



Centurion

Horizontal Split Case Pump



USER MANUAL: (INTERNATIONAL)

Installation, Operation and Maintenance



These instructions must be read prior to installing, operating, using and maintaining this equipment.

WARRANTY:

We warrant that the pump supplied from Pentair Southern Cross is free from defective material and faulty workmanship. This warranty holds good for a period of 12 months from the date of commissioning the equipment or 18 months from the date of dispatch from our factory, whichever is earlier. Our liability in respect of any claim is limited to replacing part/s free of charge ex-works or repairs of the defective part/s only to the extent that such replacement / repairs are attributable or arise solely from faulty workmanship or defective material. This warranty holds good only for the products manufactured by Pentair Southern Cross. If any modifications are done on the pump by others, warranty may be voided.



www.southerncross.pentair.com

SAFETY FIRST

CAUTIONS AND GENERAL SAFETY

This manual contains important information concerning installation, operation and proper maintenance of the Centurion Horizontal Split Case Pump. To prevent injury to personnel or equipment damage, this manual should be read and understood by those responsible for the installation, operation and maintenance of the equipment.

Section A

INTRODUCTION AND SAFETY

1. GENERAL



These instructions must always be kept close to the product's operating location or directly with the product.

Pentair Southern Cross is committed to continual quality improvement. We are available at your service to answer any technical question and provide further information about the product relating to its Installation, Operation, Repair and Fault diagnostic services.

The instructions in this manual are intended to provide relevant information to the installer and operator to work with the product. Operating the product in compliance with these instructions is important to help ensure reliability in service and avoid risks.

Local regulations are not accounted for in these instructions. Ensure such local regulations are observed by all, including those installing the product. Always coordinate repair activity with operations personnel, and follow all plant safety requirements and applicable safety and health laws and regulations.

2. DISCLAIMER

Information in this manual is considered to be reliable. In spite of all the efforts made by PSC to provide relevant information, the content of this manual may appear insufficient in some areas and is not guaranteed by PSC as to its completeness or accuracy.

PSC products are manufactured in compliance with ISO9001:2008 International Quality Management System Standard. Parts and Accessories have been designed, tested and incorporated into the products to help ensure their continued product quality and performance in use. Use of Non-PSC supplied parts and accessories may adversely affect the performance and safety features of the products. Failure to properly select, install or use authorized PSC parts and accessories is considered as misuse.

Damage or failure caused by misuse is not covered by PSC warranty. In addition, any unauthorized modification to PSC products or removal of original components may impair the safety of these products in their use and will be unwarrantable.

3. PERSONNEL QUALIFICATION AND TRAINING

All personnel involved in the operation, installation, inspection and maintenance of the unit must be qualified to carry out the work involved. If the personnel in question do not already possess the necessary knowledge and skill, appropriate training and instruction must be provided. Always coordinate repair activity with operations and health and safety personnel, and follow all plant safety requirements and applicable safety and health laws and regulations.

4. SUMMARY OF SAFETY MARKINGS

This document contains specific safety markings relating to various user instructions. The specific safety markings are:



A symbol to indicate safety instructions where non-compliance would affect personal safety and could result in loss of life.



A symbol to indicate electrical safety instructions where non-compliance would affect personal safety and could result in loss of life.



A symbol to indicate "hazardous and toxic fluid" safety instructions where non-compliance would affect personal safety and could result in loss of life.



A symbol to indicate safety instructions where non-compliance will involve some risk to safe operation and personal safety and would damage the equipment or property.



A symbol to indicate explosive atmosphere marking. It is used in safety instructions where non-compliance in the hazardous area would cause the risk of an explosion.



This sign indicates a Critical Instruction the Installer / Operator need to consider and follow.

5. MANDATORY SAFETY ACTION



ENSURE CORRECT LUBRICATION



START THE PUMP WITH OUTLET VALVE OPENED

This is recommended to minimise the risk of overloading and damaging the pump and motor at full or zero flow. The pump outlet control valve may need to be adjusted to comply with the duty following the run-up process. (See section 5, Commissioning start-up, operation and shutdown.)



NEVER RUN THE PUMP DRY



INLET VALVES TO BE FULLY OPEN WHEN PUMP IS RUNNING

Running the pump at zero flow or below the recommended minimum flow continuously will cause damage to the pump itself and to the seal.



PREVENT EXCESSIVE EXTERNAL PIPE LOAD

Do not use pump as a support for piping. Do not mount expansion joints, unless allowed by PSC in writing, so that their force, due to internal pressure, acts on the pump flange.



DO NOT RUN THE PUMP AT ABNORMALLY HIGH OR LOW FLOW RATES

Operating at a flow rate higher than normal or at a flow rate with no back pressure on the pump may overload the motor and cause cavitation. Low flow rates may cause a reduction in pump/bearing life, overheating of the pump, instability and cavitation/ vibration.



NEVER DO MAINTENANCE WORK WHEN THE UNIT IS CONNECTED TO POWER



HAZARDOUS LIQUIDS

When the pump is handling hazardous liquids care must be taken to avoid exposure to the liquid by appropriate setting of the pump, limiting personnel access and by operator training. If the liquid is flammable and/or explosive, strict safety procedures must be applied.

Gland packing must not be used when pumping hazardous liquids.



DRAIN THE PUMP AND ISOLATE PIPEWORK BEFORE DISMANTLING THE PUMP

The appropriate safety precautions should be taken where the pumped liquids are hazardous.



HANDLING COMPONENTS

Many precision parts have sharp corners and the wearing of appropriate safety gloves and equipment is required when handling these components. To lift heavy pieces above 25 kg (55 lb) use a crane appropriate for the mass and in accordance with current local regulations.



GUARDS MUST NOT BE REMOVED WHILE THE PUMP IS OPERATIONAL

The unit must not be operated unless coupling and shaft guards are in place. Failure to observe this warning could result in injury to operating personnel.



THERMAL SHOCK

Rapid changes in the temperature of the liquid within the pump can cause thermal shock, which can result in damage or breakage of components and should be avoided.



DO NOT APPLY HEAT TO REMOVE IMPELLER

Trapped lubricant or vapour could cause an explosion.

6. SAFE NOISE LEVEL

Centurion pump noise level is dependent on a number of factors – the type of driver used, the operating conditions, pipe-work design and acoustic characteristics of the building. The below table is a guide to calculating the noise level for a pump unit with any given driver.

Approximate Noise Level Table:

Driver Sound Level dB(A)	Correction For Unit – Add to motor noise level dB(A)
60 - 64	13
65 - 69	11
70 - 74	9
75 - 79	7.5
80 - 84	6.0
85 - 89	4.0

If pump noise level exceeds 85 dBa attention must be given to prevailing Health and Safety Legislation, to limit the exposure of plant operating personnel to the noise. The usual approach is to control exposure time to the noise or to enclose the machine to reduce emitted sound. You may have already specified a limiting noise level when the equipment was ordered, however if no noise requirements were defined then machines above a certain power level will exceed 85 dBa. In such situations consideration must be given to the fitting of an acoustic enclosure to meet local regulations.

7. LEAKAGE PREVENTION

The pump must only be used to handle liquids for which it has been approved to have the correct corrosion resistance. Avoid entrapment of air in the liquid in the pump and associated piping due to closing of suction and discharge valves, which could cause dangerous excessive pressures to occur if there is heat input to the liquid. This can occur if the pump is stationary or running.

Bursting of liquid containing parts due to freezing must be avoided by draining or protecting the pump and ancillary systems.

8. SAFETY NOTE

- A. The products supplied by PSC have been designed with safety in mind. Where hazards cannot be eliminated, the risk has been minimized 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.
- B. PSC products are designed for installation in designated area, which are to be kept clean and free of obstructions that may restrict safe access to the controls and maintenance access points. A Pump Duty 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.
- C. Access to the equipment should be restricted to the personnel responsible for installation, operation and maintenance of pump unit, adequately qualified and supplied with suitable personal protection equipment.
- D. PSC 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.
- E. 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 personnel protection equipment must be worn where local rules apply.
- F. Do not wear loose clothing or jewellery which could catch on the controls or become trapped in the equipment.
- G. Read the instruction manual before installation, operation and maintenance of the equipment. Check and confirm that the manual is relevant copy by comparing pump type on the nameplate and with that on the manual.
- H. Note the 'Limits of product application – permissible use' specified in the manual.
- I. Operation of the equipment beyond these limits will increase the risk from hazards noted below and may lead to premature and hazardous pump failure.
- J. 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.
- K. Improper Installation, Operation or Maintenance of this PSC Product could result in Injury or Death.

Section B

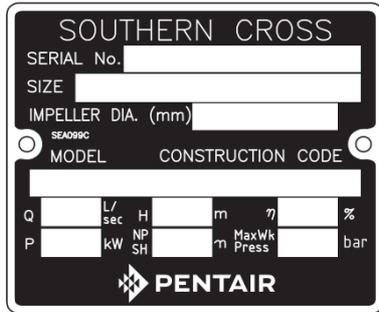
PUMP CONSTRUCTION

1. CONFIGURATIONS

The Southern Cross Centurion series pumps are single stage, double suction, horizontal or Vertical split case pump. The range is designed for continuous service in clean water pumping applications.

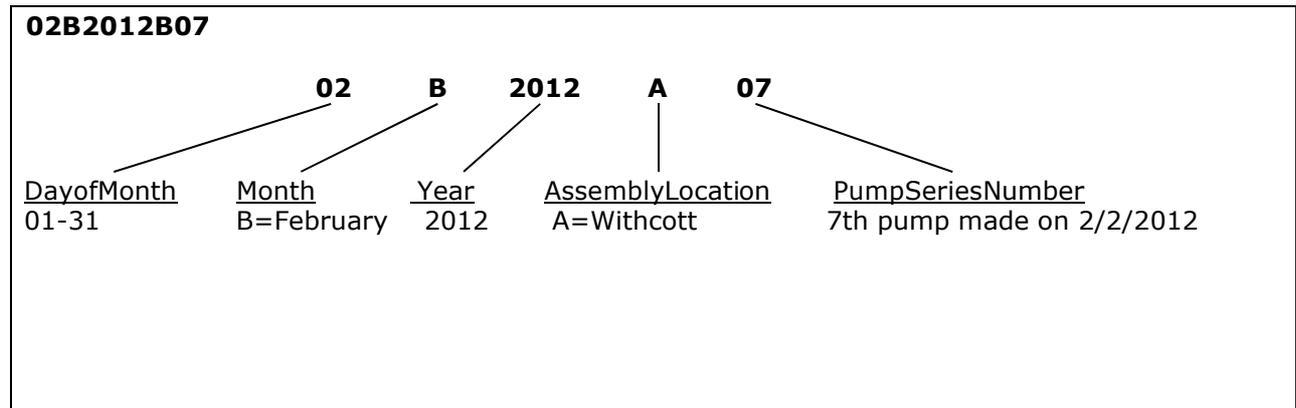
2. NOMENCLATURE AND NAME PLATE

A typical example of a Southern Cross Pump Name Plate is shown below.



2.1 Serial Number

The pump serial number is stamped on the name plate as shown above. A typical serial number is described below



2.2 Pump Size

Example: Model SS125-380H

SEREIS	DISCHARGE FLANGE	NOMINAL MAXIMUM IMPELLER DIAMETER
SS	125	380

2.3 Impeller Diameter (mm)

Actual outside diameter of the impeller in millimetres (if blank, the impeller is full-size)

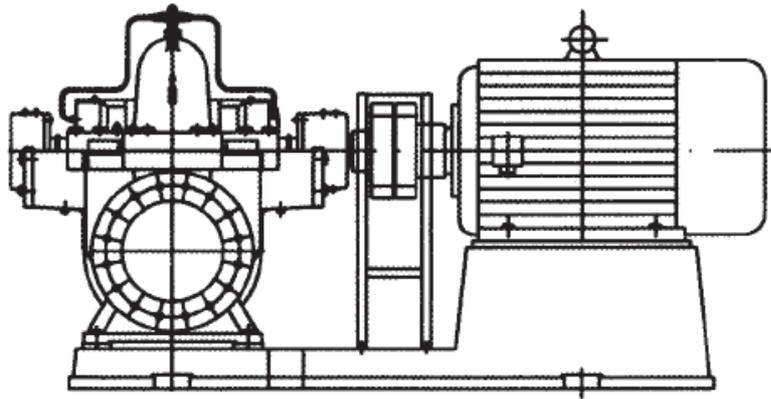
2.4 Model

"Item Code" of pump (from work order)

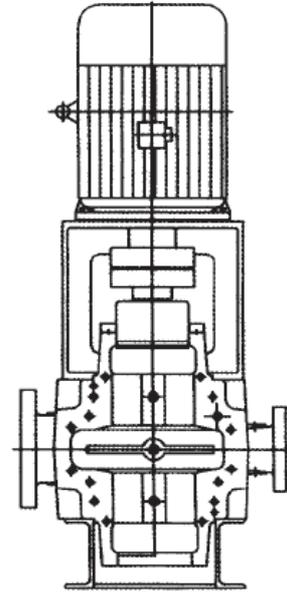
3. DESIGN OF MAJOR PARTS

3.1 Horizontal and Vertical Installations

Centurion pumps are available in either horizontal or vertical configuration. Vertical installations save considerable installation space.



Horizontal Installation



Vertical Installation

3.2 Pump Casing

The design pressure of the pump casing is 1.6Mpa & 2.5Mpa. Suction and discharge flanges are all set in the casing to enable simple maintenance and repair by simply removing the top cover without any requirement for removing pipework connections. Larger models feature a double volute design to reduce the radial force, which makes them ideal for heavy industrial applications.

3.3 Bearings

Horizontal split case pumps are provided as standard with deep groove, grease lubricated ball bearings. Bearing assembly options include oil lubricated bearings or double row drive-end bearings which can be fitted to handle high loads and to extend bearing life.

Vertical pumps are fitted with double row heavy duty, grease lubricated angular contact bearings in the drive end and a pumped product lubricated carbon/ceramic bush bearing in the non-drive end.

Optional bearing temperature and vibration sensors and external bearing cooling is available to allow reliable pumping of product up to 130°C. Under normal operating conditions, bearing life of greater than 100,000 hours can be expected

3.4 Impeller

High efficiency, balanced impeller with excellent hydraulic performance, low noise and vibration, and long service life.

3.5 Shaft

The rigid pump shaft is totally sealed from the pumped product using stainless steel shaft sleeves, making the Centurion pump suitable for heavy industrial applications.

3.6 Wear Rings

Replaceable wear rings are fitted as standard to Centurion pumps.

3.7 Mechanical Seals

Centurion pumps are fitted with unbalanced mechanical seals as standard with the option of balanced mechanical seals and single or double cartridge seals to suit particular applications.

3.8 Packed Gland Seals

Packed gland seals are available with a range of packing material options. Plan 11 Gland flushing is provided by the pumped product from the pump casing.

3.9 Construction Materials

Pumps are available in wide range of material configurations to suit the application requirements.

All pumps are manufactured using the highest quality materials to International Standards and are available in a wide range of optional materials to suit the requirements of most application or pumped product.

4.0 Driver

The driver is normally an electric motor. Different drive configurations may be fitted such as internal combustion engines, turbines, gearboxes etc.

4.1 Coupling and Coupling guards

The pump unit may be supplied with various types of coupling which are sized and selected to suit the application requirements with an adequate safety factor.

As a standard, galvanised steel Coupling Guards with end shields must be provided for safety.

4.2 Baseplate

Standard baseplates are made of Mild-steel plates folded galvanized. Non standard bases can be supplied to suit individual installation circumstances.

4.3 Accessories

Accessories such as bearing temperature and vibration monitoring, may be fitted when specified by the customer at additional cost.

4.4 Pump Direction of Rotation:

If not specified otherwise the standard direction of rotation when viewed from drive end is clockwise, the pump suction is on the right hand side and the pump discharge is on the left hand side. Anticlockwise direction of rotation is available and supplied if specified at time of purchase order.

4.5 Performance and operating limits

This product has been selected to meet the specifications of your purchase order. These pumps are furnished for a particular service condition only. Changes in the hydraulic system or Operating Condition may affect the pump's performance adversely. This is especially true if the changes reduce the pressure at the suction flange or if the liquid temperature is increased. Contact Pentair Southern Cross if there is a major change in the operating conditions to verify existing pumps' adequacy.

Section C

PUMP LUBRICATION

2. PUMPS FITTED WITH REGREASABLE OR OIL LUBRICATED BEARINGS

2.1 Grease Specification

These Pumps must not be operated over 1500rpm. Recommended grease type is Shell Alvania R3 or Bp Evergrease LC2 or equivalent high quality Extreme Pressure Lithium-based grease.

Grease nipples are provided for lubricant replenishment.

2.2 Oil Specification

Recommended Oils are those that have non-foaming properties. Typically, turbine or hydraulic oils would be suitable. Viscosity of SAE20 to SAE30 (ISO VG 46 to 100)
For continuous duty Tellus 68, Tiurbo T68 or Madrella AS68 are recommended

2.3 Change interval

Grease replenishment interval every 3 months are relevant to a pump running at 70°C Operating temperature and 1450rpm.

Oil replenishment interval every 1000 hours are relevant to a pump running at 70°C Operating temperature and 1450rpm

Section

D TRANSPORT AND STORAGE

1. GOODS RECEIVING, UNPACKING AND INSPECTION

Check Equipment against delivery / shipping documents for its completeness. Check for any damages caused due to transport. If any damage is found it should be reported to the carrier immediately. Any shortage and/or damage must be reported immediately to PSC and must be received in writing within one month of receipt of the equipment. Later claims cannot be accepted.

Check any crate, boxes or wrappings for any accessories or spare parts that may be packed separately with the equipment or attached to side walls of the box or equipment.

Inspect the preservative coating on various parts. If necessary, renew preservative in areas where it has been rubbed or scraped.

Inspect all painted surfaces. If necessary, touch up the areas where paint has been chipped or scraped. Paints and preservatives used are either PSC standard or 'special' as required by the contract specification. Refer to PSC for the description of paints and preservatives used on this order if needed.

Inspect all covers over pump openings and piping connections. If covers or seals for the covers are damaged or lose, they are to be removed, and a visual inspection made of the accessible interior areas for accumulation of foreign materials or water. If necessary, clean and preserve the interior parts as noted above to restore the parts to the "as shipped" condition. Install or replace covers and fasten securely.

2. HANDLING

Boxes, crates, pallets or cartons may be unloaded using fork-lift vehicles or slings dependent on their size and construction.

3. LIFTING



Make sure that any equipment used to lift the pump or any of its components is capable of supporting the weights encountered. Make sure that all parts are correctly rigged before attempting to lift.



Mechanical Lifting device must be used for all pump sets in excess of 25 kg. Fully trained personnel must carry out lifting, in accordance with local regulations. The driver and pump weights are recorded on general arrangement drawing included into the job user's instruction.

3.1 To Lift unit



Pump, driver and base-plate can be lifted as a unit. Sling from all lifting points provided on base-plate side rails. Failure to use all could result in permanent distortion of the base-plate. Use as long a sling as possible, or use a spreader arrangement.

Coupling bolting and spacer piece must be removed from between pump and driver half couplings before lifting base-plate with pumping element.

3.2 To lift driver

Refer to Manufacturer's Instructions

3.3 To lift complete pump only



Make sure the lifting equipment is rated to lift the pump weight. Use certified slings and chains only.

If at all possible, the pump and its component parts should be stored indoors where they will be protected from the elements.



4. STORAGE

Store the pump in location away from vibration and Dampness

4.1 Short term storage (Maximum 6 months)

If at all possible, the pump and its component parts should be stored indoors where they will be protected from the elements. In no case should any pump element be subjected to extended periods of submergence or wetting prior to start up. If it is not possible to store the pump and its components indoors, precautions must be taken to protect them from the elements. Regardless of whether storage is indoors or outside, the storage area should be vibration free. All boxes marked for indoor storage should be stored indoors. When stored outdoors the pump and its components should be protected from dirt, dust, rain, snow, or other unfavourable conditions by heavy plastic sheets, canvas, or other suitable coverings. All equipment must be placed upon skids or blocks to prevent contact with the ground and surface contaminants. Equipment must be adequately supported to prevent distortion and bending. The pump shaft should be rotated, in the direction of rotation, at least 1 and 1/4 turns each week during the storage period and any other periods of standby.

Store the pump in a clean, dry location away from vibration. Leave piping connection covers in place to keep foreign material out of pump casing. Turn pump at intervals to prevent brinelling of the bearings and seal faces, if fitted, from sticking. Electric Motors (Pump Driver) should not be stored in damp places without special protection (Refer to motor manufacturer's instructions). The pump may be stored as above for up to 6 months.

4.2 Long term storage

Depending on the length of time the equipment has been stored, and the type of storage provided (i.e. Indoor: heated, unheated, earth floor, concrete floor. Outdoors: Under roof, no roof, waterproof coverings, on concrete, on earth), the pump will require a full inspection before the scheduled installation date. This could include a visual inspection, partial or even a full dismantling of the equipment. This should be carried out by qualified personnel, or a PSC representative. Dismantling the equipment may require the replacement of gaskets and seals. All costs involved during the inspection, dismantling, replacement of parts and reassembly will be at the expense of the customer. All necessary labour, tools and cranes required will be supplied by the customer.

5. PACKAGING

Goods are packed suitable for the intended Transport as specified in the contract.

Section D

INSTALLATION

1. SAFETY INSTRUCTIONS FOR ASSEMBLY & INSTALLATION

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.

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.

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

2. LOCATION

Install the unit close to the source of the liquid to be pumped.

When selecting the location, be sure to allow adequate space for operation as well as for maintenance operations involving dismantling and inspections of parts.

Head room is an important consideration as an overhead lift of some type is required.

3. PART ASSEMBLIES

It is the responsibility of the installer to ensure that the motor is assembled to the pump and lined up.

CHECK ALIGNMENT

Prior to grouting, an initial alignment check in accordance with the alignment section of this document shall be performed to verify that coupling spacing and final alignment can be achieved without modifying the hold down bolts or the machine feet. This is necessary to ensure that the baseplate was not damaged during the transportation.



4. FOUNDATION

PUMP INSTALLATION AND FOUNDATION

There are many methods of installing pump units to their foundations. The correct method depends on the size of the pump unit, its location and noise vibration limitations. Non-compliance with the provision of correct foundation and installation may lead to failure of the pump and, as such, would be outside the terms of the warranty.



The foundation should be sufficiently rigid and substantial to prevent any pump vibration and to permanently support the baseplate at all points. The most satisfactory foundations are made of reinforced concrete. These should be poured well in advance of the installation to allow sufficient time for drying and curing.

5. INITIAL ALIGNMENT

Shaft alignment must be checked again after the final positioning of the pump unit and connection to pipe work, as this may have disturbed the pump or motor mounting positions. If hot liquids (above 80 Deg C) are being pumped, alignment should be checked and reset with the pump and motor at their normal operating temperature. If this is not possible, PSC can supply estimated initial offset figures to suit extreme operating temperatures.

PUMP ALIGNMENT AND THERMAL EXPANSION



The pump and motor will normally have to be aligned at ambient temperature and should be corrected to allow for thermal expansion at operating temperature.

5.1 Alignment methods



Ensure pump and driver are isolated electrically and the half couplings are disconnected

Align the motor to the pump, not the pump to the motor

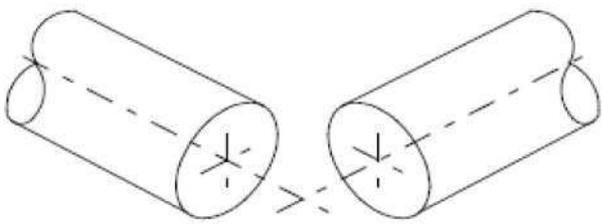
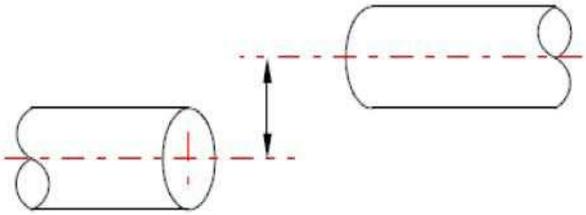


Adjustment to correct the alignment in one direction may alter the alignment in another direction. Always check in all directions after making any adjustment.

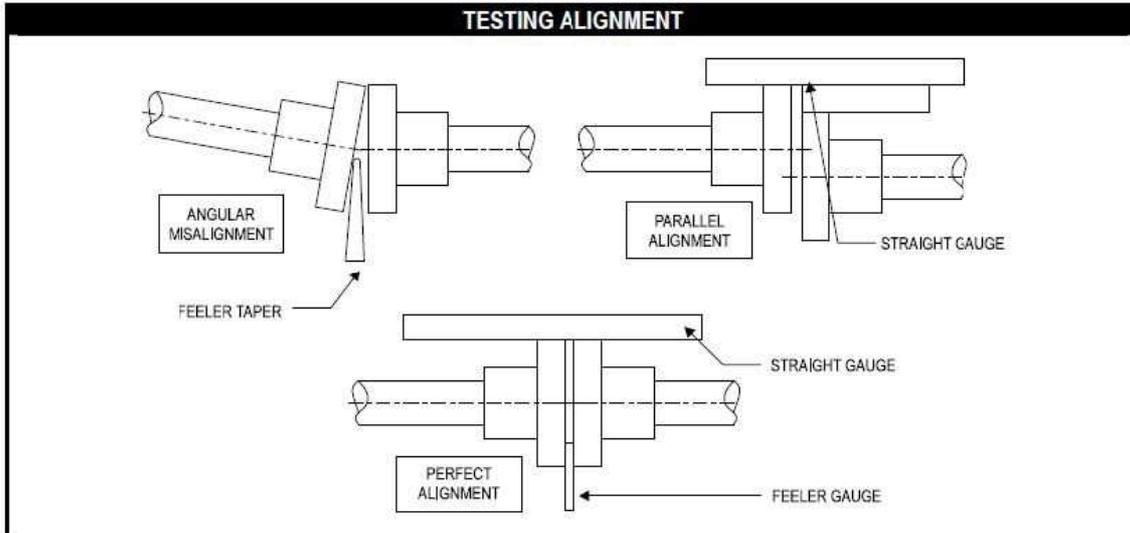


ALWAYS REMEMBER "A FLEXIBLE COUPLING IS NOT A UNIVERSAL JOINT"

Correct alignment is essential for the smooth operation of the pump. There are two types of misalignment between the pump shaft and the drive shaft, which are:

	
<p>Angular misalignment – Shaft with axis concentric, but not parallel.</p>	<p>Parallel misalignment – Shaft with axis parallel, but not concentric.</p>

This misalignment is checked by using a straight edge or any other device as shown in figure given above. A spacer type flexible coupling is used to connect pump shaft to the driver. By using spacer type of coupling, the complete rotating unit can be removed from the volute without removing pump casing or rotor and without disconnecting piping connections. However other types of coupling can be supplied against request.



The alignment is achieved by adding or removing shims under the motor feet and also moving the motor horizontally as required. In some cases where the alignment cannot be achieved it will be necessary to move the pump before recommencing the above procedure.

5.2 Shims

The shims between the equipment feet and mounting surface should be clean and dry. This is especially critical for pumps in service for some time and need to be realigned. Water, dirt and rust may change the height of the shim pack over a period of time. Shims should be made large enough to support the weight of the equipment on its mounting foot. Do not use many thin shims as this may result in a spongy mounting. Move the equipment vertically by adding or removing the calculated thickness of shims.

6. COUPLING

- a) Assemble coupling as per the manufacturer's instructions
- b) Install coupling guard

7. PIPING



DO NOT USE PUMP AS A SUPPORT FOR PIPING

7.1 Piping Good Practice

- a) In order to minimise friction losses and hydraulic noise in the pipework it is a good practice to choose pipework that is one or two sizes larger than the pump suction and discharge.
- b) Typically main pipework velocities should not exceed 2 m/s suction and 3 m/s on the discharge

7.2 Suction piping

- a) The inlet pipe should be one or two sizes larger than the pump inlet bore and pipe bends should be as large radius as possible.
- b) Double bends must be avoided in suction line and a straight run of pipe, equal to 8 or 10 times the pipe diameter is desired directly upstream of the suction nozzle.
- c) Keep the suction pipe free of all air pockets. d) Pipework reducers should have a maximum total angle of divergence of 15 degrees.
- d) The piping should be inclined up towards the pump inlet with eccentric reducers incorporated to prevent air locks.
- e) Flow should enter the pump suction with uniform flow, to minimise noise and wear.

7.3 Bypass Line

Operation at low flows results in pump horsepower heating the liquid. A bypass may be required to prevent vaporisation and subsequent pump damage

7.4 Discharge piping

- a) Install a check valve and a gate valve in the discharge piping. The check valve will protect the pump against excessive pressure when the pump stops. It will also prevent the pump from running backwards.
- b) The check valve should be installed between the gate valve and the pump nozzle in order to permit its inspection.
- c) Never throttle pump on suction side and never place a valve directly on the pump inlet nozzle.
- d) Pipework reducers should have a maximum total angle of divergence of 15 degrees.

8. ELECTRICAL CONNECTIONS

- a) Electrical connections must be made by a qualified Electrician in accordance with relevant local national and international regulations.
- b) The motor must be wired up in accordance with the motor manufacturers instructions (normally supplied within the terminal box) including any temperature, earth leakage, current and other protective devices as appropriate. The identification nameplate should be checked to ensure the power supply is appropriate.
- c) A device to provide emergency stopping must be fitted.
- d) For electrical details on pump sets with controllers see the separate wiring diagram.
- e) Check the Direction of rotation of the motor before connecting the motor to the pump.

9. PROTECTION SYSTEMS

- a) The following protection systems are recommended particularly if the pump is installed in a potentially explosive area or is handling a hazardous liquid. If in doubt consult PSC.
- b) If there is any possibility of the system allowing the pump to run against a closed valve or below minimum continuous safe flow a protection device should be installed to ensure the temperature of the liquid does not rise to an unsafe level.
- c) If there are any circumstances in which the system can allow the pump to run dry, or start up empty, a power monitor should be fitted to stop the pump or prevent it from being started. This is particularly relevant if the pump is handling a flammable liquid.
- d) To prevent excessive surface temperatures at bearings it is recommended that the pump be fitted with an internal cooling loop.

10. FINAL CHECKS

- a) Is the baseplate leveled?
- b) Foundation Bolts checked?
- c) Check the tightness of all bolts in the suction and discharge pipework?
- d) Piping Installed - Correct Vent, Gauge, Valve, Suction Strainer Locations?
- e) All Flange Bolting Correctly Torqued with appropriate gaskets in place?
- f) After connecting piping to the pump, rotate the shaft several times by hand to ensure there is no binding and all parts are free.
- g) Recheck the coupling alignment, as previously described, to ensure no strain on coupling is due to pipe. If pipe strain exists, correct piping.
- h) Coupling guard correctly installed?

Section E

COMMISSIONING AND OPERATION

1. SAFETY INSTRUCTIONS FOR COMMISSIONING & OPERATION

- Do not touch any moving or rotating parts.
- Guards must be in place before operating the equipment.
- Check that the pump is primed. Pump should never be run dry as the pumped liquid acts, as lubricant for the close running fits surrounding impeller and damage will be incurred.
- Failure to supply the stuffing box or mechanical seal with cooling of flush water may result in damage and premature failure of the pump. Standard Mechanical Seal Arrangement are supplied with API Plan11 flush.
- Do not touch surfaces, which during normal running will be sufficiently hot to cause injury. 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.
- In addition to local or site regulations for noise protection, PSC 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 be heard with ear defenders worn.



These operations must be carried out by fully trained and qualified personnel

2. PRE-COMMISSIONING PROCEDURE AND CHECKLIST

- a) The following steps should be followed at initial start-up and after the equipment has been overhauled:
 - b) Confirm correct pump is fitted into the designated functional location.
 - c) Prior to installing the pump, flush the suction side of the system to remove all deposit (slag, bolts etc.). Remove all pre-commissioning screens and replace with operational units.
 - d) Ensure the pump and piping is clean. Before putting the pump into operation, the piping should be thoroughly back flushed to remove any foreign matter which may have accumulated during installation. Take all possible care not to contaminate your system.
 - e) Inspect all nozzle connections for
 - I. Missing bolts or loose bolts
 - II. Missing gaskets
 - III. Flange alignment / Misalignment
 - f) Check Pipe work for
 - I. Correct sizing
 - II. Any suction restrictions
 - III. Make sure that all hold down bolts are in place and pulled down

- g) Check drive coupling for
 - I. Correct Alignment
 - II. The presence of preload caused by misalignment
 - III. All fasteners are tight
 - IV. Coupling has been fitted correctly
 - V. Coupling guard is correctly fitted and firm.
 - VI. Check that keys are secured in the correct position and locked down
 - VII. Turn shaft by hand and check for running clearance
- h) For Grease lubricated pumps (Regreasable Bearing type), fill about 15 gms for grease to ensure adequate lubrication at start up.
- i) For Oil lubricated pumps check level to ensure adequate lubrication at start up.
- j) Install suction strainer if required.
- k) Check that the Electrical connection is completed and signed off
 - I. Have the safety lock out device removed.
 - II. Bump start pump to check for correct orientation. If rotation is not correct refer to motor manual for appropriate connections to change rotation. Take appropriate precaution before working on the motor.
- l) If a Mechanical Seal is fitted, check
 - I. Quench or Flush is operational before start-up
 - II. Check that seal is located correctly III.
Check that seal is locked to the shaft
 - IV. Remove setting Tabs on cartridge seals



The unit must not be operated unless coupling and shaft guards are securely and completely bolted in place. Failure to observe the warning could result in injury to operating personnel

3. PRIMING

No pumping action occurs unless the pump casing is filled with liquid. Pump casing and suction pipe must therefore be completely filled with the liquid and thus all air removed before the pump is started. Several different priming methods can be used depending on the kind of installation and service involved.

- a) Liquid level above pump level Pump is set below liquid level of source of supply so that liquid always flows to pump under positive head.
- b) Priming with foot valve
 - I. When pump is installed on suction lift with foot valve at the end of suction line, fill pump with water from some outside source till all air is expelled and water flows through air vent.
 - II. When there is liquid under some pressure in the discharge pipe, priming can be effected by bypassing the pressure liquid around the check and gate valve. Of course, the initial priming must be effected from some outside source.

NOTE: In this case, the foot valve must be capable of withstanding pump pressure and possible surge

- c) Priming by ejector: An ejector operated by steam, compressed air or water under pressure and connected to air vent on top of casing can be used to remove air from and prime the pump on suction lift installations.
- d) Priming by dry vacuum pump: a hand or power pump sucks in all the air from the casing and the Suction pipe, and thus primes the system.

4. LUBRICATION

Refer section C. Re-lubricate as indicated in this Section C.

5. RUNNING

On account of its simple construction, the centrifugal pump requires practically no attention while running. Lubrication of the bearings and manipulation of the glands are the only things that need attention from the operator.

6. WEAR RINGS

Casing rings are fitted in the casing to reduce the quantity of water leaking back from the high pressure side to the suction side. When these wear rings are worn out, the clearance becomes greater and more water passes back into the suction. They must be replaced from time to time to restore the pump efficiency to its normal value.

7. PUMP STARTUP

- a) Close discharge valve if valve is not already closed. Crack open the valve to assure minimal flow.
- b) Prepare the driver for start-up in accordance with the driver manufacturer's instructions.
- c) Prime pump and ensure suction valve is open.
- d) If pump re-circulating line is used, ensure it is open, clear and free of obstructions.
- e) Turn on cooling liquid and assure correct flow exists (to cooler, insert gland etc.) as specified.
- f) Double check pumps rotation by starting unit momentarily. The direction of input shaft rotation is counter clockwise when facing pump shaft from coupling end.
- g) Ensure that the pump coasts down to a gradual stop.
- h) Start the driver and bring it up to speed quickly.
- i) As soon as the pump is up to rated speed slowly open discharge valve.
- j) This will avoid abrupt changes in velocity and prevent surging in the suction line.
- k) Perform the operating checks

8. PUMPS FITTED WITH MECHANICAL SEAL

- a) Before pumping dirty liquids it is advisable, if possible, to run in the pump mechanical seal using clean liquid to safeguard the seal face.
- b) External flush or quench should be started before the pump is run and allowed to flow for a period after the pump has stopped.

Never run a mechanical seal dry, even for a short time as it will cause a mechanical seal failure.



9. STOP / START FREQUENCY

This depends on the driver manufacturers' recommendation. Check actual capability of the driver and control/starting system before commissioning.

10. DURING OPERATION OF THE PUMP

Check the following on a regular basis

- a) The pump is running smooth.
- b) The flow of sealing liquid (if external liquid is provided for sealing purpose) is uninterrupted.
- c) The bearing temperate is within acceptable operating limits
- d) Head and capacity developed by the pump is as specified.
- e) Power consumption is within the limit.
- f) Ensure that there is no mechanical friction in the pump.
- g) Check suction and discharge pressure gauges.
- h) Check for excessive leakage at seal areas.
- i) Check for unusual noises.
- j) Check lubrication schedule
- k) Check for vibrations.



Stop the pump immediately, if any defects are noticed. Do not start the pump unless the defects are rectified. Report immediately to the supplier if it is not possible to rectify the defects.

11. STOPPING AND SHUTDOWN

- a) The centrifugal pumps can be shut down by switching off the power to the motor, with open or closed flow regulating valve. If there are no provisions against water hammer, it is recommended to close the flow regulating valve at pump discharge prior to stopping the pump, but ensure that the pump runs in this condition for no more than a few seconds.
- b) Avoid the use of instantaneous shut-off valves, such as solenoid valves. These can cause severe pump damage.
- c) If a non-return valve is not fitted, or the isolating valve at the discharge side is not completely closed, it may happen that during the shut-down the pump shaft will rotate in the opposite direction than is normal: in such cases absolutely avoid restarting the pump until the pump shaft has stopped rotating.
- d) After the first start-stop and if necessary, check pump/motor alignment and make sure that no external forces or moment rest on pump or piping.
- e) In the event the pump is shut down for an extended period of time it is recommended to completely drain the pump to prevent the possibility of freezing in the winter time and/or the possibility of corrosion due to stagnant liquid left in the pump.

Section F

MAINTENANCE AND SERVICING

1. SAFETY INSTRUCTIONS WHILE MAINTENANCE & SERVICING

- Before attempting any maintenance on a pump particularly if it has been handling any form of hazardous liquid, it should be ensured that the unit is safe to work on. The pump must be flushed thoroughly with suitable cleaner to purge away any of the product left in the pump components. 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 packing which may be contaminated.
- 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.
- 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 data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.
- 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 reconnection. In order to avoid the possibility of maintenance personnel inhaling dangerous fumes or vapours, it is recommended that the maintenance work be carried out away from the pump locations by removal of bearing housing and shaft assembly to a suitable maintenance area.

2. MAINTENANCE CHECKLIST

Preventive maintenance schedule is the periodical checks and precautions by which possibilities of failure and breakdown are made very remote.

2.1 Daily Checks

- a) Pressure gauge reading.
- b) Bearing temperature.
- c) Leakage through stuffing box.
- d) Noise and vibration.
- e) Voltage and current.
- f) Constant flow of external sealing liquid if provided.
- g) Check all lubricant levels
- h) On grease lubricated pumps (Regreasable Bearing type only), check running hours since last recharge of grease or complete grease change.

2.2 Periodical Maintenance

- a) Replenish the grease (Regreasable Bearing type only)
- b) Change the Oil (Oil Lubricated type only)
- c) Check the alignment of the pump set.
- d) Calibrate the measuring instruments.
- e) Check all paint or protective coatings.
- f) Check all power/instrument cable glands for tightness.
- g) Check the sealing connections for leakage etc.

2.3 Overhauling

When deterioration in performance or adverse operating condition is identified the pump must be scheduled for overhaul to avoid potential major damage. This work should be done by skilled personnel.

3. SPARE PARTS

3.1 Ordering of spares

The pump size and serial number are shown on the pump nameplate. When ordering spares the nameplate should be referred and following information should be quoted:

- 1) Pump serial number
- 2) Pump size
- 3) Part name — (refer to spares parts list)
- 4) Part number — (refer to spares parts list)
- 5) Number of parts required

Pentair Southern Cross supplied spares should only be used as replacements. Any change to the original design specification (modification or use of a non-genuine part) will invalidate the pump’s safety and warranty liability with Pentair Southern Cross.

3.2 Recommended spares

For start-up purposes:

Parts	Qty
Bearing & Gasket kit	1
Mechanical seals	2

For normal maintenance:

Parts	Qty
Bearing & Gasket kit	1
Wear rings	2
Mechanical seals	2
shaft	1
impeller	1

4. TYPICAL MAINTENANCE SCHEDULE

The below schedule provides a suitable timetable to monitor pump and system performance, and will provide a guide to pending maintenance requirements by comparing the current situation with previous recordings. Extreme or unusual operating environments should be taken into consideration, and shorter maintenance intervals are recommended.

ITEM	PERIOD	ACTION
Bearings	Every Month	<p>Check bearing temperatures by thermometer. If bearing temperature is above 80 Deg. C, it may be because of too much, or insufficient lubrication. If necessary, check the condition of the bearings.</p> <p>Regreasable bearings should be supplied with fresh grease of the recommended grade.</p> <p>Check for lubricant leaks. Replace seals if leaking.</p>
Seal or Gland	3 Monthly	<p>Check mechanical seal for leaks. Replace if leaking.</p> <p>Check packing for excessive leaks, and adjust or repack if necessary with the recommended grade and style of packing. When replacing packing, ensure that the lantern ring is aligned with the lubricant supply drillings.</p> <p>When repacking or replacing seals, check the condition of the shaft or sleeve.</p> <p>Replace if badly worn or corroded, and fit new bearings and seals. Check seal or gland flush piping for leaks, and repair or replace.</p>
	Yearly	<p>Check seal for wear, and replace if necessary.</p> <p>Check flush piping for scaling or blockages and clean and replace.</p>
Flexible Coupling	6 Monthly	<p>Check alignment of pump and motor. Re-align if necessary.</p> <p>Check for coupling wear and replace worn flexible element if necessary.</p> <p>Where frequent adjustment of alignment is necessary, check for cause (eg pipe loading, foundation failure, loose fasteners etc). If pipe loads are suspected, unbolt piping at suction and discharge flanges and check for mis-alignment.</p> <p>Check pipe supports and pack or adjust as required.</p>
Pressure & Flow Recordings	3 Monthly	<p>Check inlet and discharge pressure and rate of flow.</p> <p>Record these values and compare with previous recordings. A change in reading may indicate a fault in the system, wear or blockage in the pump. Investigate, and rectify as appropriate, as continued operation may result in untimely plant shutdown.</p>
Valves & Fittings	6 Monthly	<p>Check that ancillary fittings operate correctly.</p> <p>Improper function may cause premature pump failure.</p>
Rotating Element	Yearly	<p>Remove the rotating element and inspect for wear, scale buildup, or blockages.</p> <p>Clean unwanted deposits from components, as buildup will result in loss of performance.</p> <p>Check impeller running clearance.</p> <p>Replace defective components.</p>

5. TYPICAL TOOLS REQUIRED

A typical range of tools that will be required to maintain these pumps is listed below:

TOOL		WHERE USED
Open ended spanners (wrenches) to suit up to 2" (M50) screws/nuts		Undoing bearing cover
Tension wrench		Pretensioning impeller nut
Socket spanners (wrenches)		Undoing impeller nut
Socket sizes 28, 38, 48, 50 and 60A!F		
Metric Allen keys (up to 10mm)		General disassembly
Screw driver set		Removing and assembling seals/gaskets
Soft mallet		Soft loosening assembled parts
Puller or wooden wedges		removing impeller off tapered pump shaft
Dial indicator		Checking impeller run-out
Shaft Locker		Holding shaft while undoing impeller nut

Section G

PUMP TROUBLESHOOTING

1. PUMP TROUBLESHOOTING

When investigating trouble with PSC pumps, always remember that pumps have been tested at the factory and are mechanically correct when sent out. Discounting the possibility of damage during transit, most of the trouble in the field is due to faulty installation. Investigation shows that the majority of troubles with centrifugal pumps result from faulty conditions on the suction side.

2. BREAK DOWN-CAUSE-CHECK POINTS

In case of breakdown we recommend the location of the fault by using the following table:

BREAKDOWN POINTS	CHECK POINTS													
	1	7	8	9	10	11	12	13	14	15	17	18	19	23
Pump does not deliver	25	26	56	57	58									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pump delivers at reduced capacity	15	17	18	19	20	21	22	56	57	58				
	1	3	7	9	10	11	12	13	14	19	20	21	22	23
Delivery performance deteriorates	24	53	57	62										
	16	56	57	58										
Pump delivers too much	1	3	6	7	8	9	10	11	12	13	14	15	16	19
Delivery is interrupted	22	23	25	26	56	57	58	62						
	52													
After stopping pump runs in reverse direction	1	2	5	6	7	8	11	12	13	15	19	20	22	54
	55	56	57	62										
Very noisy	19	20	22	31	32	33	35	36	37	38	39	40	43	44
	47	48	49	50	51	54	55	58						
Unsteady running of pump	24	27	28	29	30	31	47	48	49	53				
Stuffing box leaks excessively	22	23	24	25	26	27	28	29	30	41	42	43		
Fumes from stuffing box	22	45	46	50										
Pump rotor locked in standstill position	23	24	25	26	27	28	29	30	40	41	42	45	47	48
Pump is heating up and seizing	49	50	54											
	19	20	21	22	31	32	33	34	35	36	37	38	39	40
Bearing temperature increases	41	42	43	44	45	46	47	48	49	51	54	55	58	
	14	22	60											
Motor will not start	14	22	27	28	40	43	50	55	56	57	58	59	60	61
Motor gets hot or burns out	14	22	27	28	45	46	50	58	59	60				
Motor is difficult to start														

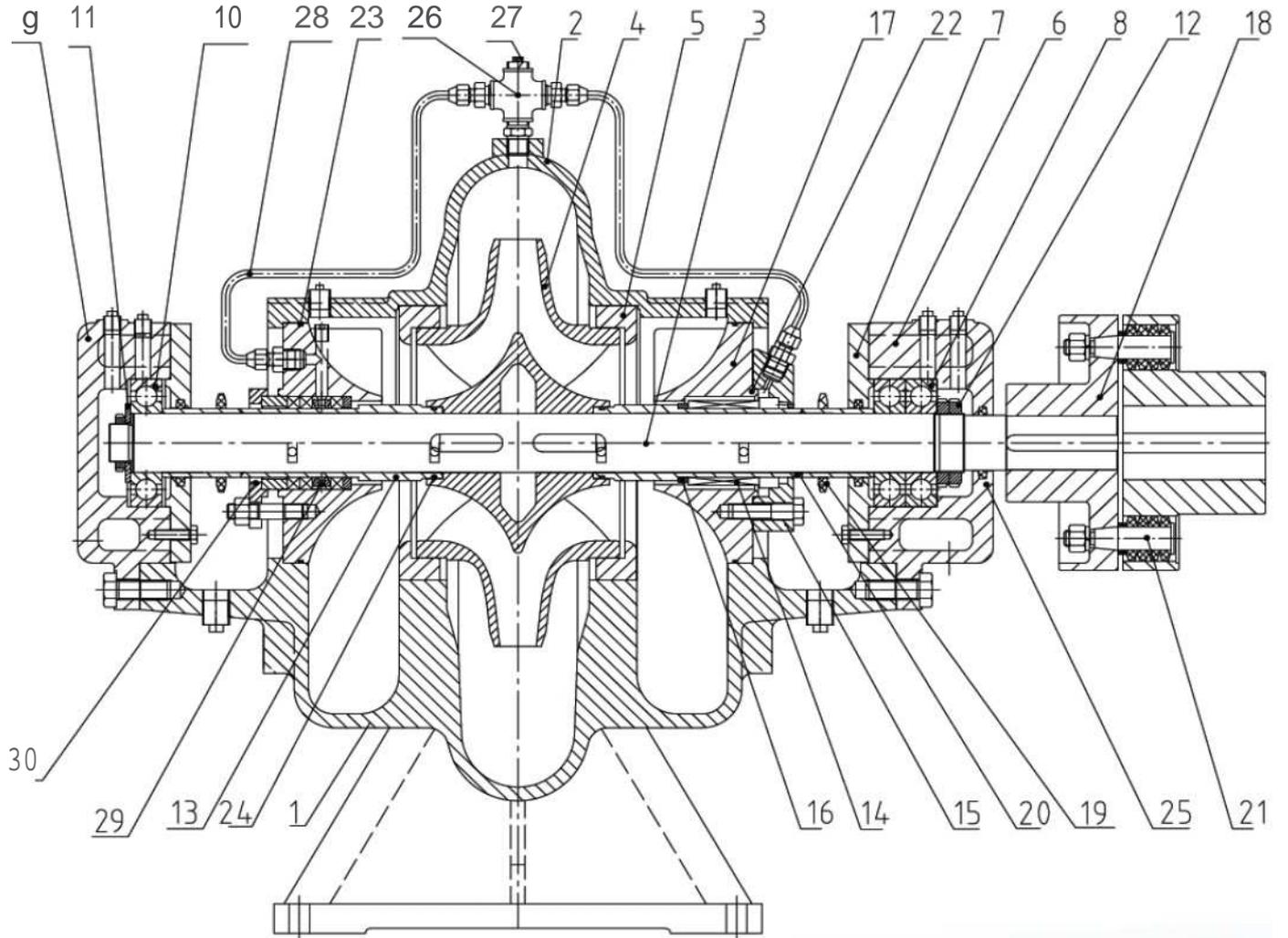
DESCRIPTION OF CHECK POINTS:

1	Suction pipe, foot valve choked.	32	Specified oil level not maintained.
2	Nominal diameter of suction line too small.	33	Insufficient lubrication of bearings.
3	Suction pipe not sufficiently submerged.	34	Ball bearings over-lubricated.
4	Too many bends in the suction line.	35	Oil/Grease quality unsuitable.
5	Clearance around suction inlet not sufficient.	36	Ball bearing incorrectly fitted.
6	Shut off valve in the suction line in unfavourable position.	37	Axial stress on ball bearings (no axial clearance for rotor).
7	Incorrect layout of suction line (formation of air pockets).	38	Bearings dirty.
8	Valve in the suction line not fully open.	39	Bearings rusty (corroded).
9	Joints in the suction line not leak-proof.	40	Axial thrust too great because of worn casing rings, relief holes obstructed.
10	Air leaking through the suction line and stuffing box etc.	41	Insufficient cooling water supply to stuffing box cooling.
11	Suction lift too high.	42	Sediment in the cooling water chamber of the stuffing box cooling.
12	Suction head too low (difference between pressure at suction connection and vapour pressure too low).	43	Alignment of coupling faulty or coupling loose.
13	Delivery liquid contains too much gas and/or air.	44	Elastic element of coupling worn.
14	Delivery liquid too viscous.	45	Pump casing under stress.
15	Insufficient venting.	46	Pipeline under stress.
16	Number of revolutions too high.	47	Shaft runs untrue.
17	Number of revolutions too low.	48	Shaft bent.
18	Incorrect direction of rotation (electric motor incorrectly connected, leads of phases on the terminal block interchanged).	49	Rotor parts insufficiently balanced.
19	Impeller clogged.	50	Rotor parts touching the casing.
20	Impeller damaged.	51	Vibration of pipe work.
21	Casing rings worn out.	52	Non-return valve gets caught.
22	Separation of crystals from the flow of pumping liquid (falling below the temperature limit/equilibrium temp).	53	Contaminated delivery liquid.
23	Sealing liquid line obstructed.	54	Obstruction in delivery line.
24	Sealing liquid contaminated.	55	Delivery flow too great.
25	Lantern ring in the stuffing box is not positioned below the sealing liquid inlet.	56	Pump unsuitable for parallel operation.
26	Sealing liquid omitted.	57	Type of pump unsuitable.
27	Packing incorrectly fitted.	58	Incorrect choice of pump for existing operating conditions.
28	Gland tightened too much/slanted.	59	Voltage too low/power supply overloaded.
29	Packing not suitable for operating conditions.	60	Short circuit in the motor.
30	Shaft sleeve worn in the region of the packing.	61	Setting of starter of motor too high.
31	Bearing worn out.	62	Temperature delivery liquid too high.

COMMISSIONING ACCEPTANCE

Project Ref No:		Client:	
Location:		Owner:	
Commissioning System:		Drawing Ref No:	
Location:			
<p>Commissioning Description:</p> <p>To review all drawings and Inspect Equipment / Installation that the system is installed safely and complying to the client and owner specification guidelines.</p>			
Client:		Equipment Number:	
Other:			
Accepted		Accepted	
Comments:		Comments:	
Name/Date Approval		Name/Date Approval	

3. CROSS SECTION- HORIZONTAL



No.

No.

No.	Part Description
1	Casing
2	Casing Top
3	Shaft
4	Impeller
5	Wear Ring
6	Bearing Housing - Drive End
7	Bearing Housing Cover - Drive End
8	Ball Bearing - Drive End*
9	Bearing Housing - Non-Drive End
10	Ball Bearing - Non-Drive End
11	External Circlips - Non-Drive End
12	Bearing Locknut - Drive End
13	Shaft Sleeves
14	Mechanical Seal
15	Seal Plate with Plan 11 Flushing
16	Sleeves Spacer for Mechanical Seal

No.	Part Description
17	Seal Chamber with Plan 01 Flushing
18	Coupling Hub
19	Water Flinger
20	Shaft & Sleeve O-ring
21	Coupling Pin and Bushing
22	Seal Plate O-ring
23	Seal Chamber O-ring
24	Impeller & Sleeve O-ring
25	Felt Ring
26	Flush Line Cross
27	Plug
28	Flush Line
30	Lantern Ring
31	Gland