# CSY Pumps
# Installation, Operation and Maintenance Manual

## SAMengineering

Customised Pump Solutions


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SABS ISO 9001

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## Contents



**NOTE:**
The information contained in this book is intended to assist operating personnel by providing information on the characteristics of the purchased equipment.

It does not relieve the user of their responsibility of using accepted engineering practices in the installation, operation, and maintenance of this equipment.

Any further questions, contact SAM Engineering (Pty) Ltd +27 (0) 11 823-4250.

## INTRODUCTION

This manual is furnished to acquaint you with the procedures to install, operate, and maintain a CSY Pump for reference. Additional information can be obtained from your SAM Engineering Sales Representative.

Equipment cannot operate well without proper care. To keep this unit at top efficiency, follow the recommended installation and servicing procedures outlined in this manual. SAM Engineering can assist in the installation of equipment to ensure that maximum machine life can be attained with minimum downtime.

## WARRANTY

Refer to your sales contract for warranty coverage.

## PUMP IDENTIFICATION

### PUMP NAMEPLATE

**SAMCO PUMPS**

| | | |
|---|---|---|
| MODEL | | SER. NO. |
| FLOW ($m^3$/hr) | | HEAD (m) |
| MAWP (KPag) | @ °C | IMP. DIA. (mm) |
| MOC | | RPM |
| SG | | HYDRO (kPag) |

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CSY Pumps are designated by serial number, model, size, and MOC (Material of Construction). This information is stamped on an identification plate and affixed to the pump frame or casing. Permanent records are kept by the factory and filed by serial number.

The pump nameplate contains the following information:

1. SERIAL NUMBER – Composed of certain groups of numbers. All groups are necessary for identification. TYPICAL EXAMPLE: P 2081 / 98

2. MODEL – CSY, followed by SIZE – Composed of three (3) groups of number. EXAMPLE: 4 x 3 x 11 – First number (4) is the ASA suction flange size in inches, second number (3) is the ASA discharge flange size in inches, the third number (11) is the nominal maximum impeller diameter in inches.

3. IMPELLER DIAMETER – This number is the impeller diameter in millimetres as supplied by the factory. EXAMPLE: 265

4. FLOW – Design flow rate in cubic metres per hour.

5. HEAD – Design head in metres.

6. MAX. DESIGN PRESSURE – This refers to factory standard hydrostatic test pressure for hydraulic end of pump.

7. MOC – Material of construction of pump shown in abbreviated form and in four parts. EXAMPLE: CI/SS/CI/EN8 – where casing, stuff box and wearplate (if fitted) are in Cast Iron / impeller in Stainless Steel / frame is in Cast Iron / shaft is in EN8

8. RPM – Design speed of pump to achieve design flow and head.

## INSTALLATION

## RECEIVING PUMP

It is imperative that you check the pump for shortages and damage immediately upon arrival. Prompt reporting to the carrier's agent, with notations made on the freight bill, will expedite satisfactory adjustment by the carrier.

Pumps and drivers are normally shipped from the factory mounted on a baseplate. Couplings may either be completely assembled or have the coupling hubs mounted on the shafts and the connecting members removed. When the connecting members are not assembled, they will be packaged in a separate container and shipped with the pump or attached to the baseplate.

Shafts are in alignment when the unit is shipped; however, due to shipping, the pumps may arrive misaligned and, therefore, alignment must be established during installation. SAM Engineering has determined that proper and correct alignment can only be made by accepted assembly practices. Refer to the following paragraphs on "Foundation", "Setting Baseplate", "Grouting Procedure", " Alignment Procedure" and "Doweling".

## STORAGE

**Short-term:** (Less than 6 months) SAM Engineering's normal packing procedure is designed to protect the pump during shipping. Upon receipt, store in a covered and dry location.

**Long-term:** (More than 6 months) Preservative treatment of bearings and machined surfaces will be required. Rotate the shaft several times every three months. Refer to driver, coupling and seal manufacturers for their long-term storage procedures. Store in a covered and dry location.

## LOCATION

The pump should be installed as near the suction supply as possible, with the shortest and most direct suction pipe practical. The total dynamic suction lift (static lift plus friction losses in suction line) should not exceed the limits for which the pump was sold.

The pump must be primed before starting. Whenever possible, the pump should be located below the fluid level to facilitate priming and assure a steady flow of liquid. This condition provides a positive suction head on the pump. It is also possible to prime the pump by pressurising the suction vessel.

When installing the pump, consider its location in relation to the system to assure that sufficient Net Positive Suction Head (NPSH) at pump suction is provided. Available NPSH must always equal or exceed the required NPSH of the pump.

The pump should be installed with sufficient accessibility for inspection and maintenance. A clear space with ample headroom should be allowed for the use of an overhead crane or hoist sufficiently strong to lift the unit.

NOTE: Allow sufficient space to be able to dismantle pump without disturbing the pump inlet and discharge piping.

Select a dry place above the floor level wherever possible.

Make sure there is a suitable power source available for the pump driver. If motor driven, electrical characteristics should be identical to those shown on the motor data plate.

## SETTING BASEPLATE/PEDESTAL

Due to the flexibility of an un-grouted base and handling in shipment, it should NOT be assumed that the unit is in alignment when it is placed on the rough foundation.

If these directions are followed, the required alignment should be readily achieved.

Initial or rough alignment must be done prior to grouting of the baseplate. Rough alignment is designated as (0.5mm).020" TIR parallel alignment and (0.2mm).009" TIR per inch of radius angular alignment (See "Alignment Procedure" described below). Use blocks at anchor bolts and midway between to position the bottom of the base at finished height (See Figure II) with foundation bolts extending through holes in the baseplate. Metal wedges with a small taper may be used in lieu of blocks and shims.

Tighten up all pump and motor bolts to ensure that they have not loosened or a "soft foot" has occurred due to base distortion in shipment.

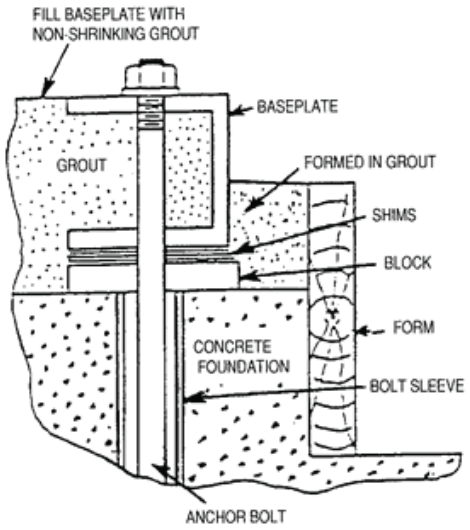
If the driver is being field installed, it should be centred in its bolt holes with shims added to bring the motor into rough alignment with the pump.

NOTE: Do not exceed six (6) shims; using as thick a shim as possible, otherwise "sponginess" or "soft foot" will result.

Level and plumb the pump shaft, coupling faces and flanges by adding or removing shims between the blocks and the bottom of the base. Tighten the anchor bolt nuts by hand at first. Being very careful not to distort the base, snug down the nuts with a wrench. The non-flexible coupling should not be reconnected until the alignment operation has been completed.

NOTE: The baseplate does not have to be level.

After foundation bolts are lightly torqued, re-check alignment requirements once more. Follow requirements outlined at the beginning of this section. If alignment must be corrected, add or remove shims or wedges under the baseplate.




## FIGURE II. GROUTING

The unit can then be grouted in (See Figure II).

Grout compensates for the uneven foundation. Together with the pedestal, it makes a very rigid interface between the pump and the foundation, distributing weight around the pedestal rim and preventing shifting.

Use an approved, non-shrinking grout such as Embeco 636 or 885 by Master Builders, Cleveland, Ohio or equivalents.

## ALIGNMENT PROCEDURE

Proper rough alignment must be made during unit setting and grouting.

There are two forms of misalignment between the pump shaft and the driver shaft as follows:

1. Angular misalignment – shafts have axis concentric at intersection, but not parallel.

2. Parallel misalignment – shafts have axis parallel, but offset.

The necessary tools for checking alignment are: (1) a straight edge and a taper gauge or set of feeler gauges or, (2) a dial indicator with mounting magnet and extension bars.

## SUCTION AND DISCHARGE PIPING

Pipe flanges should not impose any strain on the pump. This can be checked by a dial indicator. Any strain must be corrected by adjustments in the piping system.

Suction and discharge piping should be anchored, supported, and restrained near the pump to avoid strain on the pump. When using a rubber expansion joint, follow the recommendations of the Technical Handbook on Rubber Expansion Joints and Flexible Pipe Connectors, published by the Fluid Sealing Association, 2017 Walnut Street, Philadelphia, PA, 19103.

When installing the pump piping, be sure to observe the following precautions:

1. Piping should always be run to the pump.

2. Do not move pump to pipe.

3. Both the suction and discharge piping should be independently anchored near the pump and properly aligned so that no strain is transmitted to the pump when the flange bolts are tightened. Use pipe hangers or other supports at necessary intervals to provide support. When expansion joints are used in the piping system, they must be installed beyond the piping supports closest to the pump. Tie bolts should be used with expansion joints to prevent pipe strain. Do not install expansion joints next to the pump or in any way that would cause a strain on the pump resulting from system pressure changes. It is usually advisable to increase the size of both suction and discharge pipes at the pump connections to decrease the loss of head from friction.

4. Install piping as straight as possible, avoiding unnecessary bends. Where necessary, use 45° or long sweep 90° fittings to decrease friction losses.

5. Make sure that all piping joints are airtight.

6. Where flanged joints are used, assure that inside diameters match properly.

7. Remove burrs and sharp edges when making up joints.

8. Do not "spring" piping when making any connections.

9. Provide for pipe expansion when hot fluids are to be pumped.

## STUFFING BOX LUBRICATION

Contaminants in the pumped liquid must not enter the stuffing box. These contaminants may cause severe abrasion or corrosion of the shaft, or shaft sleeve, and rapid packing or mechanical seal deterioration; they can even plug the stuffing box flushing and lubrication system. The stuffing box must be supplied at all times with a source of clean, clear liquid to flush and lubricate the packing or seal. The most important consideration is to establish the optimum flushing pressure that will keep contaminants from the stuffing box cavity. If this pressure is too low, fluid being pumped may enter the stuffing box. If the pressure is too high, excessive packing or seal wear may result; and extreme heat may develop in the shaft causing higher bearing temperatures. The most desirable condition, therefore, is to use a seal water pressure slightly above the maximum stuffing box pressure.

If the pump system pressure conditions vary during the day, packing adjustment becomes difficult. Consideration should be given to using a mechanical seal (See "Mechanical Seals").

### Mechanical seals

Leakage is eliminated when a seal is properly installed, and normal life is much greater than that of packing on similar applications. A mechanical shaft seal is supplied in place of a packed stuffing box when specifically requested. The change from packing to an alternate arrangement may be made in the field by competent service personnel. Conversion parts may be ordered from your SAM Engineering Sales Representative.

Just as with packing, the mechanical seal chamber must be supplied with a source of clean, clear liquid to flush and lubricate the seal. The most important consideration is to establish the optimum flushing pressure that will keep contaminants from the seal cavity. If this pressure is too low, fluid being pumped may enter the stuffing box. If the pressure is too high, excessive seal wear may result.

## OPERATION

## PRE-START CHECKS

Before the initial start of the pump, make the following inspections:

1. Check the alignment between the pump and the motor.
2. Check all connections to the motor and starting device with a wiring diagram. Check voltage, phase and frequency on the motor nameplate with a line circuit.
3. Check suction and discharge piping and pressure gauges for proper operation.
4. Check impeller adjustment.
5. Turn the rotating element by hand to ensure that it rotates freely.
6. Check the stuffing box adjustment, lubrication and piping.
7. Check driver lubrication.
8. Ensure that pump bearings are properly lubricated.
9. Ensure that coupling is properly lubricated, if required.
10. Ensure that the pump is full of liquid and all valves are properly set and operational, with the discharge valve and the suction valve open. Purge all air from the top of the casing and from the mechanical seal chamber.
11. Check rotation. Be sure that the driver operates in the direction indicated by the arrow on the pump casing as serious damage can result if the pump is operated with incorrect rotation. Check rotation each time the motor leads have been disconnected.

## PRIMING

If the pump is installed with a positive head on the suction, it can be primed by opening the suction and vent valve and allowing the liquid to enter the casing.

If the pump is installed with a suction lift, priming must be done by other methods such as foot valves, ejectors or by manually filling the casing and suction line.

NOTE: Under either condition, the pump must be completely filled with liquid before starting. The pump must not be run dry in the hope it will prime itself.

## STARTING

1. Close the drain valves.
2. Open all valves fully in the suction and discharge lines.
3. Turn on seal water to the stuffing box (if pumped fluid is dirty, these lines should always be left open, except when using double mechanical seals).
4. Prime the pump.

NOTE: If the pump does not prime properly, or loses prime during start-up, it should be shut down and the condition corrected before the procedure is repeated.

5. Start the pump driver (turbines and engines may require warming up; consult the manufacturer's instructions).
6. When the pump is operating at full speed, check to see that the check valve has opened up. Check valve must open within five seconds or less after start-up to prevent damage to the pump by operating at zero flow.
7. Adjust the seal water valves to produce the recommended pressure for either the mechanical seal or packed stuffing box.

## SHUTDOWN

1. The following steps will take care of most normal shutdowns of the pump. Make any further adjustments of process piping, valves, etc., as required. If the pump is to be removed from service for an extended period of time, refer to sections on "Storage" and "Freeze Protection".

2. Shut down the driver (consult the manufacturer's instructions for special operations).

3. Close the suction and discharge valves.

4. Close the seal water valves (if pumped liquid is dirty, or if leakage is to be prevented, these lines should always be left open, except when the pump is completely drained).

5. Open the drain valves as required.

## MAINTENANCE

## GENERAL MAINTENANCE AND PERIODIC INSPECTION

Operating conditions vary so widely that to recommend one schedule of preventative maintenance for all centrifugal pumps is not possible. Yet, some sort of regular inspection must be planned and followed. We suggest a permanent record be kept of the periodic inspections and maintenance performed on your pump. This recognition of maintenance procedure will keep your pump in good working condition, and prevent costly breakdowns.

One of the best rules to follow in the proper maintenance of your centrifugal pump is to keep a record of actual operating hours. Then, after a predetermined period of operation has elapsed, the pump should be given a thorough inspection. The length of this operating period will vary with different applications, and can only be determined from experience. New equipment, however, should be examined after a relatively short period of operation. The next inspection period can be lengthened somewhat. This system can be followed until a maximum period of operation is reached, which should be considered the operating schedule between inspections. See “Maintenance Time Table”.

## LUBRICATION

### Bearings

### Grease:

Grease lubricated ball bearings are packed with grease at the factory and ordinarily will require no attention before starting, provided the pump has been stored in a clean, dry place prior to its first operation. The bearings should be watched in the first hour or so after the pump has been started to ensure that they are operating properly.

In greasing anti-friction bearings, the use of high pressure equipment is not only unnecessary, but is actually undesirable unless used with great care. High pressure may damage the bearings or seals, cause unnecessary loss of grease, create a danger of overheating due to overgreasing, and produce unsightly conditions around the bearing. EXCESS GREASE IS THE MOST COMMON CAUSE OF OVER-HEATING. Adequate lubrication is assured if the level of grease is maintained at about ½ the capacity of the bearing and bearing housing space. Any greater amount will, as a rule, be discharged by the seal or vent and be wasted.

The importance of proper lubrication cannot be over-emphasised. Lubrication frequency depends upon the speed, size and type of bearing, as well as the operating temperature or environmental conditions. Generally, the smaller the bearing and the faster the speed, the more frequent the interval for re-lubrication with grease. It is recommended that a certain amount of grease be added at intervals of three to six months to replace the small quantity of grease lost between grease flushing intervals. For average bearing housing designs, one ounce of grease will be sufficient at these intervals. For larger or smaller bearing housings, this amount may have to be adjusted.

A lithium based NLGI - 2 Grade grease should be used for lubricating bearings where the ambient temperature is above -6°C. Grease lubricated bearings are packed at the factory with Mobilux EP No.2 grease. Other recommended greases are Texaco Multifak EP-2 and Shell Alvania EP-2.

Greases made from animal or vegetable oils are not recommended due to the danger of deterioration and forming of acid. Do not use graphite.

## Refilling grease after cleaning:

When cleaning the bearings during a major overhaul, use a bearing cleaning solvent, industrial cleaning solvent or kerosene. In case of badly oxidised grease, soak bearings in hot, light oil (93° to 115°C). Do not use gasoline. Use lint-free cloths. Do not use waste rags.

Hand-pack the clean bearings (not the housing) until completely full with fresh grease while the pump is disassembled. Add additional grease to the bearing housing. The resulting total level of grease should be about ½ the capacity of the bearing and bearing housing space. On vertical pumps, place some grease on the frame ledge above the inboard (lower) bearing. Remove the vent plug to allow any excess grease to be expelled during the first 24 hours of operation, then replace all vent plugs.

## Periodic addition of grease:

Grease lubricated ball bearings are packed with grease at the factory. Store the pump in a clean, dry place prior to its first operation.

If there is uncertainty about the amount of grease in a bearing at re-lubrication intervals, the safe rule is to add grease slowly (one ounce at a time) as the bearing operates (if this is safe). Remember, a ball or roller bearing in most applications is assured of adequate lubrication if the level of grease is maintained at about ½ the capacity of the bearing and bearing housing space. Any greater amount will, as a rule, be discharged by the seals or vent and be wasted. EXCESS GREASE IS THE MOST COMMON CAUSE OF OVERHEATING OF THE BEARINGS. Remove vent plugs for the first 24 hours of operation after re-greasing.

## Bearing temperature:

Normally, the maximum desirable operating temperature for ball bearings is 80°C as measured on the bearing housing. Special designs may have higher limits. Should the temperature of the bearing frame rise above the limit, the pump should be shut down to determine the cause. A bearing frame, which feels hot to the touch of the hand, is not necessarily running hot. Check with an accurate temperature measuring device to be sure.

## Oil:

Oil lubrication on sewage pumps is considered special. Oil lubricated pumps may have an oil ring in which the oil is picked up from the reservoir by a rotating oil ring and deposited on the shaft and bearings inside the bearing housing; or they may have an oil slinger which creates a mist of fine droplets over the entire interior of the bearing cavity.

After the pump has been installed, flush the frame to remove dirt, grit and other impurities that may have entered the bearing housing during shipment or assembly. Refill the frame with proper lubricant. The oil level to be maintained is shown by a line in the sight glass or oil level indicator.

A Mobil DTE Medium turbine oil, or equal, meeting the following specification will provide satisfactory lubrication. The oils can be furnished by all major oil companies. It is the responsibility of the oil vendor to supply a suitable lubricant.

NOTE: Oils from different suppliers should not be mixed. Engine oils are not recommended.

The oil should be a non-foaming, well refined, good grade, straight cut, filtered mineral oil. It must be free from water, sediment, resin, soaps, acid and fillers of any kind.

In installations with moderate temperature changes, low humidity and a clean atmosphere, the oil should be changed after approximately 1000 hours of operation. The oil should be inspected at this time to determine the operating period before the next oil change. Oil change periods may be increased up to 4000 hours based on an 8000 hour year. Check the oil frequently for moisture, dirt or signs of "breakdown", especially during the first 1000 hours.

NOTE: Do not over-oil; this causes the bearings to run hot. The maximum desirable bearing housing operating temperature for all ball bearings is 180°F. Should the temperature of the bearing frame exceed 80°C (measured by thermometer), shut down the pump to determine the cause.

## CLEANING WITHOUT DISMANTLING THE PUMP

An increasing suction nozzle, bolted to the suction flange, is recommended industry practice (if this is not done, a short section of pipe designed so that it can be readily dropped out of the line can be installed adjacent to the suction flange). With this arrangement, any matter clogging the impeller is accessible by removing the nozzle (or pipe section).

The SAM Engineering suction nozzle is also equipped with a hand-hole with removable cover and a pipe tap for injecting high pressure clean-out water into the pump. This high pressure water (up to 80 psi maximum) can be injected to flush out any matter clogging the impeller or water passages. The water should be applied only with the suction valve closed.

Other cleaning methods include running an auger into the pump through the clean-out hole in the suction elbow or through the casing hand-hole. This should free any clogging in the impeller eye.

If the pump cannot be freed of clogging after the above methods have been tried, dismantle the unit to locate the trouble.

CAUTION: Do not open hand-hole cover unless the driver has been locked out and the pump drained of fluid. Failure to follow these instructions may result in serious injury, death or property damage.

| PERIOD | INSPECTION |
|---|---|
| Every month | Check the bearing temperature with a thermometer, not by hand. If the bearings are running hot (over 180°), it may be the result of too much lubricant. If changing the lubricant does not correct the condition, disassemble and inspect the bearings. |
| Every 3 months | Check the grease lubricated bearings for saponification. This condition is usually incurred by the infiltration of water or other fluid past the bearing shaft seals and can be noticed immediately upon inspection, since it gives the grease a whitish colour. Wash out the bearings with a clean industrial solvent and replace the grease with the proper type as recommended. |
| Every 6 months | Check the packing and replace if necessary. Use the grade recommended. Be sure the seal cages are centred in the stuffing box at the entrance of the stuffing box piping connection.<br><br>Check the shaft or shaft sleeve for scoring. Scoring accelerates packing wear.<br><br>Check the alignment of the pump and motor. Shim up units if necessary. If misalignment recurs frequently, inspect the entire piping system. Unbolt piping at the suction and discharge flanges to see if it springs away, thereby indicating strain on the casing. Inspect all piping supports for soundness and effective support of load. |
| Every year | Remove the rotating element. Inspect thoroughly for wear and order replacement parts if necessary.<br><br>Check wearing clearances. Clearance between impeller inlet and suction cover or between impeller wear ring and suction wearplate.<br><br>Remove any deposit or scaling. Clean out stuffing box piping.<br><br>Measure total dynamic suction and discharge head as a test of pipe connection. Record the figures and compare them with the figures of the last test. This is important, especially where the fluid being pumped tends to form a deposit on internal surfaces. Inspect foot valves and check valves, especially the check valve which safeguards against water hammer when the pump stops. A faulty foot or check valve will reflect also in poor performance of the pump while in operation. |

NOTE: The above timetable is based on the assumption that after start-up, the unit has been regularly monitored and such a schedule was found to be consistent with operation, as shown by stable readings. Extreme or unusual applications or conditions should be taken into consideration and may require shorter maintenance intervals.

| No liquid delivered | |
|---|---|
| **CAUSES** | **CURES** |
| 1. Lack of prime | Fill pump and suction pipe completely with liquid. |
| 2. Loss of prime | Check for leaks in suction pipe joints and fittings; vent casing to remove accumulated air. |
| 3. Suction lift too high | If no obstruction at inlet, check for pipe friction losses. However, static lift may be too great. Measure with mercury column or vacuum gauge while pump operates. If static lift is too high, liquid to be pumped must be raised or pump lowered. |
| 4. Discharge system head too high | Check pipe friction losses. Larger discharge piping may correct condition. Check that valves are wide open. |
| 5. Speed too low | Check whether motor is directly across-the-line and receiving full voltage. Alternatively, frequency may be too low; motor may have an open phase. |
| 6. Wrong direction of rotation | Check motor rotation with directional arrow on pump casing. Wrong rotation will cause pump damage. |
| 7. Impeller completely plugged | Dismantle pump or use piping hand hole to clean impeller. |
| **Not enough liquid delivered** | |
| **CAUSES** | **CURES** |
| 8. Air leaks in suction piping | If liquid pumped is water or other non-explosive material, and explosive gas or dust is not present, test flanges for leakage with a flame or match. For such liquids as gasoline, suction line can be tested by shutting off or plugging inlet and putting line under pressure. A gauge will indicate a leak with a drop of pressure. |
| 9. Air leaks in stuffing box | Increase seal lubricant pressure to above atmosphere. |
| 10. Speed too low | See item 5. |
| 11. Discharge system head too high | See item 4. |

## SERVICING GENERAL MAINTENANCE NOTES

When assembling and disassembling the pump frame, it is easier to work in the vertical position. Place the pump frame, minus the impeller, on a flat table or support with a hole in the centre for the shaft to pass through. Use a hoist to handle larger pumps. If the pump bearings or seals are to be removed, it is recommended they be replaced rather than reusing old parts. If they fail in service as a result of damage sustained during disassembly, the cost of replacing them again will be much greater than the cost of new parts in the first place.

## DISASSEMBLY

(Refer to parts list and assembly sections)

### Wet end:

1. Close the discharge and suction valves.
2. Lock out power to the driver.
3. Disconnect the power source from the driver, following proper safety precautions.
4. Turn off packing or seal liquid supply and disconnect all piping to the stuffing box.
5. Open the drain plugs and drain casing.
6. Disconnect the coupling.
   a. Pump with standard flexible coupling: Disconnect the driver half coupling and remove the driver. Shims and dowels under the driver feet should be marked so that they can be replaced in the proper location when the driver is reinstalled.
   b. Pump with spacer type coupling: Remove spacer portion of coupling. Driver half coupling may be left assembled and driver need not be moved. Note: Pump half coupling is removed only if the pump is to be completely dismantled.
   c. Pump with V-Belt drive: Remove belts and pump sheave.
7. Rotating Element Removal: Unbolt and remove the foot support from the frame.
8. Remove bolts that secure the rotating element to the casing and pull the entire rotating element from the casing. The casing may be left connected to the piping unless it or the suction cover is to be replaced or repaired. Remove casing joint gasket.
9. Impeller Removal: Unlock and remove the impeller nut set screw and impeller nut. The nut has right hand threads for both clockwise and counter clockwise directions of impeller rotation. The impeller nut set screw has been locked in place with a retaining compound. Application of heat from a small propane torch may be necessary to remove the set screw.
10. Remove the impeller and the impeller key from the tapered shaft. Wedges may be used to remove the impeller, but they should be placed directly behind the vanes to avoid damaging the impeller. The impeller can also be removed by using a simple puller.
11. If the impeller is equipped with a wear ring (optional) and if the wear ring is to be replaced, pry it off using a screwdriver or small pry bar. The wear ring is held in place using a retaining compound, so the application of heat from a small propane torch will be helpful.
12. Suction cover is equipped with a wearplate and if the wearplate is to be replaced, pry it off using a screwdriver or small pry bar. The wearplate is held in place with a retaining compound, so the application of heat from a small propane torch will be helpful.

### Pumps with packing:

1. Loosen packing gland.
2. Remove the two screws that secure the stuffing box cover to the frame. Remove the stuffing box cover with the packing arrangement.
3. Dismantle the stuffing box cover by removing gland, packing, lantern ring, and packing base ring.
4. Remove the set screw from the sleeve and slide the shaft sleeve off the shaft.
5. Remove the O-ring from the shaft.

### Pumps with standard double mechanical seal:

NOTE: Use care when performing the following steps so as not to damage or scratch the seal parts.

1. Remove the two screws that secure the stuffing box cover to the frame.
2. Remove the set screw from sleeve.
3. Remove screws holding the mechanical seal gland. Use care since seal faces are spring loaded.
4. Carefully pull the stuffing box cover with the stationary seat off the shaft.
5. Slide the shaft sleeve with the mechanical seal parts off the shaft.
6. Slide the gland with the stationary seat off the shaft.
7. Remove the mechanical seal parts from the sleeve and stationary seats from the stuffing box and gland.
8. Remove the O-ring from the shaft.

### Frame

Remove the pump half coupling and coupling key if these parts have been left on the shaft.

1. Remove the deflectors from both ends of the frame.
2. Remove the four cap screws securing the outboard bearing housing to the frame.
3. Pull out the adjusting shims.

NOTE: Do not discard shims. They will be needed to re-adjust clearance when the pump is reassembled. Two of the screws removed in Step 2 can be used as jacking screws on most frames.

4. Pull the complete shaft and bearing assembly out of the outboard end of the frame.
5. Press the bearing cover out of the inboard end of the frame.
6. Press out the inboard bearing seal.
7. Remove the bearing housing snap ring and grease retainer from the outboard bearing housing.
8. Remove the bearing housing from the outboard end of the shaft.
9. Press out the outboard bearing seal from the outboard bearing housing.
10. Bend the locking tabs on the bearing lock washer out of the slots on the bearing locknut, and remove the nut using either a spanner wrench or a drift pin and hammer.
11. Remove the outboard bearing from the shaft.

NOTE: When removing bearings, do not apply pressure to the outer race. Apply pressure to the inner race only. This will avoid any possible damage to the bearings.

12. Remove grease retainer and bearing housing snap ring from shaft.
13. Remove the inboard bearing from the shaft.

## PART INSPECTION

When the pump is dismantled for any reason, we recommend that all parts be inspected for wear or damage. Check the following and replace parts when necessary.

### Casing

All machined surfaces should be cleaned. Remove rust, burrs or raised surfaces from the main casing joint. Check for evidence of extreme wear or corrosion, especially at threaded taps and gasket joints.

### Suction cover

Check and clean machined surfaces and gasket joint. Inspect for wear. Check suction wearplate.

### Stuffing box cover

Check and clean machined surfaces and gasket joint. Make sure the stuffing box cavity is clean. Inspect and clean seal water inlet.

### Stuffing box parts

1. Pumps with packing: Inspect gland and lantern ring. Replace packing.

2. Pumps with mechanical seal: Inspect for wear, deterioration of bellows, broken spring, broken or scratched seal seats.

### Impeller

Check impeller vanes, impeller bore, and keyway for signs of wear, breakage or corrosion. Inspect impeller hub and impeller back vanes on rear of impeller (some impellers do not have back vanes), check impeller wear ring or inlet face for wear.

### Shaft sleeve

Inspect the shaft sleeve for nicks, burrs, grooves or other damage. Repair if possible; if not, replace. If the shaft sleeve for packing is grooved or worn in excess of 3/64" on the diameter, replace.

### Shaft

Check the bearing and impeller fits, lip seal surfaces and keyways for signs of wear, breakage, corrosion, nicks or burrs. Repair these surfaces if damaged, or replace the shaft. Check to see if the shaft is straight. The shaft must be within .002 TIR straightness.

### Bearings

Clean bearings using an approved bearing cleaning solvent or other non-flammable industrial solvent. Inspect the bearings, replacing them if they are noisy or rough when rotated, or if there are signs of wear or pitting in the bearing raceways.

WARNING: Under no condition should a combustible solvent such as gasoline be used to clean bearings or any other part of the pump. The use of such solvents could lead to fire or explosion. Failure to follow all instructions may result in serious injury, death or property damage.

### Grease seals: Replace

### Frame

Check machined bores for evidence of corrosion or wear. Clean old grease from frame interior.

## ASSEMBLY

Pump and frame parts are reassembled in the reverse order of dismantling, with special notes as outlined below. Follow all installation precautions covered in this manual. Always replace old gaskets, O-rings and packing. We also recommend replacing bearings if they have been removed from the shaft and lip seals whenever new bearings are installed.

### Frame

Place the bearing housing snap ring and the bearing grease retainer, in that order, on the outboard end of the pump shaft. The grease retainer has an offset surface near the inside diameter which must face away from the bearing. The flat side of the snap ring faces toward the coupling end of the shaft. THESE PARTS ARE PLACED ON THE SHAFT TO BE USED IN A LATER ASSEMBLY STEP.

1. Heat the inboard and outboard bearings to 110°C using a clean oil bath or a dry oven.

WARNING: Use insulated gloves when handling hot bearings. Failure to follow all instructions may result in serious injury, death, or property damage.

The inboard bearing is a single row bearing and fits on the impeller side of the shaft. The outboard bearing is a double row angular contact bearing and fits onto the coupling side of the shaft.

Slide both bearings onto their respective bearing fits on the shaft, being sure that the bearings press firmly against the bearing fit shoulder.

Install the bearing lock washer on the coupling end of the shaft, with the locking tabs facing away from the bearing. There is a tab on the LD. of the lock washer. This tab must fit into the groove in the pump shaft

Install the bearing lock nut with the bevelled edge facing the bearing. Tighten the lock nut using either a spanner wrench or a drift pin and hammer. Tapping the spanner wrench with a hammer will ensure the nut is tight. Be sure the nut comes to rest in a position where a slot on the nut lines up with a tab on the lock washer. Bend one of the lock washer tabs into

2. Thoroughly pack both bearings with an approved lubricant. Note that the space between the bearing and bearing lip seal should be no more than one-half to one-third full of grease to prevent overheating.

3. Press the outboard bearing seal into the outboard bearing housing.

Note: Use proper tool for assembly so lip seal does not cock.

The bearing seal must be positioned with the lip facing outward. The bearing seal is positioned in this fashion to exclude contaminant so some grease leakage may occur. Pre-lubricate lip seal with a thin film of grease.

4. Slide the outboard bearing housing over the shaft and outboard bearing. Place the bearing grease retainer against the outer race of the outboard bearing and place the snap ring into the snap ring groove in the outboard bearing housing. Be sure the snap ring is firmly seated in the groove by tapping it with a soft steel punch. The bevel on the snap ring must face away from the outboard bearing.

5. Press the inboard bearing seal into the inboard bearing cover with the lip pointing away from the bearing. Press the bearing cover into the inboard end of the frame. The bearing seal is positioned in this fashion to exclude contaminants. Some grease leakage may occur. Pre-lubricate the lip seal with a thin film of grease.

6. Slide the shaft assembly, impeller end first, into the outboard end of the frame. This may be best performed vertically. Be careful to make sure that the inboard bearing seal does not get damaged.

7. Assemble the bolts to hold the bearing housing to the frame. Do not tighten the bolts fully until the rotating element is placed into the casing and the impeller clearance is adjusted.

8. Assemble the deflectors on both ends of the frame.

9. Insert coupling key onto the shaft.

## Wet end

### Pumps with packing:

1. Insert packing base ring, two rings of packing, lantern ring, and the three additional rings of packing in the stuffing box using the shaft sleeve as a guide. Remove the shaft sleeve from the stuffing box. Make sure the lantern ring lines up with the stuffing box lubrication hole. The last ring of packing may not fit into the stuffing box until the packing gets compressed in service.

2. Install the O-ring in the shaft O-ring groove.

3. Slide the shaft sleeve over the shaft. Position the set screw hole in the shaft sleeve directly over the dimple in the pump shaft. Place the set screw through the sleeve and into the pump shaft using a retaining compound, such as Loctite 271, to lock the set screw. Do not over-tighten the set screw.

4. Place the stuffing box cover onto the frame and secure with two bolts. This may be best performed vertically.

5. Slide the packing gland into position. Tighten the gland nuts until "finger-tight". Two nuts are provided on each side for locking purposes.

### Pumps with standard double mechanical seal:

1. Install the O-ring in the shaft O-ring groove.

2. Take the stuffing box cover and place on a flat surface with the seal cavity facing up.

3. Install the inboard mechanical seal seat with O-ring into the bottom of the stuffing box.

4. Install the outboard mechanical seal seat with O-ring into the gland.

5. Grease the gasket and place on the gasket face of gland.

6. Coat the sleeve with a thin film of 10 weight silicon oil to provide a lubricant for assembly. Also coat seal faces for initial start-up. On a clean workbench, set the shaft sleeve (with the set screw hole toward the open end of the stuffing box) in the centre of the stuffing box. Install rotary parts of seal over sleeve. Care must be taken not to damage the seal face.

NOTE: When performing this step, be sure that the rotary parts and sleeve are carefully inspected.

7. Bolt the gland to the stuffing box cover using caution not to damage the seal. Use screws and washers.

8. Place the sleeve, mechanical seal and stuffing box assembly onto the shaft. Position the set screw hole directly over the dimple in the shaft. Insert the set screw into the sleeve using the dimple in the shaft as the locking point. Use a retaining compound, such as Loctite 271, to lock the set screw. Do not over-tighten the set screw.

9. Using screws, bolt the stuffing box assembly to the frame.

10. Apply water under pressure (40 psi to 60 psi) to the seal chamber and rotate the shaft slowly to check for leaks. If there is no sign of leakage, continue with assembly. Should leakage occur, the seal bellows may need to be repositioned on the shaft sleeve. This is accomplished by sliding the bellows toward the stationary seal where leakage appeared. This will require repeating steps 6 through 10. If the pump is not to be placed in service immediately, be sure that the stuffing box is completely dry to prevent any rust formation. You must continue with all assembly steps and include the impeller clearance adjustment. Seal bellows will seize against the sleeve after a short time and the impeller adjustment after that point can result in mechanical seal leakage.

11. If wearplate is to be replaced, apply retaining compound, such as Loctite 222, to wearplate and press it into the suction cover. Be sure that the wearplate seats firmly against the machined surface. The chamfered edge must face down.

13. Place the impeller key in the shaft keyway and slide the impeller on the shaft taper.

14. Assemble the impeller nut and tighten.

CAUTION: The dog point of the set screw must be fitted in the drilled hole. If this is not done, the impeller nut can loosen. Failure to do so may result in equipment and/or property damage. Do not over-tighten the set screw.

15. Place a new casing joint gasket onto the gasket surface of the stuffing box using a thin film of grease around the gasket.

16. Reassemble the complete rotating element of the pump into the casing. Be careful not to pinch the gasket. Insert bolts and a washer that secures the frame to the casing.

NOTE: When performing this step, be sure that the bearing housing bolts installed in Step 1 of the Frame Assembly are loose, and remain loose during assembly. Failure to do so may result in damage to the pump bearing housing.

Pull the casing bolts down evenly and tighten by hand, making sure the frame is not "cocked" in the casing, then start "snugging" the bolts. Do not completely tighten each bolt before tightening the next. It is recommended that the first bolt be tightened by ½ a turn, then tighten the bolt 180° opposite the first, now move to two bolts at the 90° and 270° points and tighten ½ a turn. Follow this alternating procedure until all bolts are tightened.

17. Check the impeller clearance. Adjust the number of shims to obtain the proper axial clearance between the impeller and wearplate.

18. Replace the driver and align to the pump as per the “Alignment Procedure”. Replace any shims or dowels.

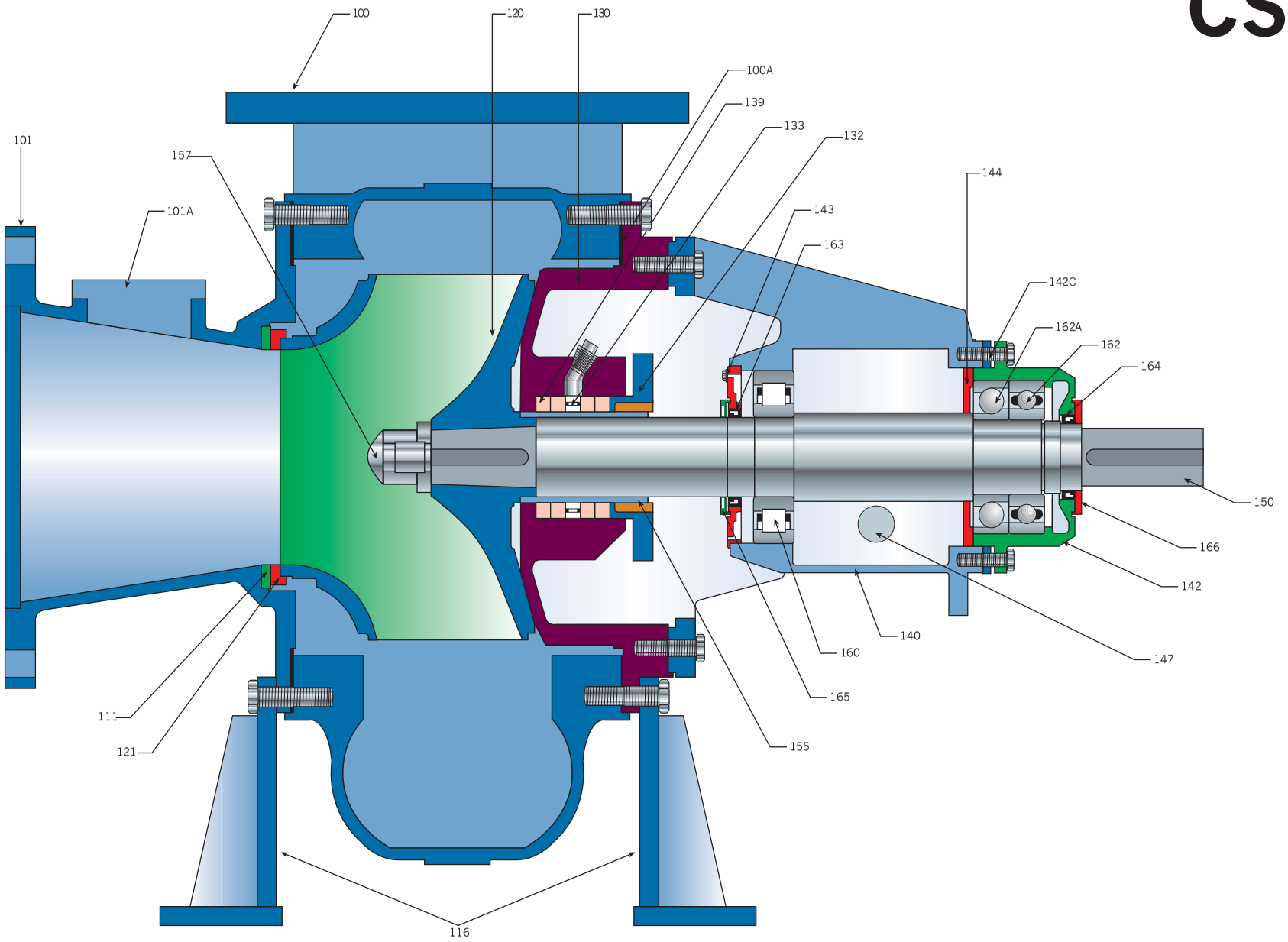
19. Reconnect the power source. Check for proper rotation of motor.

20. Reconnect the coupling between the pump and driver and re-check alignment.

21. Connect the piping to the stuffing box and turn on the sealing liquid.

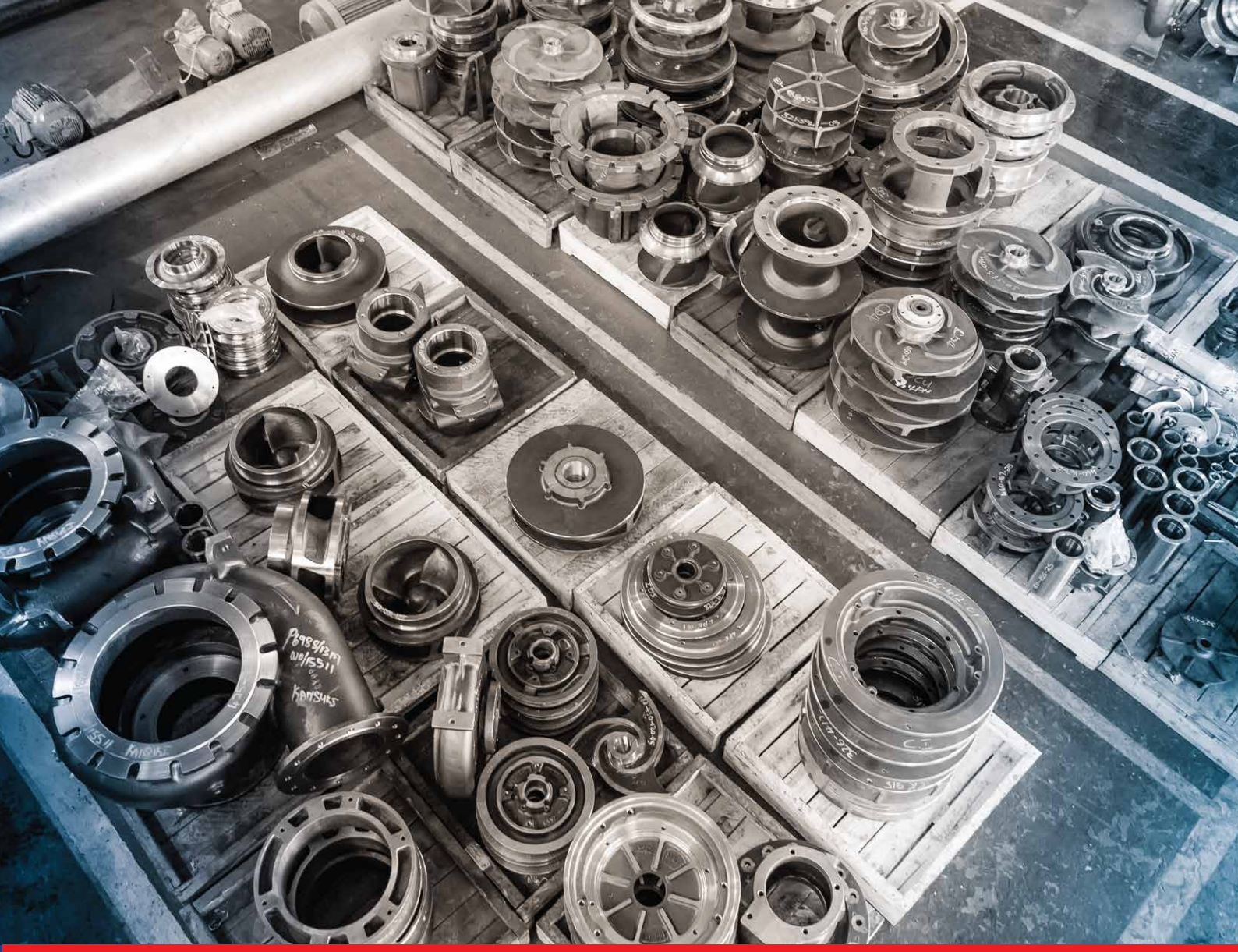
22. Open the valves, making sure that the unit is primed before starting.

# Waste Water Pump
# CSY Series




**PLEASE NOTE:**
When ordering spare parts, indicate model size, material of construction and / or pump serial number.

| Catalog Code | Part Name |
|---|---|
| 100 | Casing |
| 100A | Casing Gasket |
| 101 | Suction Cover |
| 101A | Handhole Cover |
| 111 | Wear Plate (Suction Cover) |
| 115A | Rear Side Plate Gasket |
| 116 | Foot Casing |
| 120 | Impeller |
| 121 | Wear Ring (Impeller) |
| 130 | Stuffing Box Cover |
| 132 | Gland |
| 133 | Lantern Ring |
| 139 | Packing Ring |
| 140 | Frame |
| 142 | Bearing Housing |
| 142C | Adjusting Shims |
| 143 | Bearing Cap |
| 144 | Bearing Retainer Plate |
| 147 | Oil Sight Glass |
| 150 | Shaft |
| 151 | Slinger |
| 155 | Shaft Sleeve |
| 157 | Shaft Nut |
| 160 | Roller Bearing (Inboard) |
| 162 | Ang. Contact Bearing (Outboard) |
| 162A | Ball Bearing (Outboard) |
| 163 | Oil Seal P.E |
| 164 | Oil Seal C.E |
| 165 | Deflector (Inboard) |
| 166 | Deflector (Outboard) |



# SAMengineering

## Customised Pump Solutions

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