Kestner Chemical Pumps Ltd

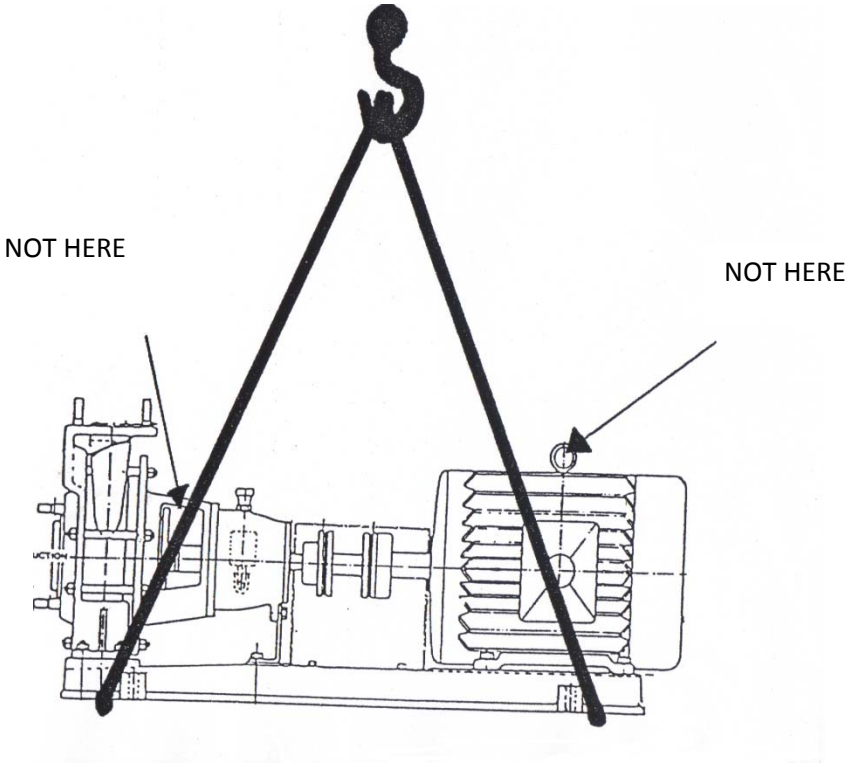
Operation and Maintenance Manual

‘KSI’ Horizontal Long Coupled Pumps

KESTNER CHEMICAL PUMPS LIMITED

WARNING

IT IS VERY IMPORTANT THAT WNEN LIFTING HORIZONTALLY MOUNTED PUMPS, THAT LIFTING SLINGS ARE USED TO LIFT THE COMPLETE BEDPLATE AND **NOT** THE PUMP OR MOTOR THUS:-



NOTE

AFTER FIXING THE UNITS IN ITS FINAL POSITION AND GROUTING THE BASEPLATE, IT IS **VERY** IMPORTANT THAT THE ALIGNMENT OF THE UNIT IS CHECKED AND INSTALLATION AND OPERATION IS IN ACCORDANCE WITH THE INSTRUCTION MANUALS.

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INSTALLATION AND INITIAL START-UP INSTRUCTIONS
HORIZONTAL CENTRIFUGAL PUMPS

PLEASE READ CAREFULLY BEFORE START UP

CHECK AS FOLLOWS:-

A) **ELECTRICAL SUPPLY**: The supply voltage against the information on the electric motor nameplate. The phasing of the supply is in accordance with the information plate on the motor.

Check the direction of rotation of the motor before coupling the pump to the motor. (MH and KSI PUMPS). This must agree with the direction arrow indicated on the bearing housing. In order to prevent serious damage to the pump which would occur due to incorrect rotation, the pump is supplied with the coupling bolts reversed or the coupling tyre disconnected. Only after checking the rotation, may these bolts or the tyre be fitted correctly in accordance with the instructions provided and correctly tightened.

B) **OIL LEVEL (MH and KSI PUMPS):** The constant level oiler should be filled with the correct grade of lubricating oil as specified in the relevant table in the maintenance instructions. The initial filling of the bearing housing may require more than one filling of the constant level oiler.

C) **SEAL FLUSHING:** Certain types of mechanical seal require a water, product or other liquid flushing supply. This connection must be made and the flush checked to ensure the specified flowrate and pressure are available before start-up. Consider using 'Lockshield' type valves to ensure that the sealant flush supply cannot be interrupted during pump operation or damage to the seals will result.

D) **MECHANICAL SEAL COMPRESSION:** This and the clamping of the seal to the impeller shaft must be checked before start-up. Where cartridge type mechanical seals have been used the settings are pre-set, and it is only necessary to ensure that the clamping grubscrews are fully tightened. (See also separate sheet for mechanical seal notes).

E) **ALIGNMENT:** The alignment of the electric motor and pump should be checked, also make sure that there are no excessive pipe loadings which could pull the pump out of alignment. For the same reasons, check that the bedplate feet are properly packed on the foundations before tightening the holding down bolts. It is beneficial to use flexible compensators capable of accepting axial movement and compatible with the pumped fluid. These should be mounted as close as possible and in-line with the pump suction and discharge branches.

F) **START-UP:** The pump must be primed with liquor before starting, it is detrimental to the pump to run at 'shut valve' with no flow through the pump for a period exceeding two minutes.

G) **LONG TERM STORAGE:** The pump unit should be rotated by hand at least weekly.

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FAILURE TO PUMP

In the unlikely event of the pump failing to pump correctly the following points should be checked.

(A) Air Leaks into the suction pipework.

(B) Air lock in the pump casing due to incorrect priming.

(C) Suction pipework may be blocked with solid material.

(D) Pump speed possibly incorrect due to faulty electrical connection.

ROUTINE CHECKS DURING NORMAL RUNNING

(A) Excessive noise or vibration.

(B) Bearing temperature.

(C) Oil level (MH and KSI Pumps).

(D) Mechanical seal leakage (see also separate notes on mechanical seal operation).

GENERAL POINTS TO NOTE ON INITIAL INSTALLATION

(A) Pipework should not allow air pockets to form in the suction pipework.

(B) To ensure a smooth liquor flow into the pump the number of bends, valves and other obstructions etc, should be kept to a minimum. Suction pipework should be equal to or larger than that of the pump suction diameter.

(C) There must be no excessive 'springing' of the connecting pipework as this causes excess mechanical loading on the pump casing. Pipework must be amply supported.

(D) It is good practice to install a control valve close to the pump on the delivery side to allow for delivery control adjustments. Control of the pump flow should not be effected by a valve in the suction pipework.

(E) The Keebush and Keeplus pumps should have a 3mm thick rubber joints, Shore hardness 50-70 fitted between the pump branches and connecting pipework. The rubber must be compatible with the pumped fluid.

(F) The metal pumps should have C.A.F. jointing gasket material 1-2mm thick between the pump branches and connecting pipework. The joint must be compatible with the pumped fluid.

(G) The pump branch flanges, seal clamp plate and pump casing fasteners should be tightened to torque figures given in the maintenance instructions.

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SPECIAL INSTRUCTIONS REGARDING SILICON IRON PUMPS.

High Silicon Iron process equipment has been serving the chemical and associated industries for nearly eighty years. The corrosion resistance of this alloy has been claimed by many to be unexcelled by any commercially available metal or alloy, together with its excellent corrosion resistance High Silicon Iron by virtue of its hardness finds many applications where corrosion and / or erosion is present.

The greatest hindrance to the wide-spread use of this alloy has been its susceptibility to thermal and mechanical shock. It is therefore important that the following points are considered to achieve a long and trouble free service life.

1) Thermal shock should be minimised and if possible gradually heat equipment to elevated working temperatures.

2) Do not allow staff to 'hose down' equipment working at high temperatures. Rapid changes in ambient temperature may induce thermal shock, however, gradual temperature changes generally cause no service difficulties.

3) Fitment of pipework expansion bellows, compatible with the pumped fluid, will reduce any mechanical loads or vibrations.

4) Check the correct alignment of suction and discharge pipework this should be adequately and independently supported. The pump casing should **not** be used as a pipework support.

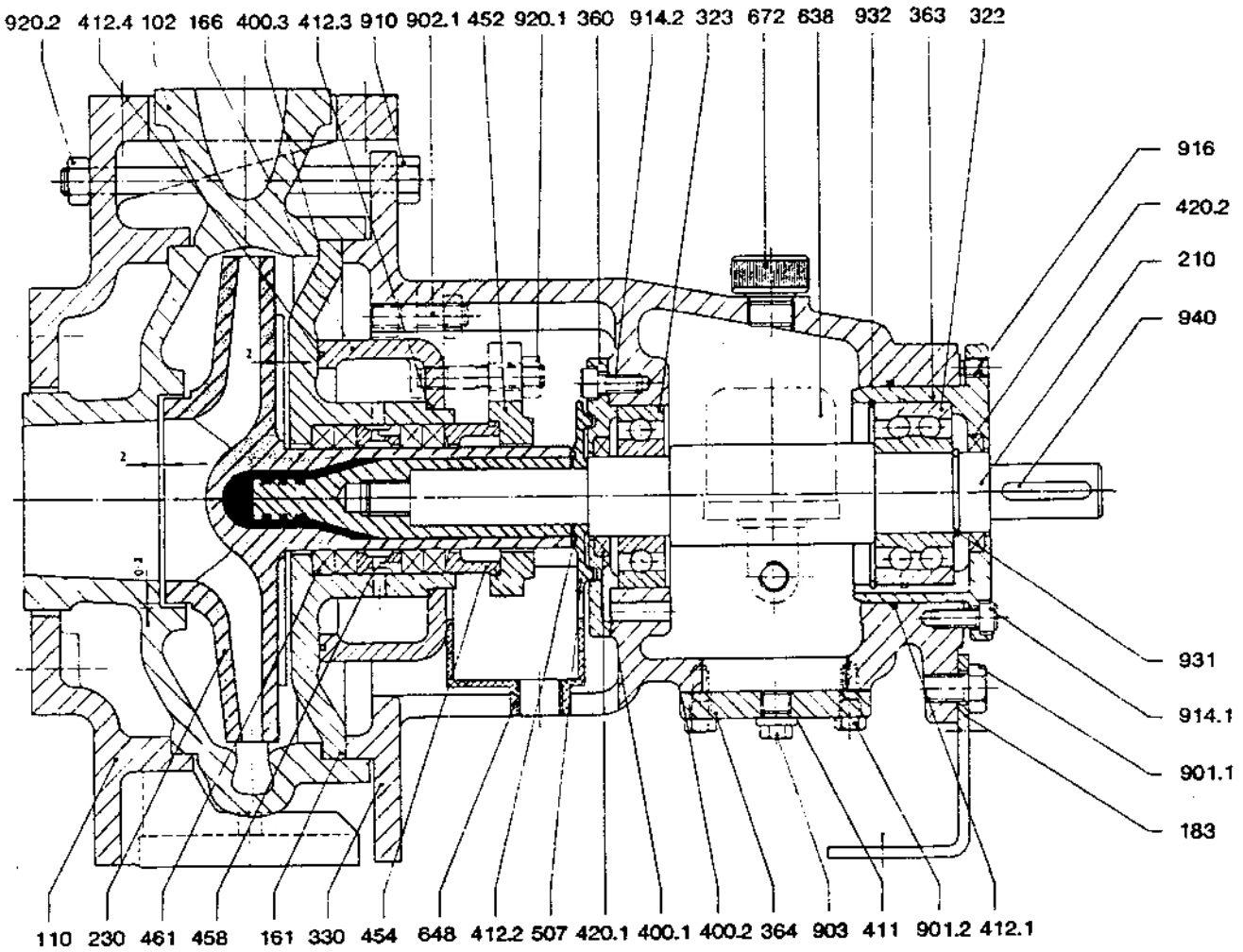
5) Reduce any imposed pipework loading by not overtightening pipe flange connections (see torque chart for maximum recommended values).

6) High Silicon Iron alloys are very hard and machining of holes is very difficult, welding of castings is also impractical and should not be attempted.

7) Metal pumps should have Compressed Asbestos Fibres or similar jointing gasket material 1-2mm thick between the pump branches and connecting pipework. The joint material must be compatible with the pumped fluid.

Sectional Drawing and Parts List

The sectional drawing and parts lists shown refer to model KSI equipped with a soft packing and without bearing frame cooling. Additional parts are needed for the mechanical and hydrodynamic shaft sealing options and for bearing frame cooling.



Part No.	Designation	Construction Material	Part No.	Designation	Construction Material
102	Casing	Alloy*	420.2	Oil seal	Ntr. Rubber
110	Casing clamping plate	GG20	452	Gland	1.4500
161	Casing back plate	Alloy*	454	Gland follower	1.4500
166	Cooling chamber	GG20	458	Lantern ring	1.4500
183	Support foot	St 37-2	461	Gland packing	
210	Shaft	C-45	507	Flinger	1.4500
230	Impeller	Alloy*	638	Constant level oiler	Plastic
322	Bearing D.E.		648	Drip tray	1.4500
323	Bearing N.D.E.		672	Breather plug	Brass
330	Bearing Housing	GG20	901.1	Hex screw	DIN 601 4.6
360	Bearing cover	GG20	901.2	Hex screw	DIN 601 4.6
363	Bearing cartridge	GG20	902.1	Stud	DIN 939 4.6
364	Window cover	GG20	903	Collared plug	DIN 910 5.8
400.1	Gasket	IT400	910	Hex head bolt	DIN 931 4.6
400.2	Gasket	IT400	914.1	Cap screw	DIN 7984 8.8
400.3	Gasket	IT400	914.2	Cap screw	DIN 7984 8.8
411	Joint ring	IT400	916	Grub screw (Dog point)	DIN 915 8.8
412.1	O-ring	Neoprene	920.1	Hex nut	DIN 934 4.6
412.2	O-ring	Viton Rubber	920.2	Hex nut	DIN 934 4.6
412.3	O-ring	Viton Rubber	931	Circlip internal	Spring Steel
412.4	O-ring	Viton Rubber	932	Circlip external	Spring Steel
420.1	Oil seal	Ntr. Rubber	940	Coupling key	St 60

*Liquid end parts are cast in different alloys depending on application, such as high silicon iron (14 to 15% Si) or Ni-Hard 2B.

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INSTALLATION AND INITIAL START-UP INSTRUCTIONS FOR KSI MODEL HORIZONTAL PUMPS

GENERAL

1.1 We undertake to guarantee the suitability of the material of construction used only on condition that the pump is operated in accordance with the operating conditions specified and confirmed by us.

1.2 Pump testing may be conducted if specified at the time of purchase, or at a later date if requested, at extra cost. By observing the following instructions, the pump will give trouble free operation, and meet the specified design parameters.

1.3 Each pump unit is provided with a stainless steel nameplate fixed to the bearing frame. When ordering spare parts, please quote the pump serial number, pump type, the description of the part number as given in the parts list.

1.4 Nameplate details given the following serial number which is unique to the unit supplied i.e. 00000/CFH/0000.

1.5 The following spare parts are recommended for two years continuous operation.

PART NO.	DESCRIPTION	MATERIAL
210	Drive shaft	Steel
230	Impeller	Alloy
322	DE Bearing	-
323	NDE Bearing	-
400	Gasket	CAF
400.1	Gasket	CAF
400.2	Gasket	CAF
400.3	Gasket	CAF
411	Gasket	CAF
412	'O' Ring	Viton/Neoprene
412.1	'O' Ring	Viton/Neoprene
412.2	'O' Ring	Viton/Neoprene
412.3	'O' Ring	Viton/Neoprene
412.4	'O' Ring	Viton/Neoprene
420.1	Oil Seal	Nitrile
420.2	Oil Seal	Nitrile
461	Gland Packing Set	Fluograf
507	Flinger	Alloy

NOTE: ALWAYS USE ORIGINAL MANUFACTURERS PARTS WHEN RE-FURBISHING THE PUMP.

HANDLING

2.0 WHILE LIFTING THE PUMP UNIT OUT OF THE BOX USE NYLON OR JUTE ROPE, AVOID THE USE OF STEEL ROPES.

INSTALLATION

3.0 **Preparation of foundations**. Prepare the foundation keeping in mind the type of soil at the site. The top face of the foundation should be flat and horizontal. Place pipe sleeves for the foundation bolts while the foundations are being cast. Suitable allowance for grouting should be made.

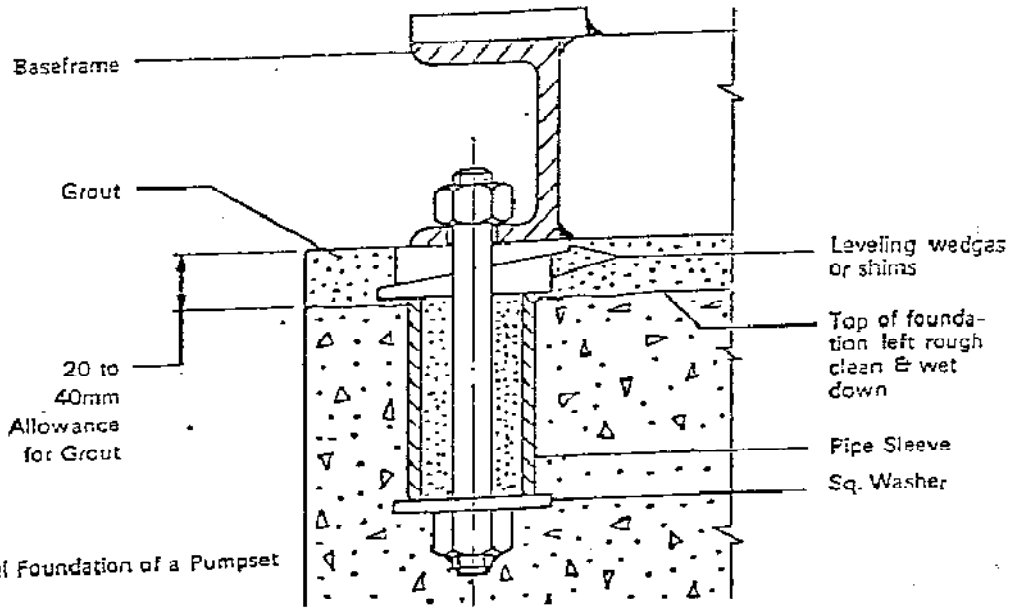


Fig. 1: Typical Foundation of a Pumpset

3.1 Suspend the foundation bolts from the baseplate and place the pumpset on the foundation. Level it with the aid of a spirit level placed on the pump shaft/discharge nozzle. Insert suitable shims or levelling wedges under the baseplate to level the pumpset (see Fig 1 above). After this, grout the foundation bolts. When the foundation bolts are set firmly tighten the baseplate, making sure that the levelling of the pumpset is not disturbed. Now grout the baseplate to the foundation with non shrinking mortar. Ensure that no cavities are left unfilled. It is important that the alignment of the coupling and drive is then re-checked.

3.2 **Coupling Alignment**: Correct alignment of the shaft is an important consideration in the correct operation of the unit. Even if the pump and motor are supplied from the factory in an aligned condition, there is every possibility of the alignment being disturbed during transit or while tightening the baseplate to the foundation. Therefore, it should be checked before putting the pump into service. See Fig 2a, 2b and 2c for checking the alignment of the coupling.

3.3 **Piping:** Connect the pipework to the delivery and suction flanges of the pump respectively. The weight of the pipework should not be allowed to act upon the pump and should be adequately supported. It is important that the suction and delivery pipes do not exert any strain on the pump flanges. The nominal sizes of the pump nozzles.

We also recommend that check valves or non-return valves and isolating valves are installed in the system, depending upon the type of installation. Also consideration should be given to compensate for any possible thermal expansion in the pipelines so that they do not impose any additional loadings on the pump branches. These loads can cause distortion of the unit causing seal failure and bearing failure etc.

3.4 **Auxiliary piping connections:-** Please ensure that auxiliary pipework connections such as seal flushing, quenching, sealing, cooling etc are correctly connected and supply the specified flowrate and pressure for correct operation.

3.5 **Coupling guard**: To ensure safe operation and prevent accidents, the pump should only be operated when the unit is correctly fitted with the coupling guard.

Commissioning

4.0 Check the lubricating oil level in the bearing pedestal. Fill the oil up to the level shown on the indicator fitted on the bearing frame. Do not put excess oil in the unit as this may cause overheating of the bearings. See the enclosed data sheet for correct grade of oil. Do not mix oil types or grades. Always maintain the oil level by regularly replenishing the quantity of oil lost in normal operation.

Where a constant level oiler is provided, the procedure for oil filling is as follows; unscrew the breather plug, pour in the correct grade of oil through the breather plug using a suitable funnel after having hinged down the reservoir of the constant level oiler until oil appears in the elbow of the constant level oiler. Then fill the reservoir of the oiler and snap it back into its normal operating position. Fit the breather plug. Allow a few minutes to elapse, re-check the oil level in the reservoir. The reservoir should always remain filled.

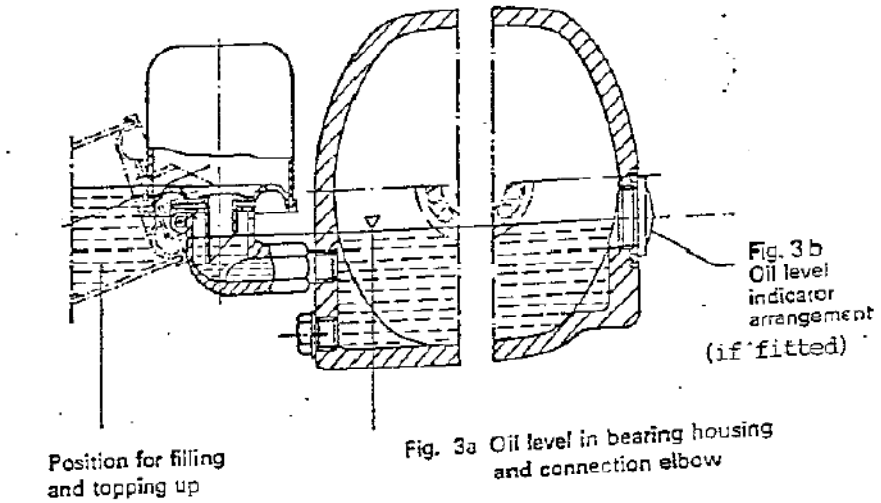


Fig. 3a Oil level in bearing housing and connection elbow

The enclosed Lubrication Chart gives details of the correct grade and type of mineral oil to ensure long bearing life under normal operating conditions.

BEARING LUBRICATION

5.0 The recommended oils to ensure long bearing life, are given in the table below. Care should be taken to ensure that oil types are not mixed and oil changes made at the specified intervals.

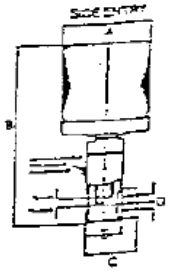
BEARING HOUSING TEMPERATURE ◦C	PUMP SPEED	ISO VISCOSITY
ABOVE 65 CENT	1450 RPM 2900 RPM	46 VG
30 TO 65 CENT	1450 RPM 2900 RPM	32 VG
-8 TO 30 CENT	1450 RPM 2900 RPM	15 VG

NOTE: Oil life is reduced by substained use above 85 Cent. Frequent oil changes and the use of the oil cooler should be considered.

5.1 **Lubrication:-** The first oil change should be carried out after 300 hours of operation. After this, change the oil after every 3000 hours of operation. The procedure for changing the oil is given in section 4.0.

IMPORTANT NOTE

5.2 Some models of the KSI range are now fitted with a variable level Constant Level Oiler. The setting screw should be adjusted to give the maximum oil level
i.e. Dimension 'B'= 5 1/12" (140mm)
Dimension 'F'= 19/32" (15mm)



Filling:- Unscrew the breather plu. Pour in the oil through the breather plug hole after removing the glass bottle portion, until oil appears in the bottom of the inlet pipe of the constant level oiler. Remove the glass reservoir bottle from the dip pipe tube and fill with oil.

Replace the dip tube pipe onto the glass bottle, place a finger on the angle of the outlet tube and invert. Then push the dip tube into the fixed oiler until the circlip grips the tube. Fit the breather plug and wait for a few minutes. Check the oil level in the reservoir.

The reservoir should **always** remain filled during operation of the unit – check frequently.

ROUTINE CHECKS

5.3 Check the pump for free rotation. The supply voltage should be checked with the motor nameplate. The phasing of the supply should be in accordance with the information plate on the motor. Check the direction of rotation of the motor before coupling the pump to the motor. This must agree with the direction arrow indicated on the bearing housing.

Check the auxiliary pipelines are in order. See attached section regarding the use of mechanical shaft seals if fitted.

Check the pump is fully primed if it is working against a suction lift. Remove any are in the suction pipeline by venting it by means of a vacuum pump or any other suitable equipment.

Check that the isolating valve in the discharge line is fully closed.

SWITCHING ON: Close the discharge line valve fully. Start the pump unit. Open the isolating valve gradually only after the motor has attained its full operating speed. Adjust the opening point until the correct flowrate has been achieved. Check that the electric motor is not overloaded by checking the current drawn by the motor, the full load current is stated on the motor nameplate.

Check the bearing temperature after the correct operating temperature has been attained. Check all pipelines for leakages. Check the leakage through the gland packing at the stuffing box. Even though excessive leakage is not recommended, the gland should drip a little and with some regularity.

SWITCHING OFF: Close the discharge line valve. If a non-return valve is used, the isolating valve can remain open. Stop the motor. Close the auxiliary pipe connections, if any, only after stopping the motor. Stop the cooling water supply to the oil cooler, if fitted.

GENERAL OPERATION

5.4 The following points should be checked at regular intervals.
The pump should run smoothly, free from vibration.
The electric motor should not be overloaded. The pressure gauge reading and the power consumption should not exceed the specified ratings.
Avoid prolonged running of the pump against a closed valve in the discharge line as this will generate excessive heat due to 'churning' which is not desirable.
The bearing temperature should not exceed 50 deg.Cent. above the ambient.
The maximum temperature allowed is 85 deg. Cent.
Auxiliary pipework connections should not be closed whilst the pump is running.
Wherever necessary, provide a pressure gauge with a cock on the discharge line near to the pump discharge nozzle. A suction line gauge is also strongly recommended.
Provision of an Ammeter to maintain a constant check on the current drawn by the motor so as to avoid overloading of the motor is also advisable.

DISMANTLING

6.0 Isolate or disconnect the electrical supply to the motor.
Drain the oil from the bearing housing by removing the drain plug (903) and remove the coupling guard.
Disconnect the spacer coupling by removing the flexible tyre. If no spacer type coupling is fitted, remove the electric motor.
Disconnect any auxiliary piping connections, such as flushing, seal quenching or oil cooler supply and drain.
Drain the pump casing and remove the unit from the baseplate.
Remove the body clamp bolts (910) and split the casing assembly.
Remove the rotor (230) by unscrewing from the main drive shaft (210), remove the gland assembly and pump backplate (161) complete with the rotor (230). Now remove the gland follower (454), gland packing set (461), lantern ring (458), Flinger (507) from the casing backplate (161). Carefully remove the 'O' rings (412) and inspect each 'O' ring carefully and replace if necessary.
In the case where a mechanical shaft seal is fitted as standard, unscrew the two seal housing clamp bolts, remove the impeller, backplate and seals as complete unit. Remove the seal clamp plate and seal housing and remove the rear seal and using a suitable drift carefully push the impeller through the pump backplate and then remove the front seal. The mechanical seal seats can then be removed from both the seal housing and the pump backplate by using a suitable drift and carefully applying a light firm pressure. The seal seat 'O'rings or square section seals may then be fully inspected and replaced if necessary. Remove the bearing housing (330), both the drive end (322) and non drive end (323) bearings may then be removed for inspection.
Drive out the shaft (210) by light tapping on the shaft with a soft faced mallet or wooded block from the impeller side. The drive end bearing (322) will come out with the shaft.
Remove the circlip (932) from the shaft and remove the drive end bearing housing (363), remove the circlip (931) and the bearing may then be removed with a puller. The non drive end bearing (323) may then be removed with a puller.
Inspect the oil seals (420.1 and 420.2) and replace if necessary.
Clean all of the components and carefully check them for wear tear, especially the drive shaft, stuffing box components, bearings. Replace all damaged or worn parts with new items.

RE-ASSEMBLY OF THE UNIT

7.0 Usually the assembly proceeds in the reverse sequence to the dismantling operation.
Mechanical seal assembly should be done as per the following instructions.
Take care while mounting the bearings, bearing covers along with the oil seals on the drive shaft to ensure that the oil seal lips are not damaged.

7.1 The procedure for packing the stuffing box with gland packings is given on the enclosed data sheets.

7.2 After re-assembly of the unit, the rotor should turn freely without touching the volute casing etc. There may be a little resistance from the gland packing set if they are fitted or from the mechanical seal face friction. This resistance is always different from the feeling of internal components touching.

ASSEMBLY OF DOUBLE MECHANICAL SEALS

7.3 The procedure given below is for the initial fitment of double type 59U Eurodin John Crane mechanical shaft seals, assuming that all items are new, in clean and unused condition**. (USING GROUP 1 BEARING FRAME).**

Ensure that the rotor setting dimension of 2mm is correctly set between the rotor (230) and the backplate (161).

If this is not correct proceed as follows:-
The method of achieving the correct setting clearance is to first machine a steel setting washer approx 80mm o/dia by 50mm I/dia by 2.0mm thick. Slide the setting washer onto the rotor stalk and then place the rotor stalk through the backplate bore with the setting washer sandwiched between the back of the rotor and the face of the backplate. Screw the assembly onto the pump drive shaft (940) until fully engaged on the thread. Loosen the cap screws (914.1) and tighten / or loosen the grubscrews (916) until the back of the rotor is tightly pulled against the setting washer and backplate. Tighten the cap screws (914.1) to lock into position. Remove the rotor, setting washer and backplate from the drive shaft. Remove the special setting washer and retain in a safe place for future use.

With the rotor on a bench with the shaft upwards, fit the mechanical seal seat to the backplate (161). Slide the pump backplate over the rotor shaft. Slide the mechanical seal with the face towards the seat onto the rotor shaft and then remove the setting clips. Using a tubular spacer exactly 68.0mm* long push the seal onto the rotor shaft with the tube until the tube end is exactly in line with the end of the rotor shaft and then tighten the three seal clamping grubscrews.

Fit the outboard seal seat to the stainless steel housing. Slide the second outboard mechanical seal onto the rotor shaft and slide down until the backs of both seals touch. Tighten the outboard seal grubscrews.

Fit the seal housing gasket, after fitting the 1/8" BSP drain plugs (if fitted) to the seal housing and coat the mating faces with red 'Hermatite' sealant. Fit the seal clamp plate (471) onto the securing studs (902.2) but do **not** tighten yet. (Leave the nuts loose).

*(=**Note:- This dimension is applicable to Group I bearing frames only – see the relevant assembly drawing fro Group II Bearing Frame Setting Dimensions**).

Place the seal housing (471) onto the backplate (161) assembly with the rotor and mechanical seals and then screw the assembly onto the pump drive shaft.
Fit the clamp bracket (110) with the volute casing secured in situ with the special bolts (903.3 and 935) to the pump bearing frame (330) after inserting the gasket (400.3). Tighten the body clamp bolts (920.2) to the correct torque setting. Then full tighten the seal housing retaining studs evenly, until the clamp plate is tight. (some distortion of the seal housing clamp plate may occur).

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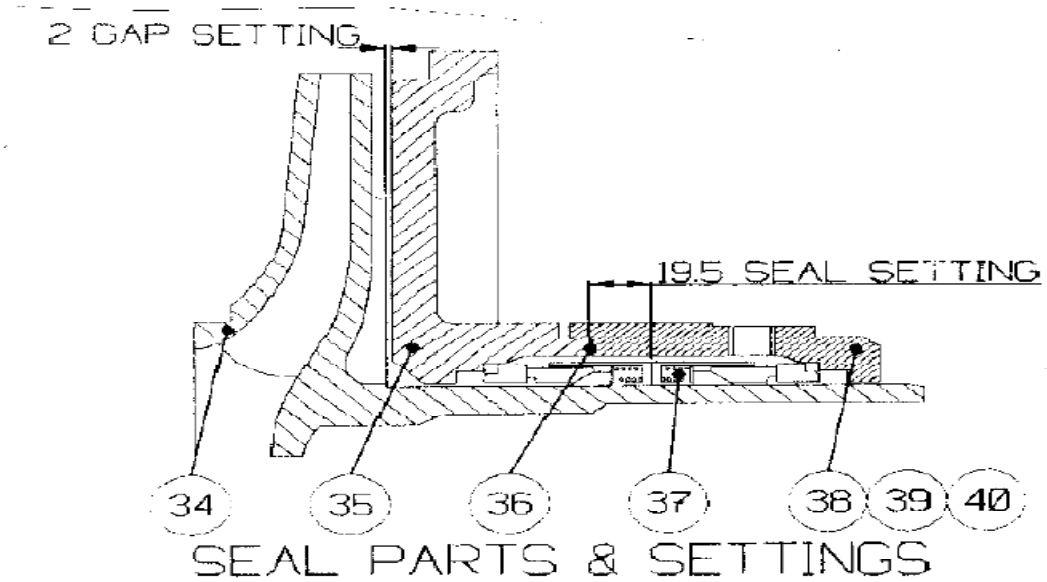
Fit the sealant flush inlet/outlet hoses and hydrostatically pressure test the seal chamber to 100 LBS/sq inch for approx 15 minutes, rotate the drive shaft in the correct direction occasionally to check for any leakage, prior to re-commissioning the unit.

Note: It is strongly advised that spare gaskets, joints and mechanical seals are held on site for emergency repairs.

BEARING FRAME	SIZE	SETTING WASHER DIMENSIONS
GROUP I FRAMES	40/160	80MM O/D x 50MM I/D X 2.0MM TH'K
	40/200	80MM O/D x 50MM 1/D X 2.0MM TH'K
	50/160	80MM O/D X 50MM I/D X 2.0MM TH'K
	50/200	80MM O/D X 50MM I/D X 2.0MM TH'K
GROUP II FRAMES	50/250	100MM O/D X 65MM I/D X 2.0MM TH'K
	50/315	100MM O/D X 65MM I/D X 2.0MM TH'K
	80/200	100MM O/D X 65MM I/D X 2.0MM TH'K
	80/250	100MM O/D X 65MM I/D X 2.0MM TH'K
	100/200	100MM O/D X 65MM I/D X 2.0MM TH'K

NOTE: FOR DETAILS OF GROUP II SEAL SETTING POSITION REFER TO THE SECTIONAL ASSEMBLY DRAWING BELOW:-



ASSEMBLY OF SINGLE MECHANICAL SEALS (CONICAL SEAL HOUSING)

7.4 The procedure given below is for the initial fitment of single type 59U or 502 Eurodin John Crane mechanical shaft seal, assuming that all items are new, in clean and unused condition. (**USING GROUP I BEARING FRAME).**

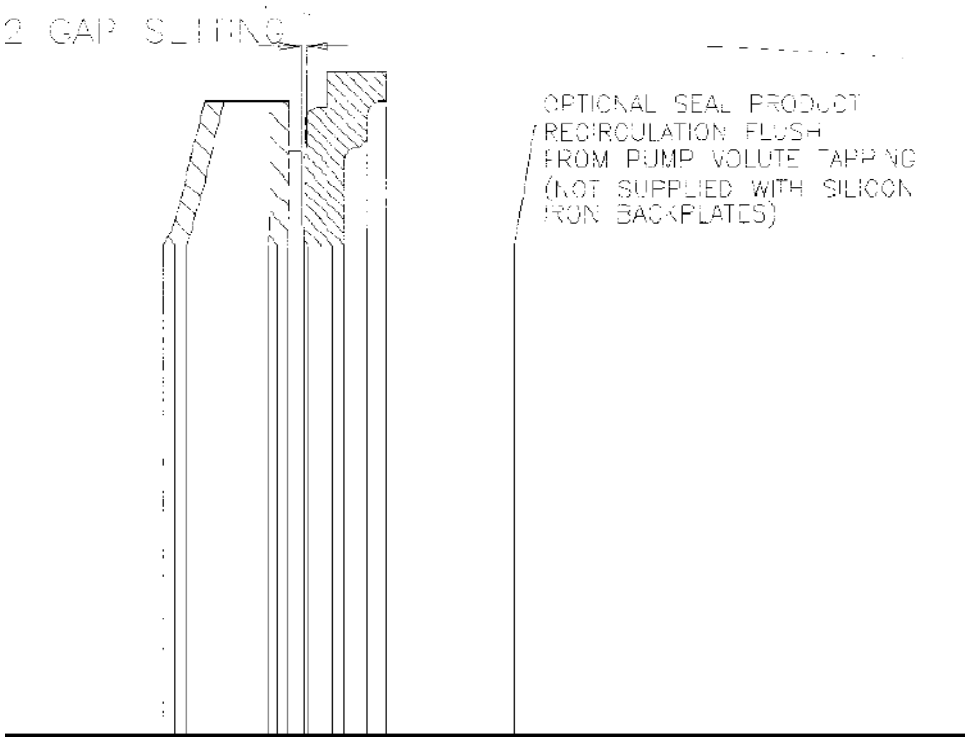
Ensure that the rotor setting dimension of 2mm is correctly set between the rotor (230) and the backplate (161). If this is not correct re-set the rotor as described previously to obtain this dimension.

With the rotor on a bench and the shaft upwards, fit the mechanical seal to the rotor. The seal face should be upwards and the seal fitted so that the back of the seal component is flush with the back shroud of the impeller. Insert the seal seat into the pump backplate recess ensuring that the 'O' ring or PTFE seal seat joint is correctly located. Slide the pump backplate over the rotor shaft. When fitting a type 59U seal tighten the grubscrews when the seal is in position and remove the setting clips.

Place the backplate (161) assembly with the mechanical seal seat over the rotor shaft and mechanical seal, and then screw the assembly onto the pump drive shaft. The seal setting dimension is achieved by using the correct components and the seal working distance set automatically.

Fit the clamp bracket (110) with the volute casing secured in situ with the special bolts (903.3 and 935) to the pump bearing frame (330) after inserting the gasket (400.3). Tighten the body clamp bolts (920.2) to the correct torque setting.

Re connect the seal re-circulation pipes after reassembly to ensure a product flush re-circulation (if fitted).



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RECOMMENDED 'MAXIMUM' TORQUE SETTINGS

KSI MODEL PUMP SIZE	BODY CLAMP BOLTS		SUCTION FLANGE BOLTS		DISCHARGE FLANGE BOLTS	
	SIZE	Kgf-cm	SIZE	Kgf-cm	SIZE	Kgf-cm
40 / ---	M12	300	65 M16	200	40 M16	225
50 / ---	M12	350	80 M16	200	50 M16	225
80 / ---	M16	500	125 M16	250	80 M16	300
100 / ---	M16	550	125 M16	250	100 M16	300

$$\text{Lb} - \text{ft} = \frac{\text{kgf} - \text{cm} \times 9.807}{100 \times 1.3558}$$

REV: 1/9/96

LONG TERM STORAGE

8.0 The pump unit should be stored in a dry vibration free location preferably in the horizontal position. The pump unit should be rotated at least weekly and the motor checked for free rotation prior to installation.
(See separate notes regarding long term mechanical seal storage).

NOTE:-

ALWAYS USE ORIGINAL MANUFACTURERS PARTS WHEN RE-FURBISHING THE UNIT.

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TROUBLE SHOOTING GUIDE

PROBLEM	CAUSE	REMEDY
Rate of flow	Pump rotates in wrong direction. Impeller or strainer clogged. Sealing clearance increased. Delivery head requirement higher than specified. Pump speed too low. Frictional losses higher than Specified. Viscosity of liquid higher than specified. Impeller worn.	Reverse the connections to the motor terminal. Clean respective part. Replace worn components. Consult manufacturer for fitting larger dia. Impeller. Voltage drop or low frequency, use motor of correct speed. Increase pipe size. Consult manufacturer for possibility of changing the impeller. Replace with new component.
Pump discharge too high.	Delivery head lower than specified.	(a) Throttle discharge valve. (b) By-pass part of the capacity. (c) Reduce impeller diameter. (d) Fit orifice plate in discharge line.
Pump Vibrates	Pump starves Impeller out of balance Due to clogging. Misalignment. Bearing worn out. Undue stress on pump flanges. Foundation not rigid. Rotating part rubbing.	Check suction conditions Clean impeller. Check and re-align unit. Change bearings. Anchor pipelines correctly. Check foundation and correct. Check rotating assembly.
Motor overloaded	Specific gravity of liquid Higher than specified. Viscosity higher than specified. Impeller rubbing against Backplate/suction cover. Heavy friction in stuffing box Bush and sleeve. Excessive flowrate.	Use motor of higher rating. Regulate viscosity or consult the Manufacturer. Check the internal operating Clearances. Check clearances, shaft straightness and alignment. Throttle the valve on discharge side.

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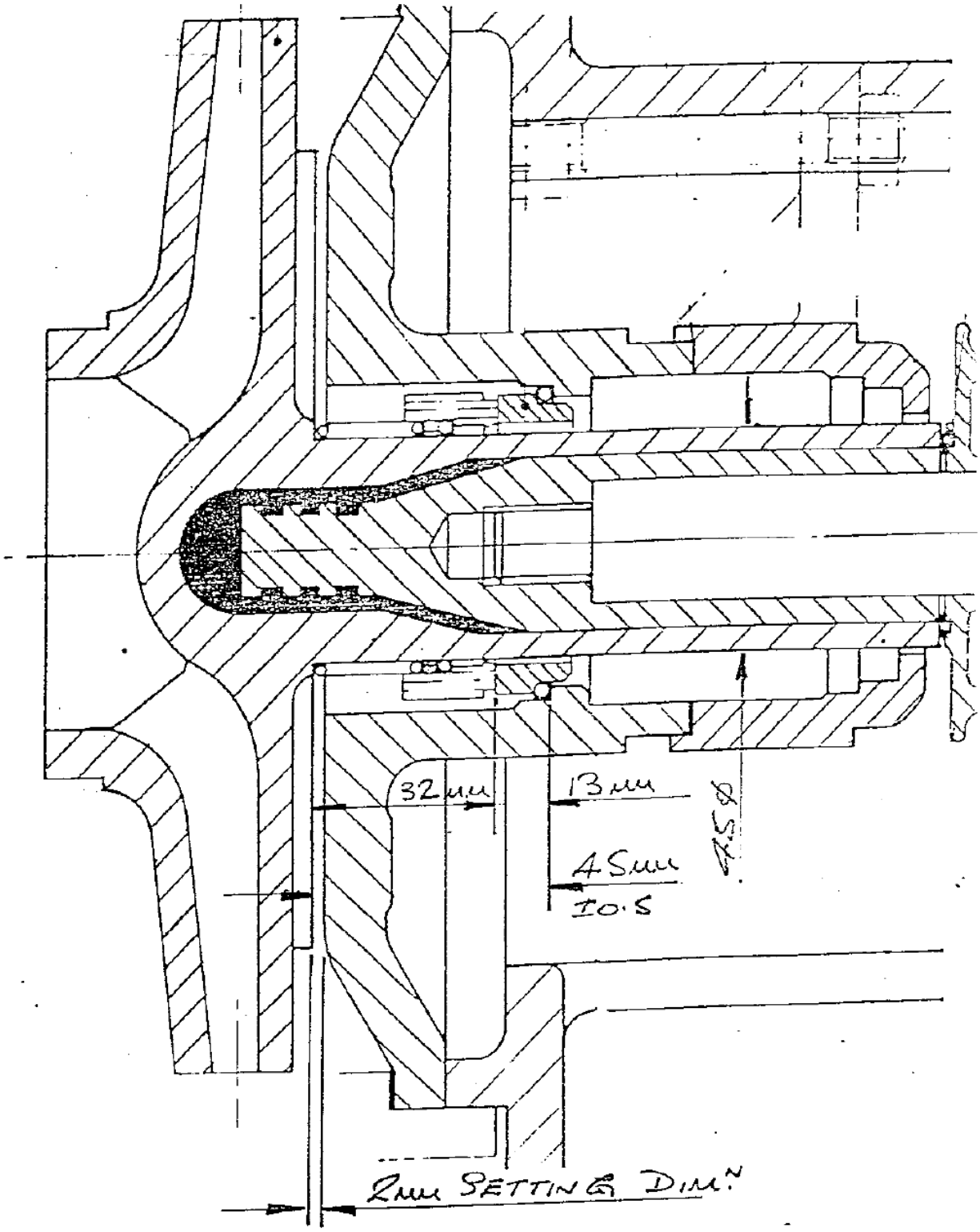

TYPICAL SINGLE MECHANICAL SEAL ARRANGEMENT

45MM SIZE

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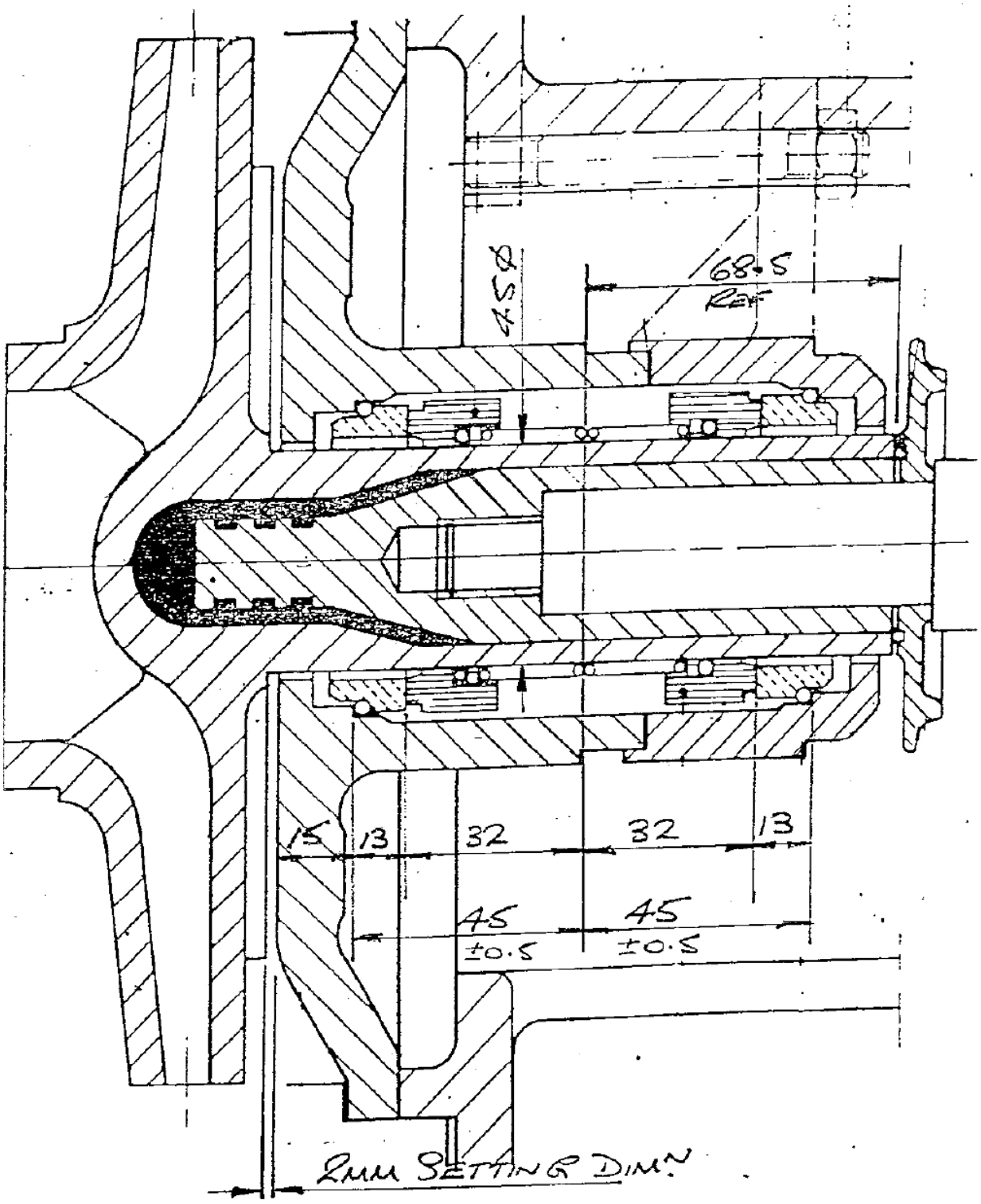


TYPICAL DOUBLE MECHANICAL SEAL ARRANGEMENT

45MM SIZE.

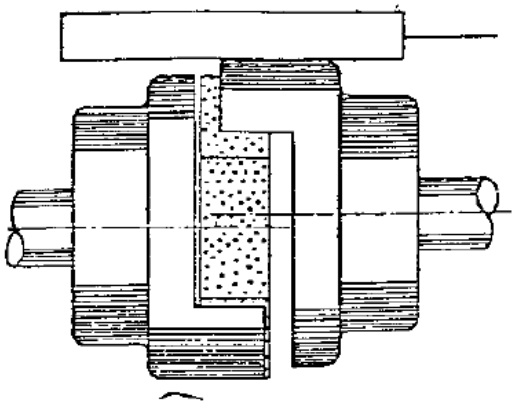


Fig. 2 a : Checking Parallel Alignment

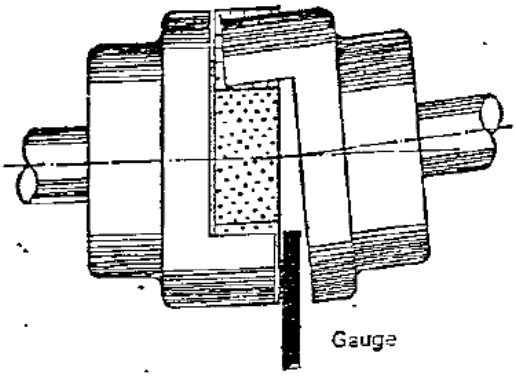


Fig. 2 b : Checking Angular Alignment

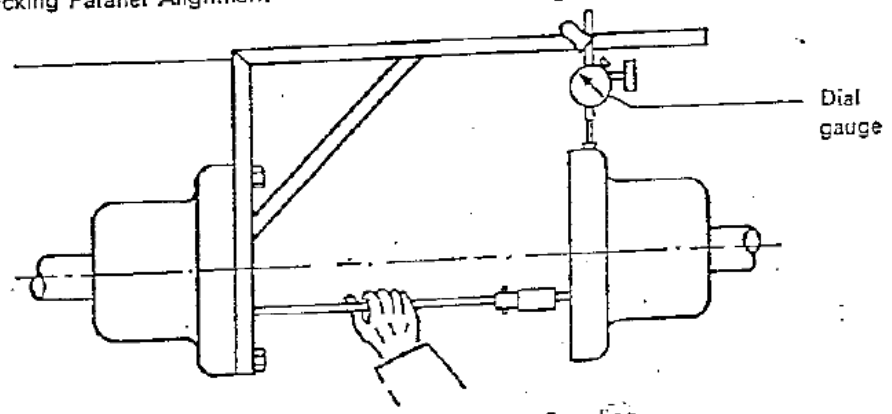


Fig. 2 c : Alignment of Spacer type Coupling

KESTNER CHEMICAL PUMPS LIMITED

INSTALLATION INSTRUCTIONS FOR 'FENAFLEX' TYPE SPACER COUPLINGSB

ASSEMBLY

1.0 Thoroughly clean all components paying particular attention to the removal of the protective coating in the flange bores and bushes.

1.1 Place each cleaned 'Taper Lock Bush' in its respective flange and slide the flange onto its shaft. If keys are required. Side fitting keys with top clearance should be used.

1.2 using a straight edge line up the faces indicated with the shaft ends. Using a dial clock gauge check the runout of the spacer flange.

1.3 Position 'Fenaflex' flange on the spacer shaft to dimension 'Y' shown in table 3 below and secure with 'Taper Lock Bush'. This ensures that the distance between the flanges 'M' is maintained on assembly.

1.4 Locate spacer sub-assembly on to the spacer flange engage spigot, align holes and insert screws and tighten to the torques given in table 4.

1.5 Open out the tyre and fit over the coupling flanges ensuring that the tyre bead seats properly on the flanges. To ensure proper seating it may be necessary to strike the tyre with a small mallet. When seated there should be a gap in the tyre as shown in table 2.

1.6 Tighten clamping ring screws alternatively and evenly (half a turn at a time), working around each flange until the required screw torque is achieved, see table I.

DISMANTLING

1.1 Support the spacer sub-assembly.

1.2 Remove the clamping ring screws progressively and evenly (half a turn at a time) to prevent distortion of the clamping rings.

1.3 Remove the tyre.

1.4 Remove the spacer flange screws and lift out the spacer sub-assembly.

TABLE 1

Coupling Size		F40	F50	F60	F70	F80	F90	F100	F110	F120	F140	F160	F180	F200	F220	F250
M mm		22	25	33	24	26	29	29	25	29	33	30	46	48	55	59
Clamping Screw Torque	Nm	15	15	15	24	24	40	40	40	50	55	80	105	120	165	165

KESTNER CHEMICAL PUMPS LIMITED

INSTALLTION INSTRUCTIONS FOR METASTREAM TYPE 'TDE' FLEXIBLE SPACER COUPLINGS (STYLE 2)

1.0 Fit the two flanged hubs to the driving and driven shafts in the usual manner ensuring that the shaft ends are flush with the inner face of the hub.

1.1 Set the distance between shaft ends (DBSE) taking into account any axial movement of the driving and driven shafts.

1.2 Ensure that both shafts are correctly aligned.

1.3 Fit one membrane assembly and spacer piece to one of the hubs. Make sure that the sleeves (8) are located on the spigots of the hub and the spacer. Ensure that the washer (5) abuts the overload collar (9).

1.4 At the opposite end align the gaps in the hub spigot and the spacer spigot and insert the second membrane assembly locating two of the sleeves (8) on the spigots of the hub and spacer. SEE FIG 'A'.

1.5 Partially insert two socket head cap screws (6) into the sleeve (8) via the two smaller diameter holes in the hub. SEE FIG 'B'.

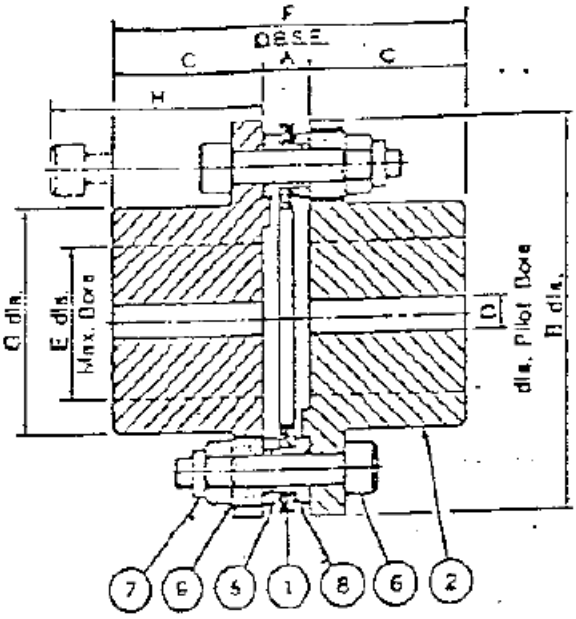
1.6 Holding either the hub or the spacer stationary rotate the free component through 90 degrees until the holes are in line.

1.7 Insert the two remaining socket head cap screws (6) through the two sleeves (8) complete with overload collars (9) and fit the nyloc nuts (7) SEE FIG 'C'.

1.8 Push home the socket head cap screws inserted in paragraph 1.5 above and fit the remaining two overload collars (9) any nyloc nuts (7). Tighten all nuts evenly to the torque figures below for the size of coupling fitted.

TORQUE FIGURES

Coupling Size	Old Coupling Size	lb/ft	Kg/m
2	16	4.5	0.6
3	25	6.5	0.9
8	63	11.0	1.5
20	160	22.0	3.1
30	250	45.0	6.2
80	630	72.0	9.9
170	1600	200.0	28.8
260	2500	200.0	28.8



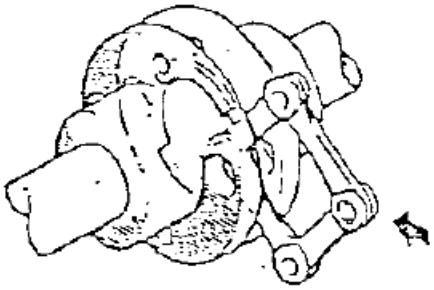


Fig A

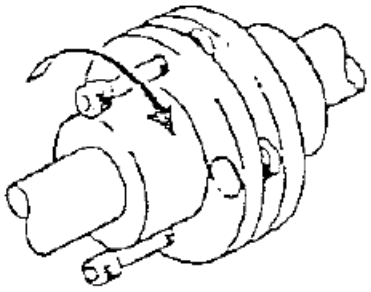


Fig B

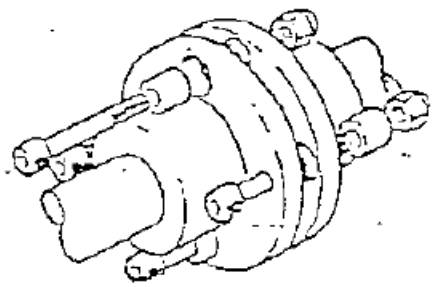


Fig C

KESTNER CHEMICAL PUMPS LIMITED

INSTALLTION INSTRUCTIONS FOR METASTREAM TYPE 'TDE' FLEXIBLE SPACER COUPLINGS (STYLE 1)

1.0 Fit the two flanged hubs to the driving and driven shafts in the usual manner ensuring that the shaft ends are flush with the inner face of the hub.

1.1 Set the distance between shaft ends (DBSE) taking into account any axial movement of the driving and driven shafts.

1.2 Ensure that both shafts are correctly aligned.

1.3 Align the gaps in the spigots of each hub and insert the membrane assembly locating two of the sleeves (8) on the spigots of each hub. Ensure that the washer (5) abuts the overload collar (9). SEE FIG 'A'.

1.4 Partially insert two socket head cap screws (6) into the sleeve (8) via the two smaller diameter holes in the hub. SEE FIG 'B'.

1.5 Holding either the hub or the spacer stationary rotate the free component through 90 degrees until the holes are in line.

1.6 Insert the two remaining socket head cap screws (6) through the two sleeves (8) complete with overload collars (9) and fit the nyloc nuts (7) SEE FIG 'C'.

1.7 Push home the socket head cap screws inserted in paragraph 1.4 above and fit the remaining two overload collars (9) any nyloc nuts (7). Tighten all nuts evenly to the torque figures below for the size of coupling fitted.

TORQUE FIGURES

Coupling Size	Old Coupling Size	lb/ft	Kg/m
2	16	4.5	0.6
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8	63	11.0	1.5
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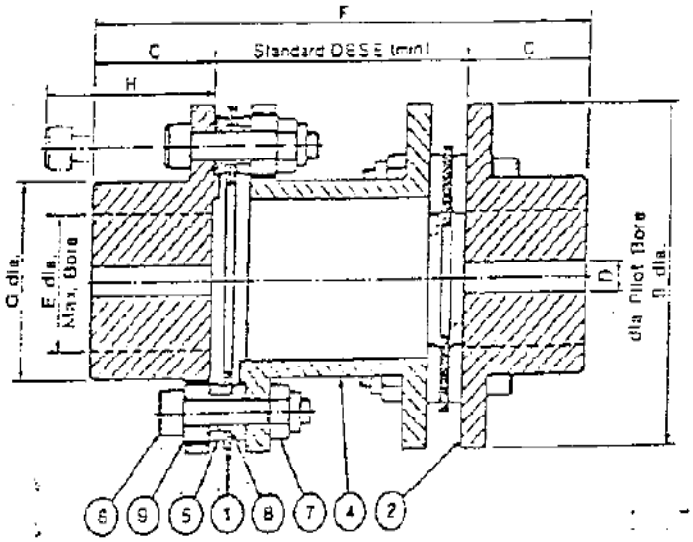
30	250	45.0	6.2
80	630	72.0	9.9
170	1600	200.0	28.8
260	2500	200.0	28.8

ROUTINE EXAMINATION

Under normal conditions the Metastream type TDE coupling will give long and trouble free service. The membrane assemblies should be checked from time to time for any visible signs of fatigue and if cracks are to be seen the membrane pack should be replaced. If the hubs or shafts have been disturbed for any reason, alignment must be checked as a matter of routine.

REPLACEMENT MEMBRANE PACKS ARE AVAILABLE TO ORDER.



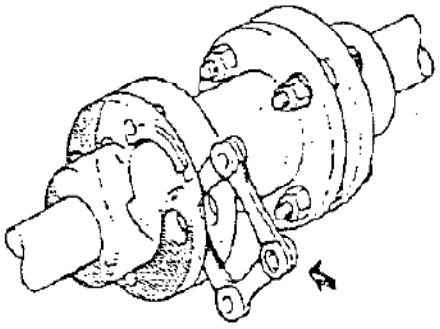


Fig A

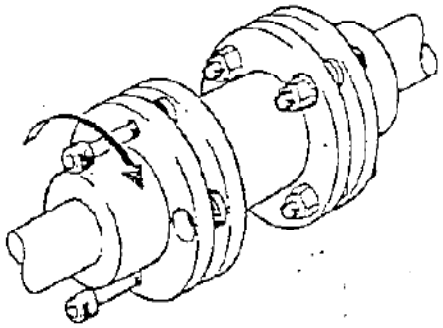


Fig B

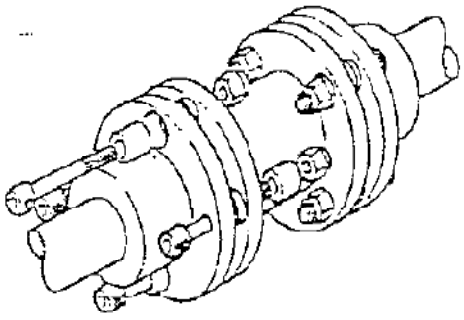


Fig C

KESTNER CHEMICAL PUMPS LTD

INSTALLATION INSTRUCTIONS FOR 'FENAFLEX' TYPE SPACER COUPLINGS

ASSEMBLY OF TYRE COUPLINGS

1.0 Thoroughly clean all components, paying particular attention to the removal of the protective coating in the bore of the flanges.

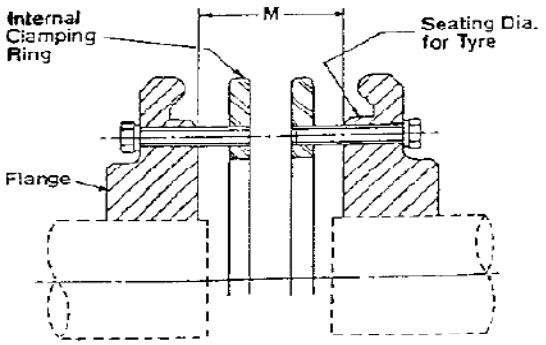
1.1 Fit the flanges to the shafts after placing the external clamp rings on the shafts. (Where Taper Lock Bushes are used, see separate fitting instructions supplied). Locate the flanges so that dimension 'M' is obtained (see section 1.2). Flanges with internal clamping rings should then have the clamping rings fitted, engaging only two of the threads of the screws at this time.

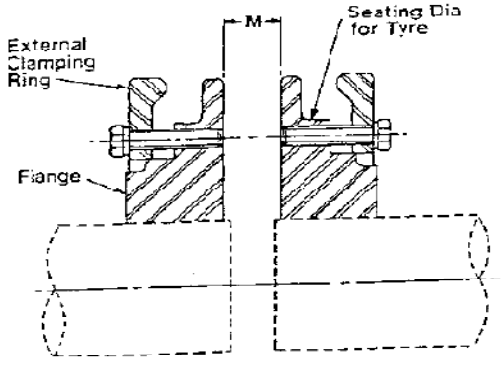
1.2 Bring the shafts into line until dimension 'M' is obtained (table 1). If shaft end float is to occur, locate the shafts at the mid position of end float when checking dimension 'M'. Note that shaft ends may project beyond the faces of the flanges if required. In this event, allow sufficient space between shaft ends for end float and mis-alignment. Flanges should be fitted with the end of the shaft when used with Mill-Motor flanges.

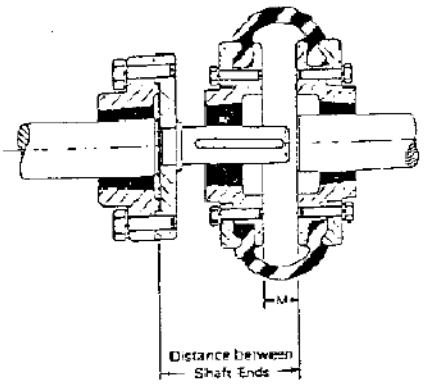
1.3 Check parallel alignment by laying a straight edge across the flanges at several positions around the circumference. Check angular alignment by measuring the gap between the flanges at several positions around the circumference. It is desirable to align the coupling as accurately as possible, particularly on high speed applications.

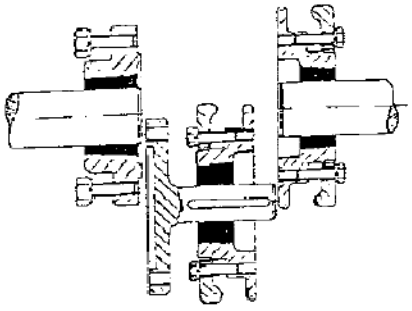
1.4 Open out the tyre and fit over the coupling flanges ensuring that the tyre beads seat properly on the flanges and/or clamping rings. To ensure proper seating it may be necessary to strike the outside diameter of the tyre with a small mallet. When seated there should be a gap between the ends of the tyre as shown in table 2.

1.5 Tighten the clamping ring screws alternatively and evenly (half a turn at a time) working around each flange until the required screw torque is achieved (table 2).









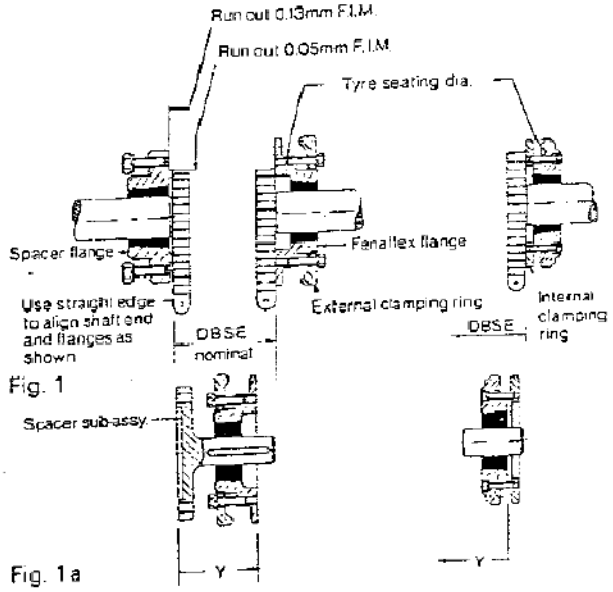


Fig. 1

Fig. 1a

TABLE 2

COUPLING SIZE	F40 to F60	F70 to F120	F140 and F160	F180 to F250
Tyre Gap mm	2	3	5	6

TABLE 3

	'Y' for nominal D.B.S.E.		
	100	140	180
F40	83	123	
F50	82	122	
F60	75	115	155
F70	75	116	156
F80	74	114	154
F90		111	151
F100		111	151
F110		115	155
F120		111	151
F140		104	144

TABLE 4

Flange size	Screws	
	Size	Torque Nm
SM16	M10	20
SM25	M12	25
SM30	M16	40
SM35	M16	90

Note: If necessary the D.B.S.E. may be extended. The maximum D.B.S.E. possible is achieved when the spacer shaft end and driven shaft end are flush with the face of their respective Taper Lock® bushes.

KESTNER CHEMICAL PUMPS LIMITED

GENERAL POINTS REGARDING MECHANICAL SEALS

The main consideration in starting up equipment with mechanical shaft seals is to ensure that the seal faces are immersed in liquid from the very beginning so that they will not be scored or damaged by dry operation. The recommendations below will be applicable to most types of seal installations, if followed successful start-up and normal seal life can be expected.

(1) Caution that the equipment is not run dry while checking the electric motor for the correct direction of rotation. Kestner horizontal pumps are generally dispatched from the works with the spacer coupling disconnected to ensure that this does not occur. The direction should be checked and then the coupling can be connected for operation. A slight turnover by hand will not damage the seals, however, full motor speed for a short period under dry conditions will destroy or severely damage the rubbing faces.

(2) Sealant connections at the stuffing box should be connected and the specified coolant flowrate and pressure should be checked and confirmed prior to starting the equipment. Flow switches in the sealant supply lines may be beneficial to prevent energizing the electric motor drive under 'no-flow' conditions.

(3) On hot operational equipment that is shut down at the end of the day, it is generally advisable to leave the sealant liquid flowing at least long enough for the seal chamber to cool below the temperature limits of the materials in the seal.

(4) Most double mechanical seals are dependant upon the controlled pressure and flow of the sealing fluid to function correctly (generally a minimum of 1 bar above the stuffing box / discharge pressure). Even before the shaft is rotated the sealing liquid pressure must exceed the product pressure opposing the seal.

(5) A squealing noise indicates insufficient liquid at the seal faces (that is the faces are running dry) and to avoid reduced seal life the installation should be checked immediately. Dry operation from the sudden loss of suction liquor is sometimes encountered and should be rectified immediately to prevent possible damage to the seal faces.

(6) New plant start-up should consider the presence of dirt and debris in the system during construction. This cannot be eliminated entirely however, proper cleaning and flushing pipelines prior to running the equipment can greatly eliminate many seal failures. The use of strainers, cyclone separators and filters on critical installations during commissioning is often advisable for new plant initial start-up as a large percentage of seal failures occur during the commissioning process.

(7) If a seal leaks slightly on start-up allow a reasonable period of time for it to adjust itself. Liquids with good lubricating properties will naturally take longer to bed-in. When a seal starts out with a slight leak and gets progressively less with running, it is indicative of a leakage across the seal faces and continued running will cure it.

Where leakage occurs initially and is not affected by running it generally indicates seal damage or misalignment.

(8) Unless absolutely necessary **DO NOT OPEN SEAL FACES FOR INSPECTION**. After a seal has been running for some time a wear pattern is established between the two faces which microscopically mates these two faces, since it is very unlikely that the two faces can be put back together in their exact wear pattern position, disturbing the seal in any manner will probably necessitate establishing a new wear pattern, perhaps after re-lapping the mating faces.

(9) **CAVITATION**:- Excessive cavitation can cause seal failure, in addition to any damage which may occur in the pump. Cavitation causes severe vibration of the pump shaft, shaft deflection and bearing failure. Pump cavitation is generally indicated by excessive noise in the pump casing.

(10) Stand-by equipment having mechanical seals should not be allowed to stand idle for long periods of time. Rotate the equipment at least once a week, if only for a few moments. Better still allow a designated period for placing the unit on line. This procedure will generally only take a minimum period of time and effort as almost all stand-by and duty equipment have common suction and delivery pipework.

(11) It should be borne in mind that the driver alignment is checked at our works prior to dispatch, however, this should be re-checked after final installation at site. Also the effect of pipework strain is well documented as to the damage it can cause to pump bearings and seals. Pipework should be of the correct size, properly aligned and adequately supported with expansion bellows fitted if necessary. The pump suction and delivery branches should not be used as pipework supports.

(12) Long term storage: It is recommended that mechanical seals left in storage for over 2 years are returned to the manufacturer for inspection.

For seals already installed in the equipment :- Pumps subject to long term storage (over 1 year) are best stored without the mechanical seals being fitted. Seal installation should only then be carried out shortly before the actual start-up of the equipment.

KESTNER CHEMICAL PUMPS LIMITED

REMOVING THE COMPLETE SEAL

(A) Remove the seal unit from the equipment. Any adapter ring/abutment collar can be left on the shaft, located in its correct position. The seat and its sealing component(s) can also be removed. The seat is to be cleaned and de-greased before being coated in a film of oil and sealed in Polythene wrapping. All PFTE and Elastomer parts can be disassembled, dried and stored in black plastic bags before being kept in a cool, dark area. The seal unit is to be totally dried and stored in polythene wrapping or a bag containing a moisture absorbing agent, (eg a bag of silica gel). The rotating shaft and seat recess/abutment on the equipment should be thoroughly cleaned, de-greased and dried before being protected from corrosion for the duration of its time in storage.

(B) **Leaving the seals in the equipment**:-

Pumps equipped with double seals:- The seal chamber is to be filled with ethylene glycol with an inhibitor to prevent corrosion. Suction and discharge flanges are to be covered to exclude the ingress of dirt. Covers should be marked:- **DO NOT REMOVE UNTIL EQUIPMENT IS INSTALLED.** The open area between the glandplate and shaft or shaft sleeve, it to be protected from airborne dirt, (eg with masking tape or suitable glued in rubber gasket ring, that has a close clearance with the shaft / sleeve O.D). If at all possible, the shaft should be rotated slowly by hand in the direction of the normal equipment approx once every week.

Pumps equipped with single seals:- The seal chamber should be completely dry. The seal faces should ideally be assembled dry also. If hydrostatic or acceptance testing is to be done by the equipment manufacturer, then the seal area must be flushed clean and totally dried afterwards. Pumps on cryogenic duties should be drained from the lowest point and then blown through with dry, hot air or Nitrogen for at least 30 minutes. Suction and discharge flanges are to be covered to exclude the ingress of dirt. Covers should be marked:- **DO NOT REMOVE UNTIL EQUIPMENT IS INSTALLED.** The open area between the glandplate and shaft sleeve is to be masked to exclude dirt. All open ports in the gland, adapter plate and stuffing box are to be plugged and sealed. Clamp bolts can be loosened off approximately 3 turns of the thread to relax the spring loading. The corresponding gap left between the stuffing box face and the glandplate should be masked to exclude dirt. If the shaft has to be rotated by hand occasionally to comply with the bearing manufacturers recommendations, then the sealing faces should be coated with a light film of clean lubricating oil.

IF THE PUMP IS TO BE STORED IN SITU, THEN IT IS RECOMMENDED TO DISCONNECT ALL ELECTRICAL CONNECTIONS TO THE PUMP MOTOR OR AT LEAST EARTH THE PUMP CASING.

KESTNER CHEMICAL PUMPS LIMITED

ELECTRIC MOTOR OPERATIONAL PROBLEMS

FAULT	CAUSE	REMEDY
Motor overheated	Motor connected in Delta instead of Star as described on nameplate.	Correct the connection
	Mains voltage deviates from the rated motor Voltage by more than 6%. Too high a voltage is particularly detrimental for multiple motors since such motors have 'no load' current approximately equal to the full load current even when operating on normal voltage.	Make arrangements for correct mains voltage to be applied.
	Volume of cooling air inadequate, cooling air ducts clogged.	Clean around motor cooling fans and arrange for unimpeded access & discharge of cooling air.
	Cooling air is pre-heated.	Arrange for cool air supply.
	Overload at normal mains voltage. Current excessive. Speed too low.	Install larger motor (size to be determined by measuring power).
	Motor capability exceeded (SI to S8) e.g the motor becomes overheated due to excessive switching frequency, in such cases it is not sufficient simply to use a larger motor since in all probability the same conditions would still arise.	It is preferable under these circum-stances to consult a qualified electrical engineer to determine the correct size of motor req in order that the motor may be adapted to suit the actual mode of operation.
	Supply cable has loose contact i.e (temporary single phasing) Burnt out fuse.	Correctly secure the loose contact. Replace the fuse.
Motor will not start	Fuse burnt out.	Replace the fuse.
	Motor protection switch has tripped.	Check motor protection switch for the correct setting and adjust.
	Motor protection switch inoperative fault in the control line.	Check operational & regulation of motor protection switch and rectify.
Motor will not start or starts with difficulty	Designed for delta connection but connected in Star.	Connect motor correctly.
	Voltage or frequency of electrical supply Deviates considerably from required value During starting conditions.	Improve mains supply conditions.
Motor will not start when connected in star will only start when connected in delta.	Torque insufficient from star connection.	If delta starting current is not excessive then re-connect for DOL starting, otherwise larger size of motor or motor Having special windings will be required.

FAULT	CAUSE	REMEDY
Motor hums and takes excessive current.	Fault in windings.	Motor to be examined and repaired by qualified electrical engineers.
	Rotor grazing.	Motor to be examined and repaired by qualified electrical engineers.
Fuses blow or motor protection switch trips immediately.	Short circuit on line.	Remove short circuit.
	Short circuit in motor.	Fault to be remedied by qualified electrical engineer.
	Line terminals incorrectly connected.	Correct the connections.
Wrong direction of rotation.	Motor incorrectly connected.	Interchange any two of the incoming main lines.

FOR WINDING FAULTS THE MOTOR MUST BE CHECKED AND REPAIRED BY QUALIFIED ELECTRICAL ENGINEERS.

One Phase burnt out.	One phase missing in delta connection motor protection inadequate.	Motor should be re-wound. Motor protective switch to be correctly set.
Two Phases burnt out.	One phase missing in star connection motor protection inadequate.	Motor to be rewound and protective switch adjusted correctly.
Three phases burnt out uniformly.	Overload, blocking, Excessive switching Frequency. Insufficient motor protection incorrect connection.	Motor to be rewound and protective switch adjusted correctly. Wiring to be Corrected and drive checked.
Winding fault (several windings burnt out in one slot).	Mechanical damage to winding or other insulation faults.	Motor to be rewound.

KESTNER CHEMICAL PUMPS LIMITED

BEARING DAMAGE AND CORRECTIVE MEASURES

DAMAGE	DESCRIPTION	CAUSES	CORRECTION
Flaking	The surface of the guide way begins wearing away. Conspicuous hills and valleys form soon afterward.	Excessive loads or improper handling improper mounting. Improper precision in the shaft or housing. Insufficient clearance. Contamination. Rust. Drop in hardness due to abnormally high Temperatures.	Review application conditions. Select a different type of bearing. Re-evaluate the clearance. Improve the precision of the shaft and housing. Re-evaluate the layout (design) of the area around the housing. Review assembly procedures and review lubricant type and lubrication methods.
Seizure	The bearing heats up and becomes discoloured. Eventually the bearing will seize up.	Insufficient clearance (including clearances made smaller by local deformation). Insufficient lubrication or improper lubricant. Excessive loads. (excessive pressure). Skewed rollers.	Check for proper clearance (increase clearances). Review lubricant type and quantity. Review application conditions. Take steps to prevent mis-alignment. Re-evaluate the design of the area around bearing (including the fitting of the bearing). Improve assembly procedures.
Cracking & notching.	Localised flaking occurs. Little cracks Or notches appear.	Excessive shock loads. Excessive interference. Large flaking. Friction cracking. Inadequate abutment or chamfer. Improper handling (gouges from large to Foreign objects).	Review application conditions. Select proper interference and review. materials. Improve assembly procedures & take care in handling. Take measures to prevent friction Cracking (review lubricant type). Re-evaluate the design of the area around the bearing.
Retainer damage	Rivets break or become loose Resulting in retainer damage.	Excessive moment loading. High speed or excessive speed fluctuations.	Review the application conditions. Review of application conditions.

		Inadequate lubrication. Impact with foreign objects. Excessive vibration. Improper mounting (misalignment). Abnormal temperature rise. (plastic retainers).	Re-evaluation of lubrication conditions. Review of retainer type selection. Take more care in handling.
Smearing & scuffing	The surface becomes rough & some Deposits form. Scuffing generally Refers to roughness on the race collar And the ends of the rollers.	Inadequate lubrication. Entrapped foreign particles. Roller skewing due to misaligned Bearing. Bare spots in the collar oil Film due to large axial loading. Surface roughness. Excessive slippage of rolling elements.	Re-evaluation of the lubricant type and lubrication method. Review of operating conditions. Setting of a suitable pre-load. Improve sealing performance. Take care to handle the bearing Properly.
Rust & corrosion	The surface becomes either partially or fully rusted, and occasionally rust even occurs along along the rolling element pitch lines.	Poor storage conditions. Poor packaging. insufficient rust inhibitor. Penetration by water, acid, etc Handling with bare hands.	Takes measures to prevent rusting while in storage. Improve sealing Performance. Periodically, inspect the lubricating oil. Take care when handling the bearing.
Fretting	There are two types of fretting:- In one, a rusty wear powder forms on The mating surfaces. In the other, brinelling indentations form on the raceway at the rolling element pitch.	Insufficient interference. Small bearing oscillation angle. Insufficient lubrication. Fluctuating loads. Vibration during transport.	Review the interference and apply a Coat of lubricant. Pack the inner & outer ring separately for transport. When the two cannot be separated Apply a pre-load. Select a different Type of lubricant. Select a different type of bearing.
Wear	The surfaces wear & dimensional deformation results. Wear is often accompanied by roughness and Scratches.	Entrapment of foreign particles in the lubricant. Inadequate lubrication. Skewed rollers.	Review lubricant type & lubrication Methods. Improve sealing performance. Take steps to prevent misalignment.
Electrolytic corrosion	Pits form in the raceway. The pits gradually grow into ripples.	Electric current flowing through the rollers.	Create a by-pass circuit for the current. Insulate the bearing so the current does not pass through.

Dents and scratches	Scoring during assembly, gouges due to Hard foreign objects and surface Denting due to mechanical shock.	Entrapment of foreign objects. Bite-in on the flaked off side. Dropping or other mechanical shocks Due to careless handling. Assembled misalignment.	Improve handling & assembly methods. Take measures to prevent the entrapment of foreign objects. Should the damage have been caused by little pieces of metal, thoroughly Check all other locations.
Slipping or creeping	Slipping is accomplished by Mirror-like or discoloured surfaces on The ID and OD. Scuffing may also occur.	Insufficient interference in the mating section. Sleeve not fastened down properly. Abnormal temperature rise. Excessive loads.	Re-evaluate the interference. Re-evaluate usage conditions. Review the precision of the shaft and housing.

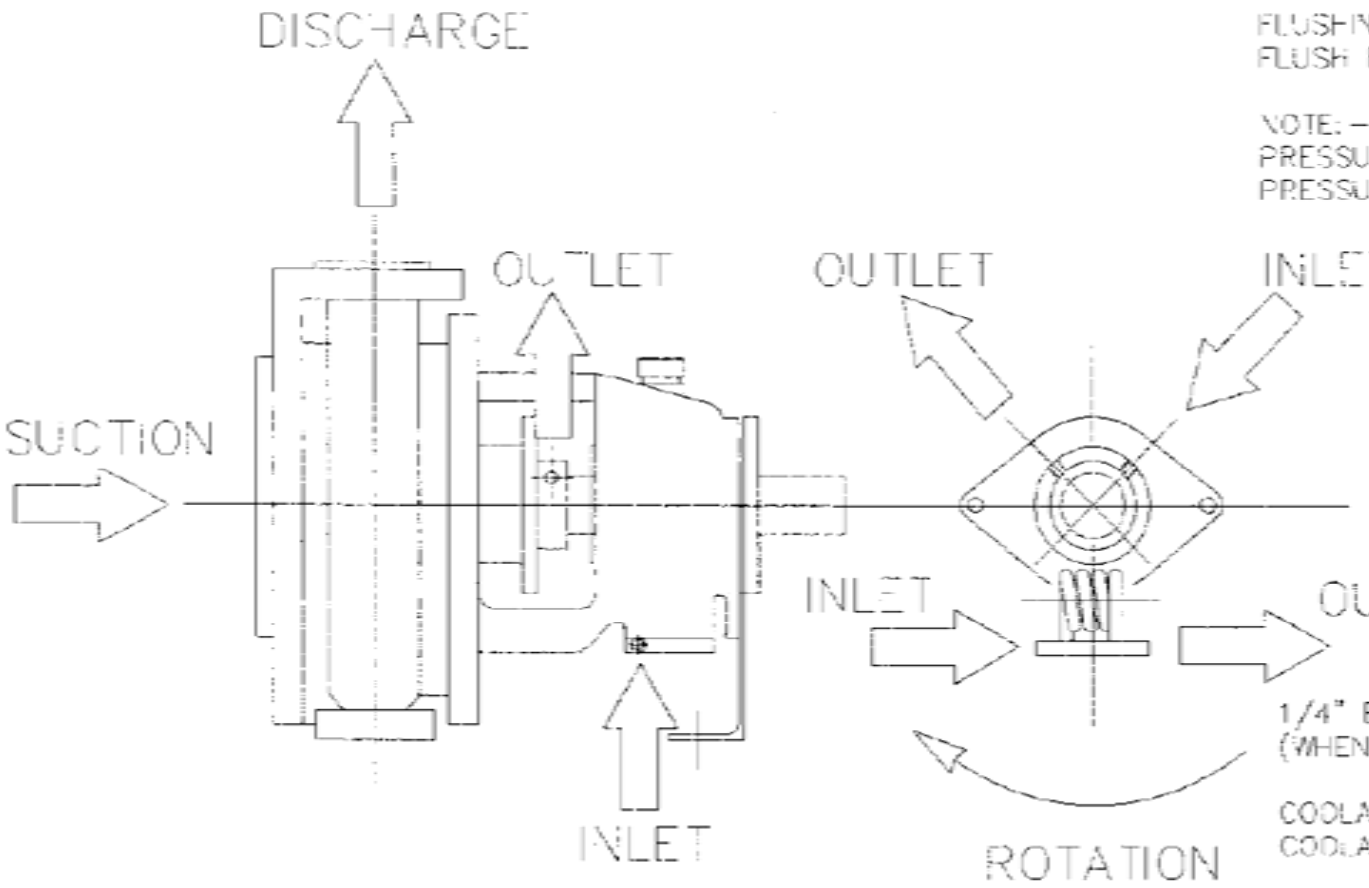
NOTE While it is course impossible to directly observe bearings in operation, one can get a good idea of how they are operating by monitoring noise, vibration temperature and lubricant condition. Types of damage typically encountered are given in the above table.

NOTE
FOR KSI PUMP MODELS THE INLET / OUTLET FLUSH CONNECTIONS ARE SITUATED ON EITHER SIDE OF THE SEAL HOUSING COVER PLATE IE - IN THE SAME PLANE AT 45 DEGREES TO THE PUMP AXIS THUS:-

1/4" BSP SEAL FLUSH CONNECTIONS
FLUSH CONNECTIONS ARE FITTED WITH 12" LONG FLEXIBLE HOSES

FLUSHING PRESSURE :- bar
FLUSH FLOWRATE:- L/min

NOTE:- FLUSH PRESSURE S MINIMUM PRESSURE ABOVE PUMP SUCTION INLET PRESSURE



1/4" BSP OIL COOLER CONNECTIONS (WHEN COOLING COIL IS FITTED)

COOLANT PRESSURE :- bar
COOLANT FLOWRATE:- L/min

DETAILS OF SEAL FLUSH / COOLING COIL CONNECTIONS FOR MODEL KS PUMPS WITH

KESTNER CHEMICAL PUMPS LIMITED

LUBRICATION CHART

EQUIVALENT OIL GRADES.

SHELL	B.P	DUCKHAMS	MOBIL	ESSO	ELF	TOTAL
TELLUS T15	ENERGOL 15	ZIRCON 15	DTE 11 M	NUTO H+15	ELFOLNA DS15	AZOLLA 10
TELLUS 32	ENERGOL 32	ZIRCON 32	DTE 24	NUTO H+32	ELFOLNA DS32	AZOLLA 32
TELLUS 46	ENERGOL 46	ZIRCON 46	DTE 25	NUTO H+46	ELFOLNA DS46	AZOLLA 46

EQUIVALENT GREASE GRADES.

SHELL	B.P	SKF	MOBIL	ESSO	ELF	TOTAL
ALVANIA R3	ENERGREASE LS 3	ALFALUB LG MT 3	MOBILUX EP 3	BEACON 3	MULTI 3	MULTI SPECIAL 3

REFER TO GREASE LUBRICATION INTERVALS ON DIAGRAM 1.

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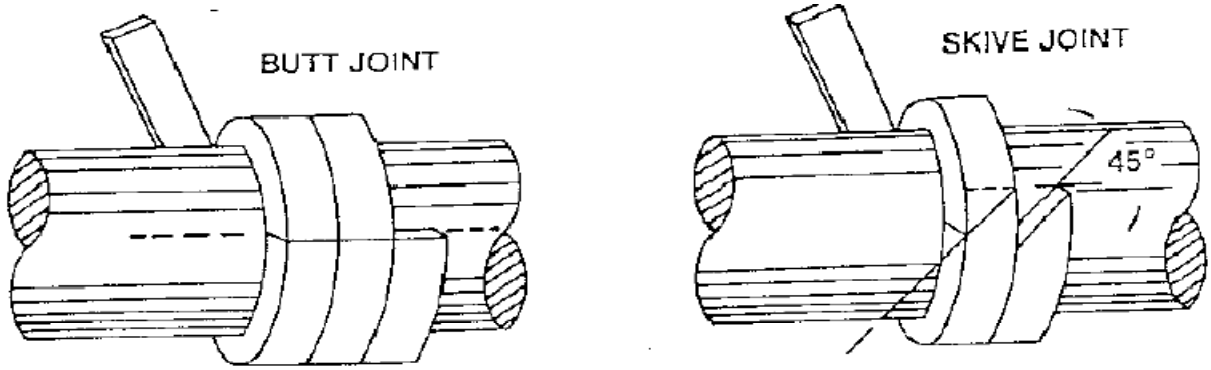
KESTNER CHEMICAL PUMPS LIMITED

1. REMOVE ALL OF THE OLD PACKING FROM THE STUFFING BOX. Clean the box and shaft thoroughly and examine the pump shaft and / or sleeve for wear or scoring. Replace the shaft or sleeve if wear is excessive.

2. USE THE CORRECT CROSS SECTION OF PACKING. To determine the correct packing size, measure the diameter of the shaft (inside the stuffing box area if possible) and then measure the diameter of the stuffing box (to give the outside diameter of the ring). Subtract the inside diameter measurement from the outside diameter measurement and divide by two. The result is the required size ... CUT... DONT WIND.

3. WHEN USING A COIL OF PACKING MATERIAL, ALWAYS CUT THE PACKING INTO SEPARATE RINGS. Never wind a coil of packing into a stuffing box. Rings can be cut with either butt (square) or skive (diagonal) joints, depending on the method of cutting. The following illustration shows these methods of preparing bulk packing. The best way to cut packing rings is to cut them on a mandrel with the same diameter as the shaft in the stuffing box area. If there is no shaft wear, the rings can be cut on the shaft outside the stuffing box. Hold the packing material tightly on the mandrel, but do not stretch the packing excessively. Cut the ring and insert it into the stuffing box, making certain that it fits the packing space correctly. Each additional ring can be cut in the same manner, or the first ring can be used as a master from which the balance of the rings may be cut.



If the butt cut rings are cut on a flat surface be sure that the side of the master rings and not the outside or inside diameter surface is laid on the rings to be cut. This is necessary so that the end of the rings can be reproduced. When cutting diagonal joints, use a mitre board so that each successive ring can be cut to the correct angle. It is necessary that the rings be cut to the correct size. Otherwise, service life is reduced.

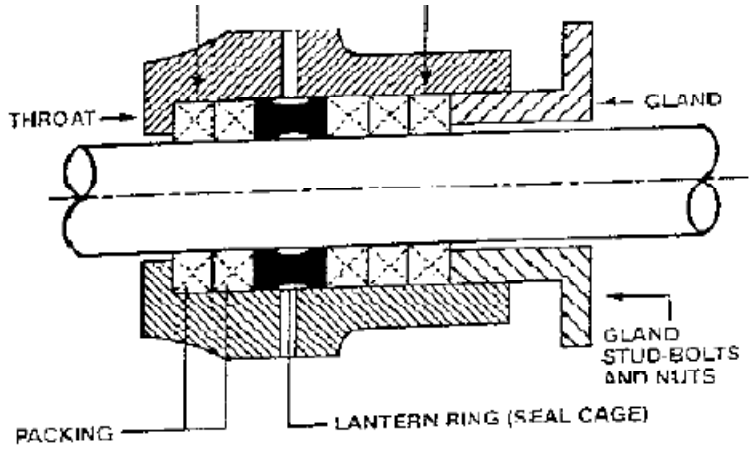
4. INSTALL ONE RING AT A TIME. Make sure it is clean and has not picked up any dirt in handling. Seat the rings firmly (except PTFE filament or graphite wound packings, which should be snugged up very gently, then tightened gradually after the packing has been placed in service). Joints of successive rings should be staggered and kept at least 90 degrees apart. Each individual ring should be firmly seated with an appropriate tamping tool. When enough rings have been individually seated so that the nose of the stuffing box gland follower will reach them, individual tamping should be supplemented by the gland.

5. AFTER THE LAST RING IS INSTALLED. Take up the gland follower bolts finger tight or very slightly snugged up. Do not jam the packing into place by excessive gland loading. Start the pump and take up the gland follower bolts evenly until leakage is reduced to an acceptable minimum. Make sure that the gland bolts are tightened evenly. STOPPING LEAKAGE ENTIRELY AT THIS POINT WILL CAUSE THE PACKING TO BURN UP.

6. ALLOW THE PACKING TO LEAK FREELY WHEN STARTING UP A NEWLY PACKED PUMP. Excessive leakage during the first hour of operation will result in a better packing life over a longer period of time. Take up the gland follower nuts evenly as the packing seats, until leakage is reduced to an acceptable level, preferably 8-10 drips per minute, per 25mm of shaft diameter. **** NEVER ATTEMPT TO STOP LEAKAGE ENTIRELY.****

7. WHEN SPECIFIED PROVIDE A MEANS OF LUBRICATION TO THE SHAFT AND PACKING THROUGH THE LANTERN RING BY SUPPLYING WATER, OIL, GREASE OR RE-CIRCULATED LIQUID FROM THE PUMP, the flush pressure should be a minimum of 1 bar above the stuffing box pressure.

Stuffing box area



8. IF THE STUFFING BOX IS FITTED WITH A LANTERN RING (SEE ILLUSTRATION ABOVE). Make sure that the lantern ring is installed in the correct position, it should be slightly behind the fluid inlet so that it will move under the inlet as the gland follower pressure is applied.

9. REPLACE THE PACKING WHEN THE LEAKAGE CANNOT BE CONTROLLED BY FURTHER TIGHTENING OF THE GLAND FOLLOWER DO NOT ATTEMPT TO ADD ANY FURTHER RINGS.

NOTE:- ALWAYS USE ORIGINAL MANUFACTURERS PARTS WHEN RE-FURBISHING THE PUMP.

10. WITH CENTRIFUGAL PUMPS about 70% of the wear is on the outer two packing rings nearest the gland follower. However each additional ring does throttle some fluid pressure. There must generally be sufficient rings so that if one fails, another doe the sealing and the pump need not be shut down for maintenance. With high temperatures and pressures, corrosive chemicals, or abrasive particles in the pumped fluid more packing rings may have been fitted by the manufacturer. In such cases, the ring nearest the pump impeller containing the pumped fluid may have the most wear due to the severe service conditions.