J. & P. RICHARDSON INDUSTRIES PTY. LTD.
A.C.N. 001 952 325



# BRISBANE CITY COUNCIL

# METROPLEX ON GATEWAY SP281

# SEWERAGE PUMPING STATION

# OPERATION AND MAINTENANCE MANUAL

BY
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## 1.0 PUMPS

SUPPLIER: KSB AJAX
CARBERRY STREET
EBBW VALE QLD 4304

PH: (07) 3282 1766
FAX: (07) 3816 0172

| | |
|---|---|
| MODEL: - | E100-380 4PL TYPE TLC |
| SERIAL NO: | F51274-1 & F51274-2 |
| MOTOR KW RATING: | 40KW |
| MOTOR SPEED: | 1470RPM |
| FULL LOAD CURRENT: | 67.0AMPS |
| VOLTAGE: | 415V |

# SERVICE MANUAL

**KSB Ajax Pumps Pty. Ltd.**

# KSB AJAX PUMPS PTY LTD

# IPSWICH WORKS

*All members of the KSB Ajax Pumps Works staff are pleased to have been part of the team who produced your unit. Every effort is made by us to ensure the product you have purchased is finished to the highest standard.*

Our Ref: Submersible-D300-Version 1.0
Manual Part Number: 5399D30

## PROJECT DETAILS

Pump Model: E100-380 TLC
Motor: 40 KW 4 Pole
Project Drawings: N/A
Pump Serial Number: F51274-1/2

## PERFORMANCE DETAIL

Duty: 58 L/s @ 32 M
Pump Efficiency: 64%
Motor Efficiency: 92%
KWH/KL: 0.1486

## SPECIAL CONSTRUCTION DETAILS

Cable Length: 20 MTRS
Thermistors Fitted: YES
Water Sensor Fitted: NO
Cable Connection: DELTA

## CLIENT

Customer: J & P RICHARDSON INDUSTRIES
Project: BRISBANE CITY COUNCIL
Pump Station: METROFLEX ON GATEWAY
Contract Number: N/A

*FOR AFTER SALES AND SERVICE CONTACT YOUR LOCAL KSB AJAX PUMPS BRANCH:*

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TOTTENHAM VIC 3012
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# 1.0 TECHNICAL DATA

## 1.1 PUMP TECHNICAL DATA

### 1.1.1 DESCRIPTION

Pump Manufacturer: KSB AJAX PUMPS
IPSWICH PUMP WORKS

### 1.1.2 PUMP DRAWINGS

Sectional Arrangement: REFER APPENDICES 12.1

Dimension Drawing: REFER APPENDICES 12.6

### 1.1.3 PUMP WEIGHT

Pump Components Weight: REFER APPENDICES 12.6

## 1.1.4 MOTOR TECHNICAL DATA

### 1.1.5 DESCRIPTION

Motor Manufacturer: KSB AJAX PUMPS
FORRERS PUMP WORKS

### 1.1.6 MOTOR PERFORMANCE DETAILS & MOTOR HARDWARE DETAILS

REFER APPENDICES 12.7 (MOTOR TECHNICAL DATA)

Motor Weight: REFER APPENDICES 12.7 (MOTOR TECHNICAL DATA)

### 1.1.7 MOTOR DRAWINGS

Sectional Arrangement: REFER APPENDICES 12.1

Mechanical Seal: REFER APPENDICES 12.1

Wiring Diagram: REFER APPENDICES 12.8

## 1.2 PUMP IDENTIFICATION

To ensure the correct procedure is followed when working on equipment and ordering spares it is essential you identify equipment correctly.

Pump units are fitted with an identification similar to:

KSB AJAX PUMPS PTY LTD

SUBMERSIBLE INDUCTION MOTOR (AS1359) AND PUMP

CONTRACT NO. [ ] SEAL NO. [ ]

PUMP TYPE [ ] MOTOR [ ]

VOLTS 3 PHASE HERTZ [ ] AMPS

RATING S1 INSUL F DESIGN [ ] CONN [ ]

KW [ ] RPM [ ] L/SEC [ ] HEAD [ ] M

MADE IN AUSTRALIA 199[ ] IPSWICH PUMP WORKS

**DETAILS ARE:**

**Contract Number** - filled in with clients contract number if known.

**Serial Number** - special serial number for this unit. This number must be quoted to ensure correct spares are supplied.

**Pump Type** - details specific pump model.

**Motor** - this nominates the motor frame size. This allows the client to follow correct procedure in the following manual eg. FR300 refers to a motor with a stator diameter nominally 300mm.

**Volts** - indicates correct operating volts.

**Hertz** - indicates correct operating frequency.

**Amps** - indicates motor full load current.

## 2.0 PRINCIPLES OF OPERATION

### 2.1 PUMP DESCRIPTION

This pump unit is a submersible, wet well, sewage pump close coupled to a submersible motor. The non clog impeller is double shrouded non-clog design with open passages to minimise the possibility of blockages while pumping sewage. The impeller and pump case are fitted with replaceable wear rings on the suction side of the impeller to maximise the life of the major components. The impeller is mounted directly onto the motor shaft via a key and positively locked by means of a lock nut. The impeller is balanced at the factory before dispatch. Motor and pump are fitted with a one piece stainless steel shaft.

Also available is a cutter pump where an open vane impeller operates against serrated suction cover. This creates a shearing action which is particularly effective for breaking down plastics and rags.

The pump and motor are normally mounted vertically. In the most common configuration a discharge stand is permanently fixed to the wet well floor. The discharge of the pump is fitted with a locking plate, which forms an automatic seal with the discharge stand when the pump is lowered onto the stand. Guide rails run from the stand to the top well opening to guide the pump onto the stand. Should maintenance on the pump or motor be required the whole unit may be lifted from the well even if the well is full.

The pump is also available in a free standing configuration, different guide arrangement or a dry well application in which the motor is fitted with a cooling jacket.

Once installed the pump will operate continuously provided there is fluid present to be pumped.

Automatic control of the pump can be achieved with a variety of electrical or mechanical controls. The pump may be stopped by isolating the motor from the power supply. **For the safety of maintenance staff it is recommended that a remote lockout type stop button or isolator is provided near the well in case of emergency.**

This is particularly important if the switchboard controlling the pump is remote from the pump station.

The pump end is normally constructed of a heavy duty high quality cast iron. All fixings are stainless steel (special materials of construction are used when specified).

## 2.2 MOTOR DESCRIPTION

This motor is a KSB Ajax Pumps, Forrers Works submersible motor. The motor is cooled by the pumping medium around the outside of the motor frame in the well. It is recommended that the motor operates submerged during its normal pumping cycle. With jacketed motors product fluid is circulated through jacket to provide cooling. It is recommended (although not essential) where possible to circulate clean water through this jacket. The motor frame is designed for heavy duty application and is constructed from cast iron. The stator assembly consists of laminations of low loss electrical grade steel clamped together with cleats in dovetail slots.

The windings are copper wire coated with polyester imide to a thickness complying with AS1194 Grade 2 insulations. The insulation material is Class F to BS2757. The winding overhangs are laced together securely then impregnated with a Class F varnish and baked at high temperature to cure the varnish to a solid homogeneous mass. Insulation is carried out using a vacuum impregnation process.

The winding tails consist of tinned, flexible copper wire of sufficient diameter to ensure that the current density at the rated load does not exceed 3.5 Amperes per square millimetre. The tails are insulated with Class F material. The winding tails are run to a terminal box. Motors below 3kw use a 3 wire star connection. 3kw and above have 6 wires to the terminal block.

The stator windings contain one positive temperature coefficient (P.T.C.) thermistor per phase in the overhang. The three thermistors are connected in series and the wires taken to a terminal block in the terminal box.

The rotor core is made of laminations of low loss electrical grade steel. These are stacked and fixed by pressure case aluminium or copper bars. The rotor is shrunk onto a stainless steel shaft and dynamically balanced.

The motor is sealed from the pump by a double mechanical seal. Seals consist of tandem seal configuration. In standard arrangement the upper seal is silicon carbide against carbon with the lower seal being silicon carbide against silicon carbide. Upper and lower seal faces are separated by an oil filled chamber.

NOTE: Motors manufactured at KSB Ajax - Ipswich Works use a white mineral oil (Whiterex 307) or equivalent which is low-toxic and environmentally friendly.

## 3.0 OPERATING PROCEDURE

### 3.1 CAUTION

**NOTE: ANY INTERFERENCE WITH THE ENCLOSURE OF THE ELECTRIC MOTOR VOIDS ANY WARRANTY ON THE ELECTRIC WINDINGS AND TERMINALS. ENSURE CORRECT SUPPLY VOLTAGE AND PHASE ROTATION IS SUPPLIED TO MOTOR AS INCORRECT ROTATION CAN CAUSE PERMANENT DAMAGE TO EQUIPMENT.**

### 3.2 STARTING

3.2.1 Check that the complete rotating element is free to turn prior to connecting electrical power.

3.2.2 Ensure pump and motor are fully submersed prior to operating. In the case of a dry well application ensure volute is full of fluid and a positive head exists on the inlet of the pump.

**NOTE: WHERE STARTING CONDITIONS HAVE BEEN CHECKED THE PUMP MAY BE STARTED WITH AN OPEN DELIVERY VALVE. AS WITH ANY CENTRIFUGAL PUMP PROLONGED OPERATION AGAINST A CLOSED DISCHARGE VALVE IS NOT RECOMMENDED.**

3.2.3 Where the discharge line has not been charged with fluid it is permissible to operate the pump against a partially closed discharge valve.

3.2.4 Ensure there is sufficient fluid in the well and then start the motor. Ensure equal and correct voltage is supplied to each phase.

3.2.5 Open the pump delivery valve slowly until the required pressure or flow is obtained.

**CAUTION: 1. PROLONGED RUNNING WITH A CLOSED DELIVERY VALVE CAN DAMAGE PUMP INTERNAL COMPONENTS AND MUST BE AVOIDED.**

3.3 **CONTINUOUS OPERATION**

Most pump installations run under automatic control so providing the pump unit has been commissioned correctly and maintenance schedules are maintained the pump unit requires little additional supervision unless there is a duty change required.

3.4 **STOPPING**

Isolate the motor from the mains and mechanically lock the isolator out. If work is to be carried out on the pump unit ensure that the isolator is mechanically locked open and power supply is isolated from motor. **Do not restart the motor before it has fully stopped.** Restarting the motor results in very high current fluctuations in the motor windings and pressure surges in the rising main and may cause serious damage to the unit or the system.

3.5 **EMERGENCY STOPPING**

Follow the procedure outlined in Section 3.4 above. It is recommended that lock out isolators be installed at all points where work is to be carried out on the pump or its associated equipment.

3.6 **ENSURING MAXIMUM LIFE FOR YOUR UNIT**

In the interest of ensuring maximum benefit and life from equipment the following basic recommendations should be followed:

a) Operate with correct power supply,
b) Provide adequate protection for equipment in the form of thermistor protection, and overload protection set to suit motor rating,
c) Do not run dry or without an adequate supply of fluid (run with motor submersed),
d) Run units in correct rotation (clockwise when viewed from drive end),

e) Operate pump in its correct range of design flow and discharge pressure.
f) Use pump in pumping medium for which unit was designed.
g) Ensure regular maintenance of station pumping units and ancillary equipment is carried out.

## 4.0 GOODS INSPECTION AND STORAGE

### 4.1 INSPECTION

4.1.1 Immediately on receipt of the equipment, inspect it thoroughly. Examine the crate and the wrapping before discarding them, since parts or accessories are sometimes wrapped individually or fastened to the crate.

4.1.2 Report any damage or shortage to KSB Ajax Pumps and the carrier immediately. All claims must be made (or confirmed) in writing within seven days.

4.1.3 If the equipment is not being installed immediately, it must be stored under suitable conditions.

### 4.2 STORAGE

#### 4.2.1 SHORT TERM

4.2.1.1 When it is necessary to store a pump for a short time before it is installed, place it in a dry location. Ensure cable ends are kept dry and cable is protected against mechanical damage.

4.2.1.2 To prevent rusting-in or seizing, lubricate the unit before storing paying particular attention to components which run in close tolerance, eg. wear rings, etc. Turn the pumpset by hand at least once a week. Extreme care should be exercised with regard to the motor cables: ensure, that the pump dose not stand on the motor cables and that the cable seal on the end of the cable is not damaged as it prevents water entering the cable.

4.2.2 **LONG TERM**

4.2.2.1 More thorough precautions are required if the pump is to be stored for an extended period of time. Refer to IPSWICH PUMPS WORKS for full information on long term storage.

Do not store any equipment in any area which is subject to either direct or indirect vibration as this can have a detrimental effect on bearings.

## 5.0 PIPEWORK INSTALLATION

### 5.1 DELIVERY PIPEWORK

5.1.1 It is essential to ensure that the delivery pipework is adequately supported and anchored to resist hydraulic thrust.

5.1.2 If the delivery pipe does not rise continuously air pockets can form in the pipe at high spots. If is good pumping practice to remove these air pockets in the pipe by venting the air through an air release.

# 6.0 PUMPSET INSTALLATION

## 6.1 PROCEDURES PRIOR TO INSTALLATION

### 6.1.1 CLEANING PRIOR TO INSTALLATIONS

6.1.1.1 All packing and crating should be removed and discarded prior to starting the installation procedure. Check all the packing before discarding it to ensure that no parts or accessories are attached to it in individual wrappings.

6.1.1.2 All parts of the assembly must be thoroughly cleaned before installation begins. All traces of rust preventative must be removed from the discharge and suction faces, exposed shafting, and all coupling surfaces.

### 6.1.2 LAY-OUT OF PUMP PARTS FOR INSTALLATION

6.1.2.1 Care must be taken to avoid damage to components whenever handling or installing them.

6.1.2.2 If suitable lifting tackle is not available, skids must be employed to transfer heavy weights at ground level. Loaded crates, individual components or subassemblies must never be dropped to the ground from a transport vehicle.

6.1.2.3 Individual components should be layed out on clean dry timbers or on a suitably cleaned surface in the order which they will be installed.

6.1.2.4 Any packing or other protective material must be removed before starting the installation procedure.

## 6.2 PUMPSET FOUNDATION

6.2.1 An adequate pump foundation is essential. It should consist of a solid block of concrete brickwork or masonry sufficiently massive and rigid to provide continuous support for the pump pedestal throughout the pumps life.

6.2.2 The top of the foundation plinth should be 25mm to 38mm below the required finished height of the stand's lower flange. This is to allow the discharge stand to be adjusted and levelled during installation. The remaining gap is filled with grout after levelling to provide support to the discharge stand.

6.2.3 Foundation bolt holes should be prepared in the foundation plinth to match the discharge stand holes. Each hole should be drilled the correct diameter to accept the masonry anchor.

## 6.3 PEDESTAL STAND LEVELLING

6.3.1 Position the masonry anchors or fixings using stand or dimension drawing as a guide.

6.3.2 Place solid packers approximately 30mm high on either side of each masonry anchor.

6.3.3 Sling the stand and lift it onto the anchors so that it sits on the packers. Level the discharge stand by placing shims between the packers and the stand.

6.3.4 Once the stand is level place a washer on each masonry anchor and screw on the nuts. Tension the nuts, until the masonry anchor has gripped firmly and the stand is clamped tight. Check stands for level after tensioning.

## 6.4 GROUTING

6.4.1 The use of good grout is important when installing a pump as it prevents lateral movement of the pedestal stand and damps vibration. The use of a non-shrink grout or other available propietry product is recommended. (Hilti provide a range of suitable fixings, adhesives & grouts).

6.4.2 After levelling and alignment is completed and all foundation bolts pulled down tightly, preparation for grouting the stand can commence. Boxing should be placed around the stand's lower flange to contain the grout when it is poured.

6.4.3 Manufacturer recommendations for application of grouting material should be followed.

**NOTE: IT IS IMPORTANT THAT THE GROUT FILLS THE CAVITY BETWEEN THE LOWER FLANGES AND THE FOUNDATION SO THAT FULL SUPPORT IS GIVEN TO THE STAND. IF NECESSARY USE A VIBRATING TOOL TO SETTLE. IT SHOULD BE CHECKED THAT THE GROUT DOES NOT SHRINK FROM THEN STAND'S FLANGE AFTER CURING.**

6.4.4 The exposed surfaces should be covered and allow to cure before loading as per Manufacturer recommendation.

6.4.5 When the grout is set, the boxing should be removed and a smooth finish given to the grout and foundation surfaces. Manufacturer recommendations should be followed.

6.4.6 After curing, where applicable guide rails and top bracket can be fitted.

## 6.5 CONNECTING THE PUMP

### 6.5.1 SUBMERSIBLE

Before lowering the pumpset onto the discharge stand the motor and pump should be checked as per Section 3 of this manual.

6.5.2 After carrying out the above checks the pumpset is ready to be installed on the discharge stand. Attach a sling to the lifting points on the motor and position the pumpset across to the well opening and lower it onto the guide rail. Lower the unit down the guide rail until it locks onto the discharge stand. It may be necessary to manipulate the unit by hand while supported to ensure that it has seated home correctly and that the seal between the pump and discharge stand is complete. Keep the pump completely vertical when lowering into position.

### 6.5.3 FREE STANDING

In the case of free standing pump, discharge pipework is securely attached to the pump discharge prior to lowering into position. It is advantageous to fit pipework with a quick connect type coupling. Ensure the pump is mounted on level foundations and slung to prevent turning.

### 6.5.4 DRYWELL

Pipework is connected to inlet and outlet.

**NOTE: UNDER ALL CIRCUMSTANCES WHEN CONNECTING PIPEWORK, DO NOT FORCE OR LOAD JOINTS. NO LOAD SHOULD BE TRANSFERRED TO PUMPS OR PEDESTALS. WHERE NECESSARY USE RUBBER STYLE JOINTS TO PREVENT TRANSFER OF VIBRATION OR LOAD TO PUMPS.**

## 6.6 COMMISSIONING THE PUMPSET

6.6.1 Start the pump unit as per Section 3 of this manual.

6.6.2 Allow it to run for approximately ten minutes to fill the pipeline with fluid and stabilise in its operation. Test readings of head, flow, voltage, current and power should then be taken to check that the unit is operating correctly. If flow measurement equipment is not available then the flow may be calculated by measuring the rate at which the fluid level drops in the wet well. The flow may be adjusted by altering the setting of the discharge pipe valve. Where pumps start against an empty rising main, operate against a partially closed valve.

6.6.3 Once the commissioning procedure outlined above has been finished the pump unit should be shut down as per Section 3 of this manual.

## 7.0 MAINTENANCE SCHEDULES

### 7.1 ROUTINE MAINTENANCE

**ALWAYS COMPLY WITH CORRECT PROCEDURES WHEN MAINTAINING PUMPING EQUIPMENT. UNDER ALL CIRCUMSTANCES SAFETY FIRST.**

When a pump station is initially commissioned it should be visited daily for the first two weeks to check that all the systems are working correctly. Particular care should be taken with a new installation that foreign matter such as concrete, tins, timber or tools do not foul the pump. The wet well should be hosed down and pumped to its minimum level each day to check for such foreign matter. All such material should be removed.

Each time the pump station is visited readings of the hours run, voltage and current should be taken and recorded in a station log book for each pump. Abnormalities in these readings are often the first sign that maintenance is required on the pump unit. Ideally the station should be visited on a daily basis to check the pumps operation, record the above data and clean any build ups of fats or foreign material in the wet well. The required frequency of visits to the well can often be established by the attention required during the daily visits for the two weeks following commissioning.

### 7.2 PERIODIC MAINTENANCE

7.2.1 The tables in Appendix 12.2 give the recommended times for periodic maintenance checks. The major check required is a six monthly or 1500 hour inspection of the motor. The procedure to be followed in this check is detailed in the following section.

7.2.2 The pump unit requires a complete overhaul once either the delivery head drops below an unacceptable level or the power consumption rises significantly. The establishing of acceptable variation to the installed performance is normally left to the maintenance engineer's discretion, however a variation of 15% in power, flow or head usually warrants investigation. The unit should then be returned to KSB Ajax Pumps or the instructions in Sections 8 to 11 followed to repair the unit.

7.2.3 Where a pump station involves sub-contractors associated equipment it is important that their instructions are read so that a fully comprehensive maintenance schedule can be drawn up for the station.

7.2.4 **SIX MONTHLY OR 1500 HOUR INSPECTION**

7.2.4.1 The pump and motor should be checked every six months or 1500 hours of operation, whichever comes first. The checks cover the condition of the electrical insulation in the motor windings, condition of the mechanical seal and the wear of the pump components.

7.2.4.2 Refer to Section 8 to electrically disconnect the motor and lift the motor-pump from the pump well. Where possible, the incoming power isolator should be padlocked in the **'OFF'** position. Any electrical work on the enclosure of the electrical motor, should be carried out by suitably qualified personnel. Any work should be conducted following good safety procedures.

7.2.4.3 Inspect the pump end for wear or damage. Ensure all the fasteners are tight. Inspect the discharge sealing ring (120) for damage or excessive wear.

7.2.4.4 Refer to section 8 for instructions on disassembly of pump.

7.2.4.5 Check the diametrical clearance between the impeller wear rings and the case wear rings. If the diametrical clearance is greater than 1.5mm the wear rings will require replacement. Refer to section 8 for wear ring removal.

7.2.4.6 After the inspection refer to Section 11 for instructions on the procedure for replacement of pump components.

7.2.4.7 The mechanical seal should be checked to ensure it is sealing correctly. Leaving pump/motor upright remove the upper plug (15B) sealing the oil reservoir in the lower end of the motor. Draw off a small sample of oil (approx. 100mls) and put into a clean glass container. Allow the oil to settle. Inspect the oil to see that it is not milky or that water has not settled at the bottom of the container. Caution should be taken when removing the taper plugs as the oil may spray out if the pressure remains in the oil chamber.

7.2.4.8 If the oil contains water and it has been ascertained that it has not leaked through the plugs the mechanical seal may require reconditioning. Refer to Section 9 for the procedure to remove the mechanical seal.

It is quite acceptable under normal operating conditions for a small amount of water to infiltrate into the seal chamber. Above 5 percent contamination normally indicates a problem with the seal.

7.2.4.9 Refer section 1 for motor frame identification.

If the oil tested is only milky (less than 5%) it is acceptable practice to drain the oil chamber and refill with Mobil Whiterex Type 307 white mineral oil or equivalent.

For motor frame 300 lay motor on side. Remove plugs 15(c) & 15(b) then roll motor over to drain oil into a suitable container.

Roll unit over with motor still on its side and plug holes to top. Fill chamber completely with oil. After applying thread sealant replace plugs 15(c) and 15(b).

7.2.4.10 If the motor was previously stripped refer to Section 10 for motor assembly and mechanical seal assembly. Ensure that the impeller is free and revolving truly and reinstall pump-motor unit back into the pump station.

7.2.4.11 Refer to Section 3 for the procedure for reconnecting the motor to the switchboard and starting the pump.

## 8.0 TO DISASSEMBLE THE PUMP

### 8.1 PREPARATION PRIOR TO DISASSEMBLY

8.1.1 Isolate the electric motor from the mains by opening the main isolator supplying power to the switchboard or lock the power isolator and control circuit isolator for the unit (remember safety first) in the **'OFF'** position.

8.1.2 Disconnect power and control cables.

8.1.3 Close the discharge isolating valve.

8.1.4 Remove the pump from the well and thoroughly clean down the outside of the pumpset. In the case of dry well pumps it is often easier to leave volute in line and remove motor with impeller fitted.

8.1.5 The highest possible standard of cleanliness must be maintained throughout any maintenance operation.

### 8.2 DISASSEMBLY PROCEDURE (REFER SECTION 12 FOR SECTIONAL ARRANGEMENT DRAWING)

For Non Clog Pumps

8.2.1 **To remove the impeller**

8.2.1.1 Stand the pump-motor unit upright on clean, dry timbers, ensuring that it is stable. Chock it securely.

8.2.1.2 Remove the nuts, which secure the motor to the volute.

8.2.1.3 Attach a sling to the lifting points on the motor and using suitable safe lifting equipment lift the motor off the pump end. If the gasket will not release the motor from the pump end raise the pump-motor unit approximately 5mm off the timber and strike the volute with a soft hammer onto a piece of timber. The motor complete with impeller can be withdrawn from volute.

8.2.1.4 Remove gasket /O Ring between volute and motor (113) if damaged in any way.

8.2.1.5 Position the motor unit on a bench at a suitable working height and chock it securely.

8.2.1.6 Secure the impeller (102) to prevent rotation.

8.2.1.7 Remove the locknut (103) and washer (104). Using a puller remove the impeller (102) from the shaft. The impeller is driven by the shaft using a tapered drive and key. The impeller may require a gentle impact to remove. In the case of an impeller being difficult to remove the application of heat to the impeller will assist in its removal. Rapid heating of impeller minimising heat transfer to the shaft provides best results. When impeller has parallel bore an impeller puller is required to jack impeller off shaft.

8.2.2 Complete disassembly.

8.2.2.1 Check the diametral clearance between the volute wear rings (108) and the impeller wear rings (107). if the diametral clearance is greater than 1.5mm the wear rings will require replacement. Replacement if also recommended if significant scoring of wear rings has occurred. Excessive wear of wear rings result in less efficient operation of pumps, flow loss and head loss, therefore resulting in higher operating costs.

8.2.2.2 To remove the impeller wear rings (107) set the impeller in a lathe and machine if off. If a lathe is not available grind a flat through one side of the wear ring and knock the wear ring off. Ensure the original machine surface of impeller under wear ring is not damaged.

8.2.2.3 To remove the case wear ring (108) press the wear ring out of the volute.

8.2.2.4 Remove the key (33) from the shaft (4).

8.2.2.5 Discard any gasket if damaged.

8.2.2.6 Remove the discharge sealing ring (120) if it is worn, perished or damaged.

8.2.2.7 Clean all the components thoroughly and lay them out ready for reassembly.

8.3 **DISASSEMBLY OF CUTTER PUMPS.**

8.3.1 Remove Suction Cover.

8.3.2 Remove impeller lock nut then remove impeller (a puller will be required). Procedure is similar to non-clog pumps for other disassembly work.

## 9.0 TO DISASSEMBLE THE MOTOR (REFER SECTION 12 FOR SECTIONAL ARRANGEMENT DRAWINGS)

### 9.1 TO REMOVE THE MECHANICAL SEAL

#### 9.1.1 Introduction

9.1.1.1 Once the mechanical seal has been removed from the motor it should not be reinstalled. The seal should be reconditioned or replaced.
**REMEMBER: THE MECHANICAL SEAL IS THE HEART OF THE SUBMERSIBLE MOTOR. LAY MOTOR ON ITS SIDE AND DRAIN OIL AS PER SECTION 7.**

9.1.1.2 The area in which the motor is worked on MUST be very clean and extreme care should be taken not to damage or scratch the sealing area on the shaft or any of the seal components. The faces of the mechanical seal are lapped to obtain a flatness not achievable in the field and rapid deterioration of the seal faces may occur unless the instructions are followed implicitly. External seal faces are silicon carbide. This material is very hard but brittle and should be handled with extreme care.

9.1.1.3 Clean shaft under seal. Remove retaining circlip 21B and back up washer 21A. Remove external seal 21 by sliding off shaft. After being installed the rubber bellows will adhere to the shaft. The bellows may require slight compression to break the adhesion to shaft. The seal will require reasonable force to slide off the shaft.

9.1.1.4 Remove set screws (13) and spring washers (9) securing seal plate (12) to motor housing (1). Slide the seal plate (12) over the shaft (4) taking care not to let the seal seat of the external seal (21) come in contact with the shaft. Remove air compensator bag (17).

9.1.1.5 Place seal plate on a flat surface with rag placed beneath the seal seat area. Push the seal seat out from the top of the plate so that the seat is caught on the rag.

9.1.1.6 Remove retaining circlip, back up washer and seal head of the internal seal (97) with bellows as per external seal.

## 9.2 TO REMOVE THE CABLE ASSEMBLY

9.2.1 Attach support to the cables and take the weight of the cables.

9.2.2 Remove the hex head set screws (26) and (22) and spring washers (27) holding the terminal box (16) to the motor housing (1).

9.2.3 Move the terminal box (16) away from the side of the motor a sufficient amount to be able to access the terminal blocks (232). Be careful not to strain the cable leads or the motor tails which connect to the terminal blocks.

9.2.4 Disconnect cable after recording their position.

9.2.5 Lift the entire cable assembly clear of the motor and place it in an area which is clean and dry.

9.2.6 Remove the O-ring (11E).

9.2.7 **To check the cables**

9.2.7.1 Inspect the inside of the terminal box for any signs of water leaking into the motor. If water is present check the O-ring (11E) and the condition of the sealant (210). Also thoroughly inspect the cable for any nicks and cuts on the outer sheath.

9.2.7.2 Check the continuity of each lead in the cable with a multimeter. The resistance of the leads should be equal.

9.2.7.3 Check the insulation between each cable and all the rest of the cables with a 500 volt Meggar meter. The insulation between each lead and the terminal box should also be checked. All readings should be infinity.

If readings are irregular disconnect stator winding tails from terminal blocks (232) then carry out above continuity & insulation checks.

**9.3 DISASSEMBLY PROCEDURE**

9.3.1 Remove the set screws (35) and spring washers (36) from the top bearing cap (34). Remove the top bearing cap (34) from the motor housing (1).

9.3.2 Discard the O-ring (11C) from the top bearing cap (34) if O-ring (11C) is not in perfect condition.

9.3.3 See note below. Remove the set screws (9) and spring washers (13) holding the motor housing (1) to the bottom bearing bracket (7).

9.3.4 Using the jacking screw holes provided jack the motor housing (1) off the bottom bearing bracket (7).

9.3.5 Lift the entire motor frame vertically until it clears the top of end of the shaft (4). Lift with extreme care to ensure windings are not damaged. The slightest bump can result in permanent damage. The inner ring of the top bearing (5) remains on the shaft, sliding through the rollers of the bearing and through the oil seal (96). Place the motor frame on clean dry timbers.

**NOTE:** The motor housing should only be initially lifted 100mm. The lead to the water sensor probe (32) should be disconnected before lifting the motor completely off the bottom bearing bracket.

9.3.6 Discard the O-ring (11A) if not in perfect condition.

9.3.7 Remove the oil seal (96) by tapping it down, out of the bore, allowing it to drop through the motor housing.

9.3.8 Remove the outer race of the top bearing (5) from the motor housing (1). Do this by using a bearing puller or by inverting the housing and tapping the race out of the bore.

9.3.9 Clean the recess where the top bearing (5) seats.

9.3.10 If the stator (2) needs to be pressed out of the motor housing (1) the position of the stator in the housing should be measured and recorded so that it may be replaced in the same position when it is re-installed. Stator is an interference fit in the housing and requires a press to remove.

9.3.11 With 300fr motors remove fasteners (41 & 65) retaining bearing cap (40).

9.3.12 Lift the shaft (4) complete with top bearing inner ring (5), rotor (3) and bottom bearing (6) out of the bottom bearing bracket (7). If the outer race of the bottom bearing bracket (6) will not slide out of the bottom bearing bracket it may be necessary to apply heat quickly and uniformly around the boss of the bottom bearing bracket which houses the bottom bearing.

9.3.13 Lay the shaft on a clean bench at a suitable working height.

9.3.14 Remove the bottom bearing (6) with a bearing puller taking care not to damage the shaft particularly in the area where the mechanical seal sits.

9.3.15 Remove the inner ring of the top bearing (5) from the shaft with a bearing puller. It is permissible to grind a flat through one side of the ring and knock the ring off the shaft however, **extreme care must be taken** not to damage the shaft.

9.3.16 Thoroughly clean all the components and lay them out on a clean, dry surface for re-assembly.

## 9.4 COOLING JACKET

9.4.1 For special applications and dry well units, motors are fitted with a cooling jacket. The jacket consists of a cast iron chamber which allows fluid to circulate around motor housing.

9.4.2 When product is used to provide cooling, it is recommended that hoses be removed at 6 month intervals to allow jacket to be flushed out. Flushing interval can be adjusted depending on the conditions on site.

9.4.3 Jacket is a sliding fit. Remove retaining screws at top of jacket and slide jacket over housing. Under normal circumstances it should not be necessary to remove the jacket for repairs on the motor.

## 10.0 TO ASSEMBLE THE MOTOR (REFER SECTION 12 FOR SECTIONAL ARRANGEMENT DRAWINGS)

### 10.1 ASSEMBLY PROCEDURE

10.1.1 All parts including stator should be thoroughly cleaned before reassembly. If stator has been contaminated then clean and revarnish. Before the motor is re-assembled the motor housing (1) with the stator (2), shaft (4) with the rotor (3), desiccating bag (57), bottom bearing bracket (7) and seal plate (12) should all be placed in a drying oven at 80 - 90 degrees celsius overnight. The motor must be assembled on the same day that the components are removed from the drying oven, preferably while still warm. This ensures maximum displacement of any moisture from stator.

10.1.2 After the stator has been taken from the drying oven it should have the electrical checks detailed in section 3 carried out on it. It is important to carry these checks out at this stage so that it is confirmed that the stator is sound before assembly commences.

10.1.3 Before commencing to re-assemble the motor check that all the replacement parts are to hand. It is recommended that no O-rings, bearings or seals are reused when the motor is rebuilt.

10.1.4 Place the shaft (4) on a clean bench at a suitable working height.

10.1.5 Thoroughly clean the area on the shaft (4) where the bottom bearing (6) will sit with acetone to remove all traces of grease or oil. With 300fr motor, slide bearing cap (40) over shaft.

10.1.6 Clean out bottom bearing. Heat the bottom bearing (6) slightly so that it just slides onto the shaft. Do not over heat bearing. If it is necessary to apply pressure to seat the bearing against the shaft shoulder a dolly should be used to apply the force to the inner ring of the bearings. Pack bearing with grease SKFLGHT 3/1 (do not over grease). Spin bearing by hand and remove excess grease.
NOTE: Double row bearing to be fitted on shaft with filling slot facing the product end of shaft. Refer Section 12 - Bottom Bearing Installation.

10.1.7 Lift the shaft and position it above the bottom bearing bracket (7) after fitting circlip (39).

10.1.8 Lower the shaft (4) and allow the bearing to slide into the bottom bearing bracket (7). If the outer race of the bearing will not slide into the bottom bearing bracket apply heat quickly and uniformly around the boss which houses the bottom bearing. Care should be taken not to raise the temperature to a point where the grease begins to break down.

10.1.9 For 300fr fix retaining cap (40) with fixings (41 & 65).

10.1.10 Fit the inner race of the top bearing (5) to the shaft (4) using the same procedure outlined in section 10.1.5 to 10.1.7.

10.1.11 Fit the oil seal (96) to the motor housing (1) by tapping it down into its bore so that the top edge is level with the bearing bore. Ensure its correct orientation when fitting. (To retain grease).

10.1.12 Fit the outer race and rollers of the top bearing (5) to the motor housing (1). Apply heat quickly and uniformly around the boss which houses the bearing until the outer race just slides to the bottom of the bore.

Care should be taken not to raise the temperature to the point where the bearing or grease seal is affected. Use a press and suitably sized pipe jig to press outer race into place.

10.1.13 Lightly grease both the bearing race and oil seal (96) with SKF LGHT 3/1 high temperature grease.

10.1.14 Cover the top bearing (5) with a clean, dry, dust free cloth to keep dust and dirt out of the bearing.

10.1.15 If the stator (2) was pressed out of the motor housing (1) in section 9.3.5 it should be pressed back into the housing paying particular attention that it is in its original position and that the winding overhangs are not damaged in any way. Feed stator tails through side of housing and reconnect to terminal block.

The correct position of the stator (2) is centralised around the rotor.

10.1.16 Replace the O-ring (11a) on the bottom bearing bracket (7).

10.1.17 Lift the motor housing (1) across to the bottom bearing bracket. Position the housing above the shaft (4) and rotor (3) and slowly lower the housing over the rotor ensuring that the stator does not scrape down the side of the rotor.

The motor housing (1) should be held approximately 100mm above the bottom bearing bracket (7) while the control wire is connected to the water sensor (32).

10.1.18 The motor housing may require rotation to line it up with the holes in the bottom bearing bracket (7).

Care should be taken that the O-ring (11a) is not pinched as the housing seats home.

The insulation between the water sensor probe (32) and the motor housing should be checked with a 500 volt MEGGER. Test from the water sensor lead to the motor housing. The reading should show infinity.

10.1.20 Replace the fixings (9 & 13) and tighten. Through out the assembly procedure turn shaft by hand ensuring it is free to rotate at all times.

10.1.21 Replace the O-ring (11C) to the top bearing cap (34). Fit the top bearing cap (34) to the motor housing (1). Replace the set screws (35) and spring washers (36) to the top bearing cap (34) and tighten.

10.1.22 Lift the motor at its lifting points and lay it on a bench at a suitable working height.

10.2 **CABLE ASSEMBLY**

10.2.1 Lift the cable assembly (16) across to the motor.

10.2.2 Renew the O-ring (11E).

10.2.3 Position the terminal box so that the motor tails and leads reach the terminal blocks (232). Reconnect wires as per original connection.

10.2.4 Wire the earth leads to the motor housing (1) using the earth screw (29) and spring washer (28).

10.2.5 Feed the motor tails back into the motor as the terminal box (16) is placed into position against the motor housing (1).

10.2.6 Replace the set screws (26) and (22) with the spring washers (27) then tighten. Carry out insulation & continuity checks through cable to ensure no damage has occurred during assembly.

10.3 **TO ASSEMBLE THE MECHANICAL SEAL**

10.3.1 **NOTE: Seal seats and heads are silicon carbide or carbon. They must be treated with extreme care as any impact can cause chipping or breaking.**

Thoroughly inspect the shaft (4), bottom bearing bracket (7) and seal chamber (12) in the areas which the mechanical seal (21) will seat. They should be free from scratches and burrs and be spotlessly clean. Pressure compensator (12) is fitted. Replace if it has collapsed.

10.3.2 Lubricate the shaft and elastomer components with detergent and water to assist in the assembly. Under no circumstances should grease or oil be used to assist assembly.

10.3.3 Check that the o-ring is properly seated in both of the seal seat assemblies.

10.3.4 Fit the seal seat assembly into the bottom bearing bracket (7). If the seal seat is difficult to push into the recess it is permissible to cover the seal seat with a clean piece of cardboard fashioned to slide over the shaft and exert pressure on the cardboard with a jig. Both seal seats are silicon carbide. The upper rotating seal head can be carbon or silicon carbide (carbon is standard). Do not fit carbon seal head to external seal.

10.3.5 Wipe the faces of the seal with a clean, dry, dust free piece of cloth so that it is thoroughly clean.

10.3.6 Slide upper seal head along shaft until faces contact. The seal head incorporate bellows which make it quite tight to press onto the shaft.

10.3.7 Compress bellow, slide on backing ring (21A) and retaining circlip (21B) into place. It is recommended to carry out final compression of seal with circlip and washer to prevent over compression of seal.

10.3.8 Replace air compensator (17) which is held in place by locating lugs in seal chamber (12).

10.3.9 Replace the O-ring (11b) on bottom bearing bracket (7), then fix seal plate (12) to bottom bearing bracket (7) with fixings (13), nuts (31) and spring washers (85). Fit seal seat in seal plate (12).

10.3.10 Slide product end seal head onto the shaft and fit using the same procedure noted above for internal seal. (Care should be taken not to damage the lapped face). Note the bottom product faces are silicon carbide to silicon carbide).

**NOTE:** Seal must not be allowed to rest on the shaft too long before the backing washer and circlip is placed in position, as the bellows has a tendency to adhere to the shaft.

Oil chamber must be filled (as per maintenance instruction) before the pump is run. Bellow seals are often tight on the shaft requiring extra pressure and lubrication (with detergent) to fit.

**NEVER RUN THE SEAL DRY !!**

10.3.11 Fill the oil chamber with Mobil Whiterex 307 or an equivalent. Unit is filled through (15B) with level plugs (15A). Fill chamber through 15B until oil just starts to flow out of 15A. Lay motor on its side for this filling operation. Replace plugs 15A and 15B after cleaning and applying a thread sealant.

10.3.12 Hold motor vertically. Run the motor for a maximum of three minutes. Let it stand for a further thirty minutes. Check the shaft for any oil due to the seals leaking. If the amount of oil showing is only very slight clean the shaft carefully and repeat run.

If oil still leaks from the seal they have not been fitted correctly and their installation should be checked, especially the O-rings.

10.3.13 Replace the key (33).

10.3.14 Turn the motor shaft by hand to ensure that no binding has occurred. Shaft runout should be checked to ensure it is running true (within 0.05mm).

10.3.15 Remove the plug (15A) in the motor housing (1). Screw in a T-piece fitted with stop valves. Attach a vacuum pump to one branch and a bottle of dry nitrogen to the other. Evacuate the motor to a pressure of -50 to -60 Kpa (gauge pressure) and isolate the vacuum pump with the valve. Check that the motor will hold this vacuum for ten minutes. If the vacuum diminishes it is possible that an O-ring has been damaged during assembly and the O-ring will require replacement. If vacumn holds open the valve to the nitrogen tank and charge the motor with nitrogen to a pressure of 30 Kpa (gauge pressure). Repeat this procedure to ensure all air is purged from the motor.

## 10.4 COOLING JACKET

Clean surfaces of housing and inside jacket. Fit o'rings and lightly grease with rubber grease. Lower jacket onto housing.
Using lifting bolt fixing holes put a plate across the top of motor and jack the jacket into place with threaded rod. Reconnect cooling lines.

## 11.0 TO ASSEMBLE THE PUMP

### 11.1 ASSEMBLY PROCEDURE (NON CLOG PUMP)

11.1.1 Using new gaskets/O Rings recommended during the assembly procedure below. Use anti-seize on all threads.

11.1.2 Renew the discharge sealing ring (120) if required.

11.1.3 Lay the motor unit on bench at a suitable working height.

11.1.4 If the impeller wear ring (107) was removed refit a new wear ring by heating the new ring and pressing in onto the impeller (102). "Scotch key" impeller wear ring to impeller.

11.1.5 Fit the key (33) into the shaft. Ensure key is a tight fit and all burrs in keyway and key have been removed.

11.1.6 Fit the impeller (102) onto the shaft and ensure the shaft and impeller are correctly engaged. Take care that there are no burrs, defects or dirt on the shaft or impeller bore as this will affect the fit. Prior to fitting impeller balance should be checked to ensure normal wear has not caused imbalance.

11.1.7 Fit the locknut washer (104) and screw the locknut (103) onto the thread. Locknut is the nyloc type and particular care should be taken not to damage thread on the pump shaft (4).

11.1.8 Tighten the locknut (3).

11.1.9 Check runout of impeller using a dial gauge. Runout should be within 0.2mm.

11.1.10 If the case wear ring (108) requires replacing in section 8 replace the new wear ring by pressing it into the volute (101).

11.1.11 Where fitted, fit motor adaptor (114) and replace gasket. Attach a sling to the motor complete with impeller and lift the motor over to where the pump volute is supported on clean, dry timbers.

11.1.12 Renew the gasket (113) which will be between the motor and the volute (101).

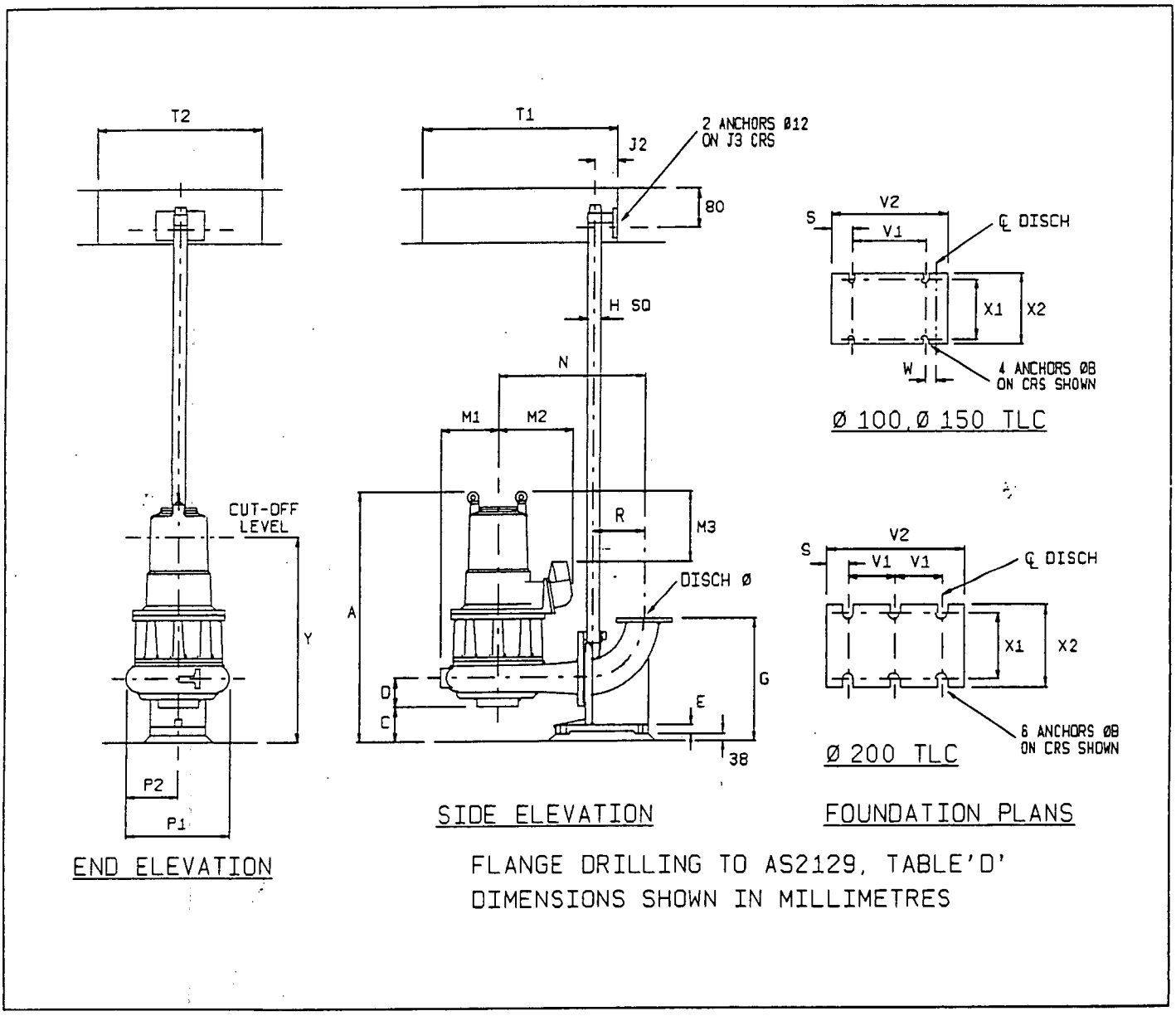
11.1.13 Lower the motor onto the double ended studs (117) making sure that the lifting points on the motor are on the same centre line as the discharge of the pump.

11.1.14 Screw the nuts (112) onto the double ended studs (117). Tighten the nuts (112) to tension.

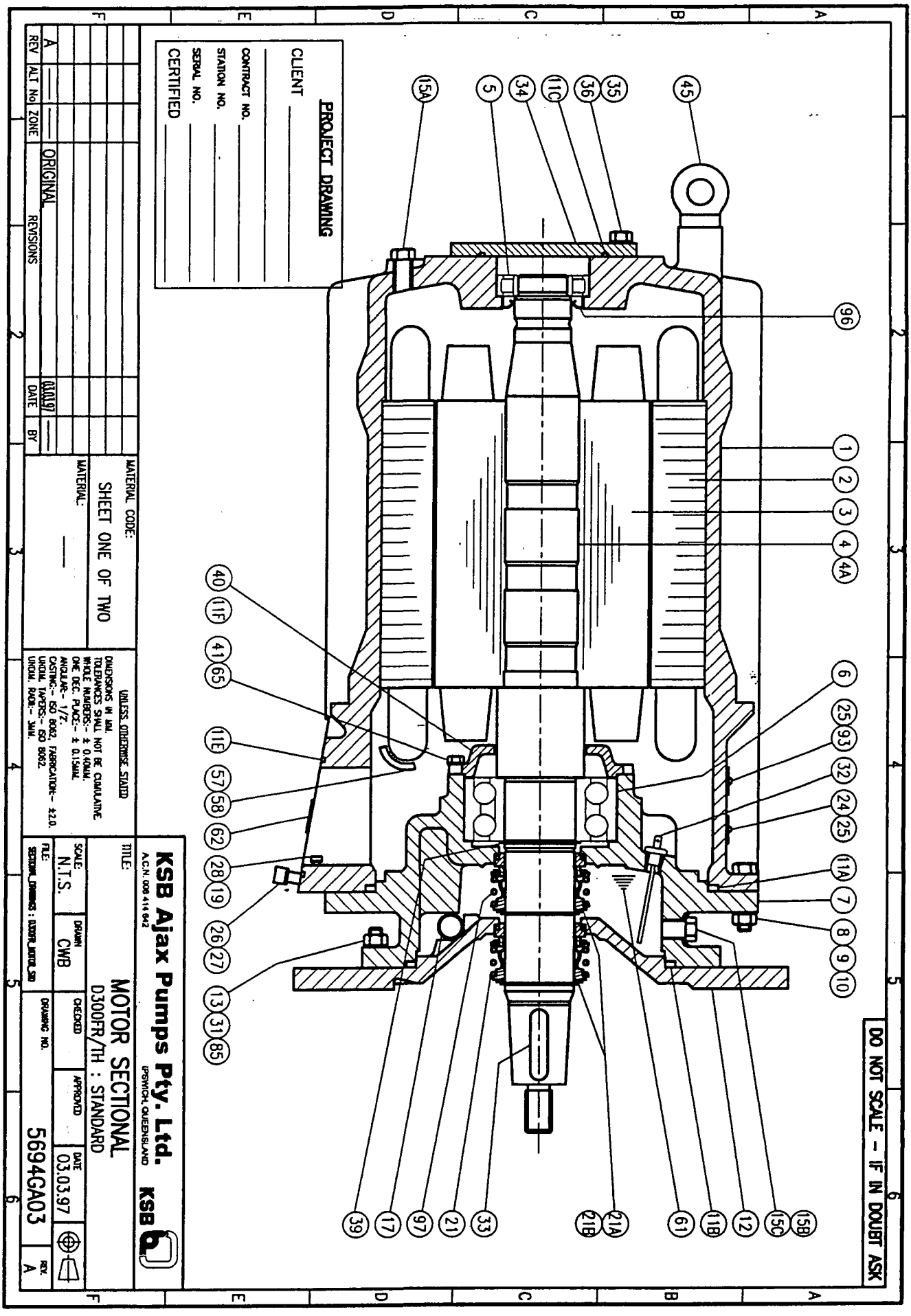
11.1.15 Turn impeller by hand to ensure it is free. Before running the pumpset the installation procedure in section 6 should be followed through thoroughly.

# 12.0 APPENDICES

## 12.1 SECTIONAL AND DIMENSIONAL DRAWINGS


T2
CUT-OFF LEVEL
Y
P2
P1
END ELEVATION
T1
J2
2 ANCHORS Ø12 ON J3 CRS
80
H SQ
N
M1
M2
R
M3
DISCH Ø
A
G
D
C
E
38
SIDE ELEVATION
V2
S
V1
℄ DISCH
X1
X2
W
4 ANCHORS ØB ON CRS SHOWN
Ø 100, Ø 150 TLC
V2
S
V1 V1
℄ DISCH
X1
X2
6 ANCHORS ØB ON CRS SHOWN
Ø 200 TLC
FOUNDATION PLANS
FLANGE DRILLING TO AS2129, TABLE'D'
DIMENSIONS SHOWN IN MILLIMETRES

| MODEL | MOTOR FRAME | DISCH | A | B | C | D | E | G | H | J2 | J3 | M1 | M2 | M3 | N | P1 | P2 | R | S | T1 | T2 | V1 | V2 | W | X1 | X2 | Y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E100-280 | 150 | 100 | 806 | 12 | 135 | 106 | 28 | 459 | 50 | 86 | 121 | 205 | N/A | N/A | 568 | 408 | 204 | 199 | 31 | 900 | 700 | 300 | 362 | 12 | 179 | 220 | 668 |
| | 165 | 100 | 828 | 12 | 135 | 106 | 28 | 459 | 50 | 86 | 121 | 205 | 185 | 277 | 568 | 408 | 204 | 199 | 31 | 900 | 700 | 300 | 362 | 12 | 179 | 220 | 760 |
| | 203 | 100 | 925 | 12 | 135 | 106 | 28 | 459 | 50 | 86 | 121 | 205 | 294 | 265 | 568 | 408 | 204 | 199 | 31 | 900 | 700 | 300 | 362 | 12 | 179 | 220 | 810 |
| | 260 | 100 | 1005 | 12 | 135 | 106 | 28 | 459 | 50 | 86 | 121 | 205 | 294 | 387 | 568 | 408 | 204 | 199 | 31 | 900 | 700 | 300 | 362 | 12 | 179 | 220 | 759 |
| E100-340 | 203 | 100 | 924 | 12 | 138 | 103 | 28 | 459 | 50 | 86 | 121 | 244 | 294 | 265 | 566 | 489 | 256 | 199 | 31 | 900 | 700 | 300 | 362 | 12 | 179 | 220 | 759 |
| | 260 | 100 | 1071 | 12 | 138 | 103 | 28 | 459 | 50 | 86 | 121 | 244 | 294 | 387 | 566 | 489 | 256 | 199 | 31 | 900 | 700 | 300 | 362 | 12 | 179 | 220 | 859 |
| E100-350 | 260 | 100 | 1071 | 16 | 127 | 114 | 28 | 459 | 50 | 86 | 121 | 319 | 294 | 387 | 598 | 548 | 274 | 199 | 31 | 900 | 800 | 300 | 362 | 12 | 179 | 220 | 859 |
| E100-380 | 260 | 100 | 1108 | 16 | 146 | 95 | 28 | 459 | 50 | 86 | 121 | 280 | 294 | 387 | 613 | 560 | 280 | 199 | 31 | 900 | 800 | 300 | 362 | 12 | 179 | 220 | 913 |
| | 300 | 100 | 1162 | 16 | 146 | 95 | 28 | 459 | 50 | 86 | 121 | 280 | 274 | 435 | 613 | 560 | 280 | 199 | 31 | 900 | 800 | 300 | 362 | 12 | 179 | 220 | 922 |
| E100-405 | 260 | 100 | 1076 | 16 | 127 | 114 | 28 | 459 | 50 | 86 | 121 | 319 | 294 | 387 | 598 | 548 | 274 | 199 | 31 | 900 | 800 | 300 | 362 | 12 | 179 | 220 | 881 |
| | 300 | 100 | 1137 | 16 | 127 | 114 | 28 | 459 | 50 | 86 | 121 | 319 | 274 | 435 | 598 | 548 | 274 | 199 | 31 | 900 | 800 | 300 | 362 | 12 | 179 | 220 | 897 |
| | 350 | 100 | 1267 | 16 | 127 | 114 | 28 | 459 | 50 | 86 | 121 | 319 | 442 | 416 | 598 | 548 | 274 | 199 | 31 | 900 | 800 | 300 | 362 | 12 | 179 | 220 | 987 |
| K150-330 | 203 | 150 | 1000 | 16 | 186 | 122 | 28 | 463 | 75 | 121 | 171 | 242 | 294 | 265 | 654 | 484 | 242 | 234 | 32 | 900 | 800 | 375 | 438 | N/A | 225 | 275 | 835 |
| | 260 | 150 | 1147 | 16 | 186 | 122 | 28 | 463 | 75 | 121 | 171 | 242 | 294 | 387 | 654 | 484 | 242 | 234 | 32 | 900 | 800 | 375 | 438 | N/A | 225 | 275 | 952 |
| | 300 | 150 | 1165 | 16 | 186 | 122 | 28 | 463 | 75 | 121 | 171 | 242 | 274 | 435 | 654 | 484 | 242 | 234 | 32 | 900 | 800 | 375 | 438 | N/A | 225 | 275 | 925 |
| | 350 | 150 | 1334 | 16 | 186 | 122 | 28 | 463 | 75 | 121 | 171 | 242 | 442 | 416 | 654 | 484 | 242 | 234 | 32 | 900 | 800 | 375 | 438 | N/A | 225 | 275 | 1054 |
| K150-350 | 260 | 150 | 1136 | 16 | 151 | 157 | 28 | 463 | 75 | 121 | 171 | 289 | 294 | 387 | 683 | 572 | 315 | 234 | 32 | 1000 | 800 | 375 | 438 | N/A | 225 | 275 | 941 |
| | 300 | 150 | 1210 | 16 | 151 | 157 | 28 | 463 | 75 | 121 | 171 | 289 | 274 | 435 | 683 | 572 | 315 | 234 | 32 | 1000 | 800 | 375 | 438 | N/A | 225 | 275 | 970 |
| | 350 | 150 | 1334 | 16 | 151 | 157 | 28 | 463 | 75 | 121 | 171 | 289 | 442 | 416 | 683 | 580 | 315 | 234 | 32 | 1000 | 800 | 375 | 438 | N/A | 225 | 275 | 1054 |
| | 370 | 150 | 1334 | 16 | 151 | 157 | 28 | 463 | 75 | 121 | 171 | 289 | 442 | 416 | 683 | 580 | 315 | 234 | 32 | 1000 | 800 | 375 | 438 | N/A | 225 | 275 | 1054 |
| K150-405 | 260 | 150 | 1142 | 16 | 218 | 90 | 28 | 463 | 75 | 121 | 171 | 283 | 294 | 387 | 781 | 569 | 305 | 234 | 32 | 900 | 800 | 375 | 438 | N/A | 225 | 275 | 947 |
| | 300 | 150 | 1204 | 16 | 218 | 90 | 28 | 463 | 75 | 121 | 171 | 283 | 274 | 435 | 781 | 569 | 305 | 234 | 32 | 900 | 800 | 375 | 438 | N/A | 225 | 275 | 964 |
| | 350 | 150 | 1334 | 16 | 218 | 90 | 28 | 463 | 75 | 121 | 171 | 283 | 442 | 416 | 781 | 569 | 305 | 234 | 32 | 900 | 800 | 375 | 438 | N/A | 225 | 275 | 1054 |
| | 370 | 150 | 1334 | 16 | 218 | 90 | 28 | 463 | 75 | 121 | 171 | 283 | 442 | 416 | 781 | 569 | 305 | 234 | 32 | 900 | 800 | 375 | 438 | N/A | 225 | 275 | 1054 |
| K200-360 | 260 | 200 | 1369 | 20 | 370 | 132 | 35 | 695 | 75 | 146 | 241 | 330 | 294 | 387 | 936 | 635 | 350 | 302 | 51 | 1000 | 800 | 254 | 610 | N/A | 305 | 406 | 1174 |
| | 300 | 200 | 1401 | 20 | 370 | 132 | 35 | 695 | 75 | 146 | 241 | 330 | 274 | 435 | 936 | 635 | 350 | 302 | 51 | 1000 | 800 | 254 | 610 | N/A | 305 | 406 | 1161 |
| | 350 | 200 | 1527 | 20 | 370 | 132 | 35 | 695 | 75 | 146 | 241 | 330 | 442 | 416 | 936 | 635 | 350 | 302 | 51 | 1000 | 800 | 254 | 610 | N/A | 305 | 406 | 1247 |
| | 370 | 200 | 1527 | 20 | 370 | 132 | 35 | 695 | 75 | 146 | 241 | 330 | 442 | 416 | 936 | 635 | 350 | 302 | 51 | 1000 | 800 | 254 | 610 | N/A | 305 | 406 | 1247 |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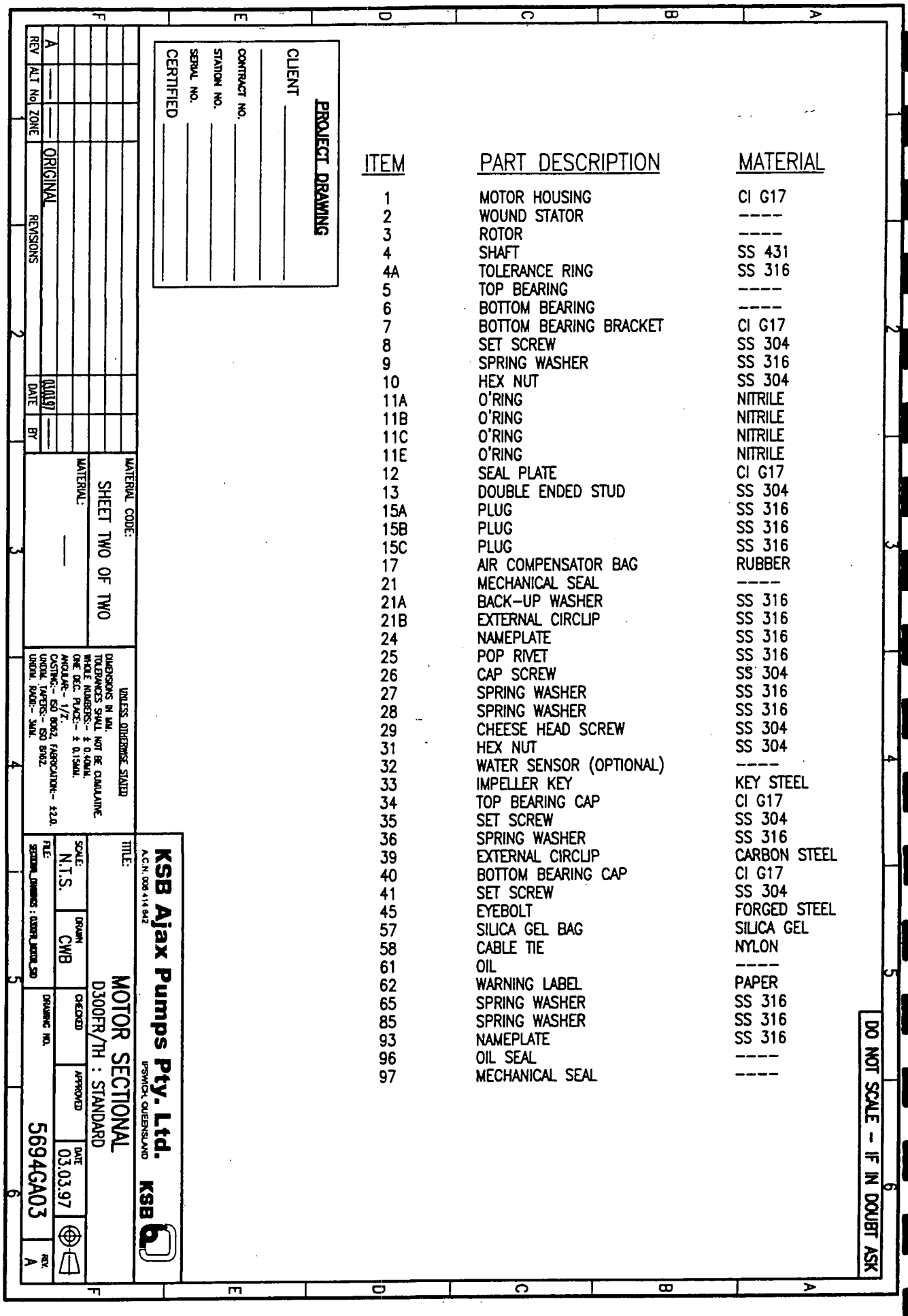
CLIENT
CONTRACT NO.
STATION NO.
SERIAL NO.
CERTIFIED
REV
ALT No
ZONE
ORIGINAL
REVISIONS
DATE
BY
MATERIAL CODE:
SHEET ONE OF TWO
MATERIAL:
UNLESS OTHERWISE STATED
DIMENSIONS IN MM.
TOLERANCES SHALL NOT BE CUMULATIVE.
WHOLE NUMBERS:- ± 0.40MM.
ONE DEC. PLACE:- ± 0.15MM.
ANGULAR:- 1/2°.
CASTING:- ISO 8062. FABRICATION:- ±2.0.
LINEAR TAPERS:- ISO 8062.
LINEAR RADII:- 3MM.
KSB Ajax Pumps Pty. Ltd.
A.C.N. 008 414 942
IPSWICH, QUEENSLAND
TITLE:
MOTOR SECTIONAL
D300FR/TH : STANDARD
SCALE:
N.T.S.
DRAWN
CWB
CHECKED
APPROVED
DATE
03.03.97
FILE:
SECTIONAL_DRAWINGS : D300FR_MOTOR.SXD
DRAWING NO.
5694GA03
REV.
A
DO NOT SCALE - IF IN DOUBT ASK
96
1
2
3
4
4A
40
11F
41
65
11E
57
58
62
28
19
26
27
13
31
85
6
25
93
32
24
25
11A
7
8
9
10
15A
5
34
11C
36
35
45
39
17
97
21
33
21A
21B
61
11B
12
15C
15B



| ITEM | PART DESCRIPTION | MATERIAL |
|---|---|---|
| 1 | MOTOR HOUSING | CI G17 |
| 2 | WOUND STATOR | ---- |
| 3 | ROTOR | ---- |
| 4 | SHAFT | SS 431 |
| 4A | TOLERANCE RING | SS 316 |
| 5 | TOP BEARING | ---- |
| 6 | BOTTOM BEARING | ---- |
| 7 | BOTTOM BEARING BRACKET | CI G17 |
| 8 | SET SCREW | SS 304 |
| 9 | SPRING WASHER | SS 316 |
| 10 | HEX NUT | SS 304 |
| 11A | O'RING | NITRILE |
| 11B | O'RING | NITRILE |
| 11C | O'RING | NITRILE |
| 11E | O'RING | NITRILE |
| 12 | SEAL PLATE | CI G17 |
| 13 | DOUBLE ENDED STUD | SS 304 |
| 15A | PLUG | SS 316 |
| 15B | PLUG | SS 316 |
| 15C | PLUG | SS 316 |
| 17 | AIR COMPENSATOR BAG | RUBBER |
| 21 | MECHANICAL SEAL | ---- |
| 21A | BACK-UP WASHER | SS 316 |
| 21B | EXTERNAL CIRCLIP | SS 316 |
| 24 | NAMEPLATE | SS 316 |
| 25 | POP RIVET | SS 316 |
| 26 | CAP SCREW | SS 304 |
| 27 | SPRING WASHER | SS 316 |
| 28 | SPRING WASHER | SS 316 |
| 29 | CHEESE HEAD SCREW | SS 304 |
| 31 | HEX NUT | SS 304 |
| 32 | WATER SENSOR (OPTIONAL) | ---- |
| 33 | IMPELLER KEY | KEY STEEL |
| 34 | TOP BEARING CAP | CI G17 |
| 35 | SET SCREW | SS 304 |
| 36 | SPRING WASHER | SS 316 |
| 39 | EXTERNAL CIRCLIP | CARBON STEEL |
| 40 | BOTTOM BEARING CAP | CI G17 |
| 41 | SET SCREW | SS 304 |
| 45 | EYEBOLT | FORGED STEEL |
| 57 | SILICA GEL BAG | SILICA GEL |
| 58 | CABLE TIE | NYLON |
| 61 | OIL | ---- |
| 62 | WARNING LABEL | PAPER |
| 65 | SPRING WASHER | SS 316 |
| 85 | SPRING WASHER | SS 316 |
| 93 | NAMEPLATE | SS 316 |
| 96 | OIL SEAL | ---- |
| 97 | MECHANICAL SEAL | ---- |

PROJECT DRAWING
CLIENT ____
CONTRACT NO. ____
STATION NO. ____
SERIAL NO. ____
CERTIFIED ____

REV A — ALT No — ZONE — ORIGINAL — BY — DATE 03/03/97

REVISIONS

MATERIAL CODE:
SHEET TWO OF TWO
MATERIAL: ____

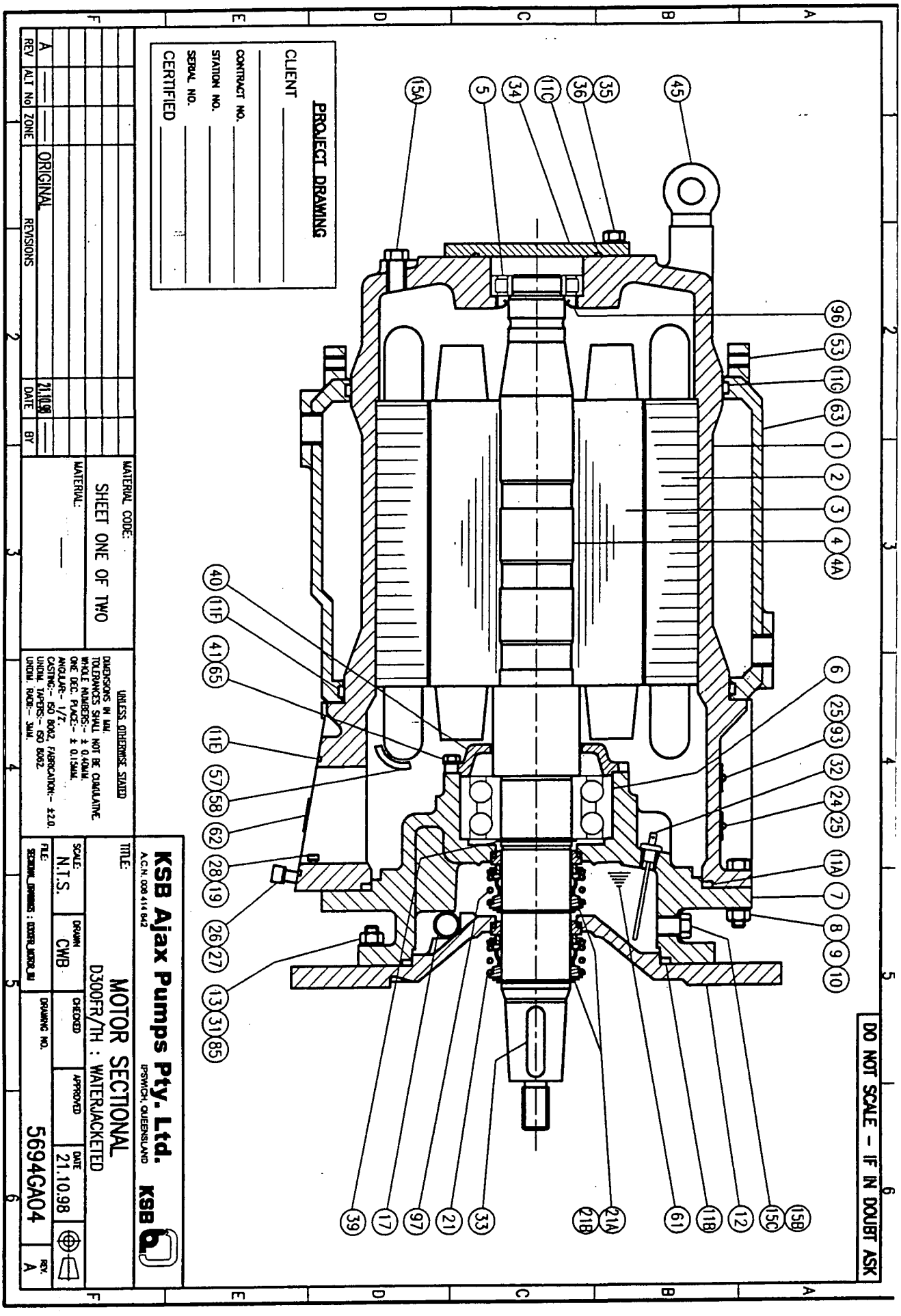
UNLESS OTHERWISE STATED
DIMENSIONS IN MM.
TOLERANCES SHALL NOT BE CUMULATIVE.
WHOLE NUMBERS:- ± 0.40MM.
ONE DEC. PLACE:- ± 0.15MM.
ANGULAR:- 1/2°.
CASTING:- ISO 8062, FABRICATION:- ±2.0.
LINEAR TAPERS:- ISO 8162.
LINEAR RADII:- 3MM.

KSB Ajax Pumps Pty. Ltd.
A.C.N. 008 414 842
IPSWICH, QUEENSLAND
KSB

TITLE:
MOTOR SECTIONAL
D300FR/TH : STANDARD

SCALE: N.T.S.
DRAWN: CWB
CHECKED
APPROVED
DATE: 03.03.97
FILE: SECTIONAL_DRAWINGS : D300FR_MOTOR.SID
DRAWING NO. 5694GA03
REV. A

DO NOT SCALE - IF IN DOUBT ASK


PROJECT DRAWING
CLIENT
CONTRACT NO.
STATION NO.
SERIAL NO.
CERTIFIED
DO NOT SCALE – IF IN DOUBT ASK
REV
ALT No
ZONE
REVISIONS
DATE
BY
ORIGINAL
21.10.98
MATERIAL CODE:
SHEET ONE OF TWO
MATERIAL:
UNLESS OTHERWISE STATED
DIMENSIONS IN MM.
TOLERANCES SHALL NOT BE CUMULATIVE.
WHOLE NUMBERS:- ± 0.40MM.
ONE DEC. PLACE:- ± 0.15MM.
ANGULAR:- 1/2°.
CASTING:- ISO 8062, FABRICATION:- ±2.0.
UNTOL. TAPERS:- ISO 8062.
UNTOL. RADII:- 3MM.
KSB Ajax Pumps Pty. Ltd.
A.C.N. 009 414 042
IPSWICH, QUEENSLAND
KSB
TITLE:
MOTOR SECTIONAL
D300FR/TH : WATERJACKETED
SCALE:
N.T.S.
DRAWN
CWB
CHECKED
APPROVED
DATE
21.10.98
FILE:
SECTIONAL_DRAWINGS : D300FR_MOTOR.DW
DRAWING NO.
5694GA04
REV.
A
45
15A
5
34
11C
36
35
96
53
11G
63
1
2
3
4
4A
40
11F
41
65
11E
57
58
62
28
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26
27
13
31
85
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25
93
32
24
25
11A
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17
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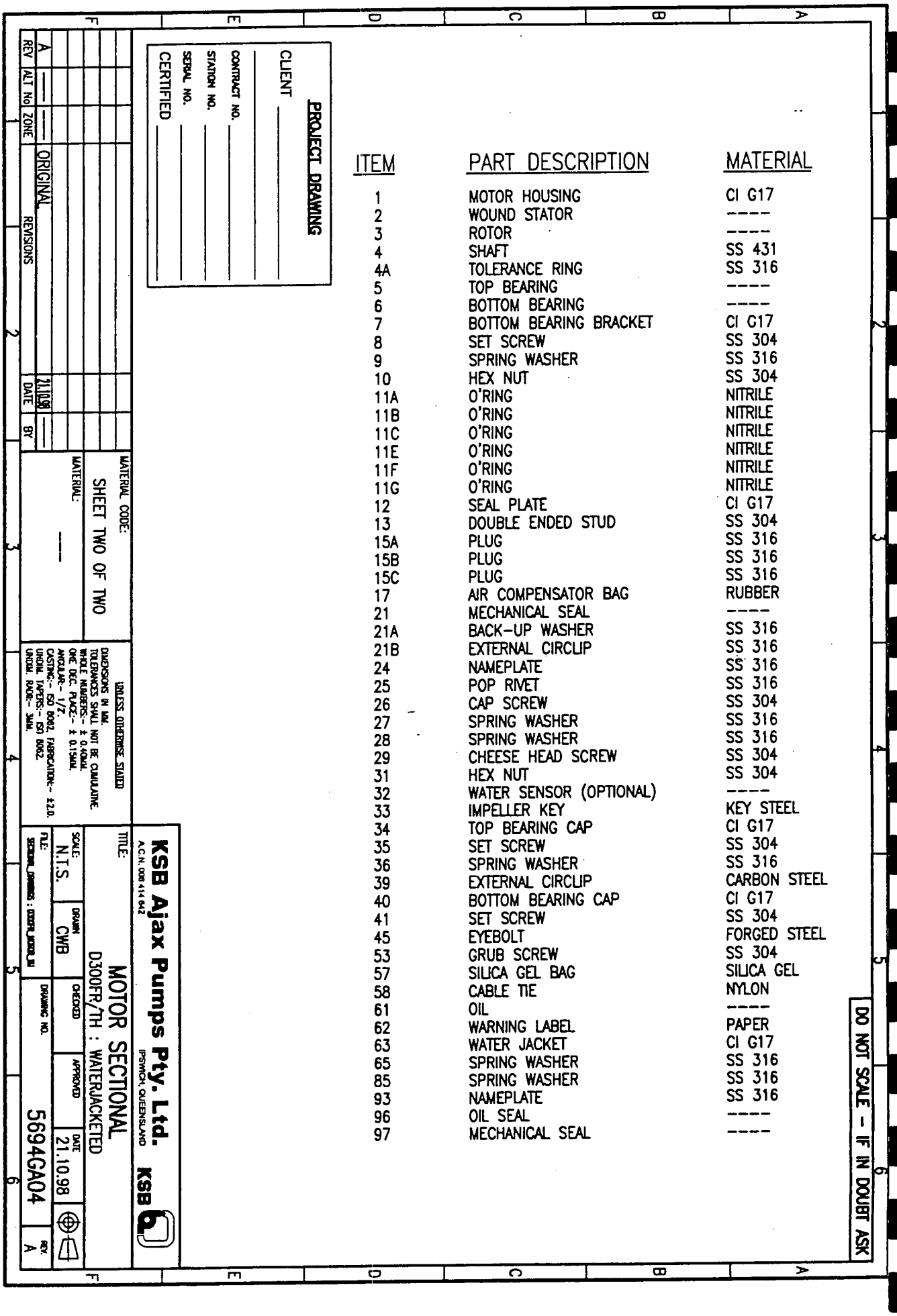
33
21A
21B
61
11B
12
15C
15B



| ITEM | PART DESCRIPTION | MATERIAL |
|---|---|---|
| 1 | MOTOR HOUSING | CI G17 |
| 2 | WOUND STATOR | ---- |
| 3 | ROTOR | ---- |
| 4 | SHAFT | SS 431 |
| 4A | TOLERANCE RING | SS 316 |
| 5 | TOP BEARING | ---- |
| 6 | BOTTOM BEARING | ---- |
| 7 | BOTTOM BEARING BRACKET | CI G17 |
| 8 | SET SCREW | SS 304 |
| 9 | SPRING WASHER | SS 316 |
| 10 | HEX NUT | SS 304 |
| 11A | O'RING | NITRILE |
| 11B | O'RING | NITRILE |
| 11C | O'RING | NITRILE |
| 11E | O'RING | NITRILE |
| 11F | O'RING | NITRILE |
| 11G | O'RING | NITRILE |
| 12 | SEAL PLATE | CI G17 |
| 13 | DOUBLE ENDED STUD | SS 304 |
| 15A | PLUG | SS 316 |
| 15B | PLUG | SS 316 |
| 15C | PLUG | SS 316 |
| 17 | AIR COMPENSATOR BAG | RUBBER |
| 21 | MECHANICAL SEAL | ---- |
| 21A | BACK-UP WASHER | SS 316 |
| 21B | EXTERNAL CIRCLIP | SS 316 |
| 24 | NAMEPLATE | SS 316 |
| 25 | POP RIVET | SS 316 |
| 26 | CAP SCREW | SS 304 |
| 27 | SPRING WASHER | SS 316 |
| 28 | SPRING WASHER | SS 316 |
| 29 | CHEESE HEAD SCREW | SS 304 |
| 31 | HEX NUT | SS 304 |
| 32 | WATER SENSOR (OPTIONAL) | ---- |
| 33 | IMPELLER KEY | KEY STEEL |
| 34 | TOP BEARING CAP | CI G17 |
| 35 | SET SCREW | SS 304 |
| 36 | SPRING WASHER | SS 316 |
| 39 | EXTERNAL CIRCLIP | CARBON STEEL |
| 40 | BOTTOM BEARING CAP | CI G17 |
| 41 | SET SCREW | SS 304 |
| 45 | EYEBOLT | FORGED STEEL |
| 53 | GRUB SCREW | SS 304 |
| 57 | SILICA GEL BAG | SILICA GEL |
| 58 | CABLE TIE | NYLON |
| 61 | OIL | ---- |
| 62 | WARNING LABEL | PAPER |
| 63 | WATER JACKET | CI G17 |
| 65 | SPRING WASHER | SS 316 |
| 85 | SPRING WASHER | SS 316 |
| 93 | NAMEPLATE | SS 316 |
| 96 | OIL SEAL | ---- |
| 97 | MECHANICAL SEAL | ---- |

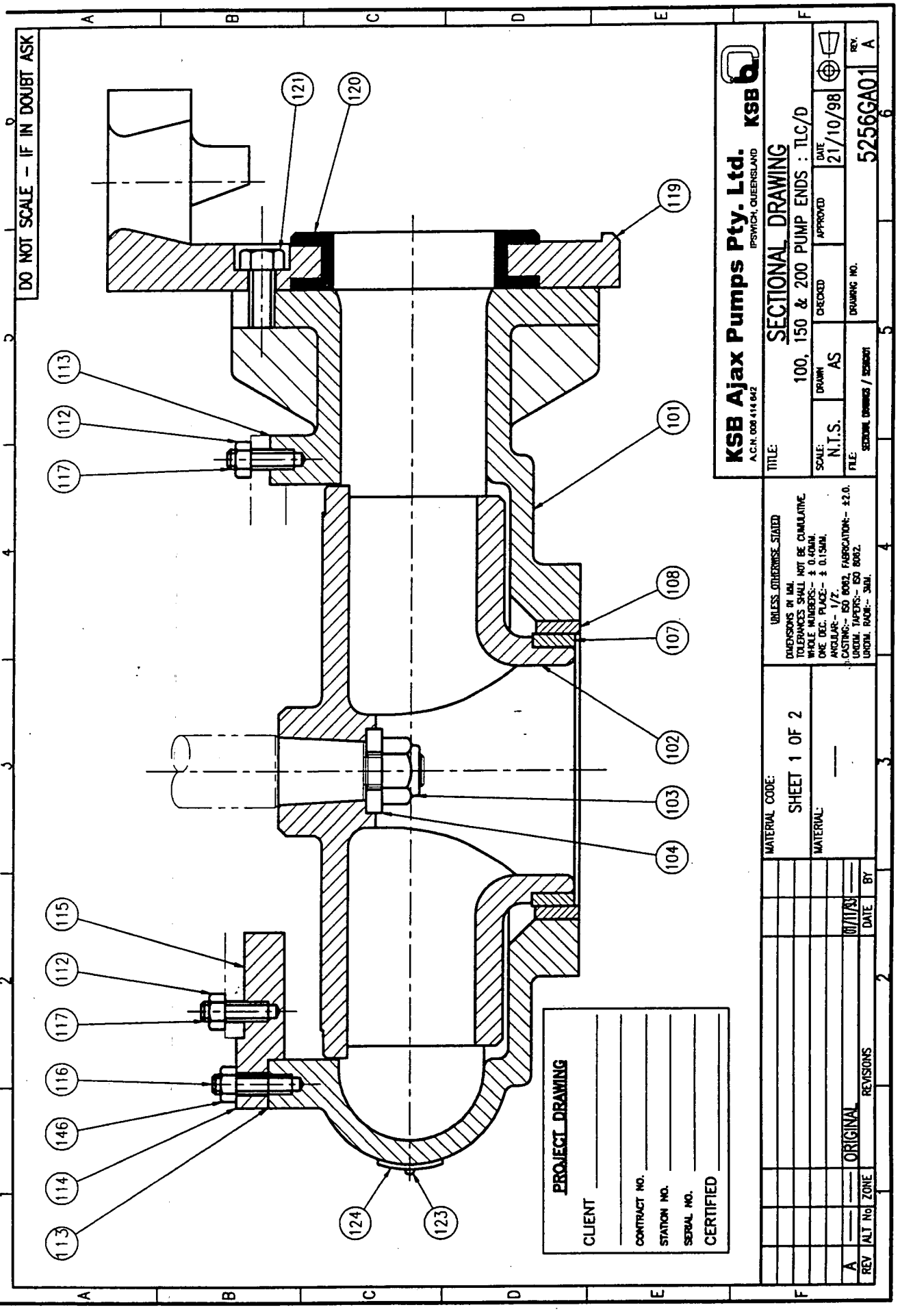
PROJECT DRAWING
CLIENT
CONTRACT NO.
STATION NO.
SERIAL NO.
CERTIFIED

REV A | ALT No | ZONE | ORIGINAL | REVISIONS | DATE 21.10.98 | BY

MATERIAL CODE: SHEET TWO OF TWO
MATERIAL: ---
UNLESS OTHERWISE STATED
DIMENSIONS IN MM. TOLERANCES SHALL NOT BE CUMULATIVE.
WHOLE NUMBERS:- ± 0.40MM. ONE DEC. PLACE:- ± 0.15MM.
ANGULAR:- 1/2°. CASTING:- ISO 8062. FABRICATION:- ±2.0.
LINEAR TAPERS:- ISO 8062. LINEAR RADII:- 3MM.

KSB Ajax Pumps Pty. Ltd.
A.C.N. 008 414 642 (PSYMOR, QUEENSLAND) KSB
TITLE: MOTOR SECTIONAL D300FR/TH : WATERJACKETED
SCALE: N.T.S. | DRAWN: CWB | CHECKED | APPROVED | DATE 21.10.98
FILE: SECTIONAL_DRAWINGS : 0300FR_JACKET.SM
DRAWING NO. 5694GA04 | REV. A

DO NOT SCALE - IF IN DOUBT ASK


DO NOT SCALE – IF IN DOUBT ASK
KSB Ajax Pumps Pty. Ltd.
IPSWICH, QUEENSLAND
A.C.N. 008 414 642
KSB
TITLE:
SECTIONAL DRAWING
100, 150 & 200 PUMP ENDS : TLC/D
SCALE: N.T.S.
DRAWN AS
CHECKED
APPROVED
DATE 21/10/98
DRAWING NO. 5256GA01
REV. A
FILE:
MATERIAL CODE:
SHEET 1 OF 2
MATERIAL: —
UNLESS OTHERWISE STATED
DIMENSIONS IN MM.
TOLERANCES SHALL NOT BE CUMULATIVE.
WHOLE NUMBERS:- ± 0.40MM.
ONE DEC. PLACE:- ± 0.15MM.
ANGULAR:- 1/2°.
CASTING:- ISO 8062. FABRICATION:- ±2.0.
LINEAR TAPERS:- ISO 8062.
LINEAR RADII:- 3MM.
PROJECT DRAWING
CLIENT
CONTRACT NO.
STATION NO.
SERIAL NO.
CERTIFIED
REV ALT No ZONE REVISIONS DATE BY
A — ORIGINAL 01/11/95 —
121
120
119
113
112
117
101
108
107
102
103
104
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117
116
146
114
113
124
123

DO NOT SCALE – IF IN DOUBT ASK

| ITEM | DESCRIPTION | MATERIAL |
|---|---|---|
| 101 | VOLUTE | C.I. G17 |
| 102 | IMPELLER | C.I. G17 |
| 103 | IMPELLER NUT | SS 316 |
| 104 | IMPELLER WASHER | SS 316 |
| 107 | WEAR RING – IMPELLER | MILD STEEL |
| 108 | WEAR RING – VOLUTE | NI CR IRON |
| 112 | NUT | SS 304 |
| 113 | GASKET | BA UNIT |
| 117 | FASTENER | SS 304 |
| 119 | LOCKING PLATE | C.I. G17 |
| 120 | DISCHARGE SEALING RING | RUBBER |
| 121 | FASTENER | SS 304 |
| 123 | NAME PLATE | SS 316 |
| 124 | RIVET | SS 316 |
| **MOTOR ADAPTOR STYLE** | | |
| 114 | MOTOR ADAPTOR | C.I. G17 |
| 115 | GASKET | BA UNIT |
| 116 | FASTENER | SS 304 |
| 146 | NUT | SS 304 |

**PROJECT DRAWING**

CLIENT _____

_____

CONTRACT NO. _____

STATION NO. _____

SERIAL NO. _____

CERTIFIED _____

| REV | ALT No | ZONE | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| A | — | — | ORIGINAL | 01/11/93 | — |

MATERIAL CODE: SHEET 2 OF 2

MATERIAL: —

UNLESS OTHERWISE STATED
DIMENSIONS IN MM.
TOLERANCES SHALL NOT BE CUMULATIVE.
WHOLE NUMBERS:- ± 0.40MM.
ONE DEC. PLACE:- ± 0.15MM.
ANGULAR:- 1/2°.
CASTING:- ISO 8062, FABRICATION:- ±2.0.
UNDIM. TAPERS:- ISO 8062.
UNDIM. RADII:- 3MM.

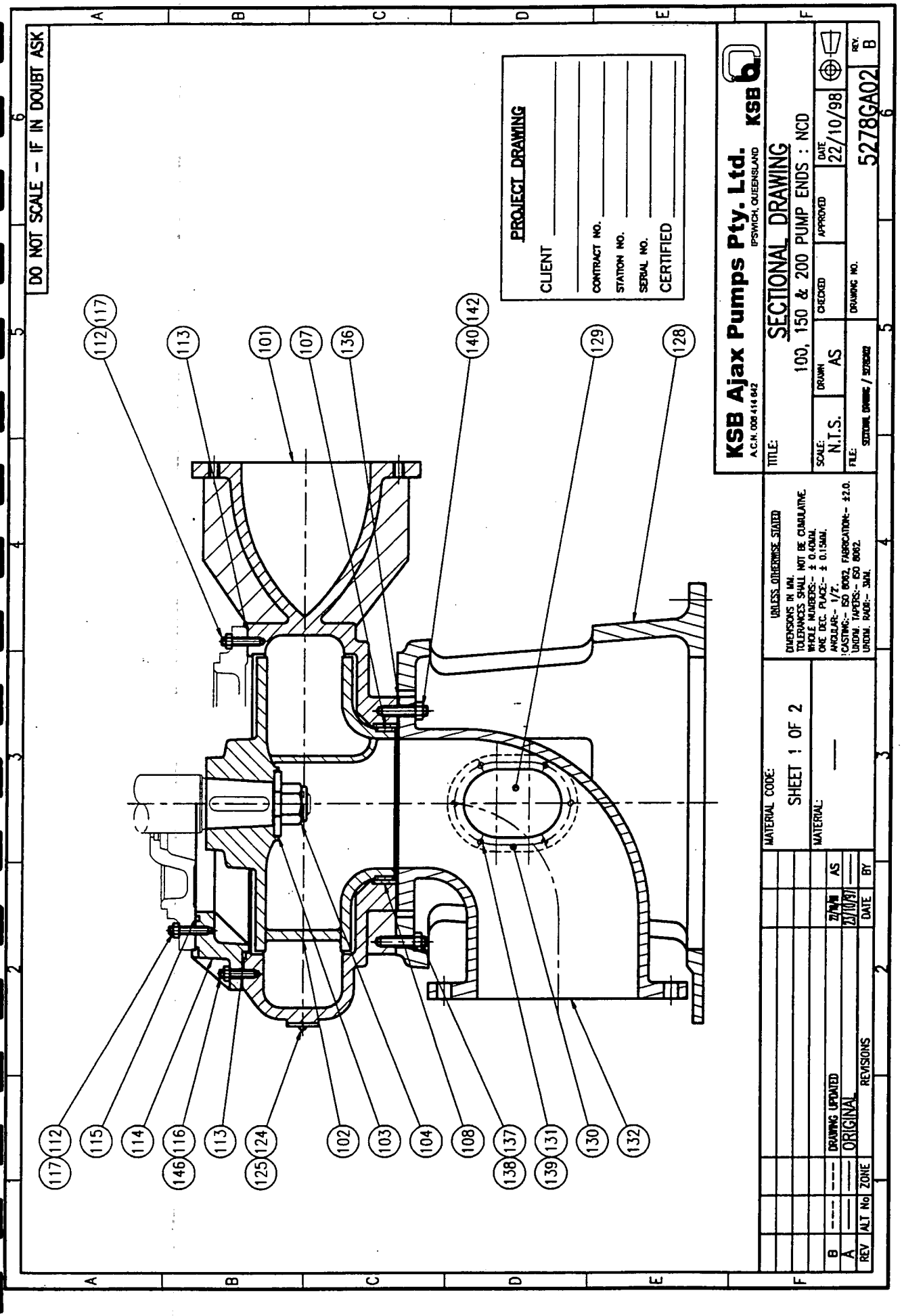
**KSB Ajax Pumps Pty. Ltd.**
A.C.N. 008 414 642 IPSWICH, QUEENSLAND KSB

TITLE: SECTIONAL DRAWING
100, 150 & 200 PUMP ENDS : TLC/D

| SCALE: | DRAWN | CHECKED | APPROVED | DATE |
|---|---|---|---|---|
| N.T.S. | AS | | | 21/10/98 |

FILE: SECTIONAL DRAWINGS / 5256GA01

DRAWING NO. 5256GA01 REV. A


DO NOT SCALE – IF IN DOUBT ASK
PROJECT DRAWING
CLIENT
CONTRACT NO.
STATION NO.
SERIAL NO.
CERTIFIED
KSB Ajax Pumps Pty. Ltd.
IPSWICH, QUEENSLAND
A.C.N. 009 414 842
KSB
TITLE:
SECTIONAL DRAWING
100, 150 & 200 PUMP ENDS : NCD
SCALE: N.T.S.
DRAWN AS
CHECKED
APPROVED
DATE 22/10/98
FILE:
DRAWING NO. 5278GA02
REV. B
MATERIAL CODE:
SHEET 1 OF 2
MATERIAL:
UNLESS OTHERWISE STATED
DIMENSIONS IN MM.
TOLERANCES SHALL NOT BE CUMULATIVE.
WHOLE NUMBERS:- ± 0.40MM.
ONE DEC. PLACE:- ± 0.15MM.
ANGULAR:- 1/2°.
CASTING:- ISO 8062. FABRICATION:- ±2.0.
UNDIM. TAPERS:- ISO 8062.
UNDIM. RADII:- 3MM.
REV ALT No ZONE REVISIONS DATE BY
B --- --- DRAWING UPDATED 27/10/97 AS
A --- --- ORIGINAL
112 117 113 101 107 136 140 142 129 128
112 117 115 114 146 116 113 125 124 102 103 104 108 138 137 139 131 130 132

DO NOT SCALE – IF IN DOUBT ASK

| ITEM | DESCRIPTION | MATERIAL |
|---|---|---|
| 101 | VOLUTE | C.I. G17 |
| 102 | IMPELLER | C.I. G17 |
| 103 | IMPELLER NUT | SS 316 |
| 104 | IMPELLER WASHER | SS 316 |
| 107 | WEAR RING – IMPELLER | MILD STEEL |
| 108 | WEAR RING – VOLUTE | NI CR IRON |
| 112 | NUT | SS 304 |
| 113 | O RING | NITRILE |
| 114 | MOTOR ADAPTOR | C.I. G17 |
| 115 | O RING | NITRILE |
| 116 | FASTENER | SS 304 |
| 117 | FASTENER | SS 304 |
| 124 | NAME PLATE | SS 316 |
| 125 | RIVET | SS 316 |
| 128 | PEDESTAL | C.I. G17 |
| 129 | CLEAN-OUT PLATE | C.I. G17 |
| 130 | GASKET | NEOPRENE |
| 131 | FASTENER | SS 304 |
| 132 | SUCTION BEND | C.I. G17 |
| 136 | GASKET | NEOPRENE |
| 137 | FASTENER | SS 304 |
| 138 | NUT | SS 304 |
| 139 | NUT | SS 304 |
| 140 | NUT | SS 304 |
| 142 | FASTENER | SS 304 |
| 146 | NUT | SS 304 |

MOTOR ADAPTOR STYLE

| | | |
|---|---|---|
| 114 | MOTOR ADAPTOR | C.I. G17 |
| 115 | GASKET | BA UNIT |
| 116 | FASTENER | SS 304 |
| 146 | NUT | SS 304 |

**PROJECT DRAWING**

CLIENT _____

CONTRACT NO. _____

STATION NO. _____

SERIAL NO. _____

CERTIFIED _____

| REV | ALT No | ZONE | REVISIONS | DATE | BY |
|---|---|---|---|---|---|
| B | --- | --- | DRAWING UPDATED | 22/10/98 | AS |
| A | --- | --- | ORIGINAL | 23/10/97 | --- |

MATERIAL CODE: SHEET 2 OF 2

MATERIAL: ---

UNLESS OTHERWISE STATED
DIMENSIONS IN MM.
TOLERANCES SHALL NOT BE CUMULATIVE.
WHOLE NUMBERS:- ± 0.40MM.
ONE DEC. PLACE:- ± 0.15MM.
ANGULAR:- 1/2°.
CASTING:- ISO 8062, FABRICATION:- ±2.0.
UNDIM. TAPERS:- ISO 8062.
UNDIM. RADII:- 3MM.

**KSB Ajax Pumps Pty. Ltd.**
A.C.N. 008 414 642 IPSWICH, QUEENSLAND KSB

TITLE: SECTIONAL DRAWING
100, 150 & 200 PUMP ENDS : NCD

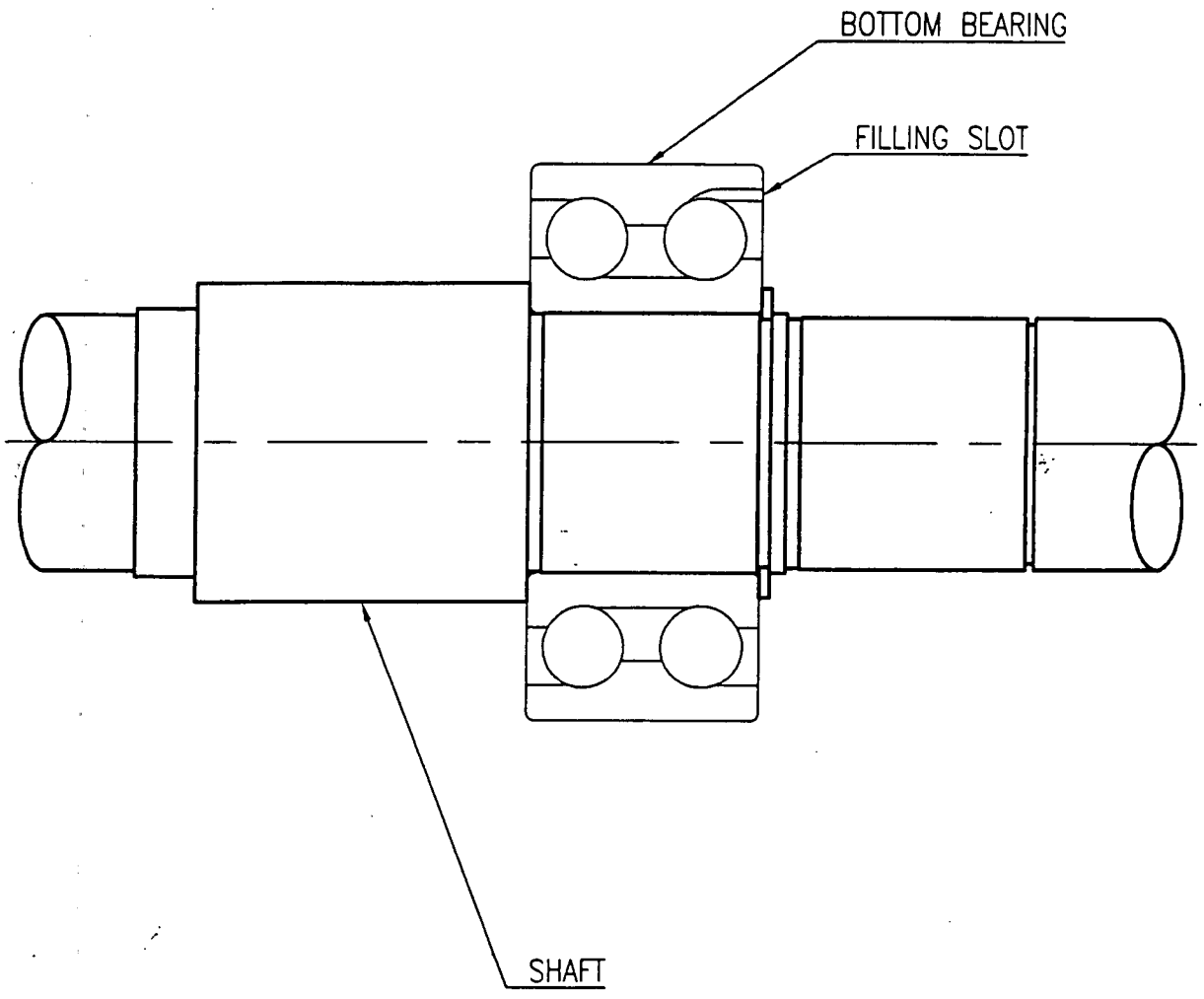
| SCALE: | DRAWN | CHECKED | APPROVED | DATE |
|---|---|---|---|---|
| N.T.S. | AS | | | 22/10/98 |

FILE: SECTIONAL DRAWING / 5278GA02

DRAWING NO. 5278GA02 REV. B

# D300FR MOTOR

## BOTTOM BEARING INSTALLATION




D300FR_BTM_BRG

## 12.2 TABLES FOR ROUTINE MAINTENANCE

## MAINTENANCE CHART

| | DAILY | WEEKLY | MONTHLY | 3 MONTHLY | 6 MONTHLY | YEARLY | REMARKS |
|---|---|---|---|---|---|---|---|
| Check for leaks. | ■ | | ■ | | | | Extend to monthly if proved satisfactory during running-in. |
| Check electrical continuity & insulation resistance. | | | ■ | | ■ | | Extend to 6 monthly if proved satisfactory during running-in. |
| Check oil in seal chamber, drain & refill. | | | | | ■ | ■ | Extend to 12 monthly if proved satisfactory during running in and 1500 hrs. Running not exceeded. |
| Check for vibration. | ■ | ■ | | | | | Extend to weekly if proved satisfactory during running-in. |
| Check cable for damage. | | | | | ■ | | Depending on environmental condition. |
| Inspect wear rings. | | | | ■ | | | Frequency can be changed depending on findings and pumping conditions. |
| Check for undue wear or corrosion of volute or impeller. | | | | ■ | | ■ | Check at end of first 3 months. Extend to yearly dependant on environmental and pumping conditions. |
| Check holding down bolts for tightness | | | | ■ | | ■ | Check at end of running in period, then at 12 monthly intervals. |
| Remove Water jacket and clean out all feeder lines. (if applicable) | | | | | ■ | | Depending on environmental condition. |

## PUMP OVERHAUL

The pump should be completely overhauled if the discharge pressure drops below an acceptable level the overhaul procedure is detailed in the maintenance instructions.

## MOTOR OVERHAUL

The motor requires overhauling if an excessive amount of water is present in the seal chamber. The motor bearings should be replaced at each major overhaul.

## PROBLEM SOLVING FOR KSB AJAX PUMPS PTY LTD SUBMERSIBLE PUMP & MOTOR

### PROBLEM SOLVING AND REMEDIAL ACTION REQUIRED

| | | |
|---|---|---|
| (A) | Power failure. | - Restore power. |
| (B) | Damaged cable. | - Repair or replace cable. |
| (C) | Blown fuses. | - Check to ensure the correct rating is being used.<br>Check that the pump is not jammed.<br>Check voltage supply.<br>Carry out insulation and continuity checks.<br>Remove cause of overload, rectify electrical problems.<br>Replace fuse. |
| (D) | Thermistor failure. | - Check thermistors using a low voltage multimeter resistance. Should be 60 OHMS to 500 OHMS.<br>Check for open circuit in thermistor wiring.<br>Check backup relay.<br>Check if more than 2.5 volts has been applied across thermistors.<br>Repair Thermistor Circuit or replace damaged components. |
| (E) | Overload tripped. | - Reset. Follow procedure as for Item C. |
| (F) | Circuit breaker tripped. | - Reset. Follow procedure as for Item C. |
| (G) | Jammed/choked impeller. | - Remove cause of blockage.<br>Check wet well for foreign material. |
| (H) | Restriction/discharge line. | - Remove restriction.<br>Check gate valve. |
| (I) | Worn wear ring. | - Replace wear rings. |
| (J) | Excess air in liquid. | - Check inlet lines into station and baffle or relocate if necessary.<br>Check level in well. |
| (K) | Head higher than design head. | - Check systems.<br>Check for blockages in system. |
| (L) | Loose or damaged wiring. | - Repair or replace as required. |
| (M) | Open circuit/burnt-out stator. | - Replace, repair or rewind stator as required. |
| (N) | Loose plug/seal compartment. | - Tighten. |

| | | |
|---|---|---|
| (O) | Damaged/worn mechanical seal. | - Replace or repair.<br>NOTE - In some cases mechanical seals are suitable for re-installation after relapping or replacement of carbide faces. |
| (P) | "O" ring/gasket failure. | - Replace. |
| (Q) | Casting fracture/failure. | - Repair or replace as required. |

# TROUBLE SHOOTING FOR KSB AJAX PUMPS PTY LTD SUBMERSIBLE PUMP AND MOTOR

## PUMP WILL NOT START

(A) Power failure.
(B) Damaged cable.
(C) Blown fuse.
(D) Thermistor failure.
(E) Jammed impeller.
(F) Overload tripped.
(G) Circuit breaker tripped.
(H) Electrical switch board fault.
(I) Motor incorrectly connected.
(J) Faulty motor winding.

## PUMP STARTS BUT MOTOR HAS EXCESS CURRENT and/or LOW SPEED

(A) Wrong direction of rotation.
(B) Over or under voltage.
(C) Clogged impeller.
(D) Failed bearing.
(E) Fault in the motor.
(F) Incorrect motor connection.
(G) Pump installed in wrong system or system change to pipework change or failure.

## PUMP RUNS BUT CAPACITY LOW

(A) Wrong direction of rotation.
(B) Impeller choked or inlet restricted.
(C) Restriction of discharge line.
(D) Wear rings worn excessively.
(E) Excessive air in liquid.
(F) Head higher than design head.
(G) Leakage from discharge.
(H) Supply voltage incorrect.

## LOW RESISTANCE READING or SHORT

(A) Water in cone housing.
(B) Cable damaged.
(C) Water in stator housing.
(D) Stator burnt out.
(E) Loose wire.
(F) Wire clamped.

## HIGH CONTINUITY READING

(A) Open circuit in stator / stator burnt out.
(B) Broken wire or loose connection.
(C) Damaged cable.

## 12.3 RECOMMENDED SPARES & LUBRICANTS

## RECOMMENDED SPARE PARTS LIST

| DESCRIPTION | ITEM NO: |
|---|---|
| Bearing Upper | 5 |
| Bearing Lower | 6 |
| Mechanical Seal - Inner | 97 |
| Mechanical Seal - Outer | 21 |
| Locknut | 103 |
| Wear Ring Impeller | 107 |
| Wear Ring Volute | 108 |
| Sealing Ring | 120 |
| 'O' Ring & Gasket Set | |

When ordering spare parts quote the serial number of the pump.

**RECOMMENDED LUBRICANTS**

Oil for Seal Chamber - Mobil Whiterex 307 (FR300 - 2.5 Lit.)

Bearing Grease - SKF LGHT 3/1 High Temperature Grease

## 12.4 RECOMMENDED TOOL LIST

This equipment can be serviced using standard equipment normally available to Electrical and Mechanical Tradespersons.

Meggar
Multimeter
Screwdrivers
Open ended spanners
Socket spanners & extension bars

Major overhauls should be carried out in a workshop containing the following:-

Presses
Heating Apparatus - Induction Heater
- Gas Flame Heater
- Oven
Bearing Pullers
Impeller Puller

## 12.5 PUMP PERFORMANCE CURVES AND SHEETS

# KSB Ajax Pumps Pty. Ltd. Submersible Electric Pump Test Data

**Customer:** *J&P RICHARDSON*
**Project:** *BRISBANE C.C METROFLEX ON GATEWAY*
**Unit Serial No.:** *F51274-1*

**Measuring Instruments:**

**Flow:** Magna Flow Meter
**Discharge Head:** 0-160 PRESSUREGAUGE
**Power:** kWH Meters

## PUMP

| | | |
|---|---|---|
| **Make:** | FORRERS | |
| **Type:** | Submersible | |
| **Model:** | E100-380 TLC | |
| **Impeller Dia.:** | 352 | mm |
| **Suction Pipe Dia.:** | 100000 | mm |
| **Discharge Pipe Dia.:** | 100 | mm |
| **Gauge Hight Cor.:** | 0 | m |

## DUTY

| | | |
|---|---|---|
| **Flow:** | 58 | l/s |
| **Head:** | 32 | M |
| **Speed:** | 1470 | rpm |
| **Power:** | 40 | kW |
| **Efficiency Pump:** | 64 | |
| **Motor Efficiency:** | 92 | |
| **kWh / kl:** | 0.1486 | |

## MOTOR

| | | |
|---|---|---|
| **Make:** | Forrer | |
| **Frame:** | 300 | |
| **Speed:** | 1470 | rpm |
| **Supply:** | 415 / 3 ph | / 50 Hz |
| **Type:** | Submersible | |
| **Serial No.:** | F51274-1 | |
| **Power:** | 40.0 | kW |
| **Amps:** | 67.0 | A |

**Barometric Pressure:** XX mbar
**Water Temperature:** XX °C
**Meter Constant in Revs/KWH:** 266.6
**No. of Revs:** 10
**Current Transformer Meters:** N

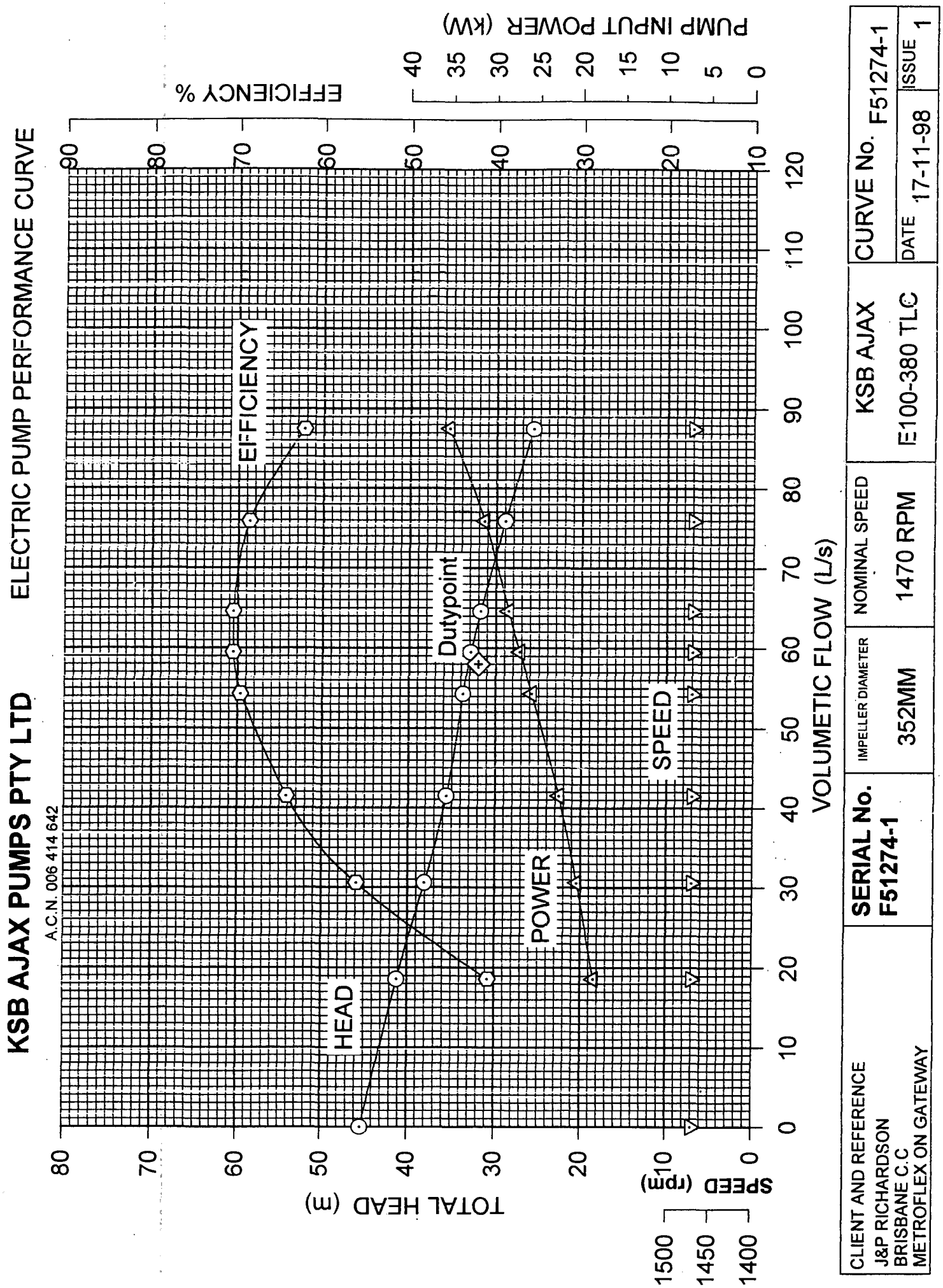
| Works Test AS 2417 Part 2 - 1980 | | | |
|---|---|---|---|
| **Quoted** | **With Toler.** | **As Tested** | |
| 0.1486 | 0.1556 | 0.1381 | **KWH/KL** |
| 64.00 | 60.80 | 70.50 | **EFF.** |
| 58.00 | $\left[\frac{H_Q \times X_H}{\Delta H}\right]^2 + \left[\frac{Q_Q \times X_Q}{\Delta Q}\right]^2$ | 59.50 | **L/S** |
| 32.00 | | 32.90 | **MHD** |
| | 2.10 | 1.00 | $\Delta H$ |
| | | 6.00 | $\Delta Q$ |

| Point No | Flow l/s | Suction Head m | Delivery Head m | Correction Head m | KWH Meter W1 | KWH Meter W2 | KWH Meter W3 | Amps A | Power in (Motor) kW | Motor Eff'y | DVH m | Speed rpm | Flow l/s | Total Head m | Power in (pump) kW | Pump Eff'y | O/All Eff'y | Energy per Vol kWh/kl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | XX | 45.30 | XX | | | | | | 92 | 0.00 | 1470 | 0.00 | 45.30 | | | 0.00 | 0.0000 |
| 2 | 18.60 | XX | 40.90 | XX | 19.44 | 20.91 | 20.31 | 37 / 34 / 36 | 20.03 | 92 | 0.29 | 1470 | 18.60 | 41.19 | 18.43 | 40.75 | 37.49 | 0.2988 |
| 3 | 30.60 | XX | 37.30 | XX | 17.60 | 18.84 | 18.28 | 40 / 37 / 38 | 22.21 | 92 | 0.77 | 1470 | 30.60 | 38.07 | 20.43 | 55.90 | 51.43 | 0.2014 |
| 4 | 41.50 | XX | 34.20 | XX | 16.00 | 16.97 | 16.53 | 44 / 40 / 42 | 24.55 | 92 | 1.42 | 1470 | 41.50 | 35.62 | 22.59 | 64.17 | 59.04 | 0.1641 |
| 5 | 54.30 | XX | 31.30 | XX | 13.97 | 14.90 | 14.47 | 50 / 45 / 47 | 28.04 | 92 | 2.44 | 1470 | 54.30 | 33.74 | 25.80 | 69.62 | 64.05 | 0.1433 |
| 6 | 59.50 | XX | 30.00 | XX | 13.25 | 14.09 | 13.72 | 52 / 46 / 48 | 29.60 | 92 | 2.93 | 1470 | 59.50 | 32.93 | 27.23 | 70.54 | 64.90 | 0.1380 |
| 7 | 64.60 | XX | 28.30 | XX | 12.78 | 13.32 | 13.10 | 54 / 48 / 51 | 31.00 | 92 | 3.45 | 1470 | 64.60 | 31.75 | 28.52 | 70.50 | 64.86 | 0.1331 |
| 8 | 75.90 | XX | 24.20 | XX | 11:50 | 12.10 | 12.03 | 59 / 53 / 55 | 34.11 | 92 | 4.76 | 1470 | 75.90 | 28.96 | 31.38 | 68.68 | 63.19 | 0.1247 |
| 9 | 87.50 | XX | 19.40 | XX | 10.25 | 10.68 | 10.59 | 66 / 60 / 62 | 38.56 | 92 | 6.33 | 1470 | 87.50 | 25.73 | 35.47 | 62.23 | 57.25 | 0.1223 |

**Reliability Test (Yes/No) -:** XX **(If Yes) Hours:** XX

**Test Officer:** DAN MACKINNON X Signed:
**Witnessed by:** Signed:

**Date:** 17/11/98 **Comments:**


KSB AJAX PUMPS PTY LTD
A.C.N. 006 414 642
ELECTRIC PUMP PERFORMANCE CURVE
EFFICIENCY %
PUMP INPUT POWER (kW)
TOTAL HEAD (m)
SPEED (rpm)
VOLUMETIC FLOW (L/s)
EFFICIENCY
Dutypoint
SPEED
POWER
HEAD
CLIENT AND REFERENCE
J&P RICHARDSON
BRISBANE C.C
METROFLEX ON GATEWAY
SERIAL No.
F51274-1
IMPELLER DIAMETER
352MM
NOMINAL SPEED
1470 RPM
KSB AJAX
E100-380 TLC
CURVE No. F51274-1
DATE 17-11-98
ISSUE 1

# KSB Ajax Pumps Pty. Ltd. Submersible Electric Pump Test Data

**Customer:** *J&P RICHARDSON*
**Project:** *BRISBANE C.C METROFLEX OF GATEWAY*
**Unit Serial No.:** *F51274-2*

**Measuring Instruments:**

**Flow:** Magna Flow Meter
**Discharge Head:** 0-160 PRESSURE GAUGE
**Power:** kWH Meters

## PUMP

| | | |
|---|---|---|
| **Make:** | FORRERS | |
| **Type:** | Submersible | |
| **Model:** | E100-380 TLC | |
| **Impeller Dia.:** | 352 | mm |
| **Suction Pipe Dia.:** | 100000 | mm |
| **Discharge Pipe Dia.:** | 100 | mm |
| **Gauge Hight Cor.:** | 0 | m |

## DUTY

| | | |
|---|---|---|
| **Flow:** | 58 | l/s |
| **Head:** | 32 | M |
| **Speed:** | 1470 | rpm |
| **Power:** | 40 | kW |
| **Efficiency Pump:** | 64 | |
| **Motor Efficiency:** | 92 | |
| **kWh / kl:** | 0.1486 | |

## MOTOR

| | | |
|---|---|---|
| **Make:** | Forrer | |
| **Frame:** | 300 | |
| **Speed:** | 1470 | rpm |
| **Supply:** | 415 / 3 ph | / 50 Hz |
| **Type:** | Submersible | |
| **Serial No.:** | F51274-2 | |
| **Power:** | 40.0 | kW |
| **Amps:** | 67 0 | A |

**Barometric Pressure:** XX mbar
**Water Temperature:** XX °C
**Meter Constant in Revs/KWH:** 266.6
**No. of Revs:** 10
**Current Transformer Meters:** N

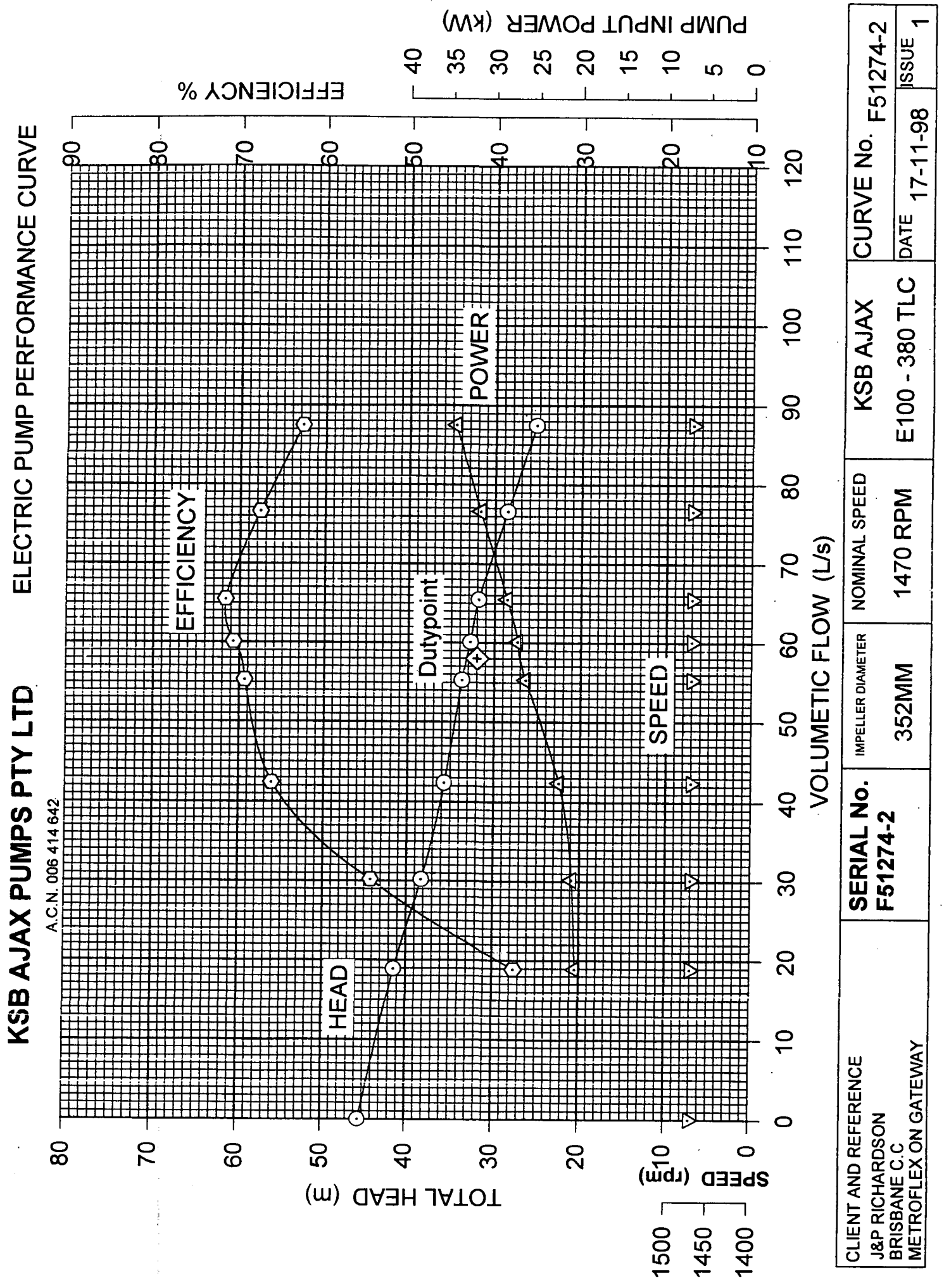
| Works Test AS 2417 Part 2 - 1980 | | | |
|---|---|---|---|
| **Quoted** | **With Toler.** | **As Tested** | |
| 0.1486 | 0.1556 | 0.1373 | **KWH/KL** |
| 64.00 | 60.80 | 70.60 | **EFF.** |
| 58.00 | $\left\lvert\frac{H_Q \times X_H}{\Delta H}\right\rvert^2 + \left\lvert\frac{Q_G \times X_Q}{\Delta Q}\right\rvert^2$ | 60.10 | **L/S** |
| 32.00 | | 32.77 | **MHD** |
| | 1.43 | 1.30 | $\Delta H$ |
| | | 6.00 | $\Delta Q$ |

| Point No | Flow l/s | Suction Head m | Delivery Head m | Correction Head m | KWH Meter W1 | KWH Meter W2 | KWH Meter W3 | Amps A | Power in (Motor) kW | Motor Eff'y | DVH m | Speed rpm | Flow l/s | Total Head m | Power in (pump) kW | Pump Eff'y | O/All Eff'y | Energy per Vol kWh/kl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | XX | 45.50 | XX | | | | | | 92 | 0.00 | 1470 | 0.00 | 45.50 | | | 0.00 | 0.0000 |
| 2 | 18.90 | XX | 41.10 | XX | 17.50 | 18.82 | 18.40 | 40 / 37 / 38 | 22.21 | 92 | 0.30 | 1470 | 18.90 | 41.40 | 20.43 | 37.54 | 34.54 | 0.3260 |
| 3 | 30.20 | XX | 37.50 | XX | 17.16 | 18.38 | 18.00 | 42 / 38 / 39 | 22.70 | 92 | 0.75 | 1470 | 30.20 | 38.25 | 20.88 | 54.24 | 49.90 | 0.2085 |
| 4 | 42.40 | XX | 34.20 | XX | 16.00 | 17.12 | 16.72 | 44 / 40 / 41 | 24.38 | 92 | 1.49 | 1470 | 42.40 | 35.69 | 22.43 | 66.13 | 60.84 | 0.1596 |
| 5 | 55.30 | XX | 31.20 | XX | 13.50 | 14.72 | 14.18 | 51 / 46 / 47 | 28.66 | 92 | 2.53 | 1470 | 55.30 | 33.73 | 26.37 | 69.35 | 63.80 | 0.1438 |
| 6 | 60.10 | XX | 29.80 | XX | 13.22 | 13.97 | 13.72 | 52 / 47 / 49 | 29.71 | 92 | 2.99 | 1470 | 60.10 | 32.79 | 27.33 | 70.69 | 65.03 | 0.1371 |
| 7 | 65.50 | XX | 28.30 | XX | 12.56 | 13.50 | 13.09 | 54 / 49 / 51 | 31.04 | 92 | 3.55 | 1470 | 65.50 | 31.85 | 28.56 | 71.61 | 65.88 | 0.1315 |
| 8 | 76.60 | XX | 23.70 | XX | 11.50 | 12.03 | 11.75 | 59 / 53 / 56 | 34.45 | 92 | 4.85 | 1470 | 76.60 | 28.55 | 31.69 | 67.66 | 62.25 | 0.1248 |
| 9 | 87.50 | XX | 19.00 | XX | 10.34 | 11.15 | 10.78 | 65 / 58 / 61 | 37.66 | 92 | 6.33 | 1470 | 87.50 | 25.33 | 34.65 | 62.72 | 57.70 | 0.1194 |

**Reliability Test (Yes/No) -:** XX **(If Yes) Hours:** XX

**Test Officer:** W.P. O' DOHERTY 1 **Signed:**
**Witnessed by:** **Signed:**

**Date:** 17/11/98 **Comments:**


KSB AJAX PUMPS PTY LTD
A.C.N. 006 414 642
ELECTRIC PUMP PERFORMANCE CURVE
EFFICIENCY %
PUMP INPUT POWER (kW)
TOTAL HEAD (m)
SPEED (rpm)
VOLUMETIC FLOW (L/s)
EFFICIENCY
POWER
HEAD
SPEED
Dutypoint
CLIENT AND REFERENCE
J&P RICHARDSON
BRISBANE C.C
METROFLEX ON GATEWAY
SERIAL No.
F51274-2
IMPELLER DIAMETER
352MM
NOMINAL SPEED
1470 RPM
KSB AJAX
E100 - 380 TLC
CURVE No. F51274-2
DATE 17-11-98
ISSUE 1

## 12.6 PUMP TECHNICAL DATA & DIMENSION SHEETS

## FORRERS PUMP DETAILS

| Model (Old Model No) | SP280 | SGV100-150 | SGV280 | 4S250/3 | 4S330/3 |
|---|---|---|---|---|---|
| Model (New Model No) | | | | E100-280 | E100-340 |
| Discharge Diameter | 75 | 75 | 75 | 100 | 100 |
| Inlet Diameter | 75 | 75 | 75 | 125 | 170 |
| Impeller Type | Shredder | Shredder | Shredder | Non Clog | Non Clog |
| Impeller Fixing | Locknut | Locknut | Locknut | Taper/Locknut | Taper/Locknut |
| Rang to fit pump | 180 - 100 | 150 - 100 | 180 - 100 | 277 - 185 | 340 - 275 |
| W/ring Diametrical Clearance | N/A | N/A | N/A | 0.82-0.61 | 340 - 275 |
| W/ring Fixing | N/A | N/A | N/A | Pressed | Pressed |
| Min Submergence - TLC | 440 | 440 | 440 | 440 | 440 |
| Weight - Pump Only | 40 | 38 | 40 | 96 | 114 |

## FORRERS PUMP DETAILS

| Model (Old Model No.) | 4S350/3 | 4S380/4 | 4S405/3 | 6D330/3.5 | 6D350/4 |
|---|---|---|---|---|---|
| Model (New Model No.) | E100-350 | E100-380 | E100-405 | K150-330 | K150-350 |
| Discharge Diameter | 100 | 100 | 100 | 150 | 150 |
| Inlet Diameter | 168 | 100 | 185 | 125 | 150 |
| Impeller Type | Non Clog | Non Clog | Non Clog | Non Clog | Non Clog |
| Impeller Fixing | Taper/Lockn ut | Taper/Lockn ut | Taper/Lockn ut | Taper/Lockn ut | Taper/Locknut |
| Range to fit pump | 355 - 340 | 370 - 270 | 406 - 346 | 330 - 250 | 344 - 265 |
| W/ring Diametrical Clearance | 0.81-0.71 | 0.81-0.71 | 0.81 -0.71 | 0.81-0.71 | 0.81-0.71 |
| W/ring Fixing | Pressed | Pressed | Pressed | Pressed | Pressed |
| Min Submergence - TLC | 440 | 450 | 440 | 550 | 550 |
| Weight - Pump Only | 135 | 131 | 155 | 170 | 198 |

## FORRERS PUMP DETAILS

| Model (Old Model No) | 6D405/3 | 6D430/4 | 6D480/3 | 8D360/4 | 8D405/4 |
|---|---|---|---|---|---|
| Model (new Model No) | K150-405 | K150-430 | K150-480 | K200-360 | K200-405 |
| Discharge Diameter | 150 | 150 | 150 | 200 | 200 |
| Inlet Diameter | 170 | 168 | 157 | 185 | 212 |
| Impeller Type | Non Clog | Non Clog | Non Clog | Non Clog | Non Clog |
| Impeller Fixing | Taper/Lockn ut | Taper/Lockn ut | Taper/Lockn ut | Taper/Lockn ut | Taper/Lockn ut |
| Range to fit pump | 406 - 345 | 440 - 342 | 485 - 435 | 364 - 272 | 406 - 350 |
| W/ring Diametrical Clearance | 0.81-0.71 | 0.81-0.71 | 0.71-0.71 | 0.89-0.64 | 0.79-0.64 |
| W/ring Fixing | Pressed | Pressed | Pressed | Pressed | Pressed |
| Weight - Pump Only | 190 | 218 | 340 | 310 | 320 |

## 12.7 MOTOR TECHNICAL DATA SHEETS

# MOTOR TECHNICAL DATA
# (COMMON CONSTRUCTION DETAIL)

| | |
|---|---|
| Frame Size | 300 |
| Enclosure | IP68 |
| Insulation Class | F |
| Mechanical Seal Size | 63 |
| Seal Face Material | EXTERNAL SIC/SIC<br>INTERNAL SIC/C |
| Seal Style | TANDEM<br>FIGURE 3 |
| NDE Bearing | NU209<br>EC-C3 |
| Size | Dia. 45 |
| D.E. Bearing | 3313<br>C3 |
| Size | Dia. 65 |
| Bearing Lubrication | Sealed/<br>Grease |
| Weight | 315 |

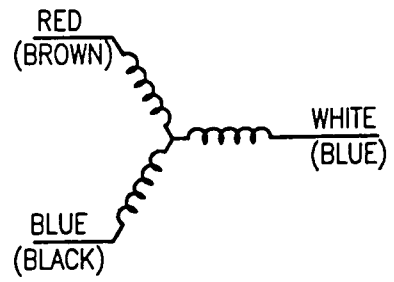
Note: Bearing Types - Examples 6302 VV-C3 indicates ball bearing
NU204EC-C3 indicates roller bearing
7315BECB-C3 indicates to matched angular contact ball bearings

## 12.8 WIRING DIAGRAM

# MOTOR CONNECTION FOR SUBMERSIBLE MOTORS (FORRERS)

## POWER CABLE - OLEX

1

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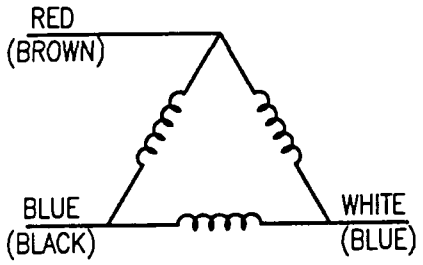
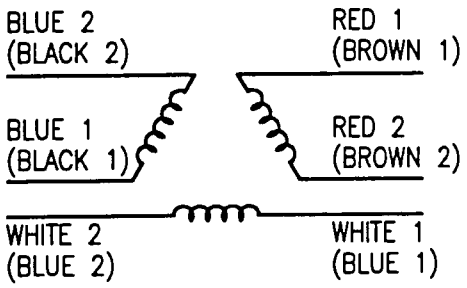
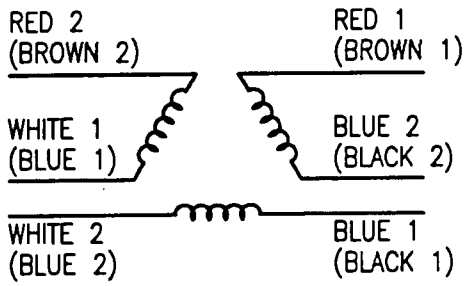



3




4




## CONTROL CABLES

5 TWO BLACKS IN MAIN CABLE
WINDING THERMISTORS

6 TWO BLACKS IN MAIN CABLE
WATER SENSOR

7 TWO BLACKS IN MAIN CABLE 1
WINDING THERMISTORS

8 TWO BLACKS IN MAIN CABLE 2
WATER SENSOR

9 SEPARATE CABLE
RED & BLUE – WINDING THERMISTORS
(BROWN & BLUE)
GREEN & WHITE – WATER SENSOR
(GREEN & BLACK)

10 SEPARATE CABLE
RED & BLACK – WATER SENSOR
(BROWN & BLUE)

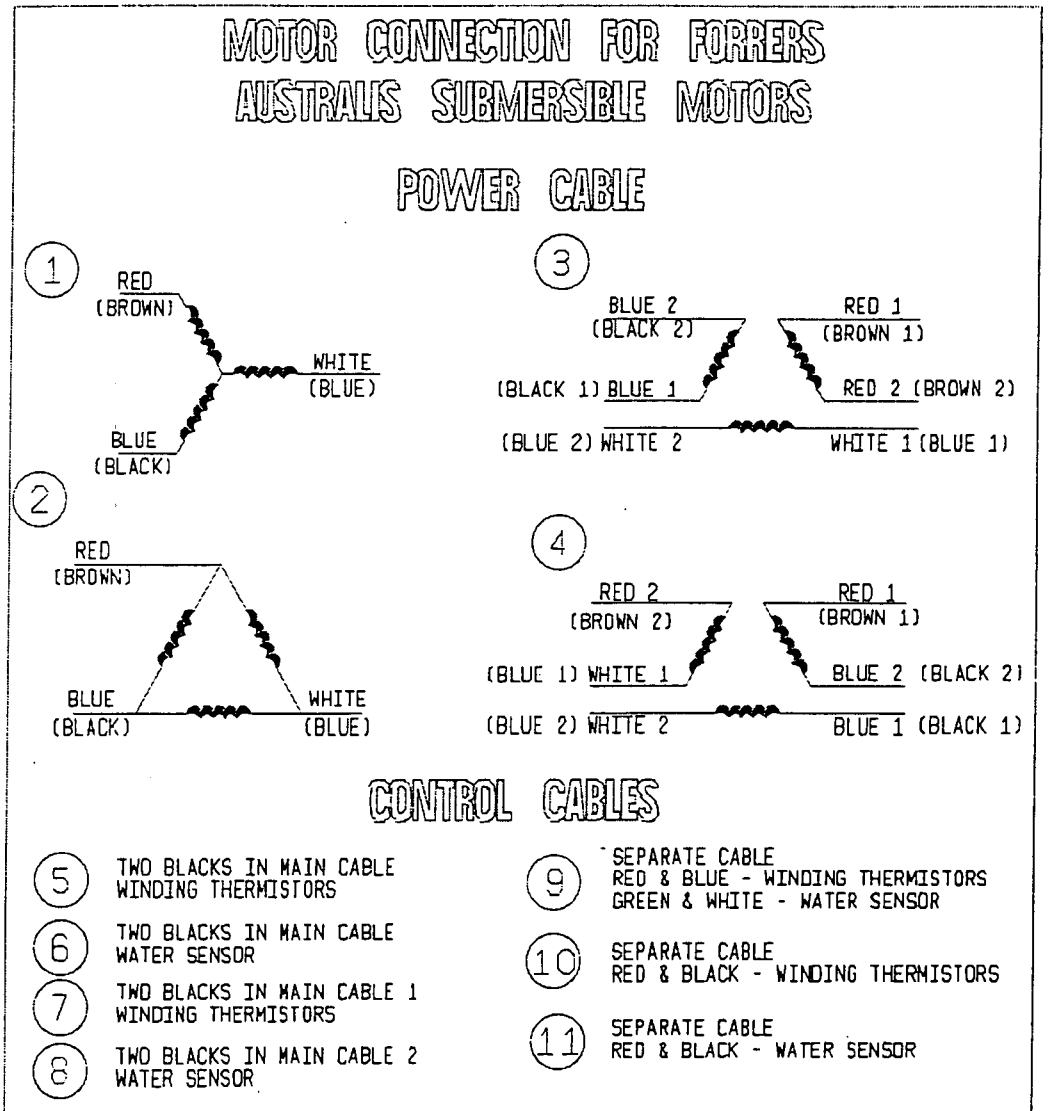
11 SEPARATE CABLE
RED & BLACK – WINDING THERMISTORS
(BROWN & BLUE)

FOR CORRECT ROTATION, DE, LOOKING INTO EYE OF IMPELLER
CONNECT R.W.B. TO R.W.B. OF A SUPPLY WITH A
TIME SEQUENCE R.W.B.

| | STANDARD MOTOR CONNECTION | | | STAR/DELTA MOTOR CONNECTION | | |
|---|---|---|---|---|---|---|
| RATING | STANDARD THERMS | STANDARD THERMS & SENSOR | STANDARD SENSOR | STAR/DELTA THERMS | STAR/DELTA THERMS & SENSOR | STAR/DELTA THERMS |
| 3kW TO 75kW | 2, 11 | 2, 9 | 2, 10 | 3, 11 | 3, 9 | 3, 10 |
| ABOVE 90kW | 4, 11 | 4, 9 | 4, 10 | 3, 11 | 3, 9 | 3, 10 |

Master_Cable_Diagram_Ole

## 12.9 MECHANICAL SEAL DATA

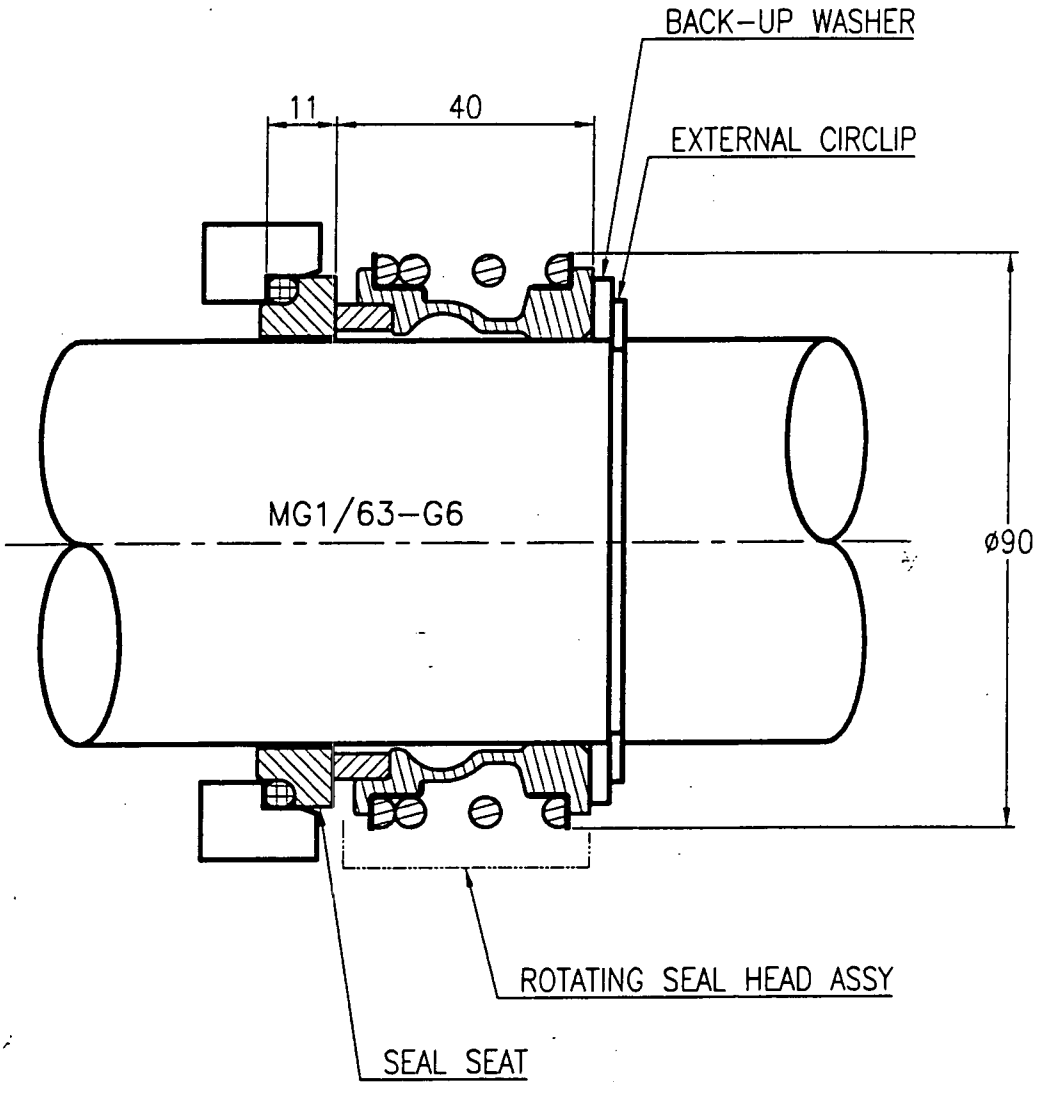



| | STANDARD MOTOR CONECTION | | | STAR/DELTA MOTOR CONNECTION | | |
|---|---|---|---|---|---|---|
| RATING | STANDARD THERMS | STANDAR THERMS & SENSOR | STANDARD SENSOR | STAR/DELTA THERMS | STAR/DELTA THERMS & SENSOR | STAR/DELTA SENSOR |
| BELOW 3kW | 1,5 | 1,5,11 | 1,6 | N/A | N/A | N/A |
| 3kW TO 45kW | 2,5 | 2,5,11 | 2,6 | 3,7 | 3,7,8 | 3,8 |
| 55kW TO 120kW | 4,7 | 4,7,8 | 4,8 | 3,7 | 3,7,8 | 3,8 |
| ABOVE 120kW | 4,10 | 4,9 | 4,11 | 3,10 | 3,9 | 3,11 |

KSB

# MECHANICAL SEAL

## BURGMANN – MG1




NOTES:
1. USE NORMAL OR SOAPY WATER TO MOUNT ELASTOMER BELLOW SEALS ONTO SHAFT.
2. NEVER USE OIL OR GREASE.
3. CHECK THAT THE RINGS, SPRINGS AND SEAL FACE SIT CORRECTLY.

MG1_63_G6_Manual

# KSB Ajax Pumps Pty. Ltd. Submersible Electric Pump Test Data

**Customer:** *J&P RICHARDSON*
**Project:** *BRISBANE C.C METROFLEX ON GATEWAY*
**Unit Serial No.:** *FS1274-1*

**Measuring Instruments:**
**Flow:** Magno Flow Meter
**Discharge Head:** 0-160 PRESSUREGAUGE
**Power:** kWH Meters

## PUMP

| | | |
|---|---|---|
| **Make:** | FORRERS | |
| **Type:** | Submersible | |
| **Model:** | E100-380 TLC | |
| **Impeller Dia.:** | 352 | mm |
| **Suction Pipe Dia.:** | 100000 | mm |
| **Discharge Pipe Dia.:** | 100 | mm |
| **Gauge Hight Cor.:** | 0 | m |

## DUTY

| | | |
|---|---|---|
| **Flow:** | 58 | l / s |
| **Head:** | 32 | M |
| **Speed:** | 1470 | rpm |
| **Power:** | 40 | kW |
| **Efficiency Pump:** | 64 | |
| **Motor Efficiency:** | 92 | |
| **kWh / kl:** | 0.1486 | |

## MOTOR

| | | |
|---|---|---|
| **Make:** | Forrer | |
| **Frame:** | 300 | |
| **Speed:** | 1470 | rpm |
| **Supply:** | 415 / 3 ph / 50 Hz | |
| **Type:** | Submersible | |
| **Serial No.:** | FS1274-1 | |
| **Power** | 40.0 | kW |
| **Amps:** | 67.0 | A |

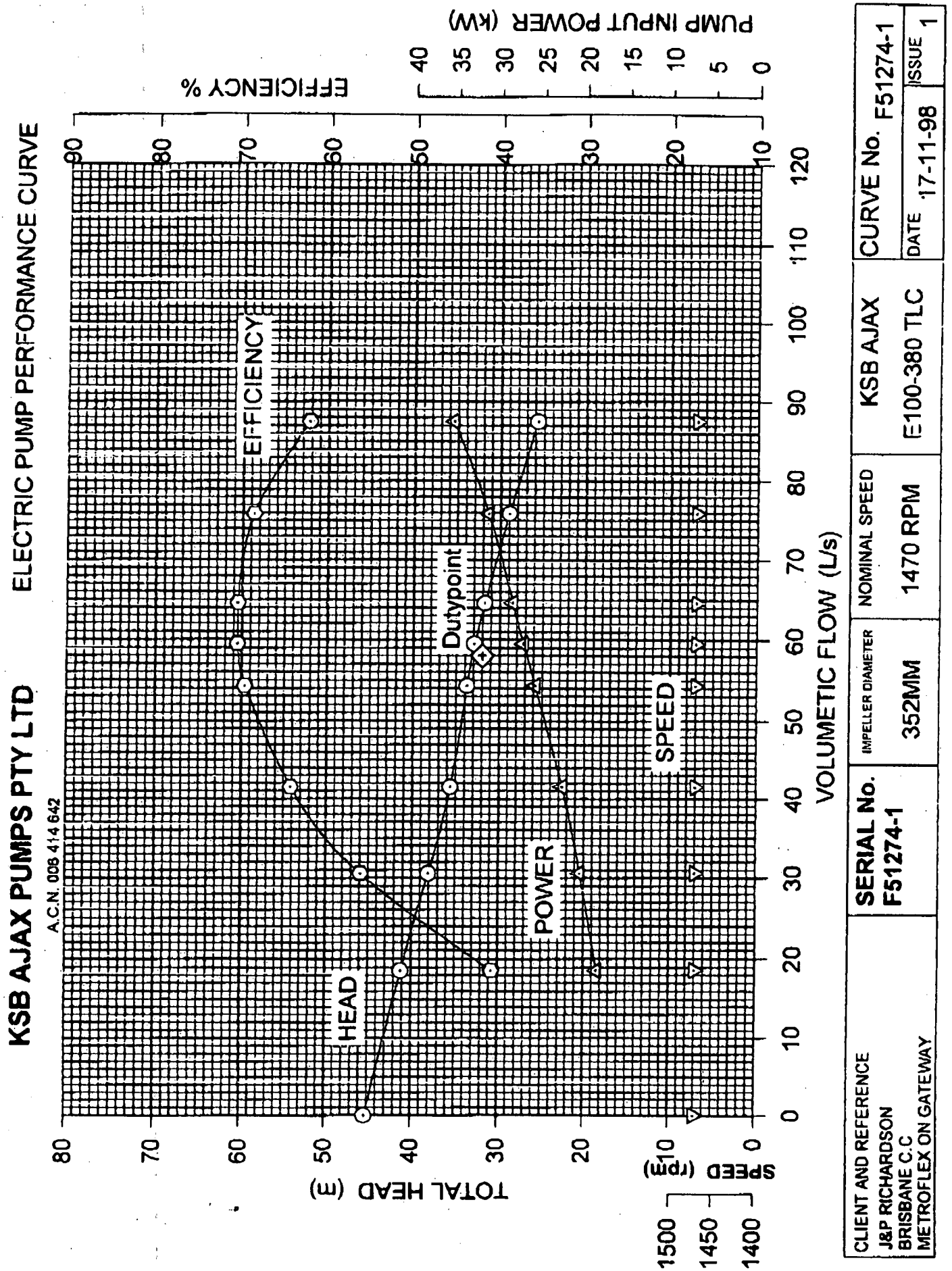
**Barometric Pressure:** XX mbar
**Water Temperature:** XX °C
**Meter Constant in Revs/KWH:** 266.6
**No. of Revs:** 10
**Current Transformer Meters:** N

| Works Test AS 2417 Part 2 - 1980 | | | |
|---|---|---|---|
| Quoted | With Toler. | As Tested | |
| 0.1486 | 0.1556 | 0.1381 | KWH/KL |
| 64.00 | 60.80 | 70.50 | EFF. |
| 58.00 | $\left[\frac{H_G \times X_H}{\Delta H}\right]^2 \cdot \left[\frac{Q_Q \times X_Q}{\delta Q}\right]^2$ | 59.50 | L/S |
| 32.00 | | 32.90 | MHD |
| | 2.10 | 1.00 | $\Delta H$ |
| | | 6.00 | $\Delta Q$ |

| Point No | Flow l/s | Suction Head m | Delivery Head m | Correction Head m | KWH Meter W1 | KWH Meter W2 | KWH Meter W3 | Amps A | Power In (Motor) kW | Motor Effy | DVH m | Speed rpm | Flow l/s | Total Head m | Power In (pump) kW | Pump Effy | O/All Effy | Energy per Vol kWh/kl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | XX | 45.30 | XX | | | | | | 92 | 0.00 | 1470 | 0.00 | 45.30 | | | 0.00 | 0.0000 |
| 2 | 18.60 | XX | 40.90 | XX | 19.44 | 20.91 | 20.31 | 37 / 34 / 36 | 20.03 | 92 | 0.29 | 1470 | 18.60 | 41.19 | 18.43 | 40.75 | 37.49 | 0.2988 |
| 3 | 30.60 | XX | 37.30 | XX | 17.60 | 18.84 | 18.28 | 40 / 37 / 38 | 22.21 | 92 | 0.77 | 1470 | 30.60 | 38.07 | 20.43 | 55.90 | 51.43 | 0.2014 |
| 4 | 41.50 | XX | 34.20 | XX | 16.00 | 16.97 | 16.53 | 44 / 40 / 42 | 24.55 | 92 | 1.42 | 1470 | 41.50 | 35.62 | 22.59 | 64.17 | 59.04 | 0.1641 |
| 5 | 54.30 | XX | 31.30 | XX | 13.97 | 14.90 | 14.47 | 50 / 45 / 47 | 28.04 | 92 | 2.44 | 1470 | 54.30 | 33.74 | 25.80 | 69.62 | 64.05 | 0.1433 |
| 6 | 59.50 | XX | 30.00 | XX | 13.25 | 14.09 | 13.72 | 52 / 46 / 48 | 29.60 | 92 | 2.93 | 1470 | 59.50 | 32.93 | 27.23 | 70.54 | 64.90 | 0.1380 |
| 7 | 64.60 | XX | 28.30 | XX | 12.78 | 13.32 | 13.10 | 54 / 48 / 51 | 31.00 | 92 | 3.45 | 1470 | 64.60 | 31.75 | 28.52 | 70.50 | 64.86 | 0.1331 |
| 8 | 75.90 | XX | 24.20 | XX | 11:50 | 12.10 | 12.03 | 59 / 53 / 55 | 34.11 | 92 | 4.76 | 1470 | 75.90 | 28.96 | 31.38 | 68.68 | 63.19 | 0.1247 |
| 9 | 87.50 | XX | 19.40 | XX | 10.25 | 10.68 | 10.59 | 66 / 60 / 62 | 38.56 | 92 | 6.33 | 1470 | 87.50 | 25.73 | 35.47 | 62.23 | 57.25 | 0.1223 |

**Reliability Test (Yes/No) -:** XX **(If Yes) Hours:** XX

**Test Officer:** DAN MACKINNON X **Signed:** **Date:** 17/11/98 **Comments:**
**Witnessed by:** **Signed:**


KSB AJAX PUMPS PTY LTD
A.C.N. 008 414 642
ELECTRIC PUMP PERFORMANCE CURVE
EFFICIENCY %
PUMP INPUT POWER (kW)
EFFICIENCY
Dutypoint
HEAD
POWER
SPEED
TOTAL HEAD (m)
SPEED (rpm)
VOLUMETIC FLOW (L/s)
CLIENT AND REFERENCE
J&P RICHARDSON
BRISBANE C.C
METROFLEX ON GATEWAY
SERIAL No.
F51274-1
IMPELLER DIAMETER
352MM
NOMINAL SPEED
1470 RPM
KSB AJAX
E100-380 TLC
CURVE No.
F51274-1
DATE
17-11-98
ISSUE
1

# KSB Ajax Pumps Pty. Ltd. Submersible Electric Pump Test Data

**Customer:** *J&P RICHARDSON*
**Project:** *BRISBANE C.C METROFLEX OF GATEWAY*
**Unit Serial No.:** *FS1274-2*

## PUMP

| | | |
|---|---|---|
| **Make:** | FORRERS | |
| **Type:** | Submersible | |
| **Model:** | E100-380 TLC | |
| **Impeller Dia.:** | 352 | mm |
| **Suction Pipe Dia.:** | 100000 | mm |
| **Discharge Pipe Dia.:** | 100 | mm |
| **Gauge Hight Cor.:** | 0 | m |

## DUTY

| | | |
|---|---|---|
| **Flow:** | 58 | l/s |
| **Head:** | 32 | M |
| **Speed:** | 1470 | rpm |
| **Power:** | 40 | kW |
| **Efficiency Pump:** | 64 | |
| **Motor Efficiency:** | 92 | |
| **kWh / kl:** | 0.1486 | |

**Barometric Pressure:** XX mbar
**Water Temperature:** XX °C
**Meter Constant in Revs/KWH:** 266.6
**No. of Revs:** 10
**Current Transformer Meters:** N

## Measuring Instruments:

| | |
|---|---|
| **Flow:** | Magna Flow Meter |
| **Discharge Head:** | 0-160 PRESSURE GAUGE |
| **Power:** | kWH Meters |

## MOTOR

| | | | |
|---|---|---|---|
| **Make:** | Forrer | | |
| **Frame:** | 300 | | |
| **Speed:** | 1470 | rpm | |
| **Supply:** | 415 | / 3 ph | / 50 Hz |
| **Type:** | Submersible | | |
| **Serial No.:** | FS1274-2 | | |
| **Power:** | 40.0 | kW | |
| **Amps:** | 67.0 | A | |

| Works Test AS 2417 Part 2 - 1980 | | | |
|---|---|---|---|
| Quoted | With Toler. | As Tested | |
| 0.1486 | 0.1556 | 0.1373 | KWH/KL |
| 64.00 | 60.80 | 70.60 | EFF. |
| 58.00 | $\left\lvert\frac{H_G \times X_H}{\Delta H}\right\rvert^3 \cdot \left\lvert\frac{Q_G \times X_Q}{\Delta Q}\right\rvert^2$ | 60.10 | L/S |
| 32.00 | | 32.77 | MHD |
| | 1.43 | 1.30 | $\Delta H$ |
| | | 6.00 | $\Delta Q$ |

| Point No | Flow l/s | Suction Head m | Delivery Head m | Correction Head m | KWH Meter W1 | KWH Meter W2 | KWH Meter W3 | Amps A | Power in (Motor) kW | Motor Effy | DVH m | Speed rpm | Flow l/s | Total Head m | Power in (pump) kW | Pump Effy | O/All Effy | Energy per Vol kWh/kl |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | XX | 45.50 | XX | | | | | | 92 | 0.00 | 1470 | 0.00 | 45.50 | | | 0.00 | 0.0000 |
| 2 | 18.90 | XX | 41.10 | XX | 17.50 | 18.82 | 18.40 | 40 / 37 / 38 | 22.21 | 92 | 0.30 | 1470 | 18.90 | 41.40 | 20.43 | 37.54 | 34.54 | 0.3260 |
| 3 | 30.20 | XX | 37.50 | XX | 17.16 | 18.38 | 18.00 | 42 / 38 / 39 | 22.70 | 92 | 0.75 | 1470 | 30.20 | 38.25 | 20.88 | 54.24 | 49.90 | 0.2085 |
| 4 | 42.40 | XX | 34.20 | XX | 16.00 | 17.12 | 16.72 | 44 / 40 / 41 | 24.38 | 92 | 1.49 | 1470 | 42.40 | 35.69 | 22.43 | 66.13 | 60.84 | 0.1596 |
| 5 | 55.30 | XX | 31.20 | XX | 13.50 | 14.72 | 14.18 | 51 / 46 / 47 | 28.66 | 92 | 2.53 | 1470 | 55.30 | 33.73 | 26.37 | 69.35 | 63.80 | 0.1438 |
| 6 | 60.10 | XX | 29.80 | XX | 13.22 | 13.97 | 13.72 | 52 / 47 / 49 | 29.71 | 92 | 2.99 | 1470 | 60.10 | 32.79 | 27.33 | 70.69 | 65.03 | 0.1371 |
| 7 | 65.50 | XX | 28.30 | XX | 12.56 | 13.50 | 13.09 | 54 / 49 / 51 | 31.04 | 92 | 3.55 | 1470 | 65.50 | 31.85 | 28.56 | 71.61 | 65.88 | 0.1315 |
| 8 | 76.60 | XX | 23.70 | XX | 11.50 | 12.03 | 11.75 | 59 / 53 / 56 | 34.45 | 92 | 4.85 | 1470 | 76.60 | 28.55 | 31.69 | 67.66 | 62.25 | 0.1248 |
| 9 | 87.50 | XX | 19.00 | XX | 10.34 | 11.15 | 10.78 | 65 / 58 / 61 | 37.66 | 92 | 6.33 | 1470 | 87.50 | 25.33 | 34.65 | 62.72 | 57.70 | 0.1194 |

**Reliability Test (Yes/No) -:** XX **(If Yes) Hours:** XX

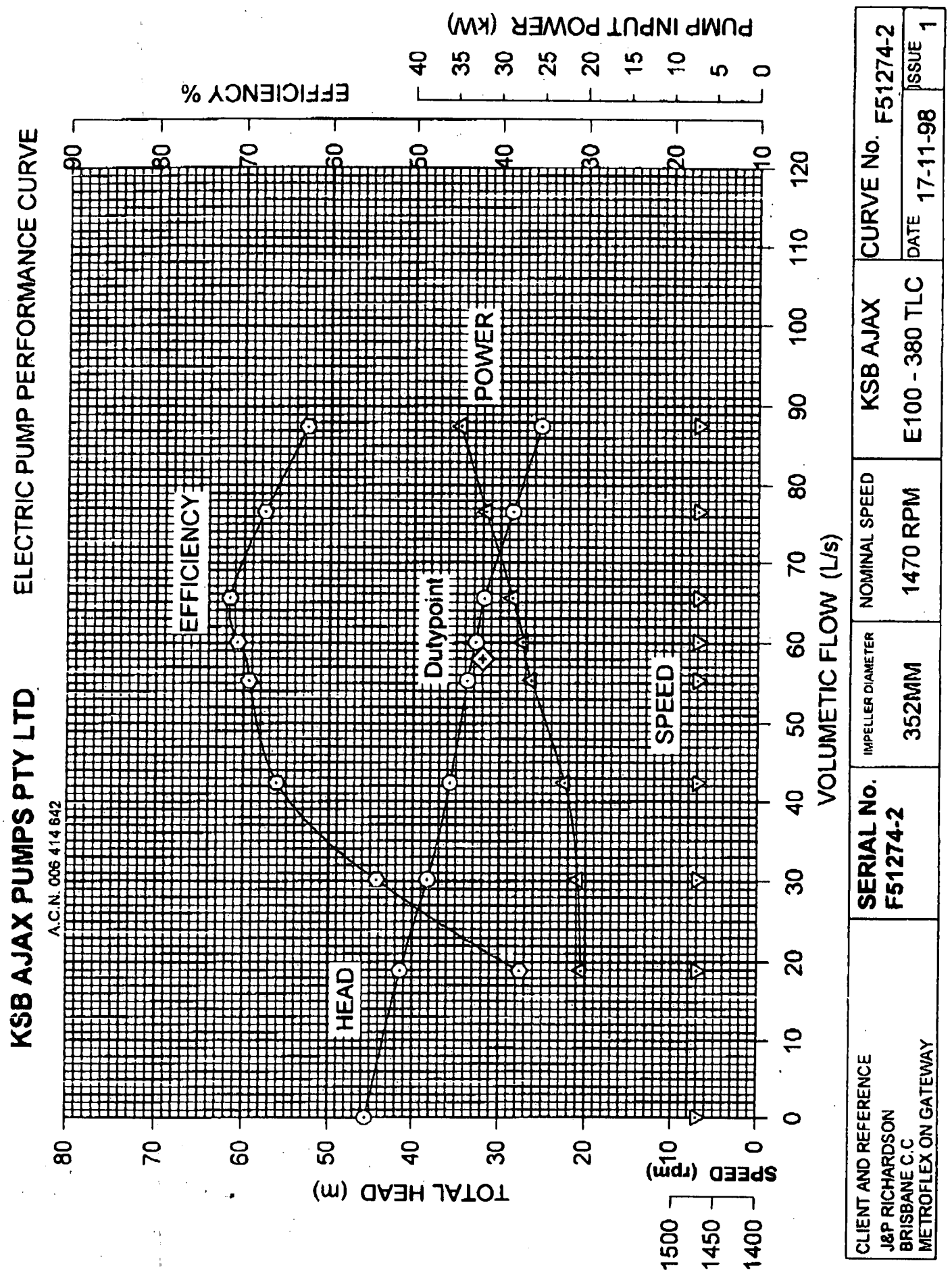
**Test Officer:** W.P. O' DOHERTY 1 **Signed:**
**Witnessed by:** **Signed:**

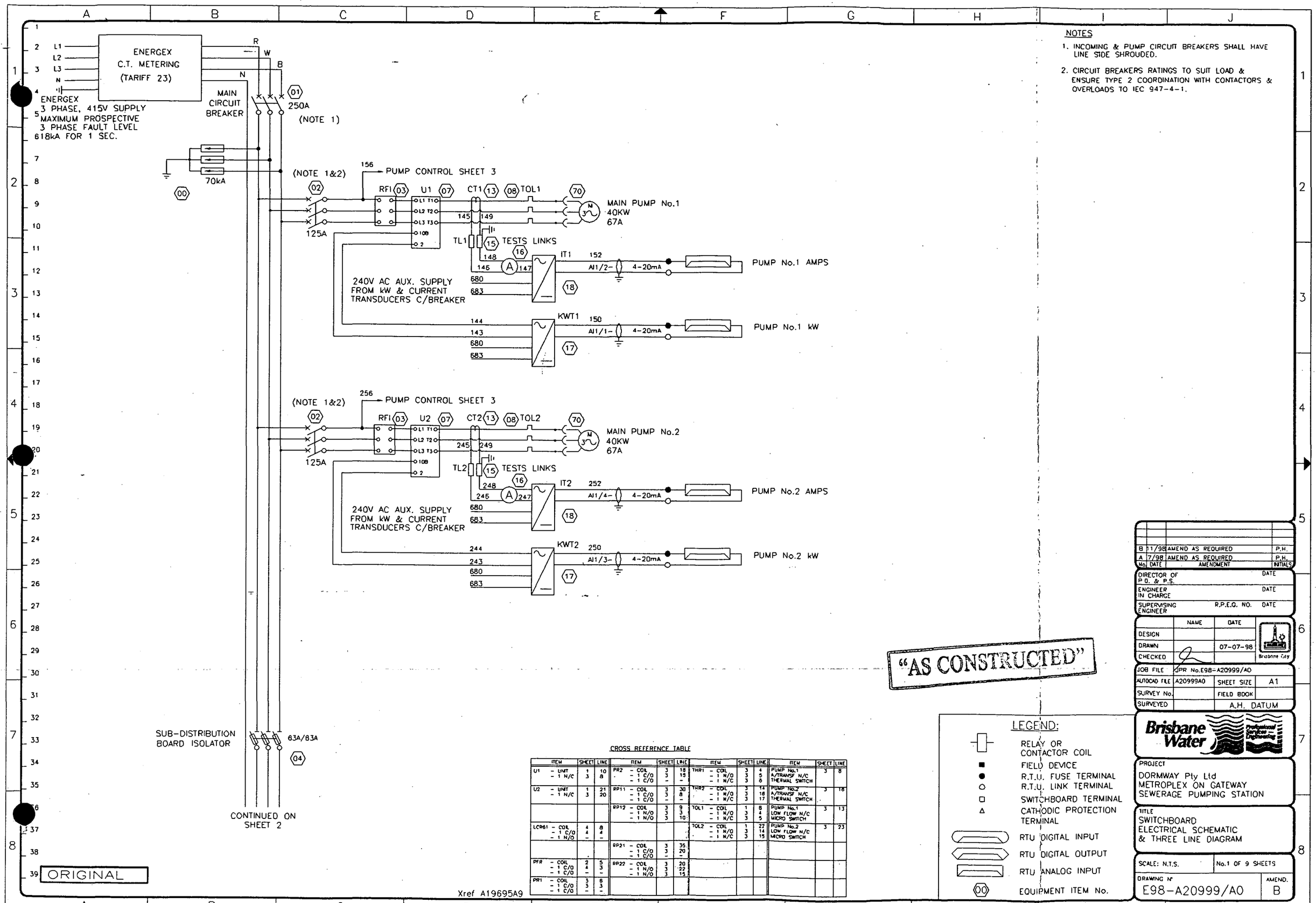
**Date:** 17/11/98 **Comments:**

DATE : 12/09/97

PAGE : 1 OF 1

DOC I.D. No : E-127 1


KSB AJAX PUMPS PTY LTD
A.C.N. 006 414 642
ELECTRIC PUMP PERFORMANCE CURVE
EFFICIENCY %
PUMP INPUT POWER (kW)
TOTAL HEAD (m)
SPEED (rpm)
VOLUMETIC FLOW (L/s)
EFFICIENCY
POWER
HEAD
Dutypoint
SPEED
CLIENT AND REFERENCE
J&P RICHARDSON
BRISBANE C.C
METROFLEX ON GATEWAY
SERIAL No.
F51274-2
IMPELLER DIAMETER
352MM
NOMINAL SPEED
1470 RPM
KSB AJAX
E100 - 380 TLC
CURVE No.
F51274-2
DATE
17-11-98
ISSUE
1




NOTES

1. INCOMING & PUMP CIRCUIT BREAKERS SHALL HAVE LINE SIDE SHROUDED.
2. CIRCUIT BREAKERS RATINGS TO SUIT LOAD & ENSURE TYPE 2 COORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.

CROSS REFERENCE TABLE

| ITEM | SHEET | LINE | ITEM | SHEET | LINE | ITEM | SHEET | LINE | ITEM | SHEET | LINE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| U1 - UNIT | 1 | 10 | PR2 - COIL | 3 | 18 | THR1 - COIL | 3 | 4 | PUMP No.1 A/TRANSF N/C | 3 | 8 |
| - 1 N/C | 3 | 8 | - 1 C/O | 3 | 19 | - 1 N/O | 3 | 5 | THERMAL SWITCH | | |
| | | | - 1 C/O | - | - | - 1 N/C | 3 | 6 | | | |
| U2 - UNIT | 1 | 21 | RP11 - COIL | 3 | 30 | THR2 - COIL | 3 | 14 | PUMP No.2 A/TRANSF N/C | 3 | 18 |
| - 1 N/C | 3 | 20 | - 1 C/O | 3 | 8 | - 1 N/O | 3 | 16 | THERMAL SWITCH | | |
| | | | - 1 C/O | - | - | - 1 N/C | 3 | 17 | | | |
| | | | RP12 - COIL | 3 | 9 | TOL1 - COIL | 1 | 8 | PUMP No.1 LOW FLOW N/C | 3 | 13 |
| | | | - 1 N/O | 3 | 3 | - 1 N/O | 3 | 4 | MICRO SWITCH | | |
| | | | - 1 N/O | 3 | 10 | - 1 N/C | 3 | 5 | | | |
| LCR61 - COIL | 4 | 8 | | | | TOL2 - COIL | 1 | 22 | PUMP No.2 LOW FLOW N/C | 3 | 23 |
| - 1 C/O | 4 | 4 | | | | - 1 N/O | 3 | 14 | MICRO SWITCH | | |
| - 1 N/O | - | - | | | | - 1 N/C | 3 | 15 | | | |
| | | | RP21 - COIL | 3 | 35 | | | | | | |
| | | | - 1 C/O | 3 | 20 | | | | | | |
| | | | - 1 C/O | - | - | | | | | | |
| PFR - COIL | 2 | 5 | RP22 - COIL | 3 | 20 | | | | | | |
| - 1 C/O | 4 | 3 | - 1 N/O | 3 | 22 | | | | | | |
| - 1 C/O | - | - | - 1 N/C | 3 | 15 | | | | | | |
| PR1 - COIL | 3 | 8 | | | | | | | | | |
| - 1 C/O | 3 | 3 | | | | | | | | | |
| - 1 C/O | - | - | | | | | | | | | |

LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- 00 EQUIPMENT ITEM No.

"AS CONSTRUCTED"

| No. | DATE | AMENDMENT | INITIALS |
|---|---|---|---|
| B | 11/98 | AMEND AS REQUIRED | P.H. |
| A | 7/98 | AMEND AS REQUIRED | P.H. |

DIRECTOR OF P.O. & P.S. — DATE

ENGINEER IN CHARGE — DATE

SUPERVISING ENGINEER — R.P.E.Q. NO. — DATE

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | 07-07-98 |
| CHECKED | | |

Brisbane City

| | | | |
|---|---|---|---|
| JOB FILE | JPR No.E98-A20999/A0 | | |
| AUTOCAD FILE | A20999A0 | SHEET SIZE | A1 |
| SURVEY No. | | FIELD BOOK | |
| SURVEYED | | A.H. DATUM | |

Brisbane Water — Professional Services — Engineering

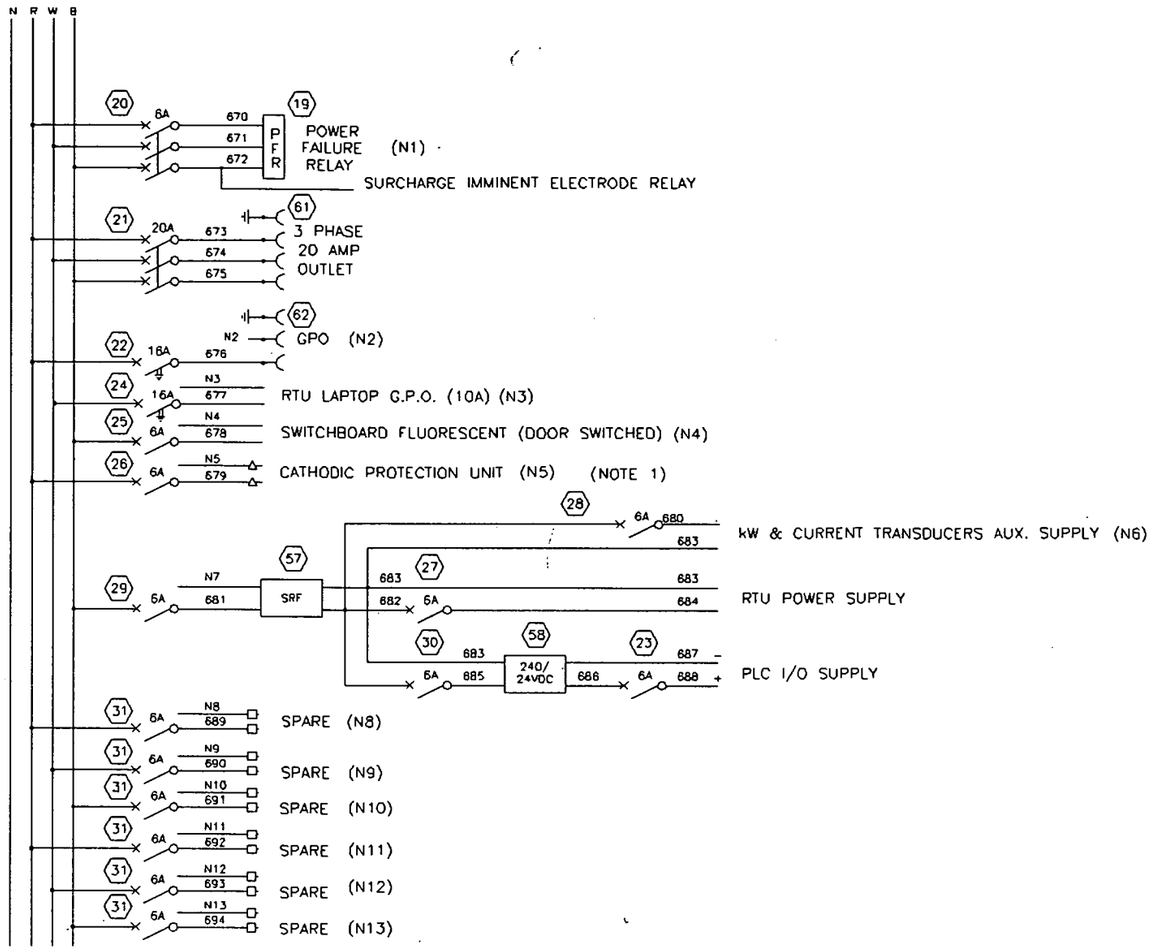
PROJECT
DORMWAY Pty Ltd
METROPLEX ON GATEWAY
SEWERAGE PUMPING STATION

TITLE
SWITCHBOARD
ELECTRICAL SCHEMATIC
& THREE LINE DIAGRAM

SCALE: N.T.S. — No.1 OF 9 SHEETS

DRAWING N° E98-A20999/A0 — AMEND. B

CONTINUED FROM —SHEET 1




## NOTES

1. CATHODIC PROTECTION – FUTURE. THIS UNIT TO BE SUPPLIED BY OTHERS. A 240VAC CABLE TO BE INSTALLED TO PROPOSED CATHODIC PROTECTION AREA TERMINAL STRIP FOR CONNECTION BY OTHERS

"AS CONSTRUCTED"

CROSS REFERENCE TABLE

| ITEM | SHEET | LINE |
|---|---|---|
| U1 – UNIT | 1 | 10 |
| – 1 N/C | 3 | 8 |
| U2 – UNIT | 1 | 21 |
| – 1 N/C | 3 | 20 |
| LCR81 – COIL | 4 | 8 |
| – 1 C/O | 4 | 4 |
| – 1 N/O | – | – |
| PFR – COIL | 2 | 5 |
| – 1 C/O | 4 | 3 |
| – 1 C/O | – | – |
| PR1 – COIL | 3 | 6 |
| – 1 C/O | 3 | 3 |
| – 1 C/O | – | – |
| PR2 – COIL | 3 | 18 |
| – 1 C/O | 3 | 15 |
| – 1 C/O | – | – |
| RP11 – COIL | 3 | 30 |
| – 1 C/O | 3 | 8 |
| – 1 C/O | – | – |
| RP12 – COIL | 3 | 9 |
| – 1 N/O | 3 | 3 |
| – 1 N/O | 3 | 10 |
| RP21 – COIL | 3 | 35 |
| – 1 C/O | 3 | 20 |
| – 1 C/O | – | – |
| RP22 – COIL | 3 | 20 |
| – 1 N/O | 3 | 22 |
| – 1 N/O | 3 | 15 |
| THP1 – COIL | 3 | 4 |
| – 1 N/O | 3 | 5 |
| – 1 N/C | 3 | 6 |
| THP2 – COIL | 3 | 14 |
| – 1 N/O | 3 | 18 |
| – 1 N/C | 3 | 17 |
| TOL1 – COIL | 1 | 8 |
| – 1 N/O | 3 | 4 |
| – 1 N/C | 3 | 5 |
| TOL2 – COIL | 1 | 22 |
| – 1 N/O | 3 | 14 |
| – 1 N/C | 3 | 15 |

| ITEM | SHEET | LINE |
|---|---|---|
| PUMP No.1 A/TRANSF N/C THERMAL SWITCH | 3 | 8 |
| PUMP No.2 A/TRANSF N/C THERMAL SWITCH | 3 | 18 |
| PUMP No.1 LOW FLOW N/C MICRO SWITCH | 3 | 13 |
| PUMP No.2 LOW FLOW N/C MICRO SWITCH | 3 | 23 |

LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- (00) EQUIPMENT ITEM No.

| No | DATE | AMENDMENT | INITIALS |
|---|---|---|---|
| B | 11/98 | AMEND AS REQUIRED | P.H. |
| A | 7/98 | AMEND AS REQUIRED | P.H. |

DIRECTOR OF P.O. & P.S. — DATE

ENGINEER IN CHARGE — DATE

SUPERVISING ENGINEER — R.P.E.Q. NO. — DATE

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | 08-07-98 |
| CHECKED | | |

Brisbane City

| | | | |
|---|---|---|---|
| JOB FILE | JPR No.E98-A20999/A1 | | |
| AUTOCAD FILE | A20999A1 | SHEET SIZE | A1 |
| SURVEY No. | | FIELD BOOK | |
| SURVEYED | | A.H. DATUM | |

Brisbane Water

PROJECT
DORMWAY Pty Ltd
METROPLEX ON GATEWAY
SEWERAGE PUMPING STATION

TITLE
SWITCHBOARD
ELECTRICAL SCHEMATIC
& THREE LINE DIAGRAM

| SCALE: N.T.S. | No.2 OF 9 SHEETS |
|---|---|
| DRAWING Nº E98-A20999/A1 | AMEND. B |

ORIGINAL

## ELV CONTROL

(NOTE 1) RTU INPUTS

PUMP No.1
- PR1-1 I1/00 — POWER ON
- TOL1-2 (47) I1/01 — THERMAL OVERLOAD
- (48) I1/02 — START
- I1/03 — EMERGENCY STOP
- THR1-2 I1/04 — THERMISTOR
- 1U1-1 (07) I1/09 — DRIVE FAULT
- (49) I1/05 — LOCAL RESET
- PR12-1 (43) I1/07 — VFD RUN CONTACT

PUMP No.2
- PR2-1 I2/00 — POWER ON
- TOL2-2 (47) I2/01 — THERMAL OVERLOAD
- (48) I2/02 — START
- I2/03 — EMERGENCY STOP
- THR2-2 I2/04 — THERMISTOR
- 2U1 (07) I2/09 — DRIVE FAULT
- (49) I2/05 — LOCAL RESET
- PR22-1 (43) I2/07 — VFD RUN CONTACT

24V DC + / 24V DC −

RTU OUTPUTS

PUMP No.1
- O1/00 R (46) — PUMP STATUS
- O1/01 RP11 (42) — RUN RELAY

PUMP No.2
- O1/04 R (46) — PUMP STATUS
- O1/05 RP21 (42) — RUN RELAY

## 240V AC CONTROL

240V AC FROM PUMP CONTROL CIRCUIT (SHT.1) (NOTE 3)

156 (37) 6A — 240V AC — 125 — RP12-2 — 126 (38) h — N14

MAIN PUMP No.1
- HOURS RUN
- THERMISTOR RELAY (AUTO RESET): 125, 135, MOTOR THERMISTOR 136 — THR1 (39); THR1-1, 127, TOL1-1, 128, 129 — PR1 (41)
- CONTROL CIRCUIT POWER ON
- INVERTER RUN SIGNAL: RP11-1 — U1 terminals 1, 2, 12A (07)
- INVERTER RUNING SIGNAL: RP12 (43) — +24VDC, −24VDC
- INVERTER FAULT SIGNAL: DRIVE FAULT, SHEET 3/8 — U1 terminals 17, 18
- OVERLOAD AUX. SUPPLY: 125 — TOL1 (08)
- VFD CUBICLE FAN: RP21 — (99)

240V AC FROM PUMP CONTROL CIRCUIT (SHT.1) (NOTE 3)

256 (37) 6A — 240V AC — 225 — RP22-2 — 226 (38) h — N15

MAIN PUMP No.2
- HOURS RUN
- THERMISTOR RELAY (AUTO RESET): 225, 235, MOTOR THERMISTOR 236 — THR2 (39); THR2-1, 227, TOL2-1, 228, 229 — PR2 (41)
- CONTROL CIRCUIT POWER ON
- INVERTER RUN SIGNAL: RP21-1 — U2 terminals 1, 2, 12A (07)
- INVERTER RUNING SIGNAL: RP22 (43) — +24VDC, −24VDC
- INVERTER FAULT SIGNAL: DRIVE FAULT, SHEET 3/20 — U2 terminals 17, 18
- OVERLOAD AUX. SUPPLY: 225 — TOL2 (08)
- VFD CUBICLE FAN: RP11 — (99)

## NOTES

1. 24V DC INPUT / OUTPUT INDIVIDUAL PROTECTION FUSES NOT SHOWN. (i.e. PART OF INTERFACE TERMINAL STRIP)
2. ALL WIRES & CABLE CORES TO BE FERRULED WITH GRAFOPLAST COMPATIBLE LABELLING.
   THE FOLLOWING PREFIXES SHALL BE USED:
   MAIN PUMP No. 1 = 1
   MAIN PUMP No. 2 = 2
   COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE)
3. PUMP CONTROL CIRCUIT BREAKERS RATED AT 9KA FOR 1 SEC.

ORIGINAL

"AS CONSTRUCTED"

CROSS REFERENCE TABLE

| ITEM | SHEET | LINE |
|---|---|---|
| U1 – UNIT – 1 N/C | 1 3 | 10 8 |
| U2 – UNIT – 1 N/C | 1 3 | 21 20 |
| LOR61 – COIL – 1 C/O – 1 N/O | 4 4 – | 8 4 – |
| PFR – COIL – 1 C/O – 1 C/O | 2 4 – | 5 3 – |
| PR1 – COIL – 1 C/O – 1 C/O | 3 3 – | 8 3 – |
| PR2 – COIL – 1 C/O – 1 N/O | 3 3 – | 18 15 – |
| RP11 – COIL – 1 C/O – 1 C/O | 3 3 – | 30 8 – |
| RP12 – COIL – 1 N/O – 1 N/O | 3 3 | 9 1 10 |
| RP21 – COIL – 1 C/O – 1 C/O | 3 3 – | 35 20 – |
| RP22 – COIL – 1 N/O – 1 N/O | 3 3 | 20 22 15 |
| THR1 – COIL – 1 N/O – 1 N/C | 3 3 | 4 5 6 |
| THR2 – COIL – 1 N/O – 1 N/C | 3 3 | 14 16 17 |
| TOL1 – COIL – 1 N/O – 1 N/C | 1 3 | 8 4 5 |
| TOL2 – COIL – 1 N/O – 1 N/C | 1 3 3 | 22 14 15 |
| PUMP No.1 A/TRANSF N/C THERMAL SWITCH | 3 | 8 |
| PUMP No.2 A/TRANSF N/C THERMAL SWITCH | 3 | 18 |
| PUMP No.1 LOW FLOW N/C MICRO SWITCH | 3 | 13 |
| PUMP No.2 LOW FLOW N/C MICRO SWITCH | 3 | 23 |

LEGEND:
- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- (00) EQUIPMENT ITEM No.

| No. | DATE | AMENDMENT | INITIALS |
|---|---|---|---|
| A | 7/98 | AMEND AS REQUIRED | P.H. |

DIRECTOR OF P.D. & P.S. — DATE
ENGINEER IN CHARGE — DATE
SUPERVISING ENGINEER — R.P.E.Q. NO. — DATE

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | 08-07-98 |
| CHECKED | | |

Brisbane City

| | | | |
|---|---|---|---|
| JOB FILE | JPR No.E98-A20999/A2 | | |
| AUTOCAD FILE | A20999A2 | SHEET SIZE | A1 |
| SURVEY No. | | FIELD BOOK | |
| SURVEYED | | A.H. DATUM | |

Brisbane Water — Professional Water Engineering

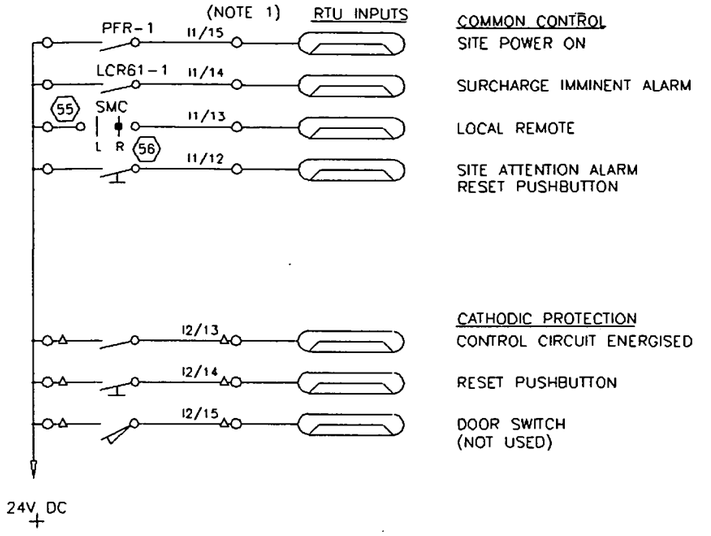
PROJECT: DORMWAY Pty Ltd METROPLEX ON GATEWAY SEWERAGE PUMPING STATION

TITLE: SWITCHBOARD ELECTRICAL SCHEMATIC

SCALE: N.T.S. — No.3 OF 9 SHEETS

DRAWING N° E98-A20999/A2 — AMEND. A

## ELV CONTROL




COMMON CONTROL
SITE POWER ON

SURCHARGE IMMINENT ALARM

LOCAL REMOTE

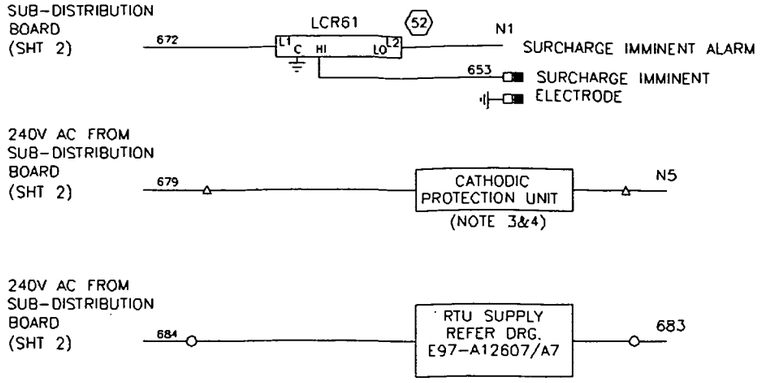
SITE ATTENTION ALARM RESET PUSHBUTTON

CATHODIC PROTECTION
CONTROL CIRCUIT ENERGISED

RESET PUSHBUTTON

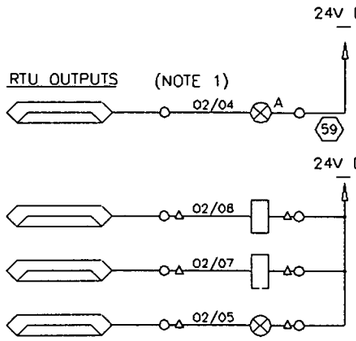
DOOR SWITCH (NOT USED)

## 240V AC CONTROL




## NOTES

1. 24V DC INPUT / OUTPUT INDIVIDUAL PROTECTION FUSES NOT SHOWN. (i.e. PART OF INTERFACE TERMINAL STRIP)
2. ALL WIRES & CABLE CORES TO BE FERRULED WITH GRAFOPLAST COMPATIBLE LABELLING. THE FOLLOWING PREFIXES SHALL BE USED:
   MAIN PUMP No. 1 = 1
   MAIN PUMP No. 2 = 2
   COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE)
3. CATHODIC PROTECTION - FUTURE
   THIS UNIT IS TO BE SUPPLIED BY OTHERS.
   RTU I/O CABLING TO BE INSTALLED TO PROPOSED CATHODIC PROTECTION TERMINAL STRIP FOR CONNECTION BY OTHERS.
4. ITEMS SHOWN AS DOTTED ARE FOR FUTURE ONLY.
5. TRANSIENT PROTECTION INTEGRAL TO RTU DIGITAL AND ANALOGUE I/O CIRCUITRY.




ATTENTION INDICATOR (SWITCHBOARD)

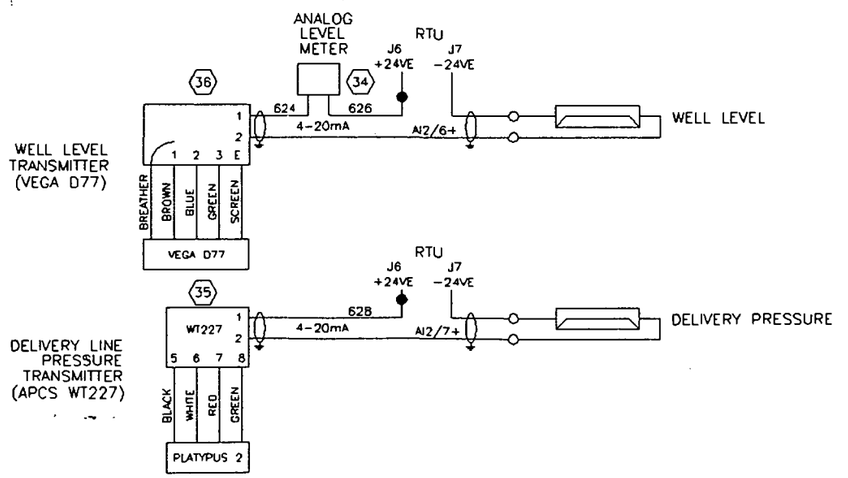
CATHODIC PROTECTION (NOTE 3&4)

DE-ENERGISE RECTIFIER UNIT

CONNECT REFERENCE ELECTRODES

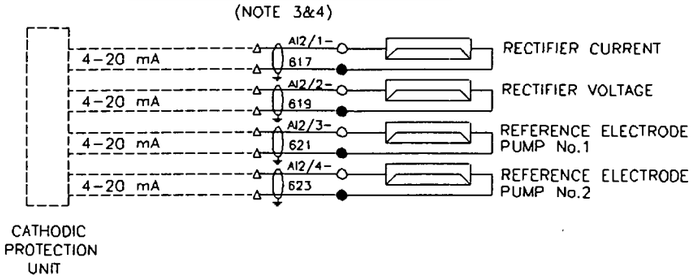
CATHODIC PROTECTION ALARM

## RTU ANALOG INPUTS FOR INSTRUMENTS




## RTU ANALOG INPUTS FOR CATHODIC PROTECTION

(NOTE 3&4)




CROSS REFERENCE TABLE

| ITEM | SHEET | LINE |
|---|---|---|
| C11 - COL | 3 | 7 |
| - 3 N/O | 1 | 5 |
| - 1 N/O | 3 | 10 |
| C12 - COL | 3 | 8 |
| - 3 N/O | 1 | 4 |
| - 1 N/O | 3 | 11 |
| - 1 N/C | 3 | 9 |
| C13 - COL | 3 | 9 |
| - 3 N/O | 1 | 6 |
| - 1 N/O | 3 | 12 |
| - 1 N/C | 3 | 8 |
| - 1 N/O | 3 | 3 |
| C21 - COL | 3 | 17 |
| - 3 N/O | 1 | 19 |
| - 1 N/O | 3 | 20 |
| C22 - COL | 3 | 18 |
| - 3 N/O | 1 | 18 |
| - 1 N/O | 3 | 21 |
| - 1 N/C | 3 | 19 |
| C23 - COL | 3 | 19 |
| - 3 N/O | 1 | 22 |
| C23 (CONT) - 1 N/O | 3 | 22 |
| - 1 N/C | 3 | 18 |
| - 1 N/O | 3 | 13 |
| LCR61 - COL | 4 | 8 |
| - 1 C/O | 4 | 4 |
| - 1 N/O | - | - |
| PFR - COL | 2 | 5 |
| - 1 C/O | 4 | 3 |
| - 1 C/O | - | - |
| PR1 - COL | 3 | 9 |
| - 1 C/O | 3 | 3 |
| - 1 C/O | - | - |
| RP2 - COL | 3 | 20 |
| - 1 C/O | 3 | 13 |
| - 1 C/O | - | - |
| RP11 - COL | 3 | 30 |
| - 1 C/O | 3 | 7 |
| - 1 C/O | - | - |
| RP12 - COL | 3 | 31 |
| - 1 C/O | 3 | 8 |
| - 1 C/O | - | - |
| RP13 - COL | 3 | 32 |
| - 1 C/O | 3 | 14 |
| - 1 C/O | - | - |
| RP21 - COL | 3 | 35 |
| - 1 C/O | 3 | 17 |
| - 1 C/O | - | - |
| RP22 - COL | 3 | 36 |
| - 1 C/O | 3 | 18 |
| - 1 C/O | - | - |
| RP23 - COL | 3 | 37 |
| - 1 C/O | 3 | 19 |
| - 1 C/O | - | - |
| THR1 - COL | 3 | 4 |
| - 1 N/O | 3 | 5 |
| - 1 N/C | 3 | 6 |
| THR2 - COL | 3 | 14 |
| - 1 N/O | 3 | 16 |
| - 1 N/C | 3 | 17 |
| TOL1 - COL | 1 | 8 |
| - 1 N/O | 3 | 4 |
| - 1 N/C | 3 | 5 |
| TOL2 - COL | 1 | 22 |
| - 1 N/O | 3 | 14 |
| - 1 N/C | 3 | 15 |
| TOL5 - COL | 1 | 30 |
| - 1 N/O | - | - |
| - 1 N/C | 4 | 2 |
| PUMP No.1 A/TRANSF N/C THERMAL SWITCH | 3 | 8 |
| PUMP No.2 A/TRANSF N/C THERMAL SWITCH | 3 | 18 |
| PUMP No.1 LOW FLOW N/C MICRO SWITCH | 3 | 13 |
| PUMP No.2 LOW FLOW N/C MICRO SWITCH | 3 | 23 |

LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- (00) EQUIPMENT ITEM No.

| No | DATE | AMENDMENT | INITIALS |
|---|---|---|---|
| B | 9/98 | AMEND AS REQUIRED | P.H. |
| A | 7/98 | AMEND AS REQUIRED | P.H. |

DIRECTOR OF P.D. & P.S. — DATE

ENGINEER IN CHARGE — DATE

SUPERVISING ENGINEER — R.P.E.Q. NO. — DATE

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | 08-07-98 |
| CHECKED | | |

Brisbane City

| | | | |
|---|---|---|---|
| JOB FILE | JPR No.E98-A20999/A3 | | |
| AUTOCAD FILE | A20999A3 | SHEET SIZE | A1 |
| SURVEY No. | | FIELD BOOK | |
| SURVEYED | | A.H. DATUM | |

Brisbane Water

PROJECT
DORMWAY Pty Ltd
METROPLEX ON GATEWAY
SEWERAGE PUMPING STATION

TITLE
SWITCHBOARD
ELECTRICAL SCHEMATIC

SCALE: N.T.S. — No.4 OF 9 SHEETS

DRAWING Nº E98-A20999/A3 — AMEND. B

ORIGINAL

24VDC SUPPLY FOR LEVEL AND PRESSURE TRANSDUCERS & ATTENTION INDICATOR

240VAC FROM SUB-DISTRIBUTION BOARD (SHT.2)

P/S 13.8V DC

12V/24V CONVERTER

RADIO

2 X 6.5 Ah BATTERIES

PDS500 TELEMETRY UNIT

ADDRESS HEXADECIMAL DECIMAL ADDRESS = 11

PUMP No.1

PUMP No.2

24V DC INPUT MODULE 1

24V DC INPUT MODULE 2

DUMMY MODULE

DIGITAL OUTPUT MODULE 1

DIGITAL OUTPUT MODULE 2

ANALOGUE INPUT MODULE 1

ANALOGUE INPUT MODULE 2

"AS CONSTRUCTED"

ORIGINAL

CROSS REFERENCE TABLE

| ITEM | SHEET | LINE |
|---|---|---|
| U1 - UNIT | 1 | 10 |
| - 1 N/C | 3 | 8 |
| U2 - UNIT | 1 | 21 |
| - 1 N/C | 3 | 20 |
| LCR81 - COIL | 4 | 8 |
| - 1 C/O | 4 | 4 |
| - 1 N/O | - | - |
| PTR - COIL | 2 | 5 |
| - 1 C/O | 4 | 3 |
| - 1 C/O | - | - |
| PR1 - COIL | 3 | 6 |
| - 1 C/O | 3 | 3 |
| - 1 C/O | - | - |
| PR2 - COIL | 3 | 18 |
| - 1 C/O | 3 | 15 |
| - 1 C/O | - | - |
| RP11 - COIL | 3 | 30 |
| - 1 C/O | 3 | 8 |
| - 1 C/O | - | - |
| RP12 - COIL | 3 | 9 |
| - 1 N/O | 3 | 3 |
| - 1 N/O | 3 | 10 |
| RP21 - COIL | 3 | 35 |
| - 1 C/O | 3 | 28 |
| - 1 C/O | - | - |
| RP22 - COIL | 3 | 29 |
| - 1 N/O | 3 | 22 |
| - 1 N/O | 3 | 15 |

| ITEM | SHEET | LINE |
|---|---|---|
| THR1 - COIL | 3 | 4 |
| - 1 N/O | 3 | 5 |
| - 1 N/C | 3 | 6 |
| THR2 - COIL | 3 | 14 |
| - 1 N/O | 3 | 18 |
| - 1 N/C | 3 | 17 |
| TOL1 - COIL | 1 | 8 |
| - 1 N/O | 3 | 4 |
| - 1 N/C | 3 | 5 |
| TOL2 - COIL | 1 | 22 |
| - 1 N/O | 3 | 14 |
| - 1 N/C | 3 | 15 |

| ITEM | SHEET | LINE |
|---|---|---|
| PUMP No.1 A/TRANSF N/C THERMAL SWITCH | 3 | 8 |
| PUMP No.2 A/TRANSF N/C THERMAL SWITCH | 3 | 18 |
| PUMP No.1 LOW FLOW N/C MICRO SWITCH | 3 | 13 |
| PUMP No.2 LOW FLOW N/C MICRO SWITCH | 3 | 23 |

LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- (00) EQUIPMENT ITEM No.

| No. | DATE | AMENDMENT | INITIALS |
|---|---|---|---|
| B | 11/98 | AMEND AS REQUIRED | P.H. |
| A | 7/98 | AMEND AS REQUIRED | P.H. |

DIRECTOR OF P.D. & P.S. — DATE

ENGINEER IN CHARGE — DATE

SUPERVISING ENGINEER — R.P.E.Q. NO. — DATE

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | 08-07-98 |
| CHECKED | | |

Brisbane City

| | | | |
|---|---|---|---|
| JOB FILE | JPR No.E98-A20999/A4 | | |
| AUTOCAD FILE | A20999A4 | SHEET SIZE | A1 |
| SURVEY No. | | FIELD BOOK | |
| SURVEYED | | A.H. DATUM | |

Brisbane Water

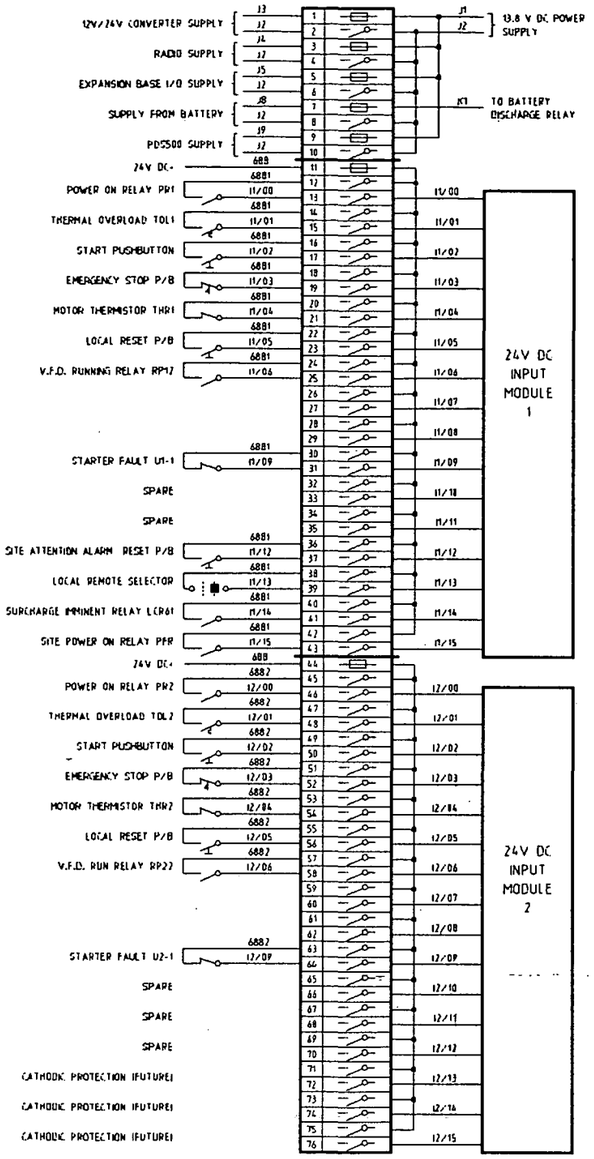
PROJECT
DORMWAY Pty Ltd
METROPLEX ON GATEWAY
SEWERAGE PUMPING STATION

TITLE
SWITCHBOARD PLC/RTU
ELECTRICAL SCHEMATIC

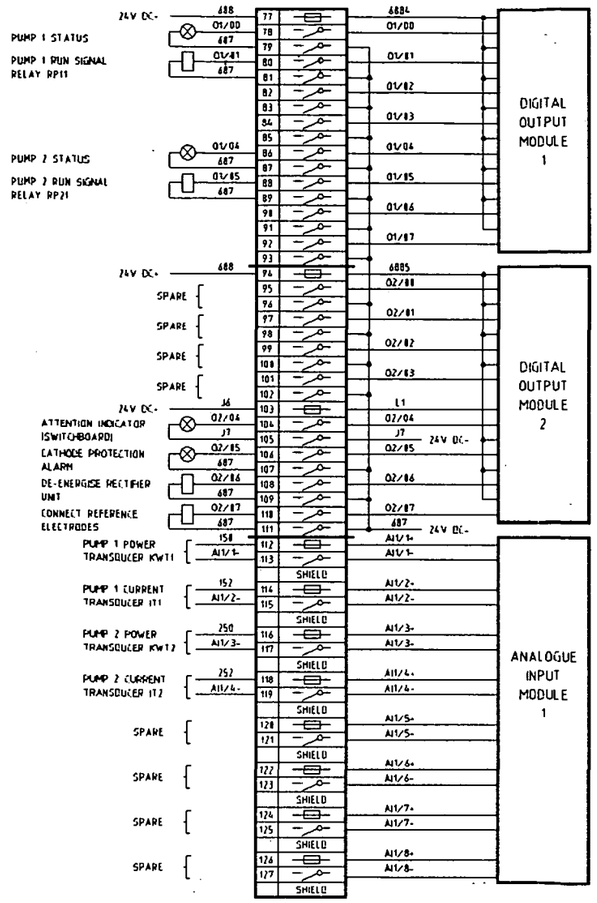
SCALE: N.T.S. — No.5 OF 9 SHEETS

DRAWING N° E98-A20999/A4 — AMEND. B

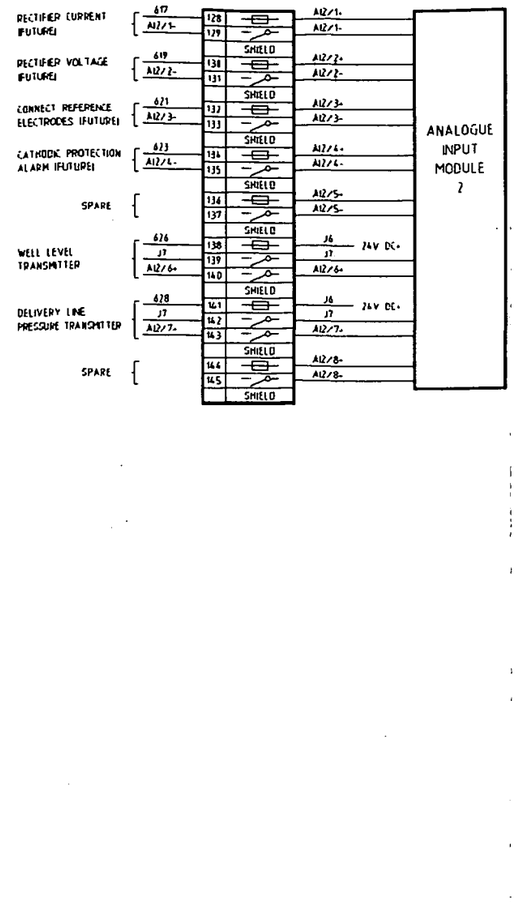
## RTU TERMINAL STRIP




## RTU TERMINAL STRIP




## RTU TERMINAL STRIP




"AS CONSTRUCTED"

ORIGINAL

LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- EQUIPMENT ITEM No.

| No. | DATE | AMENDMENT | INITIALS |
|---|---|---|---|
| B | 11/98 | AMEND AS REQUIRED | P.H. |
| A | 7/98 | AMEND AS REQUIRED | P.H. |

DIRECTOR OF P.D. & P.S. — DATE

ENGINEER IN CHARGE — DATE

SUPERVISING ENGINEER — R.P.E.Q. NO. — DATE

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | | 08-07-98 |
| CHECKED | | |

Brisbane City

| | | | |
|---|---|---|---|
| JOB FILE | SPR No.E98-A20999/A5 | | |
| AUTOCAD FILE | A20999A5 | SHEET SIZE | A1 |
| SURVEY No. | | FIELD BOOK | |
| SURVEYED | | A.H. DATUM | |

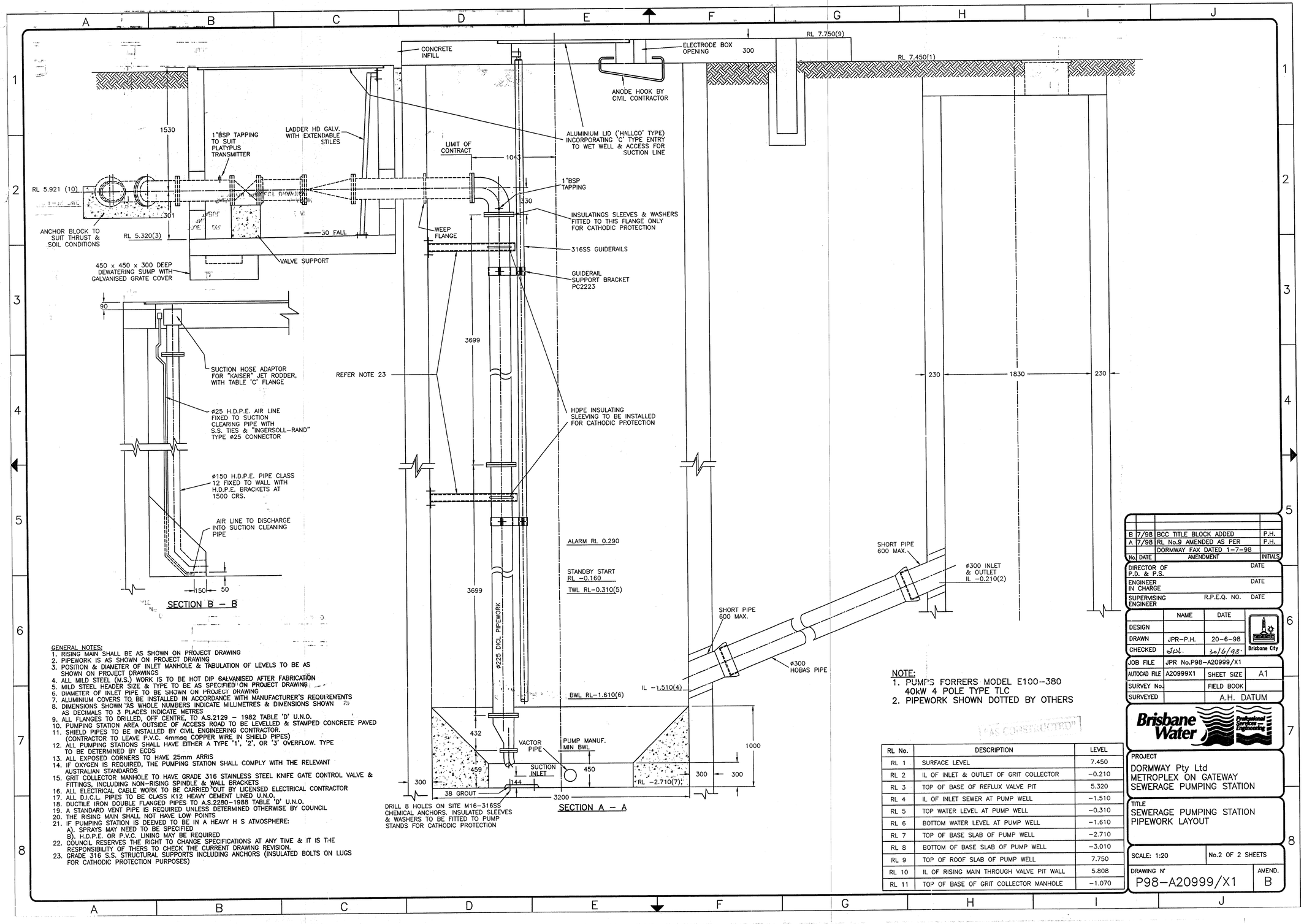
Brisbane Water

PROJECT
DORMWAY Pty Ltd
METROPLEX ON GATEWAY
SEWERAGE PUMPING STATION

TITLE
SWITCHBOARD PLC/RTU TERMINATION DIAGRAM

SCALE: N.T.S. — No.8 OF 9 SHEETS

DRAWING N° E98-A20999/A5 — AMEND. B




GENERAL NOTES:
1. RISING MAIN SHALL BE AS SHOWN ON PROJECT DRAWING
2. PIPEWORK IS AS SHOWN ON PROJECT DRAWING
3. POSITION & DIAMETER OF INLET MANHOLE & TABULATION OF LEVELS TO BE AS SHOWN ON PROJECT DRAWINGS
4. ALL MILD STEEL (M.S.) WORK IS TO BE HOT DIP GALVANISED AFTER FABRICATION
5. MILD STEEL HEADER SIZE & TYPE TO BE AS SPECIFIED ON PROJECT DRAWING
6. DIAMETER OF INLET PIPE TO BE SHOWN ON PROJECT DRAWING
7. ALUMINIUM COVERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS
8. DIMENSIONS SHOWN AS WHOLE NUMBERS INDICATE MILLIMETRES & DIMENSIONS SHOWN AS DECIMALS TO 3 PLACES INDICATE METRES
9. ALL FLANGES TO DRILLED, OFF CENTRE, TO A.S.2129 – 1982 TABLE 'D' U.N.O.
10. PUMPING STATION AREA OUTSIDE OF ACCESS ROAD TO BE LEVELLED & STAMPED CONCRETE PAVED
11. SHIELD PIPES TO BE INSTALLED BY CIVIL ENGINEERING CONTRACTOR. (CONTRACTOR TO LEAVE P.V.C. 4mmsq COPPER WIRE IN SHIELD PIPES)
12. ALL PUMPING STATIONS SHALL HAVE EITHER A TYPE '1', '2', OR '3' OVERFLOW. TYPE TO BE DETERMINED BY ECDS
13. ALL EXPOSED CORNERS TO HAVE 25mm ARRIS
14. IF OXYGEN IS REQUIRED, THE PUMPING STATION SHALL COMPLY WITH THE RELEVANT AUSTRALIAN STANDARDS
15. GRIT COLLECTOR MANHOLE TO HAVE GRADE 316 STAINLESS STEEL KNIFE GATE CONTROL VALVE & FITTINGS, INCLUDING NON-RISING SPINDLE & WALL BRACKETS
16. ALL ELECTRICAL CABLE WORK TO BE CARRIED OUT BY LICENSED ELECTRICAL CONTRACTOR
17. ALL D.I.C.L. PIPES TO BE CLASS K12 HEAVY CEMENT LINED U.N.O.
18. DUCTILE IRON DOUBLE FLANGED PIPES TO A.S.2280-1988 TABLE 'D' U.N.O.
19. A STANDARD VENT PIPE IS REQUIRED UNLESS DETERMINED OTHERWISE BY COUNCIL
20. THE RISING MAIN SHALL NOT HAVE LOW POINTS
21. IF PUMPING STATION IS DEEMED TO BE IN A HEAVY H S ATMOSPHERE:
    A). SPRAYS MAY NEED TO BE SPECIFIED
    B). H.D.P.E. OR P.V.C. LINING MAY BE REQUIRED
22. COUNCIL RESERVES THE RIGHT TO CHANGE SPECIFICATIONS AT ANY TIME & IT IS THE RESPONSIBILITY OF THERS TO CHECK THE CURRENT DRAWING REVISION.
23. GRADE 316 S.S. STRUCTURAL SUPPORTS INCLUDING ANCHORS (INSULATED BOLTS ON LUGS FOR CATHODIC PROTECTION PURPOSES)

NOTE:
1. PUMPS FORRERS MODEL E100-380 40kW 4 POLE TYPE TLC
2. PIPEWORK SHOWN DOTTED BY OTHERS

"AS CONSTRUCTED"

| RL No. | DESCRIPTION | LEVEL |
|---|---|---|
| RL 1 | SURFACE LEVEL | 7.450 |
| RL 2 | IL OF INLET & OUTLET OF GRIT COLLECTOR | -0.210 |
| RL 3 | TOP OF BASE OF REFLUX VALVE PIT | 5.320 |
| RL 4 | IL OF INLET SEWER AT PUMP WELL | -1.510 |
| RL 5 | TOP WATER LEVEL AT PUMP WELL | -0.310 |
| RL 6 | BOTTOM WATER LEVEL AT PUMP WELL | -1.610 |
| RL 7 | TOP OF BASE SLAB OF PUMP WELL | -2.710 |
| RL 8 | BOTTOM OF BASE SLAB OF PUMP WELL | -3.010 |
| RL 9 | TOP OF ROOF SLAB OF PUMP WELL | 7.750 |
| RL 10 | IL OF RISING MAIN THROUGH VALVE PIT WALL | 5.808 |
| RL 11 | TOP OF BASE OF GRIT COLLECTOR MANHOLE | -1.070 |

| No. | DATE | AMENDMENT | INITIALS |
|---|---|---|---|
| B | 7/98 | BCC TITLE BLOCK ADDED | P.H. |
| A | 7/98 | RL No.9 AMENDED AS PER DORMWAY FAX DATED 1-7-98 | P.H. |

DIRECTOR OF P.D. & P.S. — DATE
ENGINEER IN CHARGE — DATE
SUPERVISING ENGINEER — R.P.E.Q. NO. — DATE

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | JPR-P.H. | 20-6-98 |
| CHECKED | | 30/6/98 |

Brisbane City

| | | | |
|---|---|---|---|
| JOB FILE | JPR No.P98-A20999/X1 | | |
| AUTOCAD FILE | A20999X1 | SHEET SIZE | A1 |
| SURVEY No. | | FIELD BOOK | |
| SURVEYED | | A.H. DATUM | |

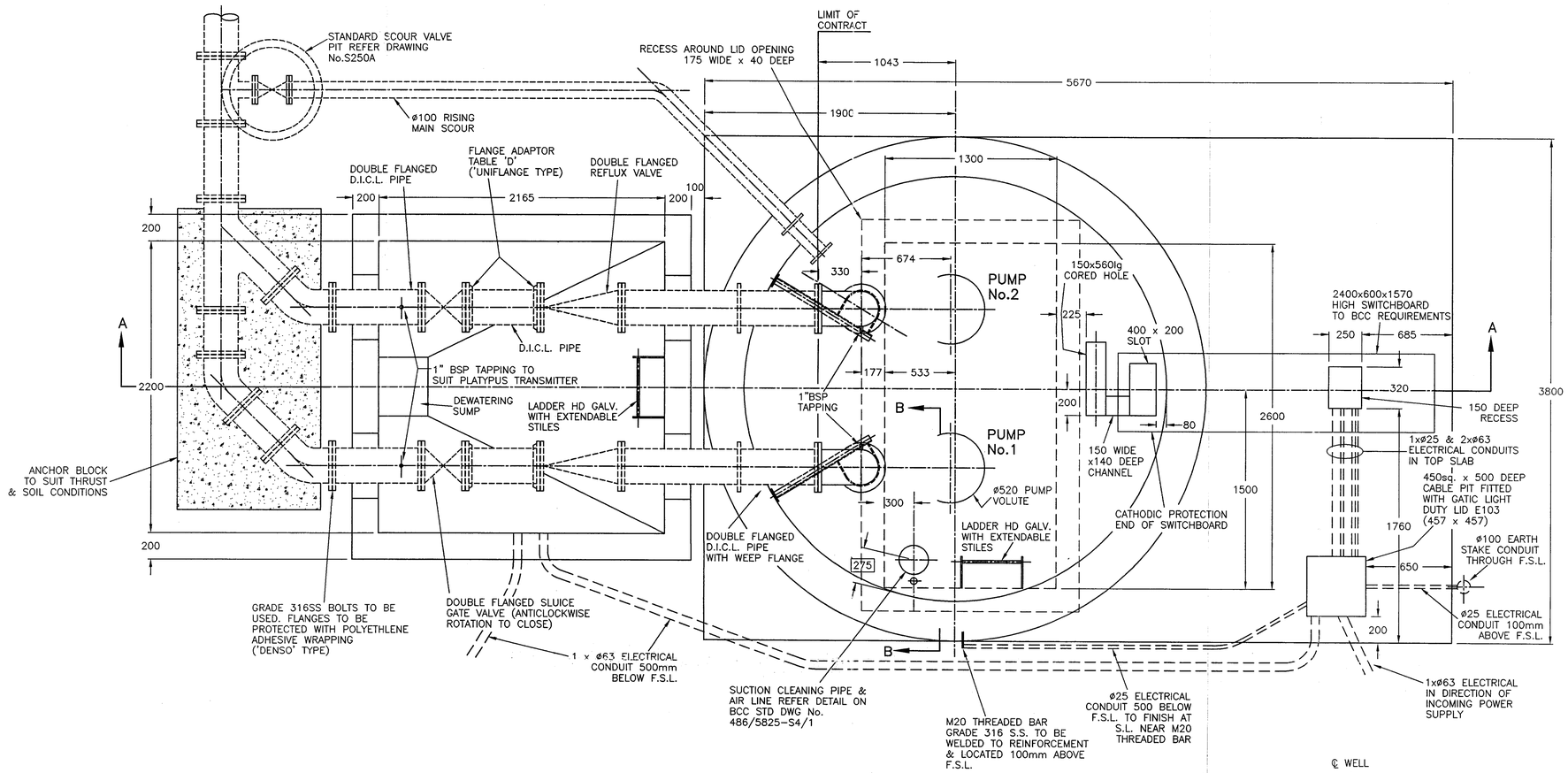
Brisbane Water — Professional Services in Engineering

PROJECT
DORMWAY Pty Ltd
METROPLEX ON GATEWAY
SEWERAGE PUMPING STATION

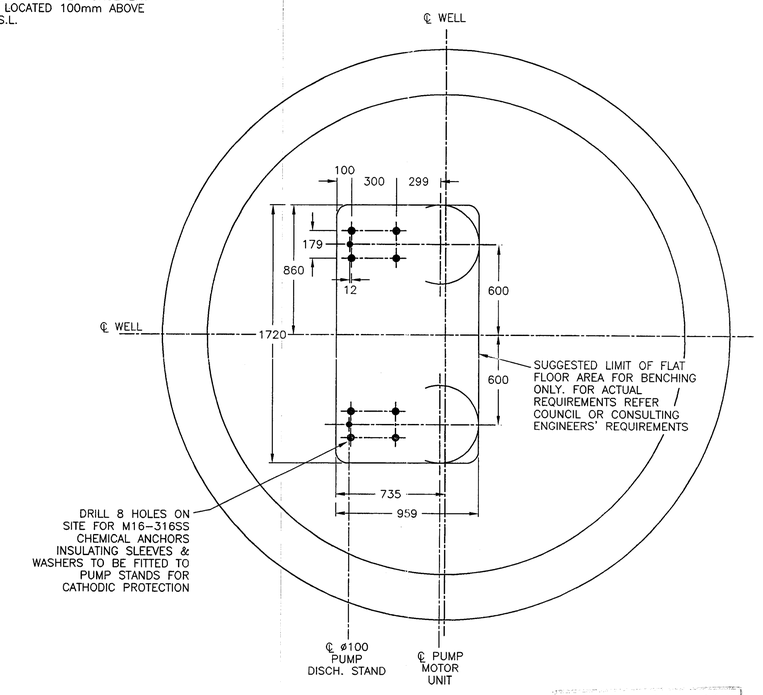
TITLE
SEWERAGE PUMPING STATION
PIPEWORK LAYOUT

SCALE: 1:20 — No.2 OF 2 SHEETS

DRAWING N° P98-A20999/X1 — AMEND. B




PLAN




FOUNDATION DETAIL

"AS CONSTRUCTED"

NOTE:
1. PUMPS FORRERS MODEL E100-380 40kW 4 POLE TYPE TLC
2. PIPEWORK SHOWN DOTTED BY OTHERS

| No. | DATE | AMENDMENT | INITIALS |
|---|---|---|---|
| A | 7/98 | BCC TITLE BLOCK ADDED | P.H. |

DIRECTOR OF P.D. & P.S. — DATE

ENGINEER IN CHARGE — DATE

SUPERVISING ENGINEER — R.P.E.Q. NO. — DATE

| | NAME | DATE |
|---|---|---|
| DESIGN | | |
| DRAWN | JPR-P.H. | 20-6-98 |
| CHECKED | JWL. | 30/6/98 |

Brisbane City

| | | | |
|---|---|---|---|
| JOB FILE | JPR No.P98-A20999/X0 | | |
| AUTOCAD FILE | A20999X0 | SHEET SIZE | A1 |
| SURVEY No. | | FIELD BOOK | |
| SURVEYED | | A.H. DATUM | |

Brisbane Water — Professional Services Engineering

PROJECT
DORMWAY Pty Ltd
METROPLEX ON GATEWAY
SEWERAGE PUMPING STATION

TITLE
SEWERAGE PUMPING STATION
PIPEWORK LAYOUT

SCALE: 1:20 — No.1 OF 2 SHEETS

DRAWING N° P98-A20999/X0 — AMEND. A