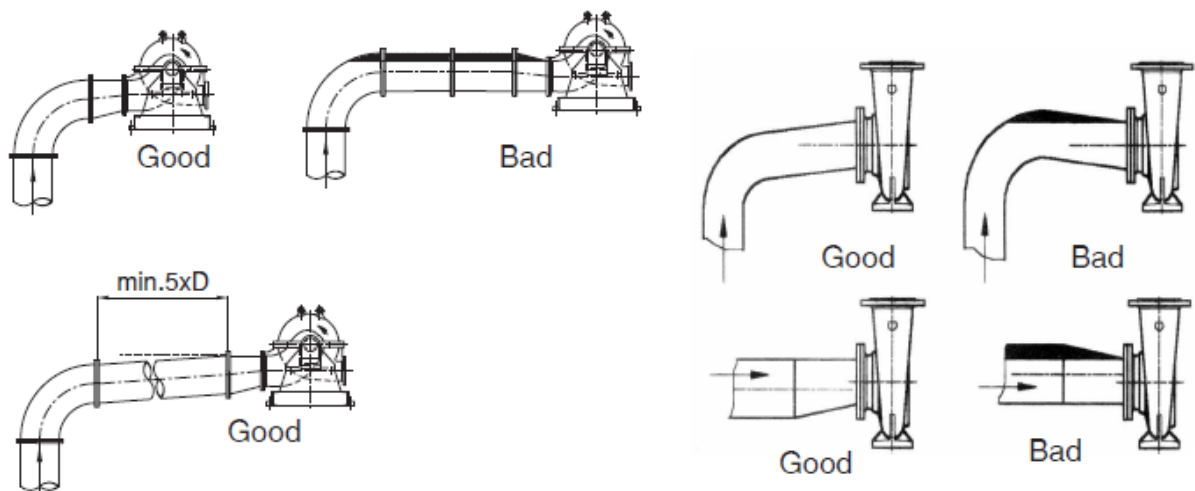
Standard elements must be used for leakage prevention. Flange gasket must be in appropriate dimensions and made of suitable material. Gasket should not disturb the flow.

7.4) PRESSURE CONTROL

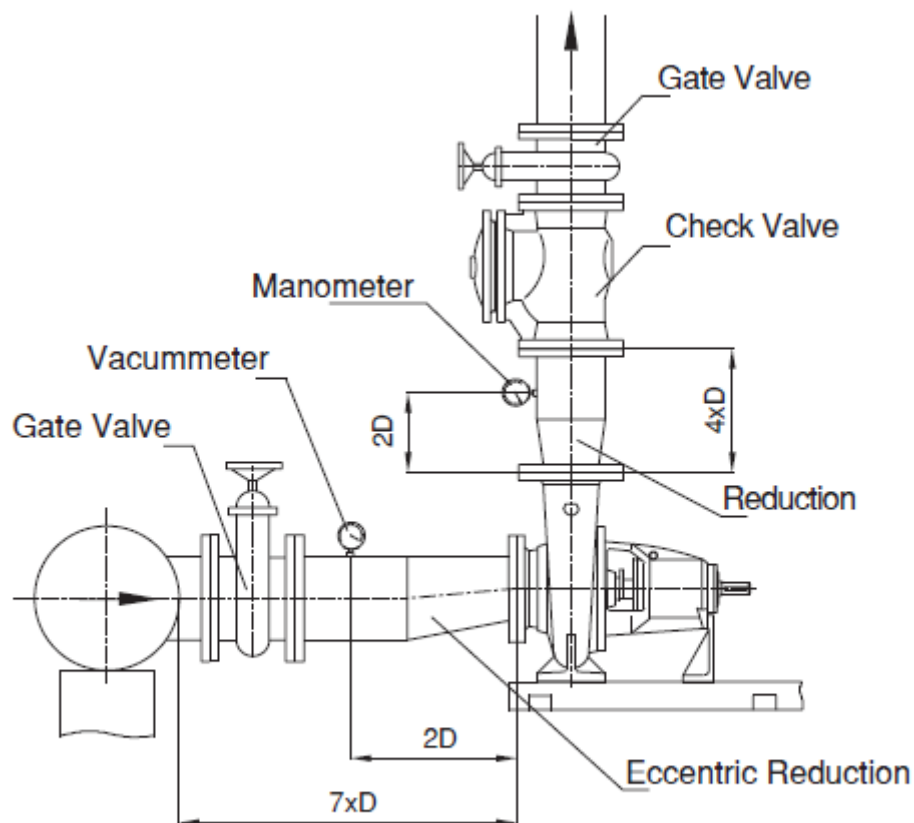
To check pressure whether it is within required interval, pressure reading can be taken by means of pressure gauges located at pumps suction and discharge flanges. Locations of gauges shown in Fig. 7/b.

7.5) DISCHARGE PIPE

- In order to regulate flow rate and discharge pressure, a valve should be fitted close to pumps as much as possible (4 times of the diameter).
- In order to prevent the reverse flow in discharge line a non-return valve must be fitted between flow control valve and pump.
- Water hammer effect in pipe installation must be calculated and appropriate measures against this effect must be taken.



(fig): 7/a



(fig): 7/b

8 – PROBLEMS IN CONNECTION WITH THE SUCTION PIPE

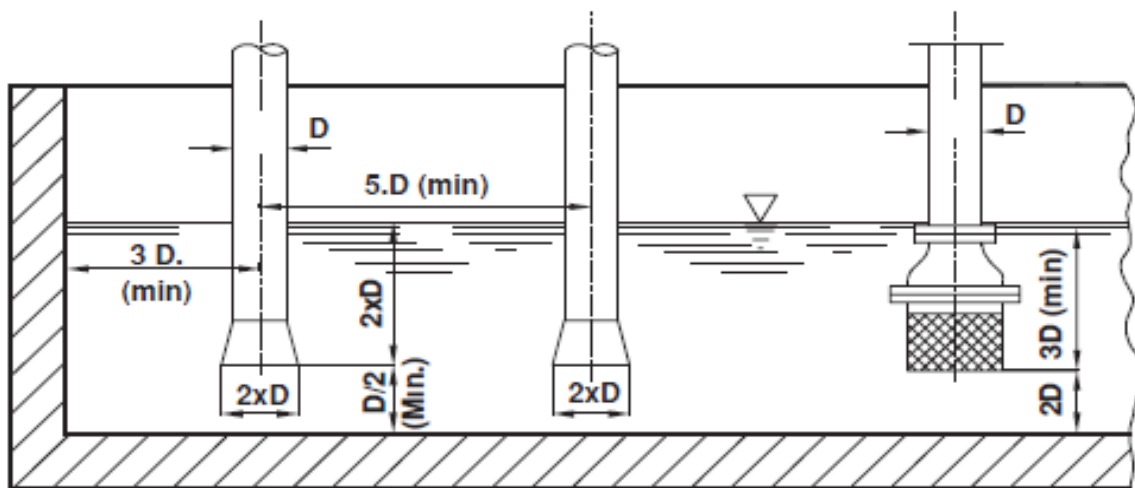
8.1) IMPORTANCE OF SUCTION IN PUMP OPERATION

In many cases, centrifugal pumps do not operate and function properly for reasons stated below:

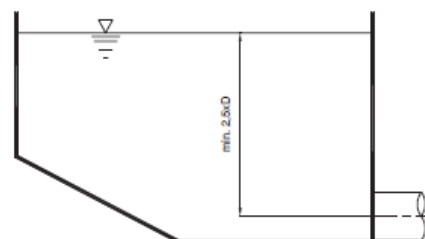
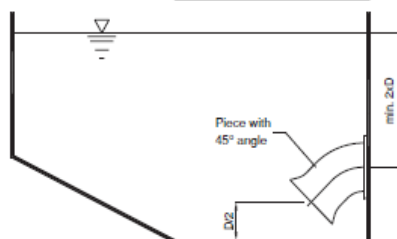
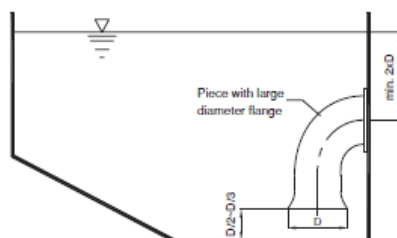
- 1 – The suction pipe diameter is too small.
- 2 – The suction pipe is not submerged deeply enough.
- 3 – Both of the above conditions are prevalent.

If the suction pipe entry velocity is too high, a vortex is formed and air is carried by vortex enters the pump. This results in rough and noisy operation of the pump and intensive vibration which might cause shaft breakage or other damages. In the amount of air entering the pump casing is too high, dry operation of the pump will start and metal seizure will occur.

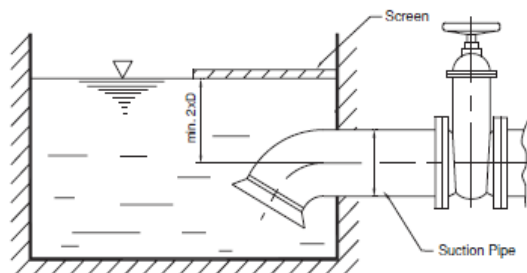
These difficulties can be overcome by selecting sufficiently large suction pipe diameters. Low entrance velocities and properly submerged suction pipe are the proper remedy for this kind of air problem (Fig. 8).



(fig): 8



Can be applied in case of low fluid level in pit and sufficiently immersed pipe to prevent vortex.



8.2) IMPORTANCE OF SUCTION PIPE SIZE

Suction pipe should be connected to pump by reducer. Frictional loss at suction pipe creates extra load on pump while it also causes pump to operate with cavitation, even causes no discharge flow.



ATTENTION:

Suction pipe size should never be smaller than pump discharge flange size in most cases it must be one size larger than pump discharge size.

Non uniform velocity distribution which causes frictional loss to increase is mainly caused by air or vapor separation which occurs within pumped fluid. It fitting such as elbows and T type fittings located close to pump suction flanges situation becomes more complicated. Non uniform flow or vapour separation causes discontinuity of flow within the pump. This results in hydraulic disturbance and consequently vibration, cavitation and excessive shaft bending occurs, shaft may break. Unless perfect suction conditions provided, velocity in short and straight suction pipe should not exceed 2 m/sec. If suction pipes are long have fittings, velocity should be 1,5 or 1,8 m/sec. Elbows fitted on suction pipe may cause complications, if necessary precautions must be taken.

If elbow has to be fitted to discharge flange of the pumps it must be fitted in VERTICAL position. If it is not possible to fit elbow vertically due lack of enough space, a straight pipe with length of at least two times of its diameter. If such pipe is not fitted between pump and elbow due to centripetal forces fluid does not enter to impeller with continuity. This situation results in unstable, noisy and inefficient operation. (Fig. 9)

8.3) OPERATING WITH AIR IN THE SUCTION LINE

Centrifugal pump should never be allowed to operate on a mixture of liquid and gases. If it is allowed, serious mechanical problem occur, pump efficiency drops and pump life is shortened. Even the existence of a small amount of air in the suction line can cause a significant decrease in flow rate and consequently in efficiency. Only 2% free air in the liquid decreases the capacity 10% and 4% air decreases capacity 43,5%.

In addition to this considerable reduction in capacity and efficiency and waste of power, the pump operates with vibration and noise. One of the most important and frequent reasons for shaft breakage is the presence of entered air. It also might be the reason for loss of suction and corrosion at greatly increased rate.

The entrance of air into the liquid being pumped may be caused by leaky suction lines an improperly packed stuffing boxes. While serious and careful measures are taken to correct these two, a third and frequent air source is overlooked.

This is the free discharge of liquid above the surface where near the place where suction pipe is submerged (Fig. 9.1).

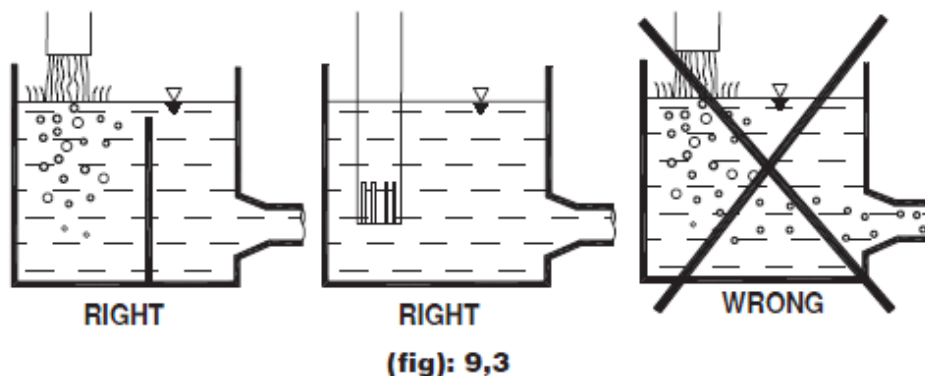
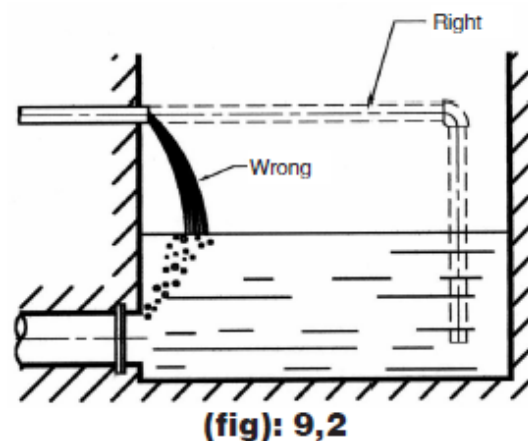
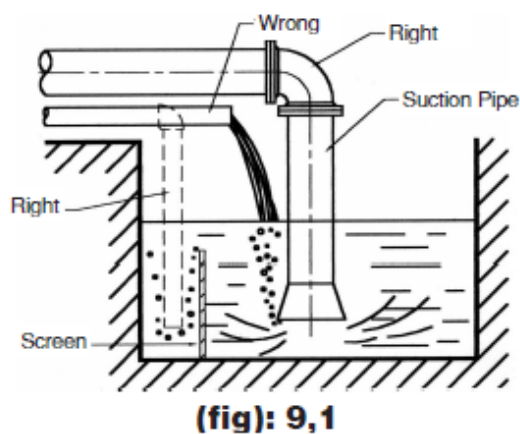
The fluid falling right on the foot valve would carry air into the suction pipe. As a result the pump can not prime and dry running and subsequent seizing follow.

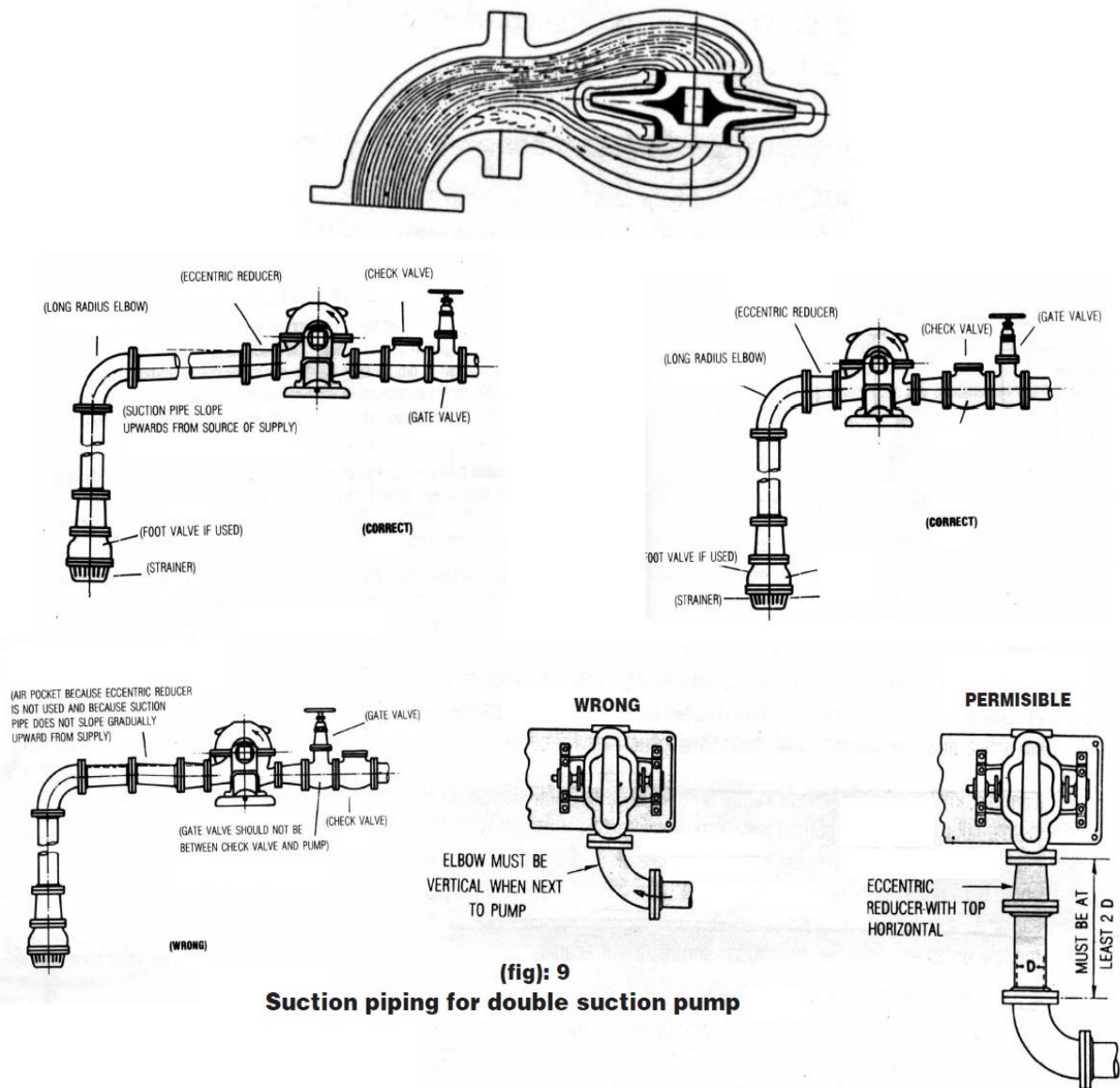
Although the suction pipe position shown in Fig. 9,2 seems to be unaffected by the free fall, some water currents and unseen vortices might carry an undesirable quantity of air into pump. In any case a free fall to the suction tank should be avoided. Especially a return pipe submerged vertically and discharging under pressure through an orifice at the end section is a proper solution (Fig. 9,3).

If the returned liquid contains a considerable amount of air or the sump is small, baffles should be used as shown in Fig. 9,1

This causes the air to separate from the returned liquid before it reaches the foot valve.

The continuous existence of air and vapor in the pumped liquid is a very important problem which must be solved immediately. All return lines should be submerged in the sump and placed sufficiently far from the pump suction.





9 – INSTALLING AND DISMANTLING THE PUMP

9.1) PREPARATION FOR DISMANTLING AND ASSEMBLY

a) INSTALLING

- Instructions must be followed, safety instructions should be obeyed and necessary safety measures must be taken during installing pump to the plant.
- Power supply cable connection should be made at the end of installation operation.



ATTENTION:

Sufficient ventilation must be provided to discharge heat generated within pump room.

- Fluid in the pipe line should be drained and all valves should be closed.
- Before installing pump into pipe line pump shaft must be rotated manually while it is coupled with motor.

- Pump, pipe line and fittings must be connected properly and without any strain, no tension must be allowed on pipe line.
- Dismantling of the pump must be made by considering the markings made during installation.

b) HYDRAULIC PRESSURE TEST

- Made to test pump strength.



ATTENTION:

Do not perform hydraulic test by air. It may cause fatal accidents

Test pressure can be 1,5 times of the pumps duty point discharge pressure at maximum

As medium use pressurized water for test.

9.2) DISMANTLING

a) PREPARATION FOR DISMANTLING

Observe and follow the following while dismantling the pump

- Motor power supply must be cut, fuses must be removed.
- Drive motor must be removed by removing bolts.
- Suction and discharge valves must be closed.
- Pumped fluid must be emptied by opening drain plug located at the bottom of the volute.
- Dairinage must be done by taking appropriate safety measures if the fluid is hazardous.



ATTENTION:

Original spare parts has to be used

When ordering spare parts; pump type, material, pump serial number has to be stated.

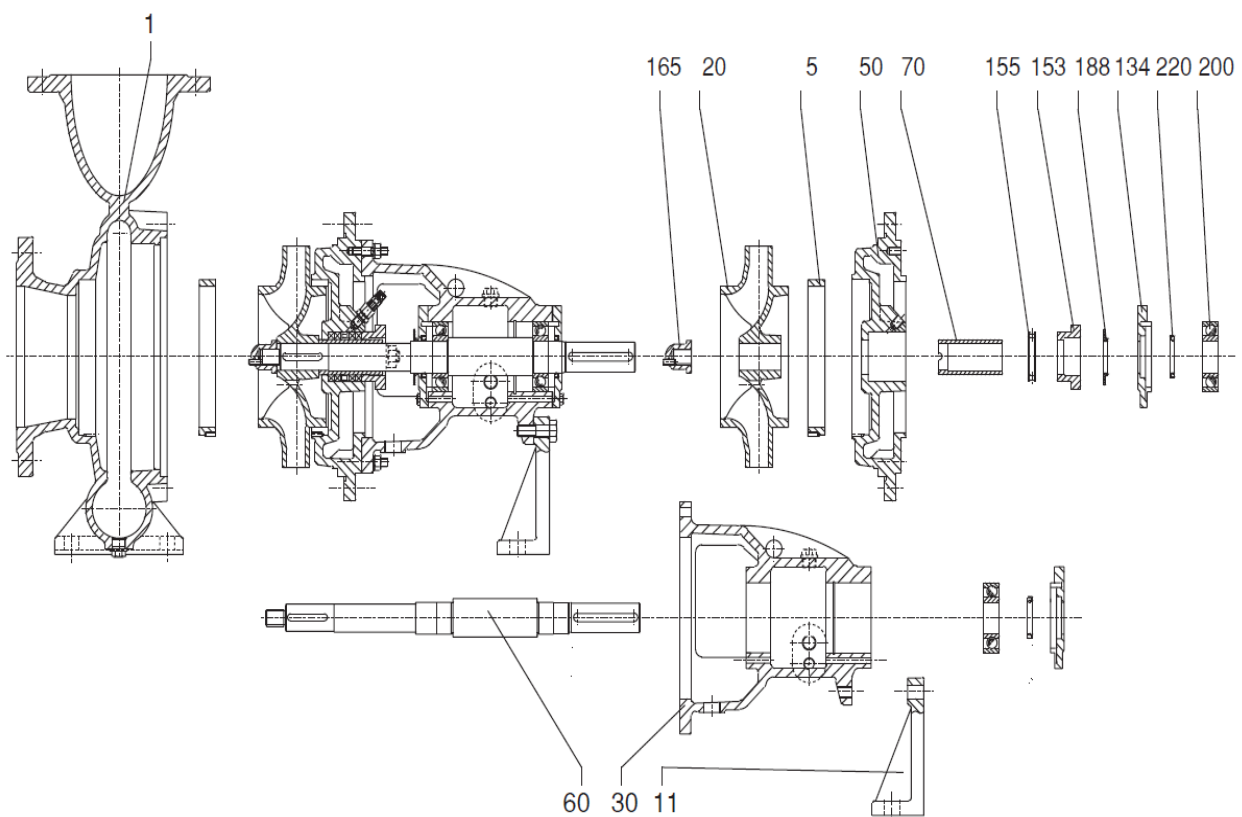
b) DISMANTLING

Observe and follow the following while dismantling the pump

- During dismantling be sure about safety working conditions.
- Mark the location of all the parts, their positions and mark them with a colour or scribe while dismantling
- Do not use a hammer or similar tools while dismantling. Use plastic hammer if necessary.
- Take necessary precautions against oil leakage keeping in mind that old oil emptied from the bearing housing and the solvents used to clean the bearings can be harmful and polluting to the environment. Keep them in restricted area.

b.1) CS-M AND CS-P SERIES PUMP (FIG. 10)

- Pump suction and discharge flanges must be dismantled from pipe installation
- Pump must be removed from base by taking out volute support foot and coupling connections
- Bearing housing stud must be removed for dismantling the pump
- Bearing housing must be hung idle
- Bearing housing must be pulled slowly towards drive motor, pulling must be done carefully since it may come out unbalanced
- After removing bearing housing dismantling can proceed on an appropriate surface
- Impeller nut must be untightened with light strokes excessive force should not be applied especially by using lever in the impeller.
- Impeller must be removed from shaft by using appropriate pull out tool
- Gland must be removed
- Stuffing box fixing bolts must be removed
- Stuffing box must be removed by pulling it axially without damaging shaft and shaft sleeve.
- Remove the cover bolts on the bearing frame that hold the bearing housing
- Use a pull out tool or a press in tool in axial direction without giving lateral load to remove bearings and shaft, from bearing housing
- remove key, shaft sleeve and bearings carefully from shaft which has been taken out-of bearing frame



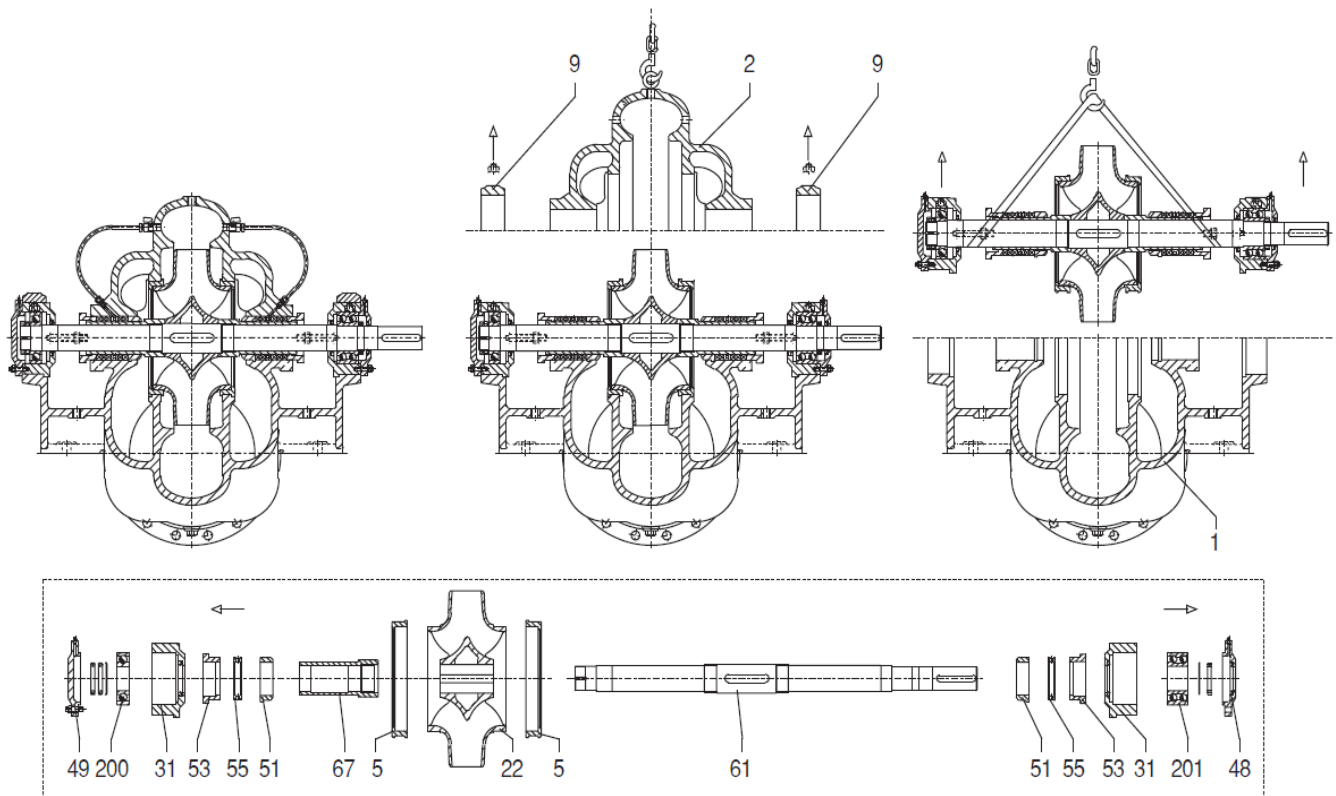
(fig): 10

b.2) DISMANTLING SPLIT CASE PUMP (FIG. 11)

- Dispose the oil in a cup by removing the plugs.
- Unbolt the studs of the top covering.
- Hold the top covering on a hanger in a that fits the lifting eye. Mount a pull-out bolt on each hole on the flange of the top covering body and move the top covering by screwing these pull-out bolts. Lift out the cover and place it in a suitable working area.
- Clean the liquid seal on the mounting surface of the top covering with solvents.
- Remove the clips on the bearing housing one by one, mark them and store them safely.
- To separate the pump and electric motor group, move the electric motor, by unbolting the motor bolts till the coupling pair is separated from each other.
- The rotor group is now ready to dismantle. Raise (lift) it from the shaft's packing gland area and from the free surfaces in between the bearing housing using a lifting belt.
- Place the dismantled rotor group on a suitable, V-shaped support. Clean the bearing housing with solvent by removing the bearing housing covers.
- Remove the shaft sleeves. The sleeves especially when operating with packing form peripheral channels and wear. If the wear in the sleeves is more than 1 – 2 mm. of the sleeves nominal diameter, the sleeves should be changed.
- Hydraulic surface of the pump's impeller should be checked. Impeller should be changed if there are wearings and changes in the shape that would affect the hydraulic characteristics and if the wearing rings are worn out and if the gap is above 0,5 mm at the radius-remove only one of the unworn shaft sleeves, preferably the one at coupling side. Impeller should be packed out with a suitable size pull out tool. Never use a hammer. The workers should take the necessary precautions during the pulling process.
- Impeller vane directions must be taken into consideration in dismantling of the impeller. New impeller must have same direction with one replaced.
- If wear observed on wear rings they must renewed by taken measurement on impeller.
- After dismantling of impeller, shaft surface where impeller fitted and surfaces of the key grooves must be checked in case of wear on these surface, shaft must be renewed.



ATTENTION: Assembly drawing must be followed when dismantling and assembling the pump



(Fig): 11

10 – SHAFT SEALING

In centrifugal pump stuffing box is the component used for shaft sealing. Mechanical seal or soft packing are two main elements for shaft sealing. Both element act like bearings over the shaft and needed to be lubricated.

10.1) SOFT PACKING

- When pump operates water must leak through sealing as droplets. Leakage must be more than 10 cm³/min and must be less than 20 cm³/min.
- Teflon packing must be cut on the shaft it will seal, with a knife properly as seen in fig. 13
- First rings ends must meet on top second rings ends must meet at bottom. Ring ends should not be on the same line.
- After placing first and second rings place lantern ring.
- Install and tighten the gland then loosen the gland. Rotate the shaft gently when shaft stops rotating do not tighten gland more.
- After fitting gland, check stuffing box temperature. Temperature should not exceed 70°C in case pumped medium temperature is same as ambient temperature.

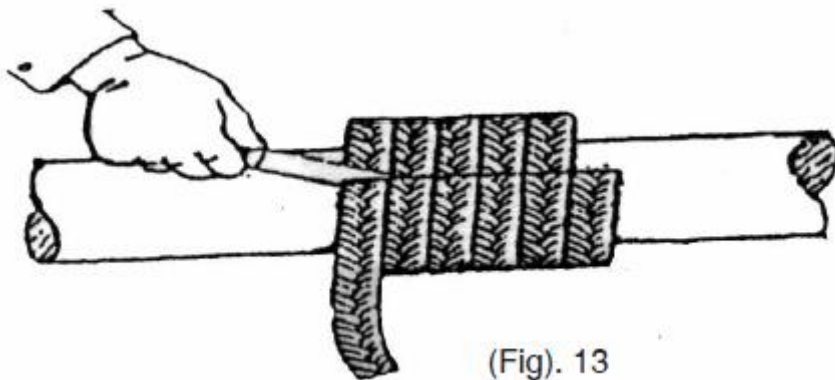
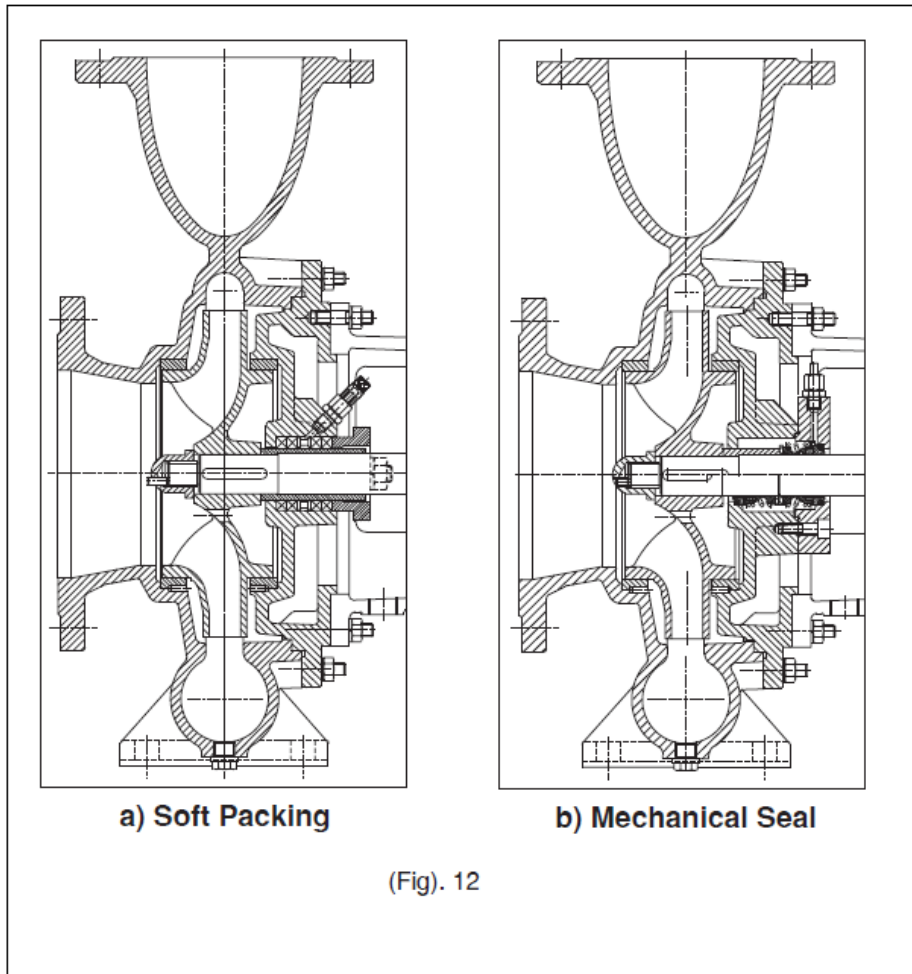
10.2) SERVICING

- Remove carefully, without exerting force, damaged and old seals from the stuffing box, through the removed seal gland and ring. Ensure no harm is done to the seal housing surfaces.

- Remove the two lantern ring pieces found between the seal, separately by means of a steel wire hook.
- After removing the seal found at the bottom or a pull-out tool of its housing, clean the seal housing thoroughly. Check whether the cooling/lubricating water hole which feeds the lantern ring is clean.



ATTENTION: Never operate the pump during servicing the packing.
 Never operate pump without packing being lubricated.
 Seals with asbestos are not used in Cadoppi pumps.



10.3) PACKING PROBLEMS

A sufficient amount of water should leak out from the stuffing box in order to lubricate the soft packing. An external source of sealing liquid is required under the circumstances given below.

- a) The internal pump pressure exerted on, in the stuffing box is negative
- b) The pumpage contains solids in suspension.
- c) The pumpage is too volatile to be a good lubricant.

If the stuffing box pressure is negative, in order to prevent air from entering the pump and also to prevent loss of prime and possible seizing of rotating parts a liquid barrier is necessary the sealing liquid which is piped externally to the stuffing box and distributed between rows of packing with the aid of the lantern ring.

If a liquid containing solids in suspension is being pumped, the amount of leakage out of the stuffing box should be reduced to a minimum because solids accumulating on the packing will score the shaft sleeve. In this case external sealing with clean water is suggested. The pressure of this water should be at least 0,7 kg/cm² above the pressure acting on the stuffing box. This way a flow of water in to the pump will occur preventing the solids from entering the stuffing box.

If the pumped medium is volatile, toxic and must be kept free of dirt, a non-soluble lubricant should be added to the packing. This will not only prevent the overheating of the stuffing box but will also minimize the leakage.

10.4) MECHANICAL SEALING

- Mechanical seal functioning properly will not cause observable leakage and does not need servicing.
- Check tightness of the mechanical seal cover.
- Sealing surfaces must be cleaned before installing, they must be installed without strain and tension.
- Mechanical seals are manufactured according to the pumped medium, manufacturer instructions must be referred.
- Mechanical seals with external cooling must be connected to water supply with pressure 1 bar more than pumps operation pressure.



ATTENTION: Never apply force when fitting mechanical seal.

11 – OPERATIONAL AND OTHER PRINCIPALS

11.1) SAFETY PRINCIPLES



ATTENTION:

- The electric panel is not within the responsibility of Cadoppi and should be manufactured according to EN – safety and other related instructions. These instructions should be applied by trained and authorized persons.
- Pump should be filled with the pump medium to be pumped and air removed. Otherwise seals may burn due to dry operation. Shaft sealing may create a problem.
- Control of direction of rotation should only be done after filling the pump with the medium.
- If filled with hot medium, work slowly to reduce expansion and sudden temperature changes.
- If pump shaft does not rotate easily by hand, pump should not be taken into operation. Pump components are subject to tension. In such case all connections must be untightened piping must be realigned. Connections get tighten without allowing tension.
- Flow which is appropriate at constant speed should only be adjusted through valves at the discharge side. Valves on the suction side should be completely open. Any danger of cavitation should be kept in mind.

11.2) FILLING / DISCHARGING OF BEARINGS

- The bearing housing of the pump should be filled with oil up to the indicator level before starting to operate the pump.
- Because the viscosity of the oil increases in cold conditions, filling of the houses should be slow and with patience.



ATTENTION:

While filling the housing with oil air bubbles in the oil causes the oil level to rise. If housings are not filled with enough oil due to this reason, the life-span of the pumps shorten.

11.3) CONTROLS PRIOR TO OPERATION

Before supplying electricity control the following:

- Are all pipe connection complete and leak proof?
- Is the valve on the discharge side shut?
- Is the valve in the suction side completely open?
- Is the motor ready for operation?
- Is the motor direction of rotation correct? (check with a short trial)

- Are the connection axially correct?
- Is the air in the pump completely discharged?
- Is the pump shaft rotating easily?

11.4) TAKING INTO OPERATION

- The valve at the suction end should be opened completely.
- The valve on the discharge side should be shut.
- Check whether pump is filled with pumped medium or not, if vacuum pump is used operate the vacuum pump to fill pump and suction line with medium.
- Start the drive motor wait until motor reactor to rated speed.
- open discharge valve slowly while checking ampermeter on the control panel. Read out on ampermeter will remain on value below motors rated current value.
- Check pressure at the discharge line. If manometer reading is below the duty point pressure close valve to obtain desired pressure. If manometer reading is higher check installation and required discharge pressure.
- When pump is started for first time, it must be operated with duty point valves for a long time.
- **Pump should only be operated by persons stated at article 2**



ATTENTION:

Pumps should never be operated on capacity and head rather than specified duty point otherwise undesired failures may occur.

- Operation with vibration and noise
- Mechanical failure
- Electric motor burn
- Increased energy consumption
- Cavitation

Never regulate flow with vane located on valve at the suction side.

11.5) STARTING FREQUENCY

A) Starting current of asynchronous electric motors is more than nominal current this leads excessive heat in motor windings and results in damage on pump shaft impeller and bearings. In order to prevent this starting frequency of pumps should not exceed some limits

Rated power (Kw)	5,5	7,5 – 15	18,5 – 30	37 – 45	55 – 75	90 – 132	160 – 200	250 – 315	400
Max No. of starts per Hour	18	12	10	8	6	5	4	3	2

**ATTENTION:**

In order to reduce failures and increase operation life pump should not be stopped and started frequently.

B)– For the direct starting () starting current = $6 \times I_n$

- For the star delta starting current = $2 \times I_n$

In star delta starting while changing from λ to delta current increase $\sqrt{3}$ times of the nominal current. Motor moment (M_n) must be larger than pumps starting moment (M_p)

- Duration of the motor to accelerate from 0 rpm to nominal speed (time for transition from λ to λ) should not exceed 15 sec. When % 90 – 95 of motors nominal speed reached starting must be changed from λ to λ . If this transition time limit exceeded excessive current will be absorbed from supply and stator windings and rotor will be damaged.

11.6) CHECKS DURING OPERATION

- RPM and discharge head must be checked
- Vibration level must be checked
- Flow in the suction line must be checked
- Shaft sealing lubrication flow must be checked
- Leakage through sealing can be $0.1 - 0.2 \text{ m}^3/\text{h}$ as vapor. Other than this leakage as droplets allowed
- Stuffing box and lubrication fluid may be hot during operation
- Bearing temperatures must be measured by thermometer, they must not exceed 70°C

**ATTENTION:**

When increase in sealing fluid flow is observed pump must be stopped and packing must be added.

11.7) OTHER PRINCIPLES

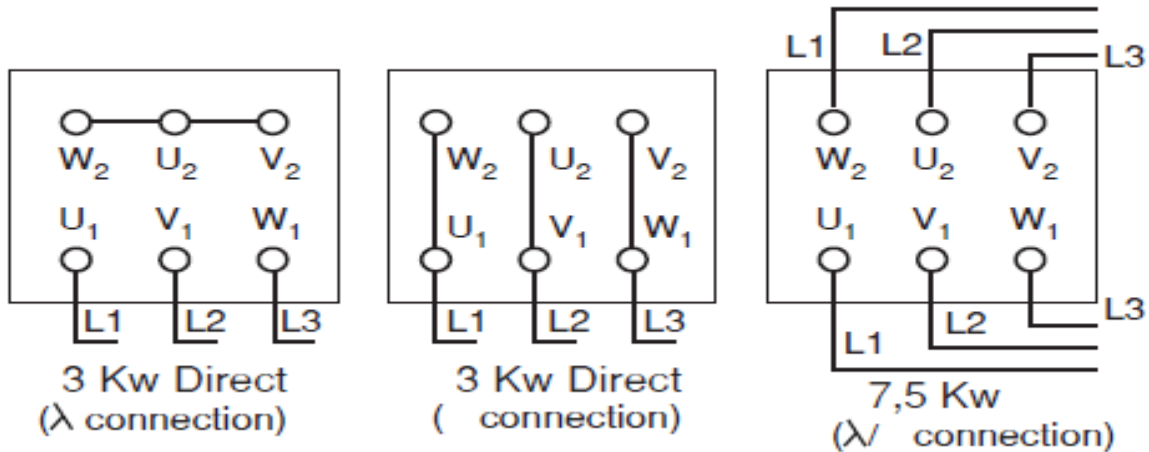
- Before stopping the pump the discharge side valve should be closed and should remain closed after stopping the pump. To avoid pump internal from freezing (also for the system) empty the pump casing by releasing the plug under the casing.

**ATTENTION:**

Ensure safety to human environment when pumping medium having explosive, parsonous, hot or crystal from properties use a by-pass line to drain.

11.8) ELECTRIC MOTOR

- Generally used electric motors are according DIN, IEC, VDE ve TSE standards, three phase, 50 Hz, F insulation IP 54 (55) protection class, S1 operation, fan cooled, squirrel cage.
- Starting method up to 5,5 Kw direct, 7,5 Kw and above star delta.
- Refer to motor catalogues for motor details.



ATTENTION:

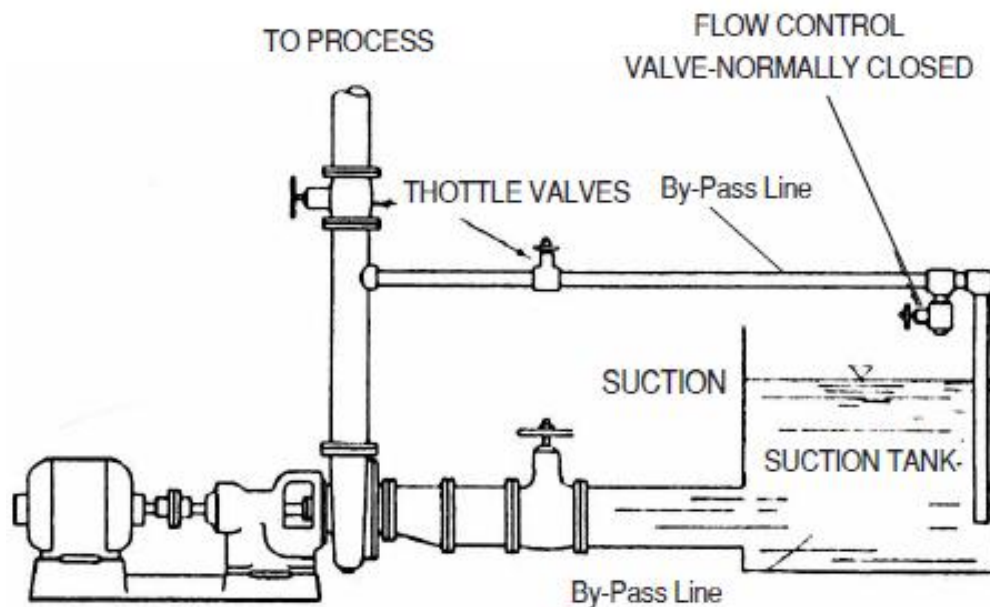
The electric motor and control panel should be connected according to the circuit diagram and should be performed by a licenced personnel

12 – THROTTLING

At the design stage of an installation, pump capacities usually determined, according to maximum capacity needed by plant or estimations of future requirements. In such cases pumps must operate with throttling to meet actual required capacity. If pump operates with throttling for a long time life of the pump decreases and maintenance costs increases considerably.

With throttling, a small percentage of optimum operation capacity delivered by pump.

The difference between power input to the pump and power delivered to water by pump transferred to pumped fluid in the form heat. Generated heat may not be disposed by pump casing and may result in excessive heat increase of the pump. Other problem that could occur with throttling; hydraulic radial forces can not be Balanced. This causes shaft to bend. Pump operates with noise and excessive vibration. These unbalanced forces may result shaft and bearing failure.



(Fig) 14

If Throttling must be made while by-pass line is fully open actual manometric head and capacity values of the installation should be re-evaluated and new values must be taken into consideration.

Pump should never be operated continuously in throttling especially when the medium contains abrasive particles. Abrasion increases considerable in throttled operation and impeller gets damaged within a couple of weeks.



ATTENTION: Do not operate the pump with throttle for a long time

13 – LUBRICATION OF PUMPS

Cadoppi grease or oil lubricated pumps are designed for easy maintenance.

13.1) GREASE LUBRICATED BEARINGS

For these pumps, lithium soap Class 3 (e.g. Shell Alvania R 3 or equivalent) bearing grease is recommended. This oxidation resistant grease can be used in a wide range of temperatures and for a large variety of services. It is suitable for hot, old, dry, wet, clean and dirty work conditions. Grease seals prevent moisture and dirt from entering the bearings (fig. 15).

After about three month of operation (2000 hours) grease should be added to the bearings. Using shorter intervals might result in overheating and consequently shortens bearing life.

13.2) OIL LUBRICATED BEARINGS

For these pumps No 30 (e.g. Shell Tellus 46 or equivalent) oil is recommended. This oxidation resistant oil can be used for low temperature operation as well.

They endure moisture, corrosion, bubbling and low temperatures. (Fig. 15.2)

(For lubricant see point 21)

13.3) SAFETY RULES

- Explosive, poisonous hot liquids may be hazardous to humans and environment.

- After draining such medium from the pump, pump interior must be cleaned.

Chemicals and solvents used for cleaning may be hazardous for environment and humans do not let these chemicals to contaminate working environment and suction basin.

- Dismantling and assembling places must be clean.

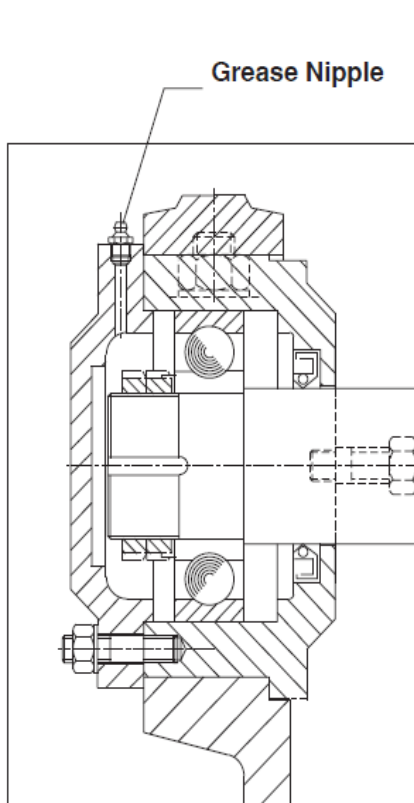
- Appropriate and safe tools must be used for assembly and dismantling.



ATTENTION:

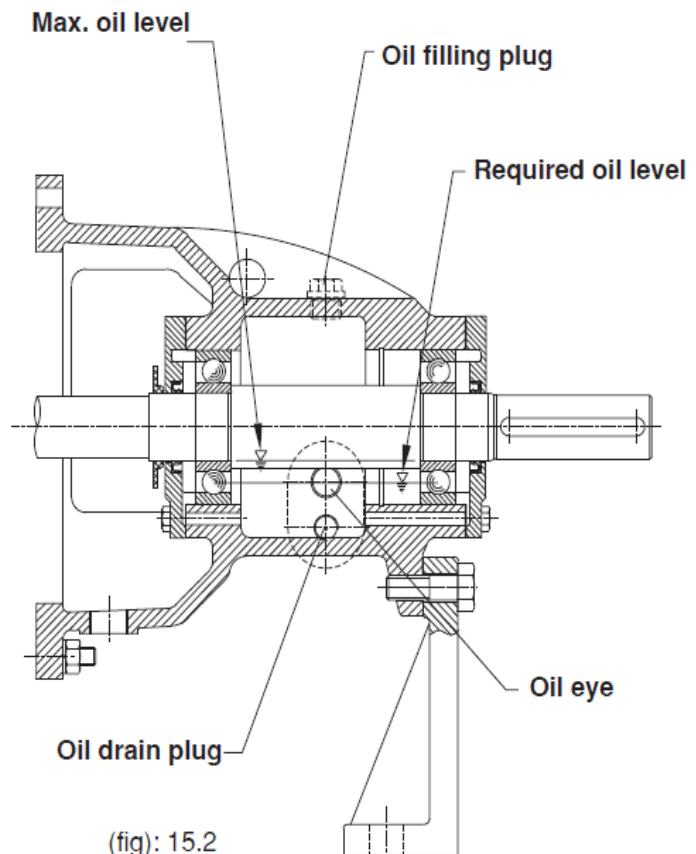
Fill the bearings with a necessary quantity of oil

Do not over fill



(fig): 15.1

Grease lubricated bearing



(fig): 15.2

Oil lubricated bearing

14 – BALL BEARINGS

For a long life and trouble-free service the below stated suggestions should be Strictly followed.

14.1) CLEANLINESS

The very first requirements is cleanliness. 90% of bearing failures are caused by dirt. Suggestion given below must be strictly followed.

- 1- Never open housing unless it is a must.
- 2- Wash hands. Wipe out dirt, particles and grease off tools.
- 3- Spread clean paper on work benches. Place the tools you cleaned and ball bearings on this clean paper only.
- 4- Bearings, bearing housings and shaft should be covered with a clean cloth when they are not being used.
- 5- Keep new bearings in their original package until the time of use.
- 6- Before reassembly clean shaft and housing with an appropriate and clean solvent.

14.2) EXTRACT BEARINGS WITH CARE

- 1- While pulling or inserting the bearing use a sleeve or puller which contact the inner race only. (some double suction pumps are the only exception to this. In these pumps the housing is used to pull the bearing).
- 2- Never apply force on the balls or ball cages. Press only against the races.
- 3- Never cock bearings. Only a sleeve which is cut square or a puller which is adjusted square should be used.
- 4- If the bearing housing is being used to pull the bearing, make sure to pull evenly and never hammer on housing or shaft. Since both are races locked, hammering affect the balls and destroy the bearing.



ATTENTION: Bearing temperature should not exceed 75°C

14.3) BEARINGS AND SHAFT INSPECTION

- 1 – Inspect the bearing carefully for flat spots, nicks or pits on the balls or races. In the presence of any of these scrap the bearing. Bearings should not be used unless they are in perfect conditions.
- 2 – Turn bearing slowly by hand see if it moves smoothly and quietly without any resistance or noise. If it does not scrap it.
- 3 – Do not hesitate to scrap it if you have the slightest doubt about the condition of the bearing. Paying only a little for a new bearing will save you time and possible

pump damage. Replace bearings at each overhaul especially when running under severe or critical circumstances.

4 – Check the shaft to see if the bearing seats are smooth and free of burrs. Smooth burrs with crocus cloth. Shaft measures should be in accordance with given tolerances. Make sure that shaft shoulders are square and do not run over.

14.4) CHECK NEW BEARINGS

– In selecting a bearing make sure it is of correct size and type. For example, an angular contact bearing which is dimensionally the same as a deep groove bearing may fit perfectly in the pump. But while the second one is suitable for and thrust in both directions the first one can resist thrust only in one direction. Also make sure that the shields, if any, are the same as in the original unit. To choose the right bearing refer to pump catalogs and bearing instruction books.

-Bearing replacement: depends on operational conditions. In general bearings must be replaced after 20.000 – 40.000 hours of operation

- Oil gasket, O-ring, Gasket replacement: On every dismantling they must be replaced.

14.5) CAREFULL INSTALLMENT

1 – Oil bearing seat on shaft lightly.

2 – Make sure that shields, if any are facing the right direction. Angular contact bearings should also face in the proper direction. If duplex bearings are used be careful that they are installed with proper faces together. Ways of installment differ depending on the model. Therefore refer to instruction books and catalogs for specific pumps.

3 – While inserting, press bearing on squarely and never cock it on the shaft. Remember that pressing sleeve must be clean, cut square and in contact with the inner race only.

4 – The shaft shoulder supports and squares the bearing. Therefore press bearing firmly against the shoulder.

5– Take special care that snap rings are correctly installed. That flat side must be against the bearing. Be sure lock nuts are tight.

6 – Lubricate as suggested in the bearings instruction book.

14.6) SUGGESTED OILING INTERVALS

Pump Speed	Oiling Period
1000 rpm	4400 Operation hours
1500 rpm	3000 Operation hours
3000 rpm	2000 Operation hours

15 –BEARING TEMPERATURE MEASUREMENT

Usually bearing temperature are checked by touching the bearing housing with the hand. If it feels “cool” or “warm” we feel assured. If it feels “hot”, without knowing what the actual operating temperature of the bearing should be, we get worried and spend much time and effort to lower the temperature.

But the human hand is not a good thermometer and estimating bearing temperature with the hand may cause a false alarm. Depending on the individual, temperature range which feels “hot” is 50 – 55°C. The human hand fails to estimate temperatures above this. The upper limit of the operating temperature for ball bearings is considered to be the temperature at which the lubricant loses its lubricating qualities and begins to carburize. Temperatures up to 70°C are extremely safe. Since about 70°C a better flow of lubricant is expected, it is desirable for bearings to operate at this temperature. This gives a clear idea why a thermometer should be used to measure bearing temperatures.

All bearings, which are not cooled with water, operate at some temperature above that of the ambient. In bearing heat is generated by the rolling friction of the balls and by the race drag. Some heat may also be added to the bearings through the shaft by conduction. The amount of heat being dissipated into surrounding atmosphere depends on the cooling area of the bearing housing and the temperature and motion of surrounding air. When a balance between the generated and dissipated heat is reached a stable operating temperature is established. This temperature remains constant unless one or more of the variables changes. No matter how hot this stable temperature feels to the human hand, it does not constitute a sign of danger unless it exceeds the upper limit of the lubricant. The temperature should be measured accurately by thermometer and recorded. A sudden and excessive rise in temperature is a danger signal and its case should be investigated. After adding only one shot of grease to the bearing check the temperature. If it has not dropped, no more grease should be added instead other likely causes, such as coupling misalignment and improper packing, should be checked. Temperature rise may not be due to bearing failure or some unnecessary loads stated above. It may be caused by an increase in the temperature of the pumped liquid or by a rise in ambient temperature during the warm summer months. Heat transfer caused by the increased temperature of the liquid pumped can be minimized by supplying the bearings with cooling water from an external source.

In many cases, bearing temperatures increase due to defective lubrication.

For example, over-greasing results in more resistance to rotation and consequently more heat is generated. Getting rid of the excessive grease will decrease the bearing temperature considerably. In most pumps, pumping hot liquids, water cooled

bearings are used. Operating temperatures of these bearings may be lower than that of the surrounding atmosphere.

Some times when pumps are first started bearing temperature seem to be too high. This is mostly due to the grease seals rather than the bearings. If this is the case the bearing temperature is reduced to a normal level as the grease seals are seated.

Operation with vibration results increase in bearing temperature and reduces bearing life.



ATTENTION: In case of excessive bearing temperature consult Cadoppi.

16 –INSTRUCTIONS TO BE FOLLOWED WHEN STARTING NEW PUMPS

- When starting new pump for the first time following must be checked.
- Pump shaft must rotate freely
- Check electrical connections.
- Check motor rotation direction
- Check pump foundation, base plate, anchor bolts and pipe connections.
- If pump shaft does not rotate freely do not start pump without taking necessary actions.



ATTENTION: Do not operate pump if coupling alignment is not made

- Packings, gland and flushing water pipes must be connected properly to allow sufficient flow.
- After all these checks, open suction valve totally and let suction line to be filled with fluid completely.
- In case of flooded suction side installation fluid fills suction easily

Installations with suction head if the system has foot valve fill the pump with fluid up to the highest level. If there is vacuum pump operate vacuum pump to make fluid to reach upper most level.

- Fluid in the pump acts as lubricant for wear rings and shaft sealing.



ATTENTION: Never operate pump in dry condition

- Start the pump and open the discharge valve as quickly as possible. Check discharge side pressure. If the pressure is not reached at specified speed stop the motor discharge the air in the pump and make necessary checks again.
- Pump which is started for the first time must be operated on specified duty point for appropriate duration.

- Do not operate pump in throttled valve this may result in heat increase.

16 – PERIODICAL CHECKS AND MAINTENANCE

- Periodical check interval: this interval must be determined by user according to operational conditions. In general pump must be checked during bearing replacement.
- In case pump is dismantled from the pipe line for the maintenance, necessary precautions must be taken in control panel for stating the pump accidentally when it is dismantled.
- Electric motors and other electrical accessories must be checked and serviced according to manufacturer's instructions.
- All instructions of this manual must be taken in consideration.
- Bearing housings manufactured with high accuracy they must be serviced with care.
- In case of bearing housing wear they must be replaced with new ones. In order to ensure this the must be checked carefully.
- Components to be checked in periodical controls: Wear rings, shaft sleeve, shaft, bearing housing, impeller, packing must be checked. If wear ring diameter reduced by 1 mm it must be replaced with new one.



ATTENTION:

Bearing housing diameter must not be larger than it is original value

- Servicing must be done in clean environment.
- When tightening bolts torque meter must be used and angle tightening must be done carefully.
- Before servicing accuracy of the measuring tools must be checked safety instructions must be obeyed.



ATTENTION:

If pump is to be sent to Cadoppi for servicing pump type and serial number must be mentioned.

17.1) PAINTING

Primary coat: Rapid cellulosic primer RAL 3013 – red

Final coat: Cellulosic – Red

NOTE: Cadoppi reserves the right to change the paint type without prior notice.

17.2) SPARE PARTS

- Cadoppi warranties to supply necessary spare parts for 10 years after date of Delivery.
- When ordering spare parts mention duty point information stated in pumps name plate (pump type, serial number, capacity flow rate, head, motor, power and speed)
- When ordering spare parts, part name, part No and quantity must be stated.
- Spare part list number of spares that should be kept in stock according to number of pumps.

Part Name	No. of pumps		
	2 – 4	5 – 7	8 and more
Impeller	1	2	%30
Wearing (set)	2	4	%50
Shaft Sleeve	3	6	%50
Packing	As No. of pumps		
Bearing	As No. of pumps		
Oil seal O-ring	As No. of pumps		
Mechanical Seal	As No. of pumps		



ATTENTION: For trouble free operation always use original spare parts

- Keep original spare parts in your stock. For number of spare to be kept in stock contact CadoPpi.

17.3) BOLT TIGHTENING MOMENTS

SCREWS	Tightening Moment	
	Classification	
	8.8	10.9
M5	6	8.7
M6	10	15
M8	25	36
M10	49	72
M12	85	125
M14	135	200
M16	210	310
M18	300	430
M20	420	610
M22	580	820
M24	710	1050
M27	1050	1550
M30	1450	2100
M33	1970	2770
M36	2480	3560

17.4) EXPECTED NOISE LEVELS

Rated Power KW	Sound Pressure Level (dB)*			
	Pump		Pump and Motor	
	1450 rpm	3000 rpm	1450 rpm	3000 rpm
0.55	54	56	61	63
0.75	54	56	61	65
1.1	56	58	63	66
1.5	57	59	65	69
2.2	59	61	66	70
3	60	62	68	72
4	61	63	70	74
5.5	62	64	71	81
7.5	63	65	72	82
11	67	70	73	83
15	69	72	74	83
18.5	70	73	75	84
22	71	75	76	84
30	74	77	78	91
37	75	78	79	92
45	76	79	80	93
55	77	80	81	93
75	78	81	82	94
90	79	82	83	94
110	80	83	85	95
132	81	84	86	95
160	82	-	87	96
200	83	-	88	-
250	85	-	89	-

***Measurement without insulation screen on reflecting surface,
in open, from 1 m. distance (ISO 3744)**

18 – CHARACTERISTIC FAULTS

FAULTS		POSSIBLE CAUSES
1) Pumps does not deliver any water or delivers less	1.1	Plant friction losses are higher than estimated (Total System Head higher than pump nominal head)
	1.2	Suction head is high
	1.3	Impeller, volute, discharge line blocked
	1.4	Wrong direction of rotation
	1.5	Suction pipe not sufficiently submerged
	1.6	Air trapped in suction line
	1.7	Air escaping into suction side through connections
	1.8	Static head is greater than pump manometric head
	1.9	Discharge line blocked
	1.10	Low speed
	1.11	Air escaping through packing
	1.12	Suction line not filled with water before starting pump
	1.13	Blocked strainer and foot valve
	1.14	Pumps not correctly selected in case of parallel operation
	1.15	Suction pipe diameter too small
2) Pump discharge head not sufficient	2.1	Air entering through suction piping or foot valve
	2.2	Low speed
	2.3	Wrong direction of rotation
	2.4	Increased medium viscosity
	2.5	System head higher than calculated
	2.6	Pump not correctly selected in case of parallel operation
	2.7	Worn or blocked impeller
	2.8	Severe pump leakage
	2.9	Discharge line blocked
3) Pump stops after operating for a while	3.1	Suction line not filled
	3.2	Air trapped in suction line
	3.3	Air escaping into suction line
	3.4	As pump starts to operate, suction level drops causing suction of air and medium
4) Motor absorbing more than required power	4.1	Motor speed higher than normal
	4.2	Wrong direction of rotation
	4.3	Total system head higher or lower than pump nominal head
	4.4	High medium viscosity and specific gravity
	4.5	Blocked impeller
	4.6	Bent pump shaft or friction between rotation and stationary part
	4.7	Worn wear ring
	4.8	Packing, shaft too tight
	4.9	Misaligned coupling
	4.10	Bearings have failed

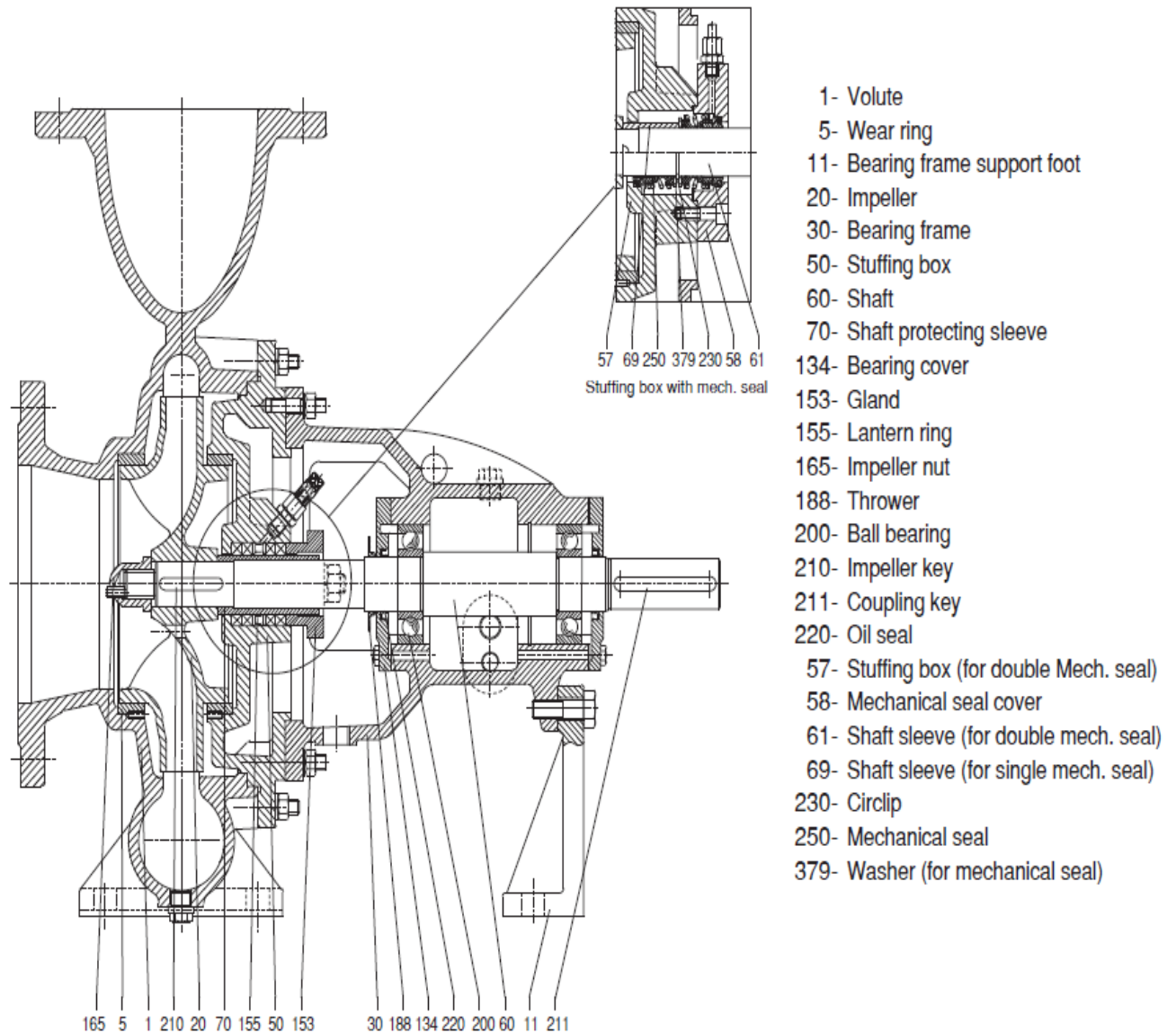
CHARACTERISTIC FAULTS

FAULTS		POSSIBLE CAUSES
5) Pump operating under vibration and noise	5.1	Air pockets trapped in pump and suction piping system. Wrong suction piping system
	5.2	Suction head too high (medium turning into vapour at suction side)
	5.3	Foot valve and strainer undersized or blocked causing loss suction
	5.4	Suction pipe not well immersed in water
	5.5	Pump operating lower or higher capacity than its nominal
	5.6	Blocked impeller
	5.7	Pump and motor misalignment or bent pump shaft
	5.8	Bearings worn, overheated or failed
	5.9	Unbalanced or badly balanced impeller
	5.10	Friction between rotating and stationary parts
	5.11	Pump foundation not rigid enough
	5.12	Suction and discharge collector connection not rigid
6) Bearing frequently humming	6.1	Bent or off centre pump shaft
	6.2	Leakage in bearing housing assembly
	6.3	Unbalanced or badly balanced impeller
	6.4	No or not sufficient oil in pump
	6.5	No or not sufficient balance holes in impeller
	6.6	Bearings are not adequately sized wrongly chosen bearings
	6.7	Bad coupling alignment
	6.8	Pump foundation not rigid enough
7) Temperature rise in the pump casing	7.1	Pump operating at no or low capacity than its normal (near/close valve operation) capacity
	7.2	Pumps not correctly selected for parallel operation
	7.3	Friction between rotating and stationary parts
	7.4	Bearings are jamming or bent shaft
	7.5	Axial loads unbalanced
	7.6	Packing too high
	7.7	Pump foundation not rigid enough, pump operating under vibration
	7.8	Pump operating closed or near close valve
8) Frequent bearing failure and motor failure	8.1	Suction problem exists, suction head too high
	8.2	Water level low
	8.3	Bad coupling alignment
	8.4	Wrong system manometric head calculation
	8.5	Pump operating close to end of curve and with low efficiency
	8.6	Pump rotates in reverse when stopped unscrewing impeller nut, check valve doesn't close at stoppage causing reverse rotation
	8.7	Wrongly assembled bearings
	8.8	Bent pump shaft
	8.9	Not appropriate pump shaft diameter
	8.10	Increased gap or worn wear rings
	8.11	Wrong bearing selection
	8.12	No oil in bearing house
	8.13	Impeller balance holes missing or impeller balance vanes too large or missing
	8.14	Large solids trapped in impeller
	8.15	Excessive pump start frequency
	8.16	Wrong / small motor selection

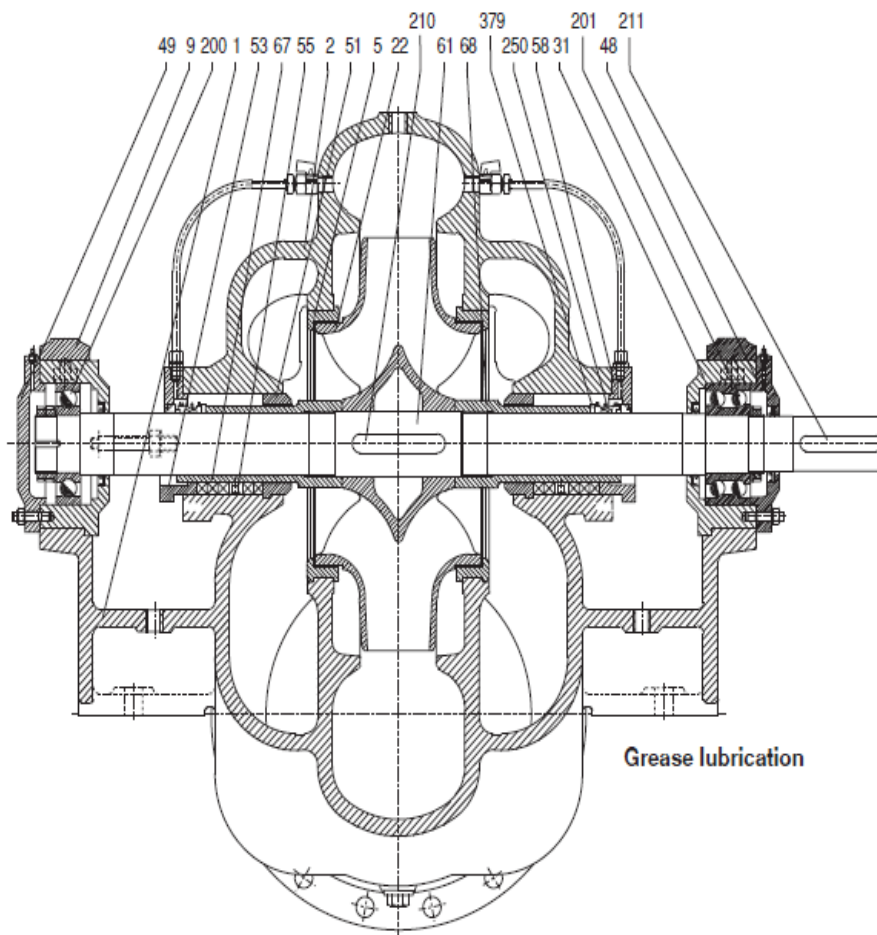
FAULTS		POSSIBLE CAUSES
9) Motor switch opens the circuit	9.1	Wrong/small circuit break selection
	9.2	Motor not selected according to pump
	9.3	Motor defective
	9.4	Power fluctuation
	9.5	Pump blocked

19 – PUMP SECTIONAL DRAWING AND PARTS LIST

19.1) PUMPS RANGE CS-M and CS-P



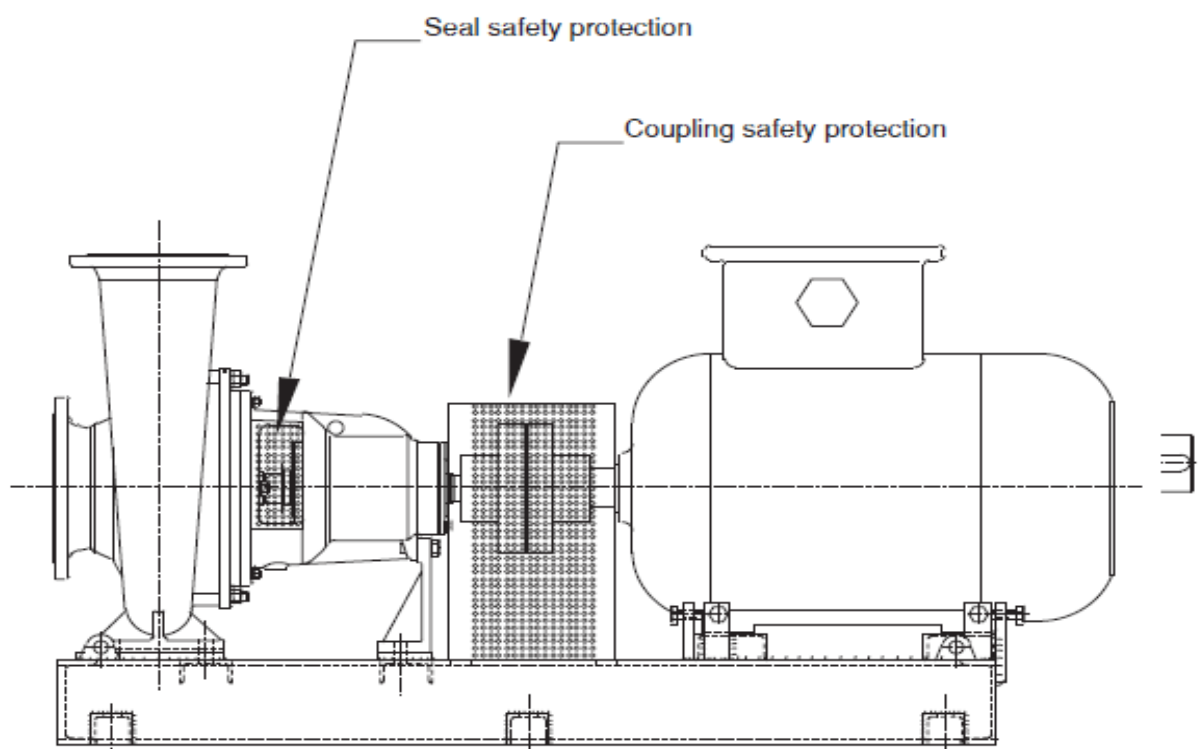
19.2) SPLIT CASE PUMP – DOUBLE SUCTION



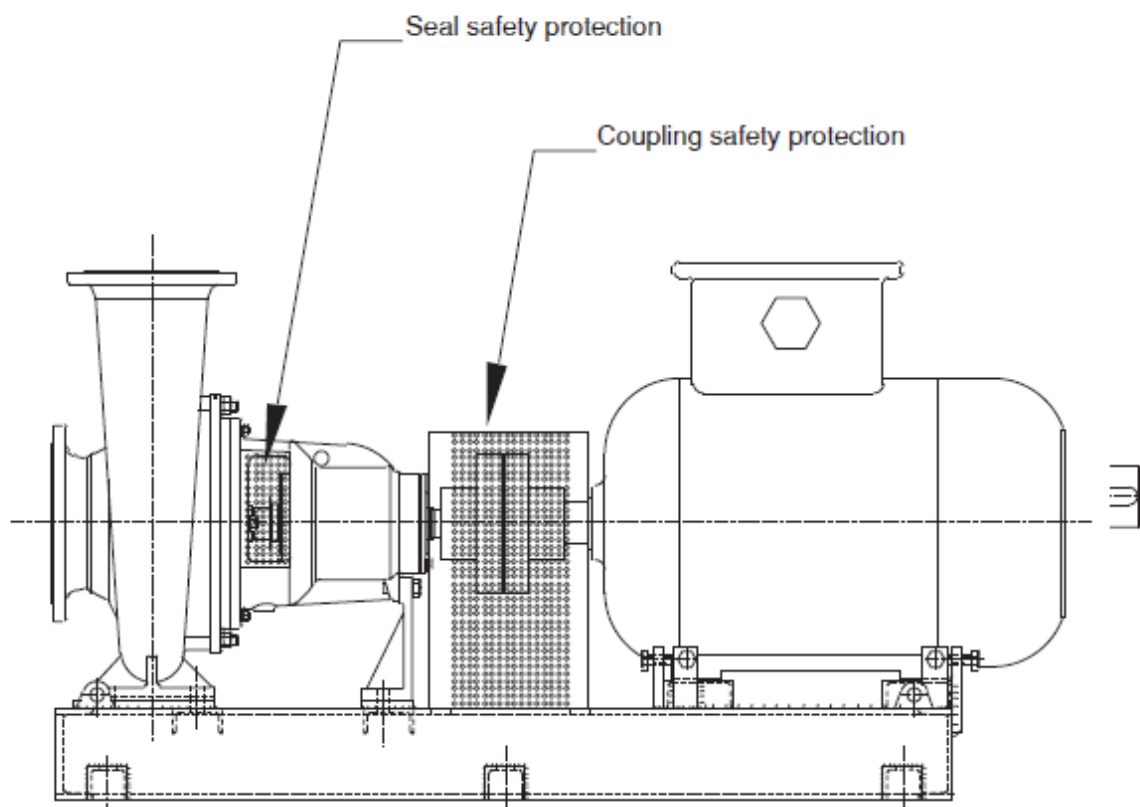
- 1- Casing half (lower)
- 2- Casing half (upper)
- 5- Wear ring
- 9- Bearing cap
- 22- Impeller
- 31- Bearing housing (Grease lubrication)
- 48- Bearing cover (Coupling end)
- 49- Bearing end cover
- 51- Stuffing box bushing
- 53- Gland
- 55- Lantern ring
- 61- Shaft
- 67- Shaft sleeve
- 200- Ball bearing
- 201- Ball bearing
- 210- Impeller key
- 211- Coupling key
- 58- Mechanical seal cover
- 68- Shaft sleeve (for mechanical seal)
- 250- Mechanical seal
- 379- Washer (for mechanical seal)

20 – SEAL AND COUPLING SAFETY PROTECTION

- In order to prevent pups to cause harm on people or equipment, safety guards must always be fitted while pumps are running
- These guards must be refitted after servicing



(fig.) 20.a N Series pumps



ATTENTION: Never operate pump without fitting guards

21 – LUBRICANT LIST FOR CS-M AND CS-P PUMPS

Lubricated Parts : Bearings

OIL SPECIFICATIONS

A) Lubrication type : Oil bath

Bearings temp.	: > 50°C
Manufacturer	: SHELL
Oil type	: Tellus T 68
Density	: 0,877 kg/dm ³
Flash point	: 230° C
Pour point	: -36°C
Viscosity (20°C)	: 173 mm ² /sn
Alternative oils	: Mobil DTE Light / HH
First change	: 300 hours
Change freq.	: 3000 hours
Max charge life	: 6 months

Bearings temp.	: < 50°C
Manufacturer	: SHELL
Oil type	: Tellus T 46
Density	: 0,872 kg/dm ³
Flash point	: 210° C
Pour point	: -39°C
Viscosity (20°C)	: 110 mm ² /sn
Alternative oils	: Mobil DTE Light / HH
First change	: 300 hours
Change freq.	: 4000 hours
Max charge life	: 12 months

Total oil quantity =>	Q	
Pump size	Kg	Litre
40/200, 40/250, 50/200, 50/250, 65/200, 80/160	0.1	0.11
50/315, 65/250, 65/315, 80/200, 80/250, 80/315, 100/200, 100/250, 100/315, 125/200, 125/250	0.2	0.26
80/400, 100/400, 125/315, 125/400, 150/250, 150/315	0.3	0.36
150/400, 200/315	0.3	0.34
150/500, 200/400, 250/315	0.5	0.52
200/500, 250/400, 250/500, 250/450, 300/315, 300/400	0.9	0.90

B) Lubrication type : Grease

Viscosity (40°C)	: 80 cst
Degree of density	: 3
Operation heat	: -20°C - + 140°C
Operation heat for long time	: 75° C
Change freq.	: -1500 – 2500 hours
Oil type	: ARCANOL MULTI 3 L71V
Alternative oils	:SKF LGMT3,SHELL ALVANIA EP GREASER



ATTENTION:

First change and change frequency are related to working conditions and real working hours