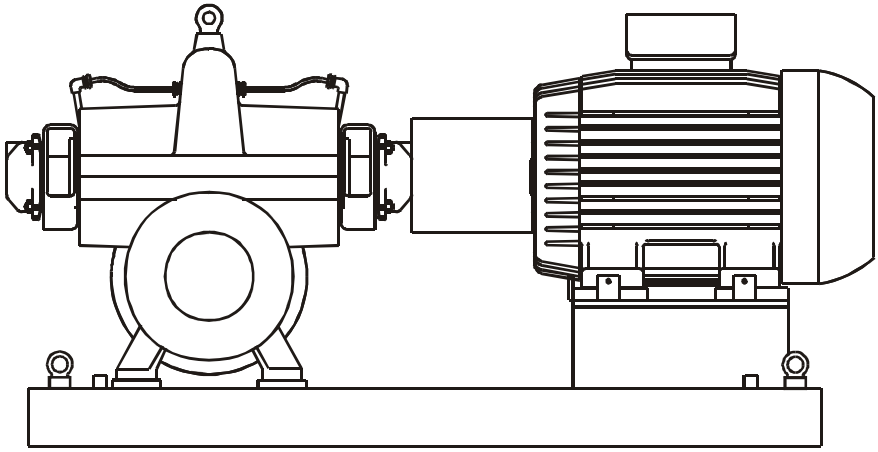
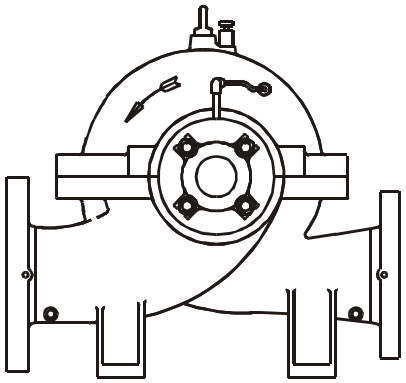
# THRUSTREAM
# STANDARD RANGE
# Horizontal Split Case
# Centrifugal Pumps
# And Pump Sets





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# DECLARATION OF CONFORMITY

We **SPP Pumps Limited**

Of Crucible Close
Mushet Industrial Park
Coleford
Gloucestershire
England
GL16 8PS

Declare that:

Equipment: **HORIZONTAL SPLIT CASE CENTRIFUGAL PUMPS**
Model/Type: **Models TB to TF** (As per the table on page 3)
Serial Number**:** As shown on the Pump Nameplate

**For Pumps and Pumpsets:**

in accordance with the following Directives:

| | |
|---|---|
| **2006/42/EC** | **The Machinery Directive** and its amending directives |
| **2006/95/EC** | **Low Voltage Directive** |

have been designed and manufactured to the following specifications:

| | |
|---|---|
| **EN 809:1998+A1:2009** | **Pumps & Pump Units for Liquids - Safety Requirements** |
| **EN 12100:2003** | **Parts 1 and 2 - Safety of Machinery** |
| **EN 60204-1:2006** | **Safety of Machinery - Electrical Equipment** |

We hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The units comply with all essential requirements of the Directive.

**For pumps supplied without drivers:**
We hereby declare that this equipment is intended to be incorporated into, or assembled with other machinery to constitute relevant machinery to comply with the essential health and safety requirements of the Directive.

The machinery covered by this declaration must NOT be put into service until the relevant machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive.

Signed:

Name: John Hollins

Position: Engineering Manager - Authorised to sign on behalf of SPP Pumps Limited
Mushet Industrial Park, Coleford, Gloucestershire, England, GL16 8PS

Date: 25 February 2010

**W12-003E**

## CONTENTS



**Introduction**

This manual gives the safety, installation, operation and maintenance instructions for pumps in the SPP Pumps Ltd **Thrustream** standard range of Horizontal split case centrifugal pumps for general water and industrial use.

Thrustream pumps are identified by their pump designation and by their size code, the first number is the delivery branch diameter and the second number is the nominal diameter of the impeller in centimetres.

The pump sizes covered by this manual are:

| ***Size*** | ***Pump*** | ***Shaft Module*** |
|---|---|---|
| 50/38 | **TE05A** | 1SE |
| 80/38 | **TE08A** | 1SE |
| 65/24 | **TB06A** | 1 |
| 80/24 | **TB08A** | 1 |
| 125/24 | **TB12A** | 1 |
| 150/24 | **TB15A** | 1 |
| 125/29 | **TC12A** | 1 |
| 80/30 | **TD08A** | 1 |
| 100/30 | **TD10A** | 1 |
| 125/30 | **TD12A** | 1 |
| 100/24 | **TB10A** | 2 |
| 250/24 | **TB25A** | 2 |
| 150/30 | **TD15A** | 2 |
| 200/30 | **TD20A** | 2 |
| 250/30 | **TD25A** | 2 |
| 100/38 | **TE10A** | 2 |
| 125/38 | **TE12A** | 2 |
| 150/38 | **TE15A** | 2 |
| 200/38 | **TE20A** | 3 |
| 250/38 | **TE25A** | 3 |
| 150/48 | **TF15A** | 3 |
| 200/48 | **TF20A** | 3 |

This manual covers the Standard Thrustream pumps that are built for use in the Horizontal position. For information on pumps built for vertical applications, please refer to a separate manual that can be obtained from SPP Pumps Limited.

**Thrustream Pumps used for Fire Protection**

Note: Thrustream fire pumps differ from standard pumps, as they have different shaft modules. For information on Thrustream fire pumps, please refer to a separate manual that can be obtained from SPP Pumps Limited.

# 1. General Information and Safety Instructions

The products supplied by SPP Pumps Ltd. have been designed with safety in mind. Where hazards cannot be eliminated, the risk has been minimised by the use of guards and other design features. Some hazards cannot be guarded against and the instructions below MUST BE COMPLIED WITH for safe operation. These instructions cannot cover all circumstances: YOU are responsible for using safe working practices at all times.

1.1 SPP Pumps Ltd. products are designed for installation in designated areas, which are to be kept clean and free of obstructions that may restrict safe access to the controls and maintenance access points.

A pump nameplate is fitted to each unit and must not be removed. Loss of this plate could make identification impossible. This in turn could affect safety and cause difficulty in obtaining spare parts. Should accidental loss or damage occur, contact SPP Pumps Ltd. immediately.

1.2 Access to the equipment should be restricted to the personnel responsible for installation, operation and maintenance and they must be trained, adequately qualified and supplied with the appropriate tools for their respective tasks.

1.3 SPP Pumps Ltd. requires that all personnel that are responsible for installation, operation or maintenance of the equipment, have access to and study the product instruction manual BEFORE any work is done and that they will comply with all local and industry based safety instructions and regulations.

1.4 Ear defenders should be worn where the specified equipment noise level exceeds locally defined safe levels. Safety glasses or goggles should be worn where working with pressurised systems and hazardous substances. Other personal protection equipment must be worn where local rules apply.

1.5 Do NOT wear loose or frayed clothing or jewellery that could catch on the controls or become trapped in the equipment.

1.6 Check and confirm that the manual is the relevant copy by comparing the serial number on the identification plate with that on the manual.

1.7 Note any limits to the pump application specified in the contract documentation. Operation of the equipment outside these limits will increase the risk from hazards noted below and may lead to premature and hazardous pump failure.

1.8 Clear and easy access to all controls, gauges and dials etc. MUST be maintained at all times. Hazardous or flammable materials must NOT be stored in pump rooms unless safe areas or racking and suitable containers have been provided.

1.9 **IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF THIS SPP PUMPS LTD PRODUCT COULD RESULT IN INJURY OR DEATH.**

1.10 Within the manual, safety instructions are marked with safety symbols.

***Hazard***
This symbol refers to general mechanical aspects of safety.

***Hazard***
This symbol refers to electrical safety.

**ATTENTION** This symbol gives warning of a hazard to the pump itself, which in turn, could cause a risk to personal safety.

# 2. Transport Handling and Storage Instructions

2.1 Transport

Horizontal Thrustream pumpsets are despatched fully assembled except where stability or handling constraints require the motor to be packed and delivered separately.

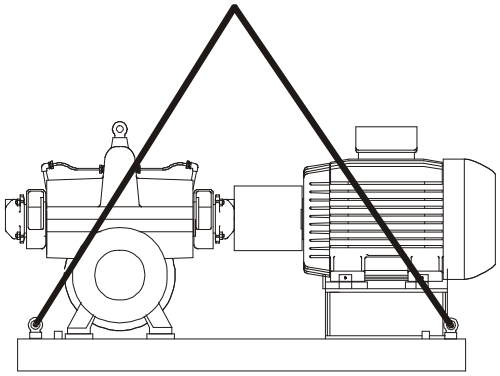
Pumps are protected against corrosion and packed for transport by normal road, rail and sea carriers.

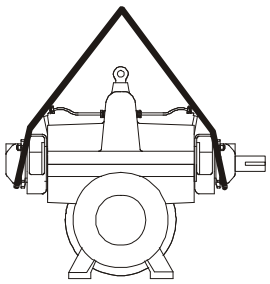
2.2 Handling

**Crushing Hazard**
When lifting the pump unit, use lifting equipment having a safe working load rating suitable for the weight specified. Use suitable slings for lifting any pump not provided with lifting points.

The use of suitable forklift truck and four-chain crane sling equipment is recommended but locally approved equipment of suitable rating maybe used.

Pumps are usually supplied on pallets for handling by forklift truck, to lift from the pallet the pump should be slung as shown.





Pump weight is shown on the general arrangement drawing supplied with each pump or pumpset.

2.3 Storage

**Shearing Hazard**
Do NOT place fingers or hands etc. into the suction or discharge pipe outlets and do NOT touch the impeller. If rotated this may cause severe injury. To prevent ingress of any objects, retain the protection covers or packaging in place until removal is necessary for installation. If the packaging or suction and discharge covers are removed for inspection purposes, replace afterwards to protect the pump and maintain safety.

2.3.1 Temporary Storage for up to Six Weeks

If the pump is not to be used immediately, it should be stored carefully in a horizontal position, in a sheltered, dry location. Additional rust preventative should be applied to all unpainted carbon steel or cast iron parts. Fit or retain in place the covers to the suction and discharge flanges and all other pipe connections. Rust preventative and flange covers should not be removed until final installation.

When pumps are not in use, the pump shaft should be rotated several turns, every six weeks.

2.3.2 Long Term Storage

It is recommended that the pump is stored in a clean dry place that is not subject to a wide temperature variation. Pack the bearings with the specified grease and periodically inspect the bearing housings to ensure that they are free from damp and moisture. Leave the covers for the suction and discharge flanges in place or replace with suitable covers to prevent ingress of dirt or moisture. Rotate the shaft several turns monthly, to distribute the grease and prevent pitting of bearing surfaces.

If storage in the open cannot be avoided, cover the pump with a tarpaulin sheet, but allow dry air to circulate around the pump.

For special protection of electric motors and mechanical seals, refer to the manufacturer's instructions in Appendix I & III.

2.3.3 Exposed or Extreme Conditions Storage

For exposed storage or extreme variants in atmospheric or environmental conditions, please refer to SPP Pumps Ltd.

# 3. General Description

SPP Pumps Ltd. Thrustream Pumps are a range of centrifugal pumps that are usually supplied as pumpsets with electric motors but can be supplied separately for customers to fit to drivers of their own preference.

### *3.1. Pumps*

The mechanical assembly comprises a rigid shaft, supported by grease-lubricated ball bearings. The pump casing is fitted with wear rings and normally contains a double entry shrouded type impeller mounted on a stiff shaft. Single side entry impellers are used for two pumps in the range. The seal chamber is housed in the casing inserts and these are retained within the casing. Some impellers may be fitted with wear rings if required. When the top half casing is removed, the bearing housings, inserts, shaft and impeller assembly can be removed from the bottom casing for maintenance without disconnection of pipework.

The suction and discharge branch flanges are positioned horizontally at 90 degrees to and below the shaft centreline. The pump casings allow for construction to suit different rotations.

The standard pump is fitted with a soft packed seal, internal component mechanical seals and external cartridge mechanical seals are available as an option. These pumps are normally supplied with a cast iron casing and impeller but bronze may be supplied where required. Other parts may be supplied in a variety of materials to suit the pump application.

In standard form, these pumps are designed to pump liquids at temperatures up to 80°C. Where pumps are needed to suit higher temperatures, please refer to SPP Pumps Ltd.

Nameplate details are shown on the back cover of this manual, full pump specification can be supplied on a data sheet, if requested.

Note 1) The head specified is the Duty Head generated by the pump only.
2) - Suction pressure must be included when assessing the Maximum Working Pressure.

### *3.2 Electric Motor Driven Pumpsets*

Pumpsets are supplied mounted on a substantial fabricated baseplate, the complete assembly is of a rigid construction, being intended for mounting on suitable foundations.

These pumpsets are supplied fitted with a proprietary high efficiency electric motor adequately sized for the duty specified. For details of the motor supplied, refer to the manufacturer's instructions in Appendix I.

The proprietary flexible coupling has been selected to meet the power transmission and other operating requirements for the pumpset. Coupling fitting and maintenance details are given in the manufacturer's instructions in Appendix II.

## 4. Assembly and Installation

**Shearing Hazard**
Do NOT place fingers or hands etc. into the suction or discharge pipe outlets and do NOT touch the impeller, if rotated this may cause severe injury. To prevent ingress of any objects, retain the protection covers or packaging in place until removal is necessary for installation.

### *4.1 Initial Inspection for Damage*

During transport and storage, accidental damage to the pump may have occurred. When the pump is to be installed, or in the event of a handling accident, carefully check that the pump is not damaged **before** installation and commissioning.

### *4.2 Preparation for Mounting*

Before installation, check that the pump mounting location is suitable for accepting the pump. Refer to the certified General Assembly drawing, for details of pump installation dimensions.

### *4.3 Location of Pump*

The pump should be located as near the liquid source as practical, with adequate accessibility for inspection and repair and sufficient headroom for lifting tackle if necessary.

Where pumps are electric motor driven, power source electrical characteristics should match those shown on motor data plate. A qualified electrical contractor should be used to make the electrical connection.

### *4.4 Foundations*

The pump is to be mounted on a substantial floor or plinth and secured with suitable foundation bolts to minimise vibration. The foundation must have a flat level surface and be of sufficient depth to contain the foundation bolts. The pump unit should be installed with the flange faces set in a vertical position. Packers may be placed under the baseplate near the bolt holes to level the unit if the floor is uneven. The foundation bolts should be tightened and the shaft alignment checked again before commissioning and putting the pump into operation.

For full installation instructions and guidance on the design of suitable foundations for pumpsets refer to the SPP Guide to Pump Installation, obtainable on request from SPP Pumps Ltd.

### *4.5 Pump Preparation*

**Abrasion & Entrapment Hazard**
Do NOT touch any moving or rotating parts. Guards are provided to prevent access to these parts, where they have been removed for maintenance they MUST be replaced before operating the equipment.

For soft packed pumps the packing rings and related components are often supplied loose. Ensure that the packing is installed as per instructions in section 6.2 paragraphs 10 to 20.

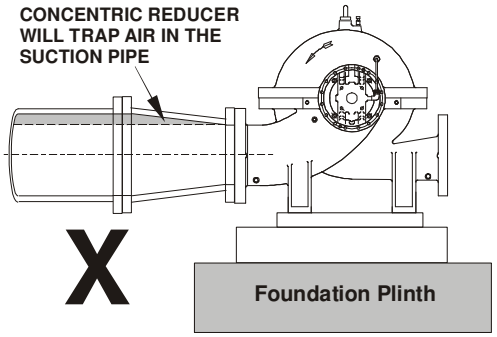
Remove packaging but leave the flange covers in place, check that impeller rotates

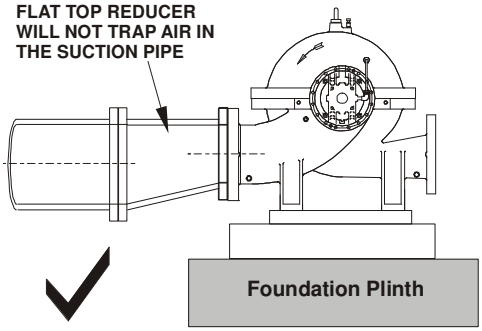
freely by hand by turning the shaft.

If the pump has been in storage, remove any protective coatings. If the bearing housings were filled with grease remove the bearing housings, clean, and re-lubricate the bearings.

### *4.6 Suction Pipework*

The run of suction pipework must be such that air can NOT become trapped where it would be drawn into the pump on starting. The bore of the suction pipe is recommended to be one or two sizes larger than the pump suction branch and reducers if used must be eccentric to eliminate the possibility of an air pocket being formed.




Bends in the suction pipeline should be as large as possible, the pipe made as short and as straight as possible and all joints must be fully airtight. A gradual rise in the suction pipeline is recommended to prevent formation of air pockets. If fitting a foot valve, it should have a free area of one and a half times the area of the suction pipe.

Where pumping water at temperatures above 70°C, care must be taken to ensure that enough pressure is available at the impeller entry to prevent vaporisation. Expansion joints are recommended to prevent strain on the pump casing.

An appropriate fine strainer is recommended to prevent foreign matter from being drawn into the pump. A screen or basket strainer may also be required to hold back larger items. These should be sized to maintain the flow through them to below 0.6 m/s.

The suction pipe work must be flushed clean to ensure that site debris is not drawn into the pump when it is commissioned.

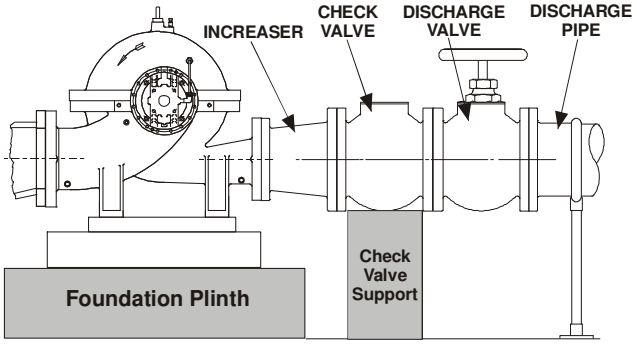
### *4.7 Discharge Pipework*

The bore of the discharge pipe should ideally be sized to ensure a flow velocity of 2.5 to 3 m/s is not exceeded. This is usually one size larger than the discharge branch. Pipework should be as short and straight as possible to reduce friction head loss.

A non-return valve is usually fitted to prevent the pump from excessive backpressure and reverse rotation and a discharge valve is usually fitted for isolation purposes to allow for inspection and maintenance on the pump.

Where adverse suction conditions may cause the pump to lose its prime, the use of an external automatic priming device, such as a vacuum pump, is recommended.

The suction and discharge pipework must be independently supported and positioned such that no excessive forces and moments are exerted on the pump flanges.




**ATTENTION** Failure to support suction and delivery pipework may result in distortion of the pump casing, with the possibility of early pump failure.

### *4.8 Guards*

If guards have been removed to install packing or to check mechanical seal connections, they MUST be replaced to maintain safe operation of the pump. Refer to the General Arrangement drawing for specific fixing methods for the guarding supplied.

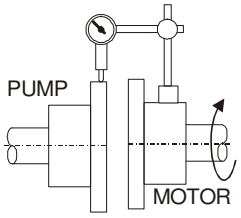
### *4.9 Coupling Alignment*

To minimise the bearing loading and to achieve full coupling and bearing life, it is recommended that the shafts are aligned as accurately as possible i.e. well below the allowable misalignment of the coupling.

Refer to the coupling manufacturer's instructions or proceed generally thus:

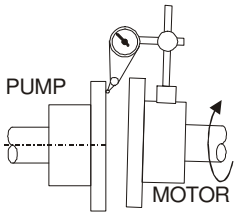
1 Lateral Alignment

Mount a dial gauge on the motor shaft or coupling with the gauge running on the outer-machined surface of the pump coupling. Turn the motor shaft and note the total indicator reading.



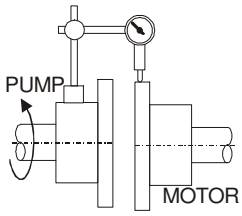

2 Angular Alignment

Mount a dial gauge on the motor shaft or coupling to run on a face of the pump coupling as near the outside edge as possible. Turn the motor shaft and note the total indicator reading.




3 Confirm Lateral Alignment

Mount the dial gauge on the pump shaft or coupling with gauge running on the outer-machined surface of the motor coupling. Turn the pump shaft in the direction of pump rotation, and note the total indicator reading.




4 Adjustment

For horizontal lateral adjustment move the motor using the motor jacking screws provided and for vertical and angular adjustment fit shims between the motor feet and the baseplate.

Note Poor alignment is a major factor contributing to shortening of pump bearing and seal life. It is recommended that alignment is checked frequently and maintained at below 10% of the manufacturer's specified figure or 0.1mm.

As the pump and motor feet are accurately machined, any discrepancy may be due to foreign matter between any of the mating faces. These should be checked for cleanliness before assembly and before resorting to using shims under the motor feet.

**ATTENTION** Shaft alignment must be checked again after the final positioning of the pump unit and connection to pipework as this may have disturbed the pump or motor mounting positions.

### *4.10 Grouting*

A space of about 25mm should be left between the top surface of the foundation plinth and the underside of the baseplate to allow for grouting.

Recommended grouting should comprise one part of cement to two parts of sand, with sufficient water to produce a heavy creamy consistency.

After the grout has dried, the alignment should be checked before commissioning and putting the pump into operation.

## 5. Commissioning and Operation

### *5.1 Commissioning Checks*

These checks must be done after first installation and after pump maintenance that required removal of the rotating assembly.

**Abrasion and Entrapment Hazard**
Do NOT touch any moving or rotating parts. Guards are provided to prevent access to these parts, where they have been removed for maintenance they MUST be replaced before operating the equipment.

Check that the rotating assembly is free to rotate by hand before connecting the power supply. Also check that the piping system has been properly connected with all joints tightened and instrumentation is in position.

Check that the pump is primed. Pumps should never be run dry as the pumped liquid acts as a lubricant for the close running fits surrounding the impeller. **Dry running can cause serious damage to the pump and seals**.

Prime the pump using an ejector, exhauster or vacuum pump. If a foot valve is used in the suction line the pump may be primed by venting and filling the casing with liquid. Open the air release valve to bleed any air trapped in the seal housing, as the seal must be lubricated and dry running often results in premature seal failure.

Disconnect the pump drive by removal of the spacer from the coupling. Connect the electrical supply to the pump unit. Momentarily switch on motor and check direction of rotation. This should match the direction of rotation of the pump. For three phase electric motors, if the direction of rotation is incorrect, disconnect the supply and change over two of the three supply phases. Replace the coupling spacer.

### *5.2 Starting Procedure*

**BEFORE A THRUSTREAM PUMP IS STARTED ALWAYS ENSURE THAT THE SUMP IS FILLED TO THE CORRECT LEVEL WITH LIQUID, AND THAT ANY LEVEL CONTROLS ARE FUNCTIONING CORRECTLY.**

**Abrasion and Entrapment Hazard**
Do NOT touch any moving or rotating parts. Guards are provided to prevent access to these parts, where they have been removed for maintenance they MUST be replaced before operating the equipment.

Check that the suction valve is open and that the pump is primed.

Open the discharge valve to one quarter open to prevent hydraulic lock from occurring. Switch on the motor and allow it to build up to full operating speed. Slowly open discharge valve until the pump reaches the required duty condition.

Check that the motor is not overloading, unit is not vibrating or excessively noisy, the motor is not overheating, and that the pump is developing the correct flow and head requirements.

If the pump is operating at its normal speed, the pump should be shut down at once if any of the following defects are found:

a) No liquid delivered.
b) Not enough liquid delivered.
c) Not enough pressure.
d) Loss of liquid after starting.
e) Vibration.
f) Motor runs hot.
g) Excessive noise from cavitation.
h) Pump overheating.

Recommended corrective action for these faults is given in Section 7 Faults and Remedial Action.

### *5.3 During Operation*

**Hot Surfaces Hazard**
Do NOT touch surfaces that during normal running will be sufficiently hot to cause injury. These are marked with the HOT warning symbol. Note that these surfaces will **remain hot after the pump has stopped**: allow sufficient time for cooling before maintenance. Be cautious and note that other parts of the pump may become hot if a fault is developing.

**Cold Conditions Hazard**
Do NOT operate water pumps in temperatures below freezing point, without first checking that the pumped fluid is not frozen and the pump is free to turn. Pumps in these environments should be drained down during inactivity and re-primed before starting.

**Hazardous Noise**
In addition to local or site regulations for noise protection, SPP Pumps Ltd. recommend the use of Personal Ear Protection equipment in all enclosed pump rooms and particularly those containing diesel engines. Care must be taken to ensure that any audible alarm or warning signal can still be heard with ear defenders worn.

**Hazardous Gases, Mists, Sprays and Leaks**
Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation of noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance (COSHH) data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.

Periodic Checks:

a) Pump Bearings:
Check the bearing temperatures do not exceed 80°C as an increase may indicate the early stages of bearing trouble.

b) Noise:
Listen for any unusual noise or an increase in normal sound level.

This may result from:

i) Loose fasteners for guards and other equipment.
ii) Air trapped in the pump i.e. the pump was not fully primed.
iii) Cavitation.
iv) Small solids in the liquid.

c) Suction Gauge Reading:
If this is lower than normal, investigate and check that valves in the suction pipework are fully open or that the suction lift may have increased.

d) Discharge Gauge Reading:
If this is lower than normal, check for a leak in the associated pipework or that a valve in the delivery line has been opened when normally it is partially closed.

5.4 Stopping Procedure

Stop the motor then fully close the discharge valve.

# 6. Maintenance and Service

6.1 General Introduction

SPP Pumps Ltd Thrustream pumps will provide many years of trouble free service when maintained in accordance with these instructions. In the event of failure of the pump it is recommended that SPP Pumps Ltd. Service Department are called to investigate and carry out repairs. The following instructions are given to cover the main elements of strip and rebuild but do NOT include instructions for work that MUST be done by an SPP Pumps Ltd. Service Engineer.

The following hazards may arise during maintenance work:

**Fluid Pressure Jet Hazards**
Check and ensure that the pump operates at below the Maximum Working Pressure specified in the manual or on the pump nameplate and before maintenance, ensure that the pump is drained down.

**Hazardous Materials**
Wear a suitable mask or respirator when working with packing or gasket components that contain fibrous material, as these can be hazardous when the fibrous dust is inhaled. Be cautious if other supplier's components have been substituted for genuine SPP Pumps Ltd parts as these may then contain hazardous materials.

**Hazardous Gases, Mists, Sprays and Leaks**
Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation of noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance (COSHH) data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.

**Recommended Maintenance Schedule**

| INSPECTION | REMARKS |
|---|---|
| **Daily Checks: (Manned Installations)** | |
| Visually check pump for leaks. | |
| Carefully check the bearing housing for any sign of temperature rise. | Check the bearing housing temperature with a suitable thermometer & refer to Fault Finding Chart in Section 7. **Maximum running temperature is 80°C(176° F).** |
| Check the pump for vibration. | Refer to Fault Finding Chart in Section 7. |
| *For mechanical seals*: | |
| Check for leaks | Renew as necessary |
| *For soft packed pumps:* | |
| Adjust gland to maintain slight leakage and check that gland drains are clear. | When gland is fully compressed, change or add more packing. *(Refer to Soft Packed Seal maintenance instructions in section 6.3).* |
| **Three Monthly Maintenance:** | |
| Lubricate the pump bearings with 15-20g of grease. | Use Texaco Multifak All Purpose EP2 grease or equivalent grease to DIN 51825: KP2 K-30. Do not overfill the bearing housing, as the bearings will overheat if overfilled. |
| **Six Monthly Maintenance:** | |
| Check coupling alignment. Check coupling pins and bushes for wear. Check holding-down bolts for tightness. | Refer to maintenance instructions adjust or renew parts as necessary.<br><br>Tighten as necessary. |
| **OVERHAUL** | |
| An overhaul is to be carried out when pump performance falls below an acceptable level. | |

**BEFORE ATTEMPTING ANY MAINTENANCE ON A PUMP, PARTICULARLY IF IT HAS BEEN HANDLING ANY FORM OF HAZARDOUS LIQUID, ENSURE THAT THE UNIT IS SAFE TO WORK ON. THE PUMP MUST BE FLUSHED THOROUGHLY WITH A SUITABLE CLEANSER TO PURGE AWAY ANY OF THE PRODUCT LEFT IN THE PUMP COMPONENTS. THIS SHOULD BE CARRIED OUT BY THE PLANT OPERATOR AND A CERTIFICATE OF CLEANLINESS OBTAINED BEFORE STARTING WORK. TO AVOID ANY RISK TO HEALTH IT IS ALSO ADVISABLE TO WEAR PROTECTIVE CLOTHING AS RECOMMENDED BY THE SITE SAFETY OFFICER, ESPECIALLY WHEN REMOVING OLD SEALS OR GASKETS THAT MAY BE CONTAMINATED.**

### *6.2 Preparation for Maintenance*

**Electric Shock & Accidental Starting Hazard**

ISOLATE the equipment before any maintenance work is done. Switch off the mains supply, remove fuses, apply lock-outs where applicable and affix suitable isolation warning signs to prevent inadvertent re-connection.

During maintenance personnel should be aware of the risks of inhaling dangerous fumes or vapours.

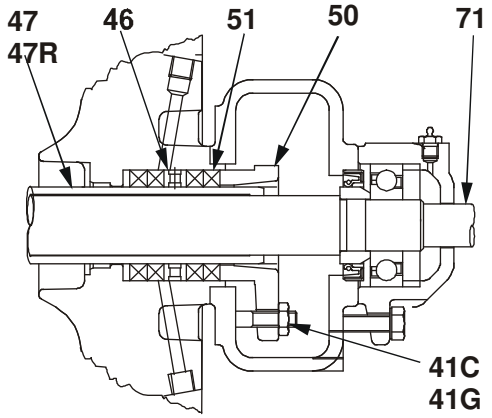
No special tools are required for pump dismantling and re-assembly. However, it is important to ensure the suitable lifting equipment is available and that the work is carried out in a clean area.

### *6.3 Repacking the Stuffing Box*

Where a soft packed gland seal is fitted it will be necessary to replace the packing rings periodically when the gland can no longer be tightened to reduce leakage to the normal level, or if the gland is overheating.

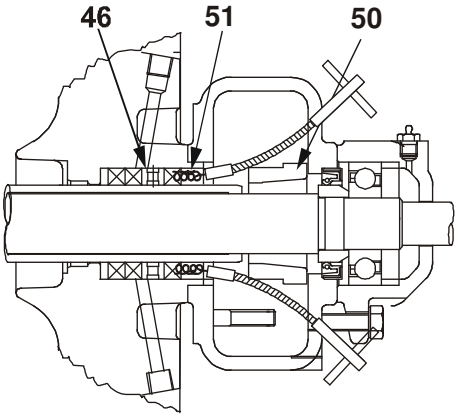
**Packing Removal Procedure**

1 Close the suction & discharge valves and release pressure from the casing, remove the gland retaining nuts (41C) and pull the gland (50) clear of the stuffing box.




2 Carefully withdraw the old packing and lantern ring (46), using a pair of extractor tools of the correct size placed on opposite sides of the pump shaft (71).

3 Clean the sleeve, the bore of stuffing box, the lantern ring and the split gland with a clean oily cloth.




4 Check the sleeve for concentricity with the stuffing box bore and that that the surface under the packing rings is free from scores, pitting or grooves.

5 Examine the gland for general condition and replace if damaged.

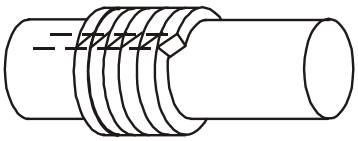
**Packing Preparation**

6 If the packing is to be cut from a coil or long length the size, number of rings and length is thus:

**Stuffing Box Data**

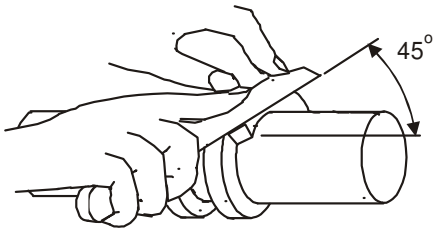
| PUMP SHAFT MODULE | SLEEVE DIA. mm | PACKING SIZE | | SIZE of RING ID x OD mm x mm | NO. OF RINGS PER BOX |
|---|---|---|---|---|---|
| | | SQUARE SECTION mm | LENGTH of ONE RING mm | | |
| 1 | 45 | 10 | 173 | 45 x 65 | 4 |
| 2 | 61 | 12 | 230 | 61 x 85 | 4 |
| 3 | 76 | 15 | 283 | 75 x 100 | 4 |

7 Wrap the packing around a dummy shaft, of the same diameter as the sleeve.



8 To assist in cutting rings, two guide lines parallel to the shaft axis and separated by a distance equal to the packing section may be drawn on the spiral.

9 Cut each ring from the spiral at an angle of 45° diagonally across the guidelines.




**Repacking Procedure**

10 Insert the first ring and tap it to the bottom of the stuffing box. Each following ring should be installed in the same manner and positioned in the stuffing box so that the "split" is advanced 120°.

11 Install the lantern ring (46) in its proper position to align with the seal lubrication connection, allowing for movement of the ring deeper into the box as the packing is compressed.

12. When the all the rings have been inserted, the last packing ring should not protrude from the stuffing box face.

13. Slide the gland into the stuffing box and ensure that it sits squarely against the last packing ring. Fit the gland retaining nuts and washers (41C & 41G) on the studs and tighten evenly to finger pressure.

14. Start the pump as per paragraph 5.2, allow pressure to increase to normal level and ensure that air is not trapped in the pump casing.

15. A soft packed gland must have slight steady leakage, and this should start soon after the pump reaches it's normal operating pressure.

16. If gland leakage stops, the pump will overheat leading to seal damage or premature pump failure. If overheating is detected, the pump must be stopped and allowed to cool and when restarted, gland leakage should start.

17. If the pump overheats again, stop the pump restart it again, do not slacken the gland retaining nuts.

18. After the pump had been running for 10 minutes with steady leakage, tighten the gland nuts by one sixth of a full turn. Continue to adjust at 10-minute intervals, each time evenly, by one sixth of a full turn, until leakage is reduced to an acceptable level (30 drops per minute minimum).

19. Excessive gland pressure will cause damage by cutting off lubrication to the packing, and the packing will burn and damage the shaft/sleeve.

### *6.3 Maintenance of Mechanical Seals*

Generally no maintenance is required on mechanical seals. They should be replaced if leakage occurs but if maintenance is required, the manufacturer's information is given in Appendix III.

For disassembly and assembly instructions for pumps fitted with internal component mechanical seals, please refer to separate instructions that can be obtained from SPP Pumps Ltd.

### *6.4 Bearing Lubrication*

The ball bearings are supplied pre-loaded with appropriate grease. A grease nipple and seals are fitted to the bearing housing to ensure that any surplus grease is trapped inside the bearing housing.

It is important to know the weight of grease delivered by each stroke your grease gun to ensure application of the correct amount of grease.

It is recommended that the drive end bearings are topped up as per the Recommended Maintenance Schedule in Section 6.

Recommended Grease Lubricant:

| International Standard | **DIN 51825: KP2 K-30** |
|---|---|
| As Supplied with a new pump. | TEXACO MULTIFAK ALL PURPOSE EP2 |

Note Greasing points may be provided for the bearings on the electric motor fitted, refer to Appendix I for motor maintenance details.

### *6.5 Bearing Replacement*

Ball bearings will provide satisfactory service for their designed working life if they are correctly lubricated and inspected at the intervals shown in Section 6. - Recommended Maintenance Schedule.

Bearing Specifications

| **Pump Shaft Module** | **Ball Bearing Reference No.** |
|---|---|
| Module 1 | 6306 |
| Module 2 | 6309 |
| Module 3 | 6312 |

A suitable bearing puller is required for removal of the bearings from the pump shaft. If a puller is not available, a hammer and soft metal drift may be used to tap evenly around the circumference of the inner ring.

Exerting force on the outer ring of a ball bearing can cause severe damage.

The work area and all tools used for bearing replacement must be clean and free of dust and grit to prevent contamination of a clean bearing and new grease.

Ball bearings should not be dismantled.

These instructions are written to cover replacement of the drive-end bearings, but they may also be applied for the non-drive end bearings.

**ATTENTION** Where cartridge mechanical seals are fitted, before replacing any pump bearing, the mechanical seals must be backed off from the seal chamber to prevent damage to the seal faces. Refer to the seal manufacturer's instructions in Appendix III.

When replacing all the bearings, complete the replacement of the non-drive end bearings BEFORE commencing to replace the drive end bearings.

## Non-Drive End Bearing Replacement Procedure

1. Remove the four hexagon screws and washers (61A &61F) and pull the bearing housing (A62) off the bearing (66). If needed, a pair of pry bars may be used to lever the bearing housing off the bearing.
2. Using a suitable punch, flatten the lock washer (75F) and unscrew the bearing locknut (75).
3. Fit a suitable bearing puller in place and pull the bearing off the shaft end.
4. Clean the bearing thoroughly with an approved cleaning fluid.
5. Dry the bearing with dry compressed air or with a clean soft cloth by hand.
6. DO NOT SPIN A CLEAN DRY BEARING.
7. Inspect the bearing for wear, fractures, cracks, corrosion or other damage, which may necessitate replacement.
8. Lightly oil the bearing and wrap them in greaseproof paper to prevent contamination before reassembly.
9. Check that the shaft and bearing housing are clean and undamaged.
10. It is recommended that a new oil seal (72) is fitted when bearings are replaced to ensure that contamination is prevented.
11. Wipe the 'oil seal recess in the support frame (61) with grease, slide the new oil seal onto the shoulder ring (77) and locate in the recess in the support frame.
12. Heat the bearing (66) to approximately $100^0$C ($212^0$F) using bearing hotplate, induction heater or oven. NOTE - Do not exceed $120^0$C ($248^0$F).
13. Slide the heated bearing onto the shaft to abut the shoulder. Ensure that the bearing sits fully and squarely against the shoulder.
14. Place the locking washer (75F) onto the shaft and screw on the bearing lock nut (75).
15. Fit and tighten the bearing locknut to 300 Nm and lift the tab of the lock washer.
16. Cool the bearing to room temperature and coat both sides with two/three ounces of recommended grease.
17. Coat the inside of the bearing housing (A62) with grease and slide into place over bearing.
18. Fit four hexagon screws and washers (61A & 61F), tighten evenly to pull the bearing housing into place.

## Drive End Bearing Replacement Procedure

To inspect or replace the drive end bearings without removal of the rotating assembly from the pump casing, it is necessary to remove the pump shaft coupling and ensure that there is sufficient clearance between the pump shaft and the motor coupling. If a spacer coupling has not been used it may be necessary to demount the motor to achieve the required clearance.

1. Remove the four hexagon screws and washers (61A &61F) and pull the bearing housing (B62) off the bearing (67). If needed, a pair of pry bars may be used to lever the bearing housing off the bearing.
2. Fit a suitable bearing puller in place and pull the bearing off the shaft end.
3. Clean the bearing thoroughly with an approved cleaning fluid.
4. Dry the bearing with dry compressed air or with a clean soft cloth by hand.
5. DO NOT SPIN A CLEAN DRY BEARING.
6. Inspect the bearing for wear, fractures, cracks,

corrosion or other damage, which may necessitate replacement.

7. Lightly oil the bearing and wrap it in greaseproof paper to prevent contamination before reassembly.

8. Check that the shaft and bearing housing are clean and undamaged.

9. It is recommended that a new oil seal (72) is fitted when bearings are replaced to ensure that contamination is prevented.

10. Wipe the 'oil seal recess in the support frame (61) with grease, slide the new oil seal onto the shoulder ring (77) and locate in the recess in the support frame.

11. Heat the bearing (66) to approximately $100^0$C ($212^0$F) using bearing hotplate, induction heater or oven. NOTE - Do not exceed $120^0$C ($248^0$F).

12. Slide the heated bearing onto the shaft to abut the shoulder. Ensure that the bearing sits fully and squarely against the shoulder.

13. Cool the bearing to room temperature and coat both sides with two/three ounces of recommended grease.

14. Coat the inside of the bearing housing (A62) with grease and slide into place over bearing.

15. Fit four hexagon screws and washers (61A & 61F), tighten evenly to pull the bearing housing into place.

16. Where mechanical seals are fitted, refit and set the mechanical seal as per the seal manufacturer's instructions in Appendix III.

17. Refit the coupling and motor, check and adjust the alignment as per instructions in section 4.8.

### *6.6 Mechanical Seal Replacement*

Mechanical seals will need replacement when failure has occurred, they may be replaced without removal of the rotating assembly

It is recommended that new mechanical seals are fitted when conducting a full pump strip-down for overhaul to give maximum operating life.

**Mechanical Seal Replacement Procedure**

1 For **non-drive end** seal replacement, proceed as per the relevant bearing replacement instructions, paragraphs 1 to 8 and for **drive end** seal replacement proceed as per the relevant bearing replacement instructions, paragraphs 1 to 7.

2 Isolate the pump and drain the casing using the air vent valves (308) and drain plugs (1D) provided.

3 Disconnect the seal flush pipe, remove the four hexagon screws (52A) that retain the mechanical seal, and slide the seal assembly off the shaft.

4 Fit a new mechanical seal as per the manufacturer's instructions in Appendix III

5 Reconnect the seal flush pipe.

6 For **non-drive end** seal replacement, proceed as per the relevant bearing replacement instructions, paragraphs 10 to 18 and for **drive end** seal replacement, proceed as per the relevant bearing replacement instructions, paragraphs 9 to 17.

### *6.7 Pump Overhaul and Repairs*

Refer to a certified Pump Section drawing or the typical cross section drawing in Section 8. Note the hazards outlined in Section 6.

**Impeller Inspection Procedure**

1 Isolate the pump and drain the casing using the air vent valves (308) and drain plug (1D) provided.

2 Remove the seal lubrication pipes (A107) from the insert (53).

3 Remove the nuts (1F) from the casing studs (1A & 1B) securing the top half casing (A1) to the bottom half casing (B1).

4 Press or tap out the spring dowels (1C).

5 Using a pair of pry bars in the slots provided between the top and bottom casings, apply pressure to break the gasket seal.

5 Using the eyebolt and a suitable lifting device, lift the top half casing (A1) clear of the impeller, place to one side on a clean flat surface.

6 At this stage, the impeller may be inspected for damage or blocking and cleaning if necessary.

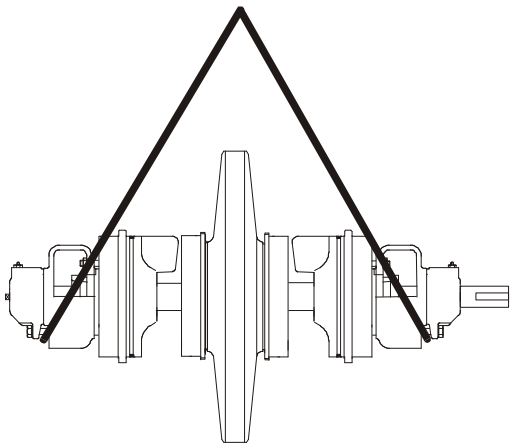
To check the pump shaft (71) and impeller (21) and to replace the wear rings (23) or soft packed seal sleeves (21F & B47), it is necessary to remove the rotating assembly from the bottom half casing.

## Preparation for Removal of the Rotating Assembly

Disconnect the motor coupling.

For pumps fitted with mechanical seals, refer to the seal manufacturer's instructions and lock the seal before removing the retaining screws (52A) and sliding the seal back from the face of the insert (A53).

Provide a suitable lifting strap and support the weight of the rotating assembly thus:



## Removal of the Rotating Assembly Procedure

1. Tap the inserts (53) with a soft-faced hammer to break the seal between the insert and the bottom half casing (B1).

2. Lift the rotating element out of the bottom half casing.

3. Lift the rotating assembly clear of the bottom half casing and support the shaft on suitable V blocks with the impeller clear of the work surface.

4 If necessary, remove the case wear ring dowels (23A) from the bottom half casing (B1).

5 With feeler gauges, check the clearance between the case wear rings (23) and the impellers (21), compare clearance with the figures below.

Note Increase in the wear ring clearance allows increased internal leakage with resultant loss of pump performance, head and efficiency. When the clearance is double the original clearance, it is recommended that new wear rings are fitted. It is permissible to run the pump with increased clearance due to wear but the loss of pump efficiency will significantly increase the pump running costs.

| Wear Ring Clearance | Diametral mm | | Radial mm | |
|---|---|---|---|---|
| Pump Size : | Min | Max | Min | Max |
| 65/24 80/24 80/30 | 0.180 | 0.302 | 0.090 | 0.151 |
| 50/38 80/38 125/29 100/30 100/24 100/38 | 0.210 | 0.350 | 0.105 | 0.175 |
| 125/24 150/24 125/30 | 0.230 | 0.370 | 0.115 | 0.185 |
| 150/30 125/38 150/38 | 0.240 | 0.401 | 0.120 | 0.200 |
| 150/48 250/24 200/30 250/30 | 0.260 | 0.421 | 0.130 | 0.210 |
| 200/38 250/38 200/48 | 0.280 | 0.441 | 0.240 | 0.220 |

## Procedure to dismantle the Rotating Assembly

1. Remove both bearing housings and bearings as per the bearing replacement procedure paragraphs 1 to 9.

2. *For soft packed pumps:* Remove the nuts (41C) and slide the glands (50) off the end of the shaft (71) and remove the inserts (41 a & B) complete with packing rings (51) and lantern rings (46) and set aside for inspection.

3. *For pumps fitted with mechanical seals:* Slide the mechanical seal assemblies off the shaft and set aside for inspection and remove the inserts (41 A & B) complete with mechanical seal (52) and throttle bush (45) and set aside for inspection.

*Impeller removal:*

4. If not already removed, remove the case wear rings (23) and set aside for inspection and measurement.

*For Clockwise pump construction:*

5. Using a suitable 'C' spanner, unscrew and remove the free - non-drive end sleeve (A47) on a soft packed pump or free - impeller nut (A21) on a pump fitted with mechanical seals.

Note Light tapping with a soft faced mallet may be needed to free the impeller from the shaft, do not damage the impeller if it is to be reused.

6. Using suitable pullers or levers slide the impeller (21) of the shaft (71) from the non-drive end.

7. Withdraw the impeller key (116) and unscrew and remove the locked - drive end sleeve (B47) on a soft packed pump or locked -

impeller nut (B21) on a pump fitted with mechanical seals.

*For Counter Clockwise pump construction:*

8. Using a suitable 'C' spanner, unscrew and remove the free - drive end sleeve (A47) on a soft packed pump or - impeller nut (A21) on umps fitted with mechanical seals.

9. Note Light tapping with a soft faced mallet may be needed to free the impeller from the shaft, do not damage the impeller if it is to be reused.

10. Using suitable pullers or levers slide the impeller (21) of the shaft (71) from the drive end.

11. Withdraw the impeller key (116) and unscrew and remove the locked – non-drive end sleeve (B47) on a soft packed pump or locked - impeller nut (B21) on pumps fitted with mechanical seals.

**Cleaning and Inspection of Parts**

1. Clean the bearings thoroughly with an approved cleaning fluid, kerosene or white spirit.

2. Dry the bearings with dry compressed air or with a clean soft cloth by hand and by spinning by hand. Confirm that the bearings rotate smoothly without slackness.

3. DO NOT OVERSPIN A CLEAN DRY BEARING.

4. Inspect the bearings for wear, fractures, cracks, corrosion or other damage to the running surfaces, which may necessitate replacement.

5. Coat the bearings with rust preventive oil and wrap in greaseproof paper.

Note: It is recommended that all oil seals, 'O' rings and gaskets: are replaced by new parts during an overhaul. If 'O' rings are to be reused they should be left in place in their grooves and protected from contamination by oil and dirt.

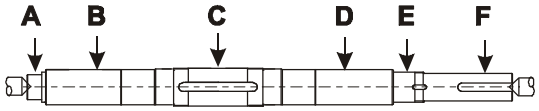
6. Remove all O-rings from their grooves and discard where these are to be replaced.

7. Remove all grease and other deposits from all other parts using suitable cleaning fluid and a clean dry cloth.

8. Coat all unpainted carbon steel parts with a light smear of oil to prevent rust.

9. Measure the inside diameter of plain bearing, wear ring and interstage plate surfaces and the outside diameter of the shaft and wear ring surfaces on each impeller, calculate the clearance and compare these with dimensions in Section 6.7.

10. Mount the shaft between point centres or on rollers, and place the stem of a dial indicator in contact with the shaft. Set the indicator dial at zero and turn the shaft slowly by hand. Readings at any point A, B, C, D and E must not vary more than 0.05mm (0.002").




11. *For soft packed pumps:* examine the shaft sleeves for wear, replace the sleeve if it is scored or has any visible surface damage.

12. If the shaft runs true within tolerance, remount the shaft as in 2 but with the sleeve fitted in position, and check the sleeves runout at the packing contact positions. Indicator readings must not vary more than 0.08mm (0.003").

13. The sleeve can be re-ground to provide a new packing surface, to a maximum of 1.0mm (0.04") below the initial diameter. Do not grind reduce sleeve diameter in the throat bush area unless scored. The surface finish of the sleeve should be 20-30 C.L.A.

14. Scour any rust or scale from internal iron non-fitting surfaces and immediately repair or renew any previous coating. Use WRC approved coating for pumps used for potable water.

15. Clean all threads with kerosene followed by wire brushing, dry and wrap shaft threads with protective adhesive tape.

16. If the unit is not to be reassembled immediately, brush all bright iron and steel surfaces with Texaco Rust Proof Compound L or Rust Proof Compound Spray or a suitable equivalent rust preventive fluid.

17. Protect all parts (especially mechanical seal parts and faces) against loss, weather or mechanical damage.

### *6.8 Pump Assembly Instructions:*

**Before Assembly**

1 Re-examine all old parts intended for re-fitting. Worn, damaged or corroded parts should either be re-conditioned or, if beyond this, be discarded and replaced by new.

2 Ensure that all parts to be refitted (especially new parts) are free from burrs, with screw threads and abutting faces clean and free from damage.

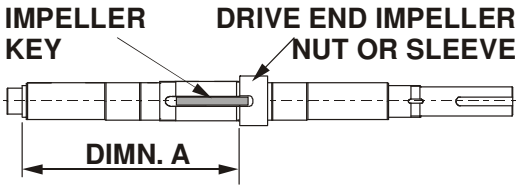
3 Examine 'O' and 'V' rings and renew if showing wear, damage or deterioration.

## Rotor Reassembly

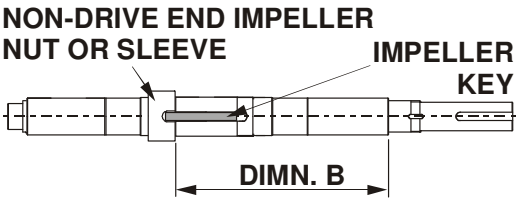
1 Lightly smear the shaft (71) with clean good quality grease.

Note The position of the impeller key (116) and the locked sleeve (B47) or impeller nut (B21) is governed by the direction of rotation of the pump. **For clockwise pumps they are fitted at the drive end of the shaft key slot and for counter-clockwise pumps they are at the non-drive end.**

*For clockwise rotation:*




*For counter-clockwise rotation:*



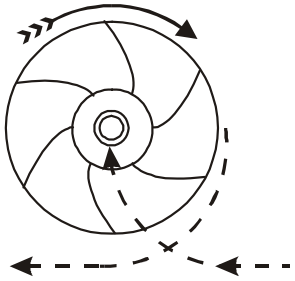

Where the location was not marked, and for non-standard pumps with mechanical seals please refer to the pump section drawing supplied or to SPP Pumps Ltd for dimensions A or B.

| For Standard Soft Packed Pumps | | | |
|---|---|---|---|
| ***Size*** | ***Pump*** | ***Dimn. A mm*** | ***Dimn. B mm*** |
| 50/38 | (TE05A) | 283 | 287 |
| 80/38 | (TE08A) | 283 | 287 |
| 65/24 | (TB06A) | 283 | 287 |
| 80/24 | (TB08A) | 283 | 287 |
| 125/24 | (TB12A) | 337 | 341 |
| 150/24 | (TB15A) | 337 | 341 |
| 125/29 | (TC12A) | 283 | 287 |
| 80/30 | (TD08A) | 283 | 287 |
| 100/30 | (TD10A) | 283 | 287 |
| 125/30 | (TD12A) | 337 | 341 |
| 100/24 | (TB10A) | 355 | 359 |
| 250/24 | (TB25A) | 415 | 419 |
| 150/30 | (TD15A) | 355 | 359 |
| 200/30 | (TD20A) | 415 | 419 |
| 250/30 | (TD25A) | 415 | 419 |
| 100/38 | (TE10A) | 355 | 359 |
| 125/38 | (TE12A) | 355 | 359 |
| 150/38 | (TE15A) | 355 | 359 |
| 200/38 | (TE20A) | 419 | 423 |
| 250/38 | (TE25A) | 419 | 423 |
| 150/48 | (TF15A) | 419 | 423 |
| 200/48 | (TF20A) | 419 | 423 |

2 Screw the locked sleeve (B47) or impeller nut (B21) onto the shaft (71) to the initial setting dimension shown in the table above. Turn the nut or sleeve to the nearest slot to align with the keyway.

3 Place impeller key (116) into keyway and tap the stepped end right home under impeller locking nut or sleeve.

4 Check the impeller for correct direction of rotation and slide onto shaft.



5. Screw free impeller locking sleeve (A47) or nut (A21) onto shaft to retain the impeller against the locked impeller nut or sleeve.

6. Position the casing wear rings (23) the correct way round and with dowel holes at the bottom and slide onto the impeller.

7. For component mechanical seals fit the rotating elements in position at this stage.

7. Lightly grease and carefully fit new 'O' rings to the inserts.

8. Slide the inserts (41) on to the shaft with the guide vane at the top position.

9. Locate the support frames in position and insert the lantern rings (46) and the glands (50) or the throttle bushes (45) and cartridge mechanical seals (52), then slide into position over the shaft to abut the inserts.

10. Fit washers and nuts (41A & 41F) to retain the support frames.

11. *For soft packed pumps:* Fit the packing (51), lantern rings (46) and glands (50) in position as per instructions in section 6.2.

12. Fit the mechanical seals to the shaft as per the manufacturer's instructions.

13. Fit new oil seals into the support frames (61) ready for assembly of the bearings and bearing housings.

14. Heat the non-drive end bearing (66) to approximately $100^0$C ($212^0$F) using bearing hot-plate, induction heater or oven. NOTE:- Do not exceed $120^0$C ($248^0$F).

15. Slide the heated bearing onto the shaft to abut the shoulder

16. Place the locking washer (75F) onto the shaft and screw on the bearing lock nut (75).

17. Fit and tighten the bearing locknut to 300 Nm and lift the tab of the lock washer.

18. Repeat paragraphs 14 to 16 for the drive end bearing (67).

19. Cool the bearings to room temperature and coat both sides with two/three ounces of recommended grease.

20. Coat the inside of the bearing housings (A62) with grease and slide into place over each bearing.

21. Secure the bearing housings (A62 & B62) to the inserts (41) with four hexagon screws & washers (61A & 61F).

22. Check and install the dowel pins (23A) to locate the case wear rings (23).

23. Place the rotating assembly into the pump casing bottom half (B1). Correct any excessive 'O' ring twisting or buckling. Check that the impeller is centralised in the casing and that there are no rubs.

24. Install casing gasket (1U) with a light coat of commercial cup grease on both gasket surfaces. Carefully align the inner edge of the gasket with the insert 'O' rings.

25. Lower the upper half casing (Al) into place and install casing joint nuts (1F).

26. NOTE: When installing upper half casing, make sure that the 'O' rings (53R) are not cut or pinched and that the gasket is hard against the 'O' rings.

27. Insert casing joint dowels (1C) and drive them home. Tighten the joint nuts (1F) to the specified torques

| Thread Size | lb/ft | Nm |
|---|---|---|
| M16 | 120 | 160 |
| M20 | 260 | 360 |
| M24 | 440 | 600 |

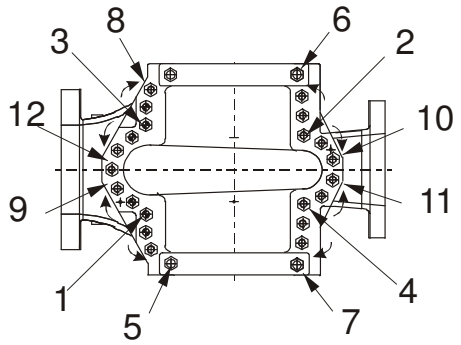
28. Tighten the case screws in the following sequence:

    a) Tighten the four 'corner' screws marked 1, 2, 3 and 4.

    b) Work outward along shaft axis toward the stuffing boxes in opposite quarters tightening screws in regions 5, 6, 7 and 8.

    c) Work outward along the branch and in opposite quarters tightening screws in regions 9, 10, 11 and 12.

    d) Repeat the whole sequence (a to d).




29. Check that the shaft turns freely by hand.

30. Top up the bearing lubrication by applying several strokes with a grease gun.

31. The pump is now ready for re-coupling to the motor and re-commissioning.

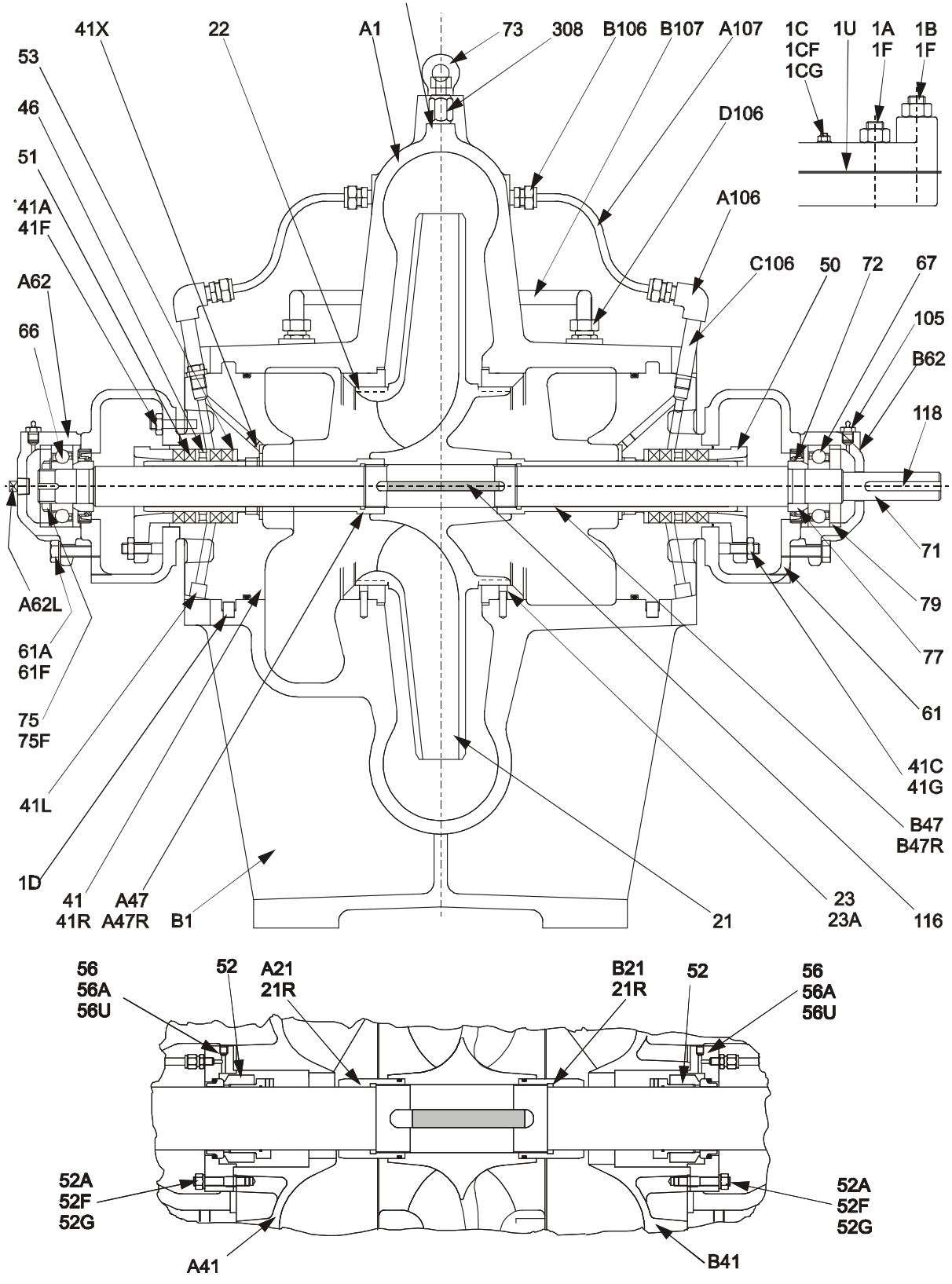
# 7. Faults and Remedial Action

| POTENTIAL FAULT OR DEFECT: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No liquid delivered. | | | | | | | | |
| | Insufficient liquid delivered. | | | | | | | |
| | | Liquid delivered at low pressure. | | | | | | |
| | | | Loss of liquid after starting. | | | | | |
| | | | | Excessive vibration. | | | | |
| | | | | | Motor runs hotter than normal. | | | |
| | | | | | | Excessive noise from pump cavitation. | | |
| | | | | | | | Pump bearings run hotter than normal. | |
| | | | | | | | | **PROBABLE CAUSES** |
| ● | | | | | | | | Pump not primed. |
| ● | ● | ● | | | | | | Speed too low. |
| | | | | | ● | ● | | Speed too high. |
| ● | ● | | ● | ● | | ● | | Air leak in suction pipework. |
| | ● | | ● | | | | | Air leak in mechanical seal. |
| | | ● | ● | ● | | ● | | Air or gas in liquid. |
| ● | ● | ● | | | ● | | | Discharge head too high (above rating). |
| | | | ● | | | | | Suction lift too high. |
| | ● | | | | | | | Not enough head for hot liquid. |
| ● | ● | | ● | ● | | ● | | Inlet pipe not submerged enough. |
| | ● | ● | | | ● | | | Viscosity of liquid greater than rating |
| | | | | | ● | | | Liquid density higher than rating. |
| ● | ● | | ● | ● | | ● | | Insufficient nett inlet head. |
| ● | ● | | | ● | | | | Impeller blocked. |
| ● | ● | ● | | | | | | Wrong direction of rotation. |
| | ● | ● | | | | | | Excessive impeller clearance. |
| | ● | ● | | ● | | | | Damaged impeller. |
| | | | | | ● | | | Rotor binding. |
| | | | | | ● | | | Defects in motor. |
| | | | | | ● | | | Voltage and/or frequency lower than rating. |
| | | | | | | | ● | Lubricating grease or dirty oil or contaminated. |
| | | | | ● | | | | Foundation not rigid. |
| | | | | ● | ● | | ● | Misalignment of pump and driver. |
| | | | | ● | | | | Bearing worn |
| | | | | ● | | | ● | Rotor out of balance. |
| | | | | ● | ● | | ● | Shaft bent. |
| | | ● | | | | | | Impeller too small. |

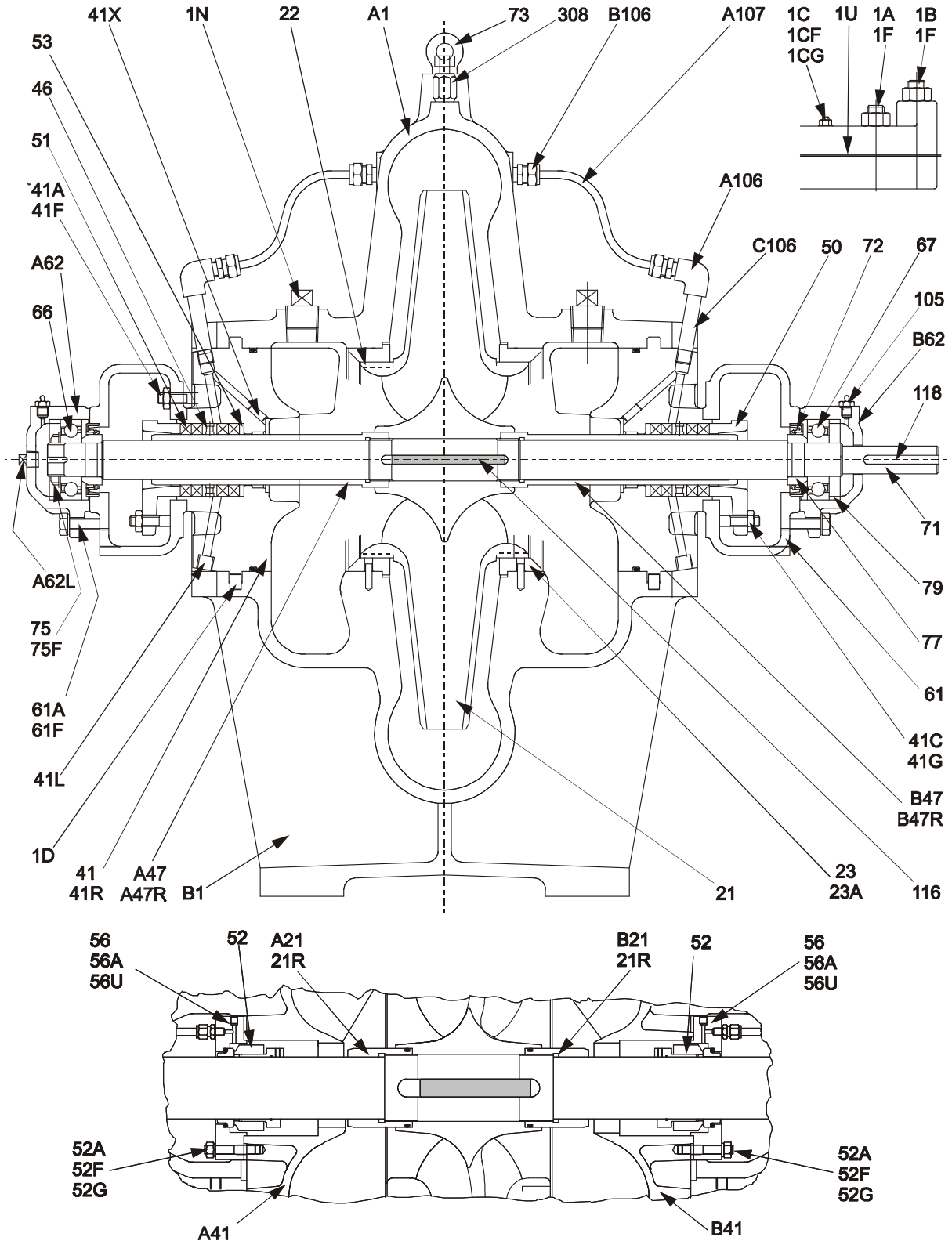
| CAUSE | REMEDIAL ACTION |
|---|---|
| Pump not primed. | Fill pump and suction pipe completely with fluid. |
| Speed too low. | Check that the motor is correctly connected and receiving the full supply voltage also confirm that the supply frequency is correct. |
| Speed too high. | Check the motor voltage. |
| Air leak in suction pipework. | Check each flange for suction draught, rectify as necessary. |
| Air leak in mechanical seal. | Check all joints, plugs and flushing lines, if fitted. Note that prolonged running with air in the mechanical seal will result in damage and failure of the seal. |
| Air or gas in liquid. | It may be possible to increase the pump performance to provide adequate pumping. |
| Discharge head too high (above rating). | Check that valves are fully open and for pipe friction losses. An increase in pipe diameter may reduce the discharge pressure. |
| Suction lift too high. | Check for obstruction of pump inlet and for inlet pipe friction losses. Measure the static lift, if above rating, raise the liquid level or lower the pump. |
| Not enough head for hot liquid. | Reduce the positive suction head by raising the liquid level. |
| Inlet pipe not submerged enough. | If the pump inlet cannot be lowered, provide a baffle to smother the inlet vortex and prevent air entering with the liquid. |
| Viscosity of liquid greater than rating. | Refer to SPP Pumps Ltd for guidance to increase the size or power of the motor or engine. |
| Liquid density higher than rating. | Refer to SPP Pumps Ltd for guidance to increase the size or power of the motor or engine. |
| Insufficient nett inlet head. | Increase the positive suction head by lowering the pump or raising the liquid level. |
| Impeller blocked. | Dismantle the pump and clean the impeller |
| Wrong direction of rotation. | Check driver rotation with the direction arrow on the pump casing. |
| Excessive impeller clearance. | Replace the impeller when clearance exceeds the maximum adjustment. |
| Rotor binding. | Check for shaft deflection, check and replace bearings if necessary. |
| Defects in motor. | Ensure that motor is adequately ventilated. Refer to manufacturers' instructions. |
| Voltage and/or frequency lower than rating. | If voltage and frequency are lower than the motor rating, arrange for provision of correct supply. |
| Lubricating grease or oil dirty or contaminated. | Dismantle the pump, clean the bearings, reassemble the pump and fill with new grease or oil |
| Foundation not rigid. | Ensure that the foundation bolts are tight, Check that foundations match SPP Pumps Ltd recommendations |
| Misalignment of pump and driver. | Realign the pump and driver as specified. |
| Bearings worn. | Remove the bearings, clean and inspect for damage and wear, replace as necessary. |
| Rotor out of balance. | Check impeller for damage, replace as necessary. |
| Shaft bent. | Check shaft run-out and replace if necessary. |
| Impeller too small. | Refer to SPP Pumps Ltd for options to fit a larger impeller. |

# 8. Pump Details:

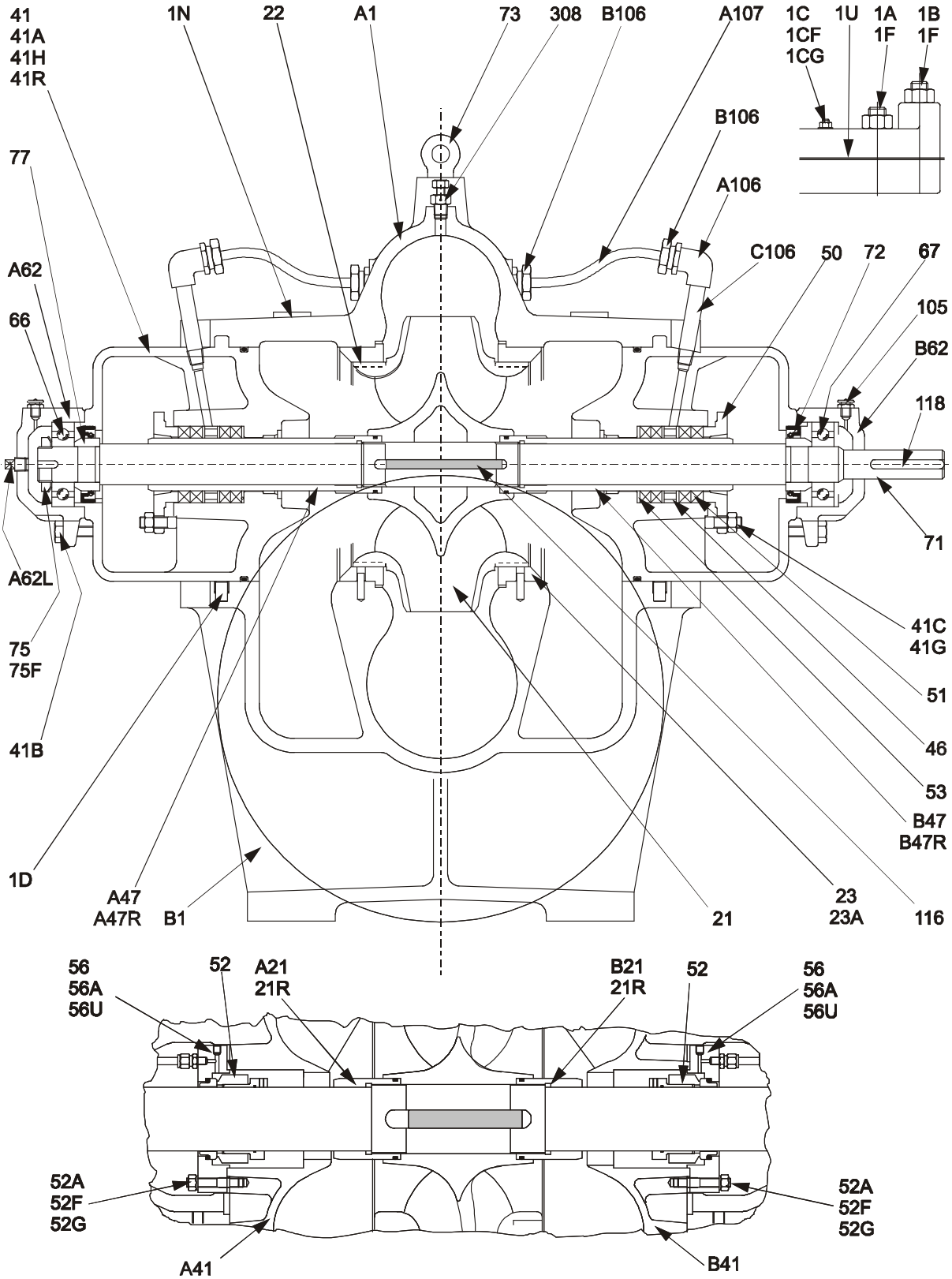
## *8.1 Typical Pump Cross Section Drawing – Module 1 (Single Side Entry Impeller)*



### *8.2 Typical Pump Cross Section Drawing – Module 1 & 2 (Double Side Entry Impeller)*



### *8.3 Typical Pump Cross Section Drawing – Module 3 (Integral Insert & Support Frame)*



### *8.4 Parts Identification List – For Modules 1, 2 & 3 Pumps:*

Note: Pump construction may vary slightly between the different pump sizes within each module, it is important to refer to the specific pump section drawing and to quote the pump serial number when ordering parts to ensure that the correct part is supplied in the original material of construction.

| *Item* | *Description* | *Qty* |
|---|---|---|
| A1 | Casing Top Half | 1 |
| B1 | Casing Bottom Half | 1 |
| 1A | Casing Stud | Varies |
| 1B | Casing Stud | 4 |
| 1C | Casing Dowel | 2 |
| 1CF | Hexagon Nut Full Dowel | 2 |
| 1CG | Plain Washer Dowel | 2 |
| 1D | Dowel Pin - Insert | 2 |
| 1F | Hexagon Nut Full Casing | Varies |
| 1L | Casing Gauge Plug (Not Shown) | 2 |
| 1M | Casing Drain Plug (Not Shown) | 2 |
| 1N | Casing Priming Plug (Not Shown) | 2 |
| 1U | Casing Gasket | 1 |
| 21 | Impeller | 1 |
| 21F | Impeller Nut – (A-Free & B-Locked) | 2 |
| 22 | Impeller Wear Ring (Where fitted) | 2 |
| 23 | Case Wear Ring | 2 |
| 23A | Dowel Case Wear Ring | 2 |
| 41 | Insert | 2 |
| 41A | Stud – Insert | 8 |
| 41C | Stud – Gland | 4 |
| 41F | Hexagon Nut Full – Support Frame | 8 |
| 41G | Hexagon Nut Full – Gland | 4 |
| 41L | Plug – Insert | 2 |
| 41R | O Ring - Insert | 2 |
| 41X | Dowel Pin – Insert | 2 |
| 45 | Throttle Bush (Mechanical Seal) | 2 |
| 46 | Lantern Ring | 2 |
| 47 | Sleeve (A-Free & B-Locked) | 2 |
| 47R | O Ring – Sleeve / Nut | 2 |
| 50 | Gland | 2 |
| 51 | Packing | 8 |
| 52 | Mechanical Seal Assy. | 2 |
| 52A | Hexagon Head Screw - M-Seal | 8 |
| 53 | Spacer Ring (Soft Packed) | 2 |
| 53 | Insert (Mechanical Seal) | 2 |
| 53A | Socket Capscrew | 8 |
| 53F | Spring Washer | 8 |
| 53R | O Ring Insert | 2 |

| **Item** | **Description** | **Qty** |
|---|---|---|
| 61 | Support Frame | 2 |
| 61A | Hexagon Headed Screw | 8 |
| 61F | Plain Washer | 8 |
| A62 | Bearing Housing Non-drive End | 1 |
| A62L | Plug Bearing Housing N.D.E | 1 |
| B62 | Bearing Housing Drive End | 1 |
| 66 | Bearing Non-drive End | 1 |
| 67 | Bearing Drive End | 1 |
| 71 | Pump Shaft | 1 |
| 72 | Oil Seal | 2 |
| 73 | Eyebolt | 1 |
| 75 | Bearing Retaining Nut | 1 |
| 75F | Bearing Lock Washer | 1 |
| 77 | Shoulder Ring | 2 |
| 79 | Spacer Ring | 1 |
| 105 | Grease Nipple | 2 |
| A106 | Elbow 90deg. | 2 |
| B106 | Stud Coupling | 4 |
| C106 | Tubular Piece | 2 |
| D106 | Stud Coupling | 2 |
| A107 | Pipe | 2 |
| B107 | Pipe | 2 |
| 116 | Key Impeller | 1 |
| 118 | Key Coupling | 1 |
| 308 | Air Vent Valve | 1 |

Replacement parts should be obtained from SPP Pumps Ltd. Spares Department; use of parts from unapproved suppliers will invalidate the pump warranty. When ordering spare parts please quote the pump serial number from the pump identification plate.

***Pump Connections:***

| Pump Connection: | Size & Type |
|---|---|
| Suction & Delivery Flanges | BS4504 PN 16 with flat face. |
| Pressure Gauge | Rp ¼ |
| Suction Gauge | Rp ¼ |
| Casing Vent | Rp ¼ |
| Casing Drain | Rp ½ |
| Gland Drain | Rp ⅜ |

# 9. Standard Metric Nut and Bolt Torque Recommendations

This information is for reference only. The user must check that the torque figures listed here are applicable to the fasteners used. Nuts and bolts should be neither under nor over tightened.

| Grade of Bolt | Approximate Torque (Nm) for Bolt Diameters: | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **M5** | **M6** | **M8** | **M10** | **M12** | **M16** | **M20** | **M24** | **M30** | **M36** |
| **4.6** | 2.7 | 4.5 | 11 | 22 | 38 | 95 | 185 | 320 | 633 | 1110 |
| **8.8** | 6.9 | 11.7 | 28 | 56 | 98 | 244 | 476 | 822 | 1634 | 2855 |
| **10.9** | 9.4 | 15.9 | 38 | 77 | 134 | 332 | 646 | 1120 | 2223 | 3885 |
| **12.9** | 11.2 | 19.1 | 46.4 | 92 | 160 | 397 | 775 | 1342 | 2666 | 4660 |

**Note:** These torque figures are approximate, and for **un-plated** fasteners only. No allowance has been made for special finishes or lubricants, washers or mating surfaces.

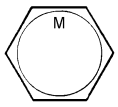
**Bolt and Nut Grade Combinations**

| | | | | | |
|---|---|---|---|---|---|
| Grade of **BOLT** | 4.6 | 8.8 | 10.9 | 12.9 | Note: It is permissible to fit higher grade nuts than recommended. |
| Grade of **NUT** | 4 | 8 | 12 | 12 | |

**Grade Identification**

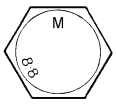
**BOLTS & NUTS - Grade 4.6**

BS4190 (ISO272, 885, 888 & 4759/1). Grade marking is optional. Normally there will be no mark other than the 'M' thus:



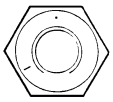

**BOLTS - Grade 8.8**

BS 3692 (ISO272, 4759/1). Grade marking is mandatory, may also have trade marks

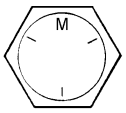



**NUTS - Grade 8**

Indented marks as a clock face, dot at 12.00, bar at 8.00, indicates grade 8 nut.



High Strength **Friction Grip** Bolts & Nuts

| BOLT | | NUT | | BOLT Grade10.9 | | NUT Grade 12 | |
|---|---|---|---|---|---|---|---|
| |   | |   | |   | |   |

**Installation & Maintenance Record:**

| Date | Summary of maintenance & repairs done - replacement parts fitted etc: | |
|---|---|---|
| | Initial Alignment TIR readings:<br>First Lateral Check: …… Angular Check: …….. Confirmed Lateral Check: …….. | |
| | Final Alignment TIR readings:<br>First Lateral Check: …… Angular Check: …….. Confirmed Lateral Check: …….. | |
| | Installed & Commissioned | Signed –<br>*Commissioning Engineer* |
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# 10. SPARES & SERVICE

SPP Pumps operate a comprehensive Spares and Service support network throughout the world, and can be contacted as follows:

| | | |
|---|---|---|
| **SPARES & SERVICE** | **Telephone:** | **+44 (0)1189 323 123** |
| *For spare parts, supply only.* | ask for - | **Spares Dept.** |
| *For breakdowns, spare parts and on-site fitting, pump installation and commissioning, and service contracts.* | ask for - | **Service Dept.** |
| *For breakdowns outside office hours.* | Telephone : | **+44 (0)1189 323 123** |
| Spares & Service Office<br>SPP Pumps Limited<br>1420 Lakeview<br>Arlington Business Park<br>Reading, Berkshire<br>RG7 4SA<br>ENGLAND | General Fax line:<br><br>Direct Fax line: | **+44 (0)1189 323 302**<br><br>**+44 (0)1189 303 259** |

Copies of this manual are available from the SPP Pumps Limited Spares & Service Department by quoting the manual reference number and revision number.

*You may enter details from your pump nameplates here for quick reference.*

| | |
|---|---|
| SPP PUMPS | **SPP Pumps Coleford, ENGLAND**<br>**Tel: +44(0)1594 832701** |
| **PUMP TYPE** | **SERIAL No.** |
| **CAPACITY** L/s | |
| **SPEED** rpm | **HEAD** m |

SPP PUMPS

**SPP Pumps Limited**
Crucible Close, Mushet Industrial Park,
Coleford, Gloucestershire, ENGLAND,
GL16 8PS
**Tel**: +44(0)1594 832701
**Fax**: +44(0)1594 836300

CE **Year**
**Weight** kg
**Serial No.**