PINE RIVERS SHIRE COUNCIL

DESIGN MANUAL

CIVIL INFRASTRUCTURE DESIGN

PINE RIVERS

SPECIFICATIONS

AusSpec	Asset Owner Specifications (Roadworks & Drainage)
AusSpec	Development Construction Specifications (Roadworks & Drainage)
PRSC 100	Roadworks Specifications
PRSC 400	Water Supply Specifications
PRSC 500	**Sewerage Specifications**

PINE RIVERS SHIRE COUNCIL

SPECIFICATIONS

PINE RIVERS

PRSC 500

SEWERAGE SPECIFICATIONS

501	Non-Pressure Sewer Pipeline Construction
502	Sewer Pressure Pipeline Construction
503	Construction of a Submersible Sewage Pumping Station
504	**Submersible Sewage Pumping and Ancillary Equipment**

PINE RIVERS SHIRE COUNCIL

PRSC 504 - SUBMERSIBLE SEWAGE PUMPING AND ANCILLARY EQUIPMENT

PRSC 504
SUBMERSIBLE SEWAGE PUMPING AND ANCILLARY EQUIPMENT

1.0.0 PURPOSE

1.1.0 The purpose of this specification is to set down the Pine Rivers Shire Council requirements for submersible sewage pumps and ancillary equipment to ensure that the quality of manufactured equipment supplied and installed in a sewage pumping station or stations will result in satisfactory performance, reliability, durability, safety and appearance.

2.0.0 SCOPE

2.1.0 This specification applies to the manufacture, supply, delivery, installation, quality assurance and testing of one or more submersible sewage pump units together with switchboards, level controls, discharge stands, pipework, guide bars and electrical wiring. The pump units may be installed as a single unit in a wet well or as dual units in a single well.

2.2.0 This specification shall also apply to the manufacture, supply, delivery, installation, quality assurance and testing of air compressors, ventilation fans or other odour control units when specified in association with the pumping equipment.

2.3.0 This specification shall be used in conjunction with the associated specifications or requirements as detailed in the documentation for a particular project.

2.4.0 This specification shall apply to works being constructed directly for the Pine Rivers Shire Council or other authority or for a principal who will hand over the ownership of the constructed works for the Pine Rivers Shire Council or who will retain ownership.

3.0.0 REFERENCES

3.1.0 The following shall have general application:-

Workplace Health and Safety Act 1995 and Regulations with Amendments.

AS 2124-1992	General Conditions of Contract

Pine Rivers Shire Council Specifications

3.2.0 The following shall apply to preparation of drawings:-

AS 1100	Technical Drawings
AS 1102	Graphical Symbols for Electrotechnology

3.3.0 The following shall apply to materials and equipment which is specified or otherwise required for the work:-

Steel and Steel Products

AS 1111	ISO Metric Commercial Hexagon Bolts and Screws
AS1111.1-2000	Product Grade C – Bolts
AS 1111.2-2000	Product Grade C – Screws
AS 1112-2000	ISO Metric Hexagon Nuts (Set)
AS 1444-1996	Wrought Alloy Steels - Standard and Hardenability [H] Series and Hardened and Tampered to Designated mechanical Properties
AS 2074-2003	Steel Castings
AS 2837-1986	Wrought Alloy Steels - Stainless Steel bars and Semi-Finished Products

Cast Iron or Ductile Iron Fittings and Valves

AS 1646.1-2000	Elastomeric Seals for Waterworks Purposes – General Requirements
AS 1830-2002	Grey Cast Iron
AS/NZS 2280-2004	Ductile Iron Pressure Pipes and Fittings
AS 2544-1995	Grey Iron Pressure Fittings
AS 2638.2-2002	Gate Valves for Waterworks Purposes – Resilient Seated
AS 3578-1993	Cast Iron Non-return Valves for General Purposes
AS 4087-2004	Metallic Flanges for Waterworks Purposes
AS 6401-2003	Knifegate Valves for Waterworks Purposes

Electrical Equipment

AS1023	Low Voltage Switchgear and Control Gear - Protection of Electric Motors
1023.1-1985	Built-In Thermal Detectors and Associated Control Units
AS1029	Low Voltage Contactors
1029.1-1985	Electromechanical (Up to and including 1000 V ac and 1200 V dc)
AS 1307 (Set)	Surge Arrestors (Diverters)
AS 1359	Rotating Electrical Machines - General Requirements
1359.10-1989	Designation and Dimension
1359.20-1980	Classification of Types of Enclosure
1359.30-1997	Preferred Outputs and Frame Sizes
1359.101-1997	Rating and Performance
1359.109-1998	Noise Limits
1359.106-1996	Methods of Cooling (IC Code)
AS 2184-1985	Low Voltage Switchgear and Control Gear - Moulded-Case Circuit-Breakers for Rated Voltages up to and Including 600 V ac and 250 V dc
AS 3111-1994	Approval and Test Specification for Miniature Over current Circuit-Breakers
AS 3133-2003	Approval and Test Specification - Air Break Switches
AS 3147-1992	Approval and Test Specification - Electric Cables - Thermoplastic Insulated - For Working Voltages up to and including 0.6/1kV
AS 3947.4.1-1995	Low Voltage Switchgear and Control Gear – Contacts and Motor Starters – Electromechanical contactors and Motor Starters
AS/NZS 5000.1-1999	Electric Cables – Polymeric Insulated – For Working Voltages up to and Including 0.6/1kV

Coatings

AS 1627	Metal Finishing - Preparation and Pre-treatment of Surfaces
1627.1-2003	Cleaning Using Liquid Solvents and Alkaline solutions
1627.2-2002	Power Tool Cleaning
1627.4-2002	Abrasive Blast Cleaning
1627.9-2002	Pictorial Surface Preparation Standards for Painting Steel Surfaces
AS/NZS 2312-2002	Guide to the Protection of Iron and Steel against Exterior Atmospheric Corrosion
AS/NZS 4158-1996	Polymeric Coatings on Valves and Fittings for Water Industry Purposes - Thermal-bonded Coatings
AS/NZS 4680-1999	Hot-dip Galvanised (Zinc) Coatings on Fabricated Ferrous Articles

3.4.0 The following shall apply to workmanship and design:-

AS/NZS 3000-2000	Electrical Installations – Australia / New Zealand Wiring Rules
3008.1.1-1998	Electrical Installations - Selection of Cables - Cables for Alternating Voltages Up To and Including 0.6/1 kV

3.5.0 The following shall apply to testing and reporting:-

AS 1055	Acoustics-Description and Measurement of Environment Noise
AS 1081	Acoustics - Measurement of Airborne Noise Emitted by rotating Electrical Machinery
AS 1217	Acoustics - Determination of Sound Power Levels of Noise Sources
AS/IEC 61672	Electroacoustics - Sound Level Metres
AS 1686-1974	Metric Units for Use in Water Supply, Sewerage and Drainage (Including Plumbing)
AS 2417-2001	Rotodynamic Pumps – Hydraulic Performance acceptance Tests – Grades 1 and 2

4.0.0 DEFINITIONS

4.1.0 For the purpose of this specification the following definitions shall apply:-

- **Sewer** - any conduit for the carrying off of sewage from any premises which is not a house drain, soil or waste pipe
- **Construction** - any work necessary for the installation, testing and commissioning of pumping and ancillary equipment for sewerage pumping stations
- **Premises** - any parcel of land improved or unimproved, for which there is a property description
- **Developer** - the company, organisation or person to whom approval has been given to carry out the works and who acts as principal for the purpose of works executed by contract
- **Consulting Engineer** - The registered professional engineering company or registered professional engineer engaged by the developer to carry out the investigation and design of the sewerage works to be constructed by the developer. When engaged for the construction phase, the company or engineer shall act as superintendent for the purpose of works carried out by contract.
- **Contract, Contractor, Principal and Superintendent** - as defined in AS 2124
- **General Manager Pine Water** - the person occupying that position or their nominated representative
- **Manager Electrical and Mechanical Services** - the person occupying that position or their nominated representative
- **Pine Rivers Shire Council engineer** - the engineer employed by the Pine Rivers Shire Council to approve, supervise or inspect sewerage works, or their nominated representative

5.0.0 SPECIFICATION

5.1.0 WORK ON PINE RIVERS SHIRE CONTROLLED PREMISES

5.1.1 Before entering these premises in order to carry out approved work, the contractor shall give the General Manager Pine Water at least two working days notice of their intention to do so.

5.1.2 The contractor shall exercise due care to prevent interference or damage to improvements existing on the premises or to their satisfactory operation. These improvements may be located above or below ground.

5.1.3 The works site shall be restored to the satisfaction of a Pine Rivers Shire Council engineer.

5.2.0 WORK ON OTHER PREMISES

5.2.1 Before entering these premises in order to carry out approved work, the contractor shall obtain the written approval of the owner of the premises to do so.

5.2.2 The contractor and their employees shall not trespass on any premises adjoining the site of the works.

5.2.3 The contractor shall exercise due care to prevent interference or damage to improvements existing on the premises or to their satisfactory operation. These improvements may be located above or below ground.

5.2.4 The premises shall be restored to the reasonable satisfaction of the owner and / or occupier of the premises. At the completion of construction and prior to the constructed works being declared practically complete, the contractor shall obtain a clearance certificate from the owner of each premises. This certificate shall indicate satisfaction at the standard of restoration.

5.2.5 Notwithstanding such clearance being obtained, the superintendent and / or a Pine Rivers Shire Council engineer may instruct the contractor to carry out further restoration work on the premises if the superintendent and / or a Pine Rivers Shire Council engineer, consider that the restoration work has not been completed to a reasonable standard.

5.3.0 WORKING HOURS

5.3.1 The contractor shall comply with the limitation on hours of work imposed by the local laws of the Pine Rivers Shire Council or as amended by any subdivisional permit or other development approval. Construction works shall be limited to between the hours of 7am and 6pm, Monday to Friday and on Saturday between 7am and 12 noon. The contractor shall not be permitted to carry out construction on Sundays and Public Holidays.

5.3.2 Where the contractor wishes to carry out construction works outside of the above hours, they shall seek approval of the superintendent and / or a Pine Rivers Shire Council engineer in writing. The request shall include the following information:-

I. the hours the contractor wishes to work
ii. the duration or period the contractor wishes to work those hours
iii. the reason why the contractor wishes to work outside the normal hours

iv. the measures the contractor intends to put in place in order to minimise any noise or other nuisance

The request shall be considered and may be refused, accepted, or accepted subject to certain conditions.

5.3.3 Notwithstanding Clauses 5.3.1 and 5.3.2 of this specification, the contractor shall comply with the Pine Rivers Shire Council local laws regarding abatement of excessive noise in relation to residential construction sites. The contractor shall also comply with the provisions of the Environmental Protection Act (1994) and relevant Australian Standards relating to noise from a construction site.

5.3.4 Should the contractor elect to carry out work outside of the normal Award hours and which, in the opinion of the General Manager Pine Water, requires the presence of a Pine Rivers Shire Council engineer, the Pine Rivers Shire Council reserves the right to recover from the contractor any cost which it incurs in making a Pine Rivers Shire Council engineer available.

5.4.0 INFORMATION SUPPLIED TO THE CONTRACTOR

5.4.1 The principal shall supply to the contractor sufficient details by way of drawings and specifications to allow the contractor to manufacture, supply and install the equipment to the principal's requirements.

5.4.2 Such information will normally be in the form of layout plans, detail plans, sectional views and elevations of equipment installation including pipework, standard drawings, electrical schematic diagrams and any other information which may be considered relevant.

5.5.0 TENDERS

5.5.1 Tenders shall be accompanied by outline plans and sectional drawings of the pump units showing the details of the pump units offered and one copy of the characteristic curves for the units showing head, efficiency and power required plotted against litres of water delivered per second over the full range from zero head to shut-off head. These curves shall be superimposed on the system resistance curves contained in the tender documents.

5.5.2 In addition, all schedules of guaranteed technical information shall be completed and the tender shall include such further information and technical literature as is necessary to fully describe the equipment offered.

5.5.3 The principal will arrange the construction of each pump well in accordance with the drawings and in accordance with any requirements for the tendered equipment.

5.5.4 The ease of operation and maintenance in addition to the economic analysis will be taken into account, when assessing tenders.

5.5.5 The information required under Section 5.5.0 of this specification shall be made available to the Pine Rivers Shire Council's Manager Electrical and Mechanical Services for approval.

5.6.0 PUMP UNITS

5.6.1 Each pump unit shall be of the submersible type and shall have the motor and impeller in the same unit. The pump unit shall be of the centre discharge type.

5.6.2 The rated speed of the pump unit shall not exceed 1500 rpm unless otherwise specified. Resonance during operation shall not occur and vibration amplitude shall not exceed 0.046 mm for four pole, 0.065 mm for six pole and 0.081 mm for eight pole motors respectively.

5.6.3 The pump unit shall be capable of pumping sewage down to the level of the pump suction. The pump unit shall be capable of operating continuously "in the dry" without damage.

5.6.4 The discharge coupling shall have a minimum internal diameter of 100 mm.

5.6.5 Each pump unit shall be capable of being lowered into or raised from the pump well by a chain or similar means. The lifting chain shall be provided with rings or Grade 304 stainless steel shackles at 1.2 m centres to enable the lifting hook to be repositioned as required. The lifting chain shall be hot dip galvanized after assembly with the lifting rings or alternatively Grade 304 stainless steel shackles may be fitted to hot dip galvanized chain. The chain shall be attached to the pump unit with Grade 304 stainless steel shackles.

5.6.6 Discharge outlets shall be so arranged that it shall not be necessary to enter the pump well to engage or release the pump unit from the delivery piping. Guide bars mating with a bracket on the pump unit or similar means shall be provided to facilitate the accurate location of the discharge outlet. Where the submerged joint involves the use of a rubber or similar gasket, this gasket shall be positively fixed to one of the jointing surfaces.

5.6.7 All cast iron parts that come in contact with sewage shall be cleaned and painted in accordance with Clause 5.18 of this specification.

5.7.0 OPERATING CONDITIONS

5.7.1 The system resistance curves on the drawings show the range of operating conditions.

5.7.2 The maximum head conditions occur when each pump unit is pumping from the low water level in the pumping station against a pipework resistance calculated using a Hazen-Williams co-efficient, C, of 100 for cement based or lined pipes and 120 for smooth lined pipes. The minimum head conditions are calculated from top water or overflow level using a Hazen-Williams co-efficient, C, of 150 for cement based or lined pipes and 160 for smooth lined pipes.

5.7.3 The duty condition, at which maximum efficiency shall normally be attained, is shown on the system resistance curve. This condition shall be the point at which the actual pump unit performance will be determined for comparison with the guaranteed performance.

5.8.0 DRAWINGS

5.8.1 All drawings associated with supply and installation of pumping and ancillary equipments, which will form part of the Pine Rivers Shire Council Sewerage System, shall be subject to approval from the Pine Rivers Shire Council's Manager Electrical and Mechanical Services.

5.8.2 Unless specified to the contrary in the job specification, the contractor shall submit drawings showing the location and dimensions of any built-in items within four weeks of the date of the "Letter of Acceptance of Tender". These drawings shall show the minimum clearance below the suction inlet to each pump unit and the floor level as 125 mm. Unless this dimension is shown it shall be deemed that the 125 mm is adequate and the contractor shall design each

pump unit to suit this clearance. The drawings shall show the position of the benching to minimise the flat area at the bottom of the pump well.

5.8.3 The contractor shall supply two complete sets of drawings for the whole of the equipment to the superintendent and / or a Pine Rivers Shire Council engineer for approval. The drawings shall be submitted as they are completed and unless specified to the contrary in the job specification the whole of the drawings shall be provided within four weeks of the date of the letter of acceptance, but in any case not less than 11 weeks before the date for practical completion. The Pine Rivers Shire Council's Manager Electrical and Mechanical Services will examine the drawings within three weeks and return unsatisfactory drawings to the contractor for correction. These drawings shall be returned to the Pine Rivers Shire Council Manager Electrical and Mechanical Services for approval within one week. This procedure will continue until the drawings are approved.

5.8.4 The drawings shall contain the following:-

i. general arrangement of each pump-well showing each pump unit and the discharge pipework layout.

ii. plan, elevation, sections and details of each pump unit and sectional view showing the arrangement of bearings and seals.

iii. pump curve for each pump including full details at the specific pump

iv. general arrangement of each switchboard showing layout of equipment for the station and fully dimensioned constructional details of the cubicle

v. complete wiring diagram, including control circuits with circuits numbered and lettered and the size of all conductors

5.8.5 The drawings shall be neatly drafted in AutoCAD (or compatible) computer aided drawing (CAD) package and be plotted on A1 size drawing transparencies. General drafting standard shall be in accordance with AS 1102.

CAD drawings shall be supplied in latest, or latest less one version of AutoCAD in DWG file format (or other compatible format approved by a Pine Rivers Shire Council engineer). The drawings shall be accompanied by all support files (text, line styles, plot controls etc.) to allow the drawings to be printed as intended.

5.8.6 Following approval and stamping of the contract drawings (normally two complete sets of drawings), a further two complete sets of drawings shall be submitted to the superintendent and / or a Pine Rivers Shire Council engineer for distribution. The drawings distribution will normally be:-

- superintendent - 1 copy
- principal - 1 copy
- contractor - 1 copy

5.8.7 In addition, two copies of the final approved CAD files in accordance with clause 5.8.5 of this specification shall be submitted to a Pine Rivers Shire Council engineer.

5.9.0 MATERIALS AND WORK STANDARDS

5.9.1 Materials shall be of the best of their respective kinds and shall conform to such standard specifications issued by the Standards Association of Australia as may be held to apply. When no Australian standard specification has been issued, other standards as approved by a Pine Rivers Shire Council engineer shall apply.

5.9.2 Unless otherwise specified, all work shall be carried out by competent tradesmen to first class standard and where applicable shall be in accordance with the relevant Australian or Pine Rivers Shire Council Standards.

5.9.3 All pump units, compressors, pipework and fabricated items supplied under this contract shall be manufactured, inspected and tested in compliance with the relevant standard and branded accordingly by the manufacturer:-

i. in terms of a standard mark licence granted by the Standard Association of Australia; or

ii. having in place a quality system accredited to AS/NZS ISO9000 series; or

iii. under the supervision of the testing organisation nominated by the contractor or approved by a Pine Rivers Shire Council engineer.

5.9.4 A Pine Rivers Shire Council engineer reserves the right to further inspect and / or test at the Pine Rivers Shire Council expense, the whole or any portion of the articles on delivery to the site of the contractor's work. If, due to damage during delivery, offloading and stacking, or due to any modification or alteration by the contractor subsequent to any previous test, an article fails to withstand the site inspection and / or test it will be rejected and shall be replaced by another, which shall fulfil all requirements of this specification, without additional charge.

5.9.5 Payment of fees for inspection and testing shall be made by the manufacturer direct to the testing organisation. The amount shown for each item in the schedule shall include inspection and testing fees for that particular item.

5.10.0 FASTENERS AND MISCELLANEOUS ITEMS

5.10.1 All fasteners used in the work excluding shackles, shall be stainless steel in accordance with AS 1444. This includes bolts, nuts, washers, studs, screws, masonry anchors and threaded items joining flanges, mounting equipment or used in the assembly of valve bodies and switchboards. Shackles shall be fabricated from Grade 304 stainless steel in accordance with AS 1444.

5.10.2 Bolts shall be hexagon head bolts complying with AS 1111 EXCEPT that the material shall be Grade 316 stainless steel. The tensile and proof loads shall comply with Table 9 of AS 1111.

5.10.3 Nuts shall be hexagon nuts complying with AS 1112 manufactured from Grade 304 stainless steel. The nuts shall be normal type complying with the proof loads given in Table 10 of AS 1112 for property class 5.

5.10.4 Washers shall be normal series washers manufactured from Grade 304 stainless steel.

5.10.5 All saddles, clips and clamps used in the work shall be fabricated from Grade 316 stainless steel.

5.10.6 All stainless steel bolts, nuts, studs or washers shall be marked either with the ISO marking "A4" or the AISI marking "316" or "304" as appropriate.

5.10.7 The contractor shall provide washers under all nuts, studs or bolts where rotation can occur during tightening of the fastener. Loctite 222 or 567 shall be used on all threads and between stainless steel mating surfaces as an anti-galling lubricant.

5.10.8 Aluminium fabricated items shall be insulated from concrete bearing surfaces by stainless steel brackets, HDPE gaskets, painting contact area with a heavy coat of approved alkali-resistant bituminous paint or by other means approved by a Pine Rivers Shire Council engineer. Where aluminium comes in contact with hot dip galvanized steel, a neoprene insertion or equivalent approved method shall be used to separate the materials.

5.10.9 Nylon or polyethylene washers, top hat sections and spacers shall be used to separate stainless steel or Monel metal fasteners from aluminium. Hole sizes shall be drilled only sufficiently large enough to accommodate the fastener and isolator chosen. Oversized holes shall not be accepted.

5.10.10 Under washers and boltheads and on bolt shanks etc, where the fastener size is too small for the above insulating methods, that is less than 3 mm diameter, a heavy application of "Duralac" to the mating surfaces can be substituted. In this case, holes shall be a maximum of only 1 mm larger than the fastener diameter.

5.10.11 Unless otherwise shown on the drawings or specified in the job specification, chemical masonry anchors shall comply with the requirements of Table 5.0.

Table 5.0

SIZE MIN	LENGTH MIN	EMBEDMENT	MIN. EDGE DISTANCE
M10	130	90	45
M12	160	110	55
M16	190	125	65

5.10.12 Unless otherwise shown on the drawings or specified in the job specification, mechanical masonry anchors shall comply with the requirements of Table 5.1.

Table 5.1

SIZE MIN	LENGTH MIN	EMBEDMENT	MIN. EDGE DISTANCE
M10	90	60	60
M12	110	80	80
M16	145	100	100

5.11.0 GALVANIZING

5.11.1 Where specified, fabricated steelwork shall be hot dip galvanized after fabrication in accordance with AS 4680. All joints shall be seal welded for fabricated steelwork.

5.11.2 Where the hot dip galvanized coating on the steelwork is damaged, the item shall be returned to the galvanising works for redipping at the contractor's expense.

5.11.3 The superintendent and / or a Pine Rivers Shire Council engineer may, in the case of minor damage accept repair to the coating. The repair shall consist of power tool cleaning in accordance with AS 1627 Part 2, followed by a minimum of two coats of Vessey Chemicals' Carbomastic 15 or an equivalent approved product with a dry film thickness of 200 microns each coat.

5.12.0 PUMP UNITS

5.12.1 The pump housing and impeller shall be Grade 250 close grained grey cast iron in accordance with AS 1830. The casing shall be tested to 1.75 MPa of water pressure and shall comply with the requirements of the clause in this specification on “Quality Assurance and Testing”. All casing joints shall have machined metal to metal faces and be seated with a nitrile and rubber “O” ring. The bolts and nuts joining the various sections of the pump housing shall be Grade 316 and Grade 304 stainless steel or better.

5.12.2 The pump shaft shall be Grade 431 stainless steel in accordance with AS 1444 with a ground finish over its entire length and shall have sufficient dimensions to transmit the maximum power of the motor.

5.12.3 An oil chamber shall be provided between the pump and the motor to lubricate and cool mechanical seal units on each side of the chamber. The lower seal shall prevent sewage, grit and other abrasives from entering the oil chamber. The seal faces shall be of tungsten carbide or silicon carbide material. The seal must also be effective for both directions of shaft rotation. The seal units shall be designed to provide reliable and durable sealing performance.

5.12.4 The pump shall be provided with a water in oil sensor.

5.12.5 The pump shall be capable of passing 75 mm diameter spheres and the design shall be such that a minimum space is occupied by the impeller blades. The impeller shall be shrouded and shall be designed so as to prevent clogging and chokage. The impeller shall be attached to the shaft by a single nut.

5.12.6 Wear rings shall be fitted to all pumps and shall be easily accessible for replacement. Casing wear rings shall be Grade H3A chrome steel in accordance with AS 2074 and impeller wear rings shall be steel. All wear rings shall be machined to interference fits and be pressed in. Running clearances shall be in a vertical plane. A macerator type impeller will be considered as complying with the requirements of this clause.

5.13.0 MOTORS

5.13.1 Each motor shall comply generally with AS 1359 and shall be suitable for connection to a three phase, 415 volt, 50 cycle, earthed neutral supply. The motor shall be insulated with a minimum of Class F materials in accordance with AS 2768 and shall be designed to operate within Class B limits as specified and measured by AS 1359 Part 32 specially impregnated for moist atmospheric conditions

5.13.2 The duty rating of the motor when determined by the method shown in AS 1359 Part 30 shall be classified as Duty S1. The output rating of the motor as defined in AS 1359 Part 30 shall

be such that:-

i. when cooled by sewage at 27°C it exceeds the power required by the pump over the whole range of discharge from shut-off head to zero head; and

ii. when cooled by air at 40°C it exceeds the power required by the pump against minimum head system resistance.

5.13.3 The motor shall be protected by positive thermal co-efficient thermistors built into the windings during manufacture in order to sense the temperature in the windings for each of the three phases. The thermistors, their fitting in the motor, reference temperatures and testing of the motor shall be in accordance with AS 1023.

5.13.4 The bearing between the motor and pump shall be sealed and the whole unit shall be capable of running for 25,000 hours without attention.

5.13.5 A 660 volt motor cable suitable for use under water shall be supplied and connected to the motor by means of a watertight joint. The cable shall be solid where it passes through a gland and be encapsulated in an appropriate sealant. The other end of the cable shall terminate in a plug which shall fit into a socket. The plug and socket shall be Clipsal 56 Series or similar approved for drives up to and including 22 kW. The plug and socket shall be Maréchal "Decontactor" Type DS or similar approved rated to the locked rotor current with two pilot pins for the thermistor cabling for drives in excess of 22 kW.

The plug and socket shall be located in a separate lower compartment in the switchboard or in a disconnecter box if required or specified in the job specification. This will allow the motor to be disconnected from the power supply by personnel who are not necessarily electrically qualified. The contractor shall supply a tapered rubber plug or other approved sealing treatment for the top of the electrical conduit.

5.13.6 Insulation resistance shall be guaranteed for both works test and site service conditions. Before and after the pump test at the works, the insulation resistance shall be not less than 15 megohms.

5.13.7 The contractor shall guarantee the insulation resistance of the motor at the end of the defects liability period. The guarantee for insulation in service shall be the recommendation of the motor manufacturer of a value above the minimum resistance at which the motor should be repaired or replaced. A 1.6 mm thick WBW Traffolyte label shall be attached beside the plug and socket for the motor giving the value at which the motor should be repaired or replaced.

5.14.0 PIPEWORK

5.14.1 The contractor shall supply and install the pipework, valves and fittings within the “Limits of the Contract” as shown on the drawings. Grey iron or ductile iron pipes and fittings shall be lined with a heavy cement lining and shall be prepared and coated in accordance with Clause 5.18.0 of this specification.

5.14.2 Ductile iron pipes and fittings shall be Class K9 or PN 20 Flanged pipes shall be fabricated using Class K12 pipes.

Ductile iron pipes shall be PN 20 or PN 35, spigot and socket ended unless otherwise noted on the drawing or in the job specification. Flanged pipes shall be fabricated using Class K12. All ductile iron pipes and fittings shall be cement lined with a Type SR or Calcium Aluminate

sulphate resisting cement, and preferably have spigots and sockets coated with a thermal bonded polymeric coating in accordance with AS 4158.

Ductile Iron pipes Class K9 and K12 are also accepted.

5.14.3 Flanged end pipes, fittings and valves are to have flanges complying with AS 4087.

Unless specified otherwise on the drawings, specifications, or schedules, flanges shall conform with the following:-

a. integrally cast flanges shall conform to Class PN 16 for ductile iron (Figure B5), or Class PN 14 for grey cast iron (Figure B2)

b. screw-on flanges shall be manufactured from ductile iron and shall conform to Class PN 16 (Figure B5). The host pipe shall be DICL Flange Class to AS/NZS 2280, or Class K12. Flanges are to be sealed on to the pipe with a suitable epoxy approved for use with potable water. Screw on flanges shall be capable of leak free operation to a pressure of 1600 kPa. The complete and assembled pipe with flange(s) shall be hydrostatically tested to this pressure before leaving the works.

c. welded-on flanges shall be manufactured of steel, and shall comply with Class PN 16 (Figure B7). Welding shall be Type SP carried out in accordance with AS/NZS 1554.1.

5.14.4 The contractor shall supply and install knife gate valves and or resilient seated sluice valves at the locations shown on the drawings.

5.14.5 Where shown on the drawings to have an extended spindle, each valve shall have its spindle extended upwards to finish, inside a 300 mm long, 100 mm diameter aluminium sleeve or a twist-locking insert box as appropriate. The top of the extension spindle shall be shaped to suit a standard valve key. The extended spindle shall be fabricated from steel and shall be hot dip galvanized after manufacture. The extended spindle shall be non-rising.

5.14.6 The discharge coupling shall be fixed to the floor of the pump well using masonry anchors of an approved type.

5.14.7 Pipe brackets shall be manufactured from steel hot dip galvanized after fabrication. The brackets shall be fastened to the concrete using M16 masonry anchors.

5.14.8 A tapping shall be made into the vertical riser 200 mm below the floor of the valve pit for each pump unit. A nominal 20 mm diameter acrylonitrile butadiene styrene (ABS) pipe shall be led from each tapping over to the wall and up to the top of the pumping station as shown on the standard drawings. Each pipe shall be fitted with a valved branch assembly to permit the fitting of a pressure gauge at the access opening. This assembly shall be located on the side of the pump unit access opening, clear of the space required for raising and lowering pump units. The pipework shall be fastened using saddles at a maximum spacing of 500 mm.

5.14.9 The contractor shall provide the necessary 20 MPa concrete pedestals for pipes or valves. The pedestals shall be formed in an approved manner.

5.15.0 SLUICE VALVES

5.15.1 Sluice valves shall be resilient seated type suitable for a working pressure of 1600 KPa and conform to AS 2638.2.

5.15.2 The stem material shall be Grade 431 stainless steel in accordance with AS 2837, with an integral thrust collar.

The stem seal shall be affected by a minimum of two “O” rings, which are able to be replaced under full working pressure.

5.15.3 The direction of closing shall be anti-clockwise.

5.15.4 The wedge shall be cast in ductile iron and totally encapsulated in an approved synthetic rubber conforming to AS1646. Partially coated wedges are not acceptable.

The valve body, bonnet and top castings shall be manufactured from ductile iron and fully enveloped with a fusion bonded powder coating, applied by the fluidised bed technique, conforming to AS 4158.1. Alternatively, components may be manufactured from an approved corrosion resistant material without protective coatings.

5.15.5 All fasteners shall be of high grade steel and completely isolated from the external environment or Grade 316 stainless steel.

5.15.6 Sluice valves shall be flanged and drilled to suit the mating flanges.

5.16.0 KNIFE GATE VALVES

5.16.1 Knife gate valves shall be flanged and drilled to suit the mating flanges. Wafer type valves shall not be installed unless specifically approved by a Pine Rivers Shire Council engineer. The body of each valve shall be made of cast iron or a non-corrosive material. Steel flanges shall not be accepted. The gate, seat and all bolts and studs shall be Grade 316 stainless steel. Nuts and washers shall be Grade 304 stainless steel. The valve stem shall be Grade 304 stainless steel or better. Washers shall be provided under all nuts and bolt heads where rotation can occur.

5.16.2 Knife gate valve seals shall be of synthetic rubber or Nylon 6. The seal shall not be located in the bottom of a recess in the valve body but shall be located in the side of the recess.

5.16.3 Each knife gate shall be tested open and to withstand 75 m head of water. The valve shall be able to operate against an unbalanced head of 10 m from the opposite direction. Drip tightness is not required for the unbalanced head test. The valves shall be fitted with handwheels unless otherwise shown on the drawings.

5.16.4 The direction of closing shall be anti-clockwise.

5.16.5 Knife gate valves for installation within concrete benching and other similar places where shown on drawings shall be bonneted valves. The valves shall comply with Clauses 5.16.1 to 5.16.3 of this specification with the appropriate actuator installed as shown on the drawings or as specified.

5.16.6 Knife gate valves, installed above ground or in sewerage wet wells, which are not of all stainless steel manufacture shall be coated in accordance with Section 5.18.0 of this specification.

5.17.0 REFLUX VALVES

5.17.1 Reflux valves utilising springs to effect closure shall not be accepted.

5.17.2 The reflux valves shall be cast iron, flanged, swing check non-return valves in accordance with AS 3578. Materials of construction shall be:-

i.	body	-	cast iron
ii.	body seat	-	bronze
iii.	clapper	-	bronze
iv.	arm and pin	-	Grade 304 stainless steel
v.	bolts, nuts and washers	-	Grade 316 stainless steel

5.17.3 Unless otherwise specified, the exterior metal parts of all valves shall be abrasive blast cleaned and painted in accordance with Section 5.18.0 of this specification.

5.18.0 COATING OF VALVES AND PIPEWORK

5.18.1 All knife gate valves, reflux valves and pipework not of all stainless steel manufacture, which is located above ground or in sewerage wet wells shall be coated in accordance with Clauses 5.18.2 and 5.18.3 of this specification.

5.18.2 ABRASIVE BLAST CLEANING

i. The surfaces to be blast cleaned shall be dry abrasive blast cleaned to a metal finish in accordance with AS 1627-Part 4 and AS 1627-Part 9 using one of the following methods:-

- grit blasting using compressed air nozzles;
- grit blasting using centrifugal wheels; or
- sand blasting using compressed air nozzles.

ii. Metallic abrasive, where used, shall comprise cast iron, cut wire or grit and shall be hard, sharp and free from dust. The maximum particle size shall be not larger than that passing through 1.18 mm Australian Standard Sieve.

iii. Non-metallic, silica free and silica material shall not be re-used in the blasting operation.

iv. All free oil and moisture shall be effectively removed from the air supply lines of all blasting equipment using adequate filters and driers.

v. After blasting, the surface shall be brushed or blown down with clean dry air (using driers and oil mist filters in air lines), or vacuum cleaned to remove all blast products and abrasives from the entire surface including pockets and corners.

vi. Blast cleaning operations shall not be performed on objects which have a surface temperature which is less than 3^0C above the dew point of the ambient temperature, or when the humidity is calculated using a hygrometer, the wet bulb temperature differs from the dry bulb temperature by less than 7½% of the dry bulb temperature.

vii. The cleaned surfaces shall be kept free of all contamination before painting and shall not be touched by bare hands or other bare parts of the body.

viii. Any areas which become contaminated shall be immediately solvent cleaned in accordance with AS 1627 - Part 1.

ix. Any surface which has been abrasive blast cleaned shall be coated within four hours or less of blasting depending on climatic conditions.

x. All reference to the standard surface preparation shall be to AS 1627 - Part 4 Section 1.4 and AS 1627 - Part 9.

5.18.3 PAINTING

i. Where fabricated articles are not specified or shown on the drawings to be galvanized or hot dip galvanized, they shall be painted.

ii. Proposed paint systems shall be submitted to the superintendent and/or a Pine Rivers Shire Council engineer for approval before use. Full details of the paint manufacturers' specifications, which shall include details of methods of application, dry film thickness, pot life, drying time, re-coating time, thinners and compatibility between primer and top coats shall be submitted.

iii. The fabricated articles shall be cleaned by abrasive blast to a surface standard at least equal to Class 2½ as defined by AS 1627 - Part 4.

iv. For wetted surfaces, the paint system shall be suitable for continuous immersion and, in the case of potable water, shall be approved by the Government Paint Committee for that purpose. The metalwork shall be painted with an approved system as detailed in AS 2312, reference LP1-A, i.e. primed with an inorganic zinc silicate with a minimum dry film thickness of 65 microns and maximum of 75 microns, followed by two coats of high build catalysed epoxy paint, the two coats being different shades or colours. Total dry film thickness shall be not less than 325 microns. Micaceous iron oxide may be incorporated into the first of the two coats to assist bonding.

v. For other surfaces, the steelwork shall be painted with an approved system as detailed in AS 2312, reference LP2-A, i.e. primed with an inorganic zinc silicate with a minimum dry film thickness of 65 microns and maximum of 75 microns, followed by two coats of high build catalysed epoxy micaceous iron oxide paint, the two coats being different shades or colours. Total dry film thickness shall be not less than 325 microns.

5.19.0 AIR COMPRESSOR

5.19.1 When specified in the job specification, the contractor shall supply and install an air compressor in an enclosure, compressor pit, or other location shown on the drawings. If a belt driven compressor unit is proposed, the unit shall be of robust design with a maximum speed of 600 r.p.m. Motors shall be suitable for connection to three phase 415 volt, 50 cycle, earthed neutral supply.

5.19.2 The compressor shall be provided with a forced ventilation cooling system where specified or necessary to maintain a suitable operating environment for the compressor. The contractor shall include design calculations which support the choice of ventilation fan and ductwork in the tender. The fan shall be a "Hamilton" series centrifugal fan as manufactured by "Plastic Product & Signs Pty Ltd" or similar approved of the required capacity and driven by a three phase, 415 volt, 50 cycle motor. Ductwork connecting to inlet and outlet attenuators shall be fabricated from 6 mm minimum thickness uPVC suitably supported with aluminium or

stainless steel clamping brackets.

5.19.3 All steel components inside the enclosure or compressor pit including equipment shall be hot dip galvanized following fabrication. All body fasteners shall be Grade 316 stainless steel.

5.19.4 The compressor air delivery pipework shall be 20 mm diameter copper and all fittings shall be silver soldered capillary. The compressor shall be protected against backflows of sewage by John's "Validus" bronze air check valve, Figure 551 with a John's bronze "j" disc globe valve Figure 101 within the compressor pit or enclosure. A bronze safety valve adjustable from 275 to 475 kPA shall be provided between the air compressor and the air check valve. A two coil "pig tail" shall be provided in the air line within the compressor pit or enclosure downstream of the globe valve to accommodate heat expansion and provide flexibility.

5.19.5 A pressure reducing valve shall be installed as per the manufacturer's recommendations to ensure the adequate circulation of the cooling oil. A solenoid valve shall be provided on the compressor side of the pressure reducing valve which shall close before the compressor stops in either manual or automatic mode. A delay off timer adjustable between 0 and 30 seconds shall be provided in the compressor control circuit to achieve the delay.

5.19.6 The contractor shall fabricate and install two sound attenuators at each compressor enclosure pit, or building, one inlet and one outlet, capable of ensuring a noise level of no greater than 50 dBA at a radius of 2 m from the enclosure pit or building. The attenuators shall be fabricated from 3 mm minimum thickness marine grade aluminium and all fasteners including rivets shall be Grade 316 stainless steel or Monel metal. The throat shall be adequately sized to provide the cooling air requirement at a reasonable head loss for the compressor unit.

5.19.7 Where the air compressor and receiver is to be housed in an enclosure, such enclosure shall be constructed from 3 mm marine grade aluminium. Joints in the enclosure shall be fully TIG welded, ground smooth and free from crevices. The enclosure shall be constructed in two halves. The bottom half shall be firmly affixed to the concrete plinth. The top half shall be attached to the bottom half by a full length stainless steel piano hinge fixed in an approved manner along one side. This will allow the top half of the enclosure to be opened to provide access to the compressor. The width of the enclosure shall be such that the hinged half of the enclosure shall clear the compressor's acoustic canopy. Two handles shall be welded to the side opposite the hinge to allow one person to open the top. When fully opened the top shall rest on the ground so as not to place any strain on the structure. Two approved padlocking facilities fabricated from aluminium or stainless steel shall be provided at each end of the enclosure on the side provided with the handles. The padlocks and keys shall be supplied by the Pine Rivers Shire Council where the equipment is to be operated and maintained by the Pine Rivers Shire Council.

5.19.8 All ventilation holes shall be covered with stainless steel wire gauze with 1.5 mm square openings. The gauze shall be retained by metal framing secured by countersunk metal thread screws. All ventilation openings shall be protected and shall be fitted with external metal shrouds of the same material as the enclosure. These shrouds shall be designed to prevent the entry of windblown rain.

5.19.9 The compressor enclosure shall be painted to the satisfaction of a Pine Rivers Shire Council engineer using a recommended coating system suitable for an aluminium substrate. The coating system and colour shall be dark green and approved by a Pine Rivers Shire Council engineer.

5.19.10 The contractor shall submit complete fabrication details of the enclosure, attenuators and ventilation system to the superintendent and / or a Pine Rivers Shire Council engineer for approval prior to fabrication commencing.

5.20.0 ELECTRICAL INSTALLATION

5.20.1 The contractor shall carry out all electrical work in accordance with:-

i. the requirements of AS 3000 and all relevant Standards Association of Australia codes
ii. the supply authority regulations
iii. the requirements of all relevant statutes
iv. the requirements of the Pine Rivers Shire Council design standards, standard specifications and standard drawings

5.21.0 ELECTRICAL CONTROL EQUIPMENT

5.21.1 Each pumping station shall be provided with the following control system:-

i. automatic control so that the duty pump unit starts when the water level reaches the top water level shown on the drawings and stops when the water level falls to the bottom water level shown.

   The standby pump unit shall start when the water level reaches the next level on the probe above that set, as top water level, for the duty pump unless otherwise shown on the drawings and shall stop when the water level reaches the next level on the probe above that set as bottom water level for the duty pump.

ii. an “on-off-auto” switch is to be provided for each pump unit to enable manual control.

5.21.2 Each pumping station shall be provided with a pump unit controller to perform the functions of:-

i. pump unit mode selection
ii. manual stop and start
iii. automatic operation as detailed in Clause 5.21.1 ii of this specification.
iv. duty selection and cycling
v. delay or instantaneous operation
vi. auto or manual alarm reset

5.21.3 Multitrode Model MT2PC pump controllers shall be provided for each well of the pump station, unless otherwise directed by the Pine Rivers Shire Council Manager Electrical and Mechanical Services.

5.21.4 Where the controller is provided, the contractor shall provide a rotary selector switch labelled “on-off pump controller" where in "pump controller" mode the pump unit is controlled by the controller. In the “off” position the motor shall stop. In the “on” position the motor shall start and run until the switch is turned off. In either mode the pump unit shall be protected by thermistors and thermal overload protection.

5.21.5 As well, each pumping station shall be provided with:-

i. an amber fault light and manual reset button both located on the front panel for each pump unit. The fault light shall be illuminated if the thermistor or thermal overload

protection is activated and shall continue to be illuminated until manually reset.

ii. a flashing amber light alarm shall commence to operate when the water level reaches 400 mm above the top water level unless shown otherwise on the drawings. Where telemetering has been provided an alarm status shall be initiated when the water level reaches the standby start level and the standby pump fails to start.

5.22.0 SWITCHBOARD AND WIRING

5.22.1 Switchboard wiring shall generally be in accordance with the Pine Rivers Shire Council standard drawings (latest issue).

The contractor shall ensure that all wiring and construction details for switchboards comply with the Pine Rivers Shire Council requirements at the time of manufacture of the switchboard.

5.22.2 Unless otherwise shown on the drawings or specified in the job specification, a steel vent pole shall be provided at each station by the principal who shall also provide for the attachment of the supply authority's consumers mains and for the support of the switchboard to be supplied under this contract.

5.22.3 The contractor shall submit details of the brackets to support the switchboard. The details of the bracket to support the supply authority's consumers' mains and the mains connection box, is shown on the Pine Rivers Shire Council standard drawings.

5.22.4 For a pole mounted switchboard, the contractor shall supply and install the electrical conduit between the pump well and the base of the switchboard. The conduit shall be rigid uPVC HD electrical conduit, sealed into the cored hole in the roof of the pump well and glanded into the base of the switchboard. The conduit shall be 150 mm or larger to suit the size of the plugs to be withdrawn through the conduit.

5.22.5 The contract includes all wiring from the supply authority point of attachment to the switchboard and from the switchboard to each motor, its local controls if required and the level controls.

5.22.6 Each switchboard shall be fitted with a three phase main isolating switch and shall have a fault rating greater than the fault level at the consumers' terminals as determined by the supply authority. The main isolating switch shall comply with the requirements of AS 3133. The pump motors shall be protected from both operational excess currents and short circuits by circuit breakers with magnetic trip. Control equipment shall be protected by appropriately rated circuit breakers. Circuit breakers shall comply with the requirements of AS 2184 and AS 3111. The voltage meter and phase failure relay shall both be protected by the same three single phase appropriately rated circuit breakers. Control circuits for each pump motor shall be separately protected.

5.22.7 The contractor shall supply and install surge diverters in accordance with AS 1307, rating 280 volts to earth 80 ka connected to 3 phases and neutral on the incoming mains within the switchboard where they shall be placed in a protective housing and connected to the earth bar.

5.22.8 A 240V 10 amp surge reduction filter shall be provided on the active and neutral cables of the control circuits derived from each phase. The unit shall have an aggregate peak impulse rating of 12,000 amps and shall include solid state surge diverters. The unit shall incorporate

filters in active and neutral with an earth conductor.

5.22.9 Control equipment shall be provided suitable for the shutting down of each motor should the allowable temperature of its windings be exceeded. The thermistor relay shall de-energise a fault relay which shall disconnect the motor control circuit and provide for fault indication and fault condition latching. The thermistor relay shall be manually reset when the temperature of the windings falls to an acceptable value. The equipment shall comply with AS 1023. The fault condition latching relay shall be manually reset using a push button on the front panel.

5.22.10 Backup overload protection shall be provided by thermal overload devices in accordance with AS 1023 Part 2 fitted to motor starters. This device shall be manually reset and shall be fitted to the contactors on the starter. The thermal overload relay shall de-energise the same fault relay as the thermistor relay. This thermal overload device shall be based on full load current with an adjustment on the current to trip. The device shall also afford protection against out-of-balance currents.

5.22.11 The switchboard shall include two 440 volt phase failure relays, automatic resetting, protected by three single phase circuit breakers as detailed in Clause 5.22.6 of this specification. The relay should incorporate features of phase imbalance, phase reversal, and under voltage.

5.22.12 The starters shall be provided with under-voltage release, with automatic reset, ammeters of accuracy Class 1.5 and hour-run meters.

5.22.13 The switchboard shall contain a water in oil monitoring device which shall activate an amber warning light. The circuit shall be automatically reset.

5.22.14 Each switchboard shall contain a voltmeter of accuracy Class 1.5 together with voltmeter selector switch to measure the voltage between each phase.

5.22.15 The starters shall be rated for intermittent duty in accordance with AS 1202. Contactor ratings shall be in accordance with AS 1029 to utilisation category AC3 and intermittent duty Class 0.1 unless specified otherwise in the job specification.

5.22.16 Where provided, auto transformers shall have three windings and be protected by positive thermal co-efficient thermistors built into the windings during manufacture in order to sense the temperature in the windings for each of the three phases. The thermistors, their fitting in the transformer, reference temperatures, and testing of the unit shall generally be in accordance with the relevant sections of AS 1023.

5.22.17 Control equipment shall be provided suitable for shutting down the electrical supply to the auto-transformers should the allowable temperature of its windings be exceeded. The auto-transformer temperature relay shall de-energise the same fault relay as the thermistor relay. The equipment shall comply with AS 1023.

5.22.18 A 24 volt power outlet shall be provided on each switchboard and the contractor shall provide a 24 volt lead light with a cord of sufficient length to reach to the inside of the pump well and down to bottom water level. When not in use the lead light shall be coiled and hung on the inside of the switchboard door. A 20 watt fluorescent light shall be mounted inside the switchboard with a labelled switch mounted on the front panel. The light shall be positioned so as to illuminate the switchboard. A 240 volt 15 amp general purpose outlet (GPO) shall be provided on the front panel. An earth leakage circuit breaker of 30 mA sensitivity shall be provided for the GPO.

5.22.19 The contract shall include the supply and installation of a flashing amber light alarm which shall commence to operate as specified previously in Clause 5.21.5.ii of this specification and shall cease only when a switch on the switchboard is manually operated. The flashing light shall be of approved manufacture and weatherproofed and shall be located on top of the switchboard cubicle or fascia of the switchboard building for external and internal switchboards respectively.

5.22.20 Indicating instruments shall have 96 mm square faces and be in accordance with AS 1042 with the accuracy class herein specified and they shall be calibrated and marked accordingly as having complied with this requirement.

5.22.21 All relays and mechanisms other than contactors shall be fully enclosed separately in air-tight containers. Exposed live metal shall be at least partly shielded to prevent accidental shock. All relays shall be supplied with inbuilt lights to indicate when the relays are energised.

5.22.22 The electrode system shall consist of a single multi-sensored probe where the distance from the stop level to the alarm level is less than 2.7 m. Where this distance exceeds 2.7 m multiple multi-sensored probes shall be provided. The probes shall as specified in Clause 5.21.3 of this specification.

5.22.23 The equipment shall be arranged so that the controls and indicators required for the day-to-day operation of the pump units shall be available readily to the operator and shall be no lower than 1200 mm and no higher than 2000 mm above access level. These would normally include isolators and circuit breakers which would be mounted behind the front panel but protruding through it. Equipment mounted on the front panel would include selector switches, general switches, push buttons, indicator lights, voltmeter and ammeters. Equipment mounted in the compartment and generally accessible only to electrically qualified personnel would include motor starters, relays, contactors, timers, transformers, neutral link, earth busbar and terminal strips.

5.22.24 The contractor shall arrange all control and power equipment in a logical grouping to mimic the front panel layout. All equipment shall be "DIN" rail mounted using plug-in bases wherever possible.

5.22.25 Push-buttons shall be of the industrial protected type with one make and one break contact per element. The start and stop elements shall not be combined into one assembly. Contacts shall be double make / break and the mechanism shall provide pre-button and post-button movement with guidance free from binding or jamming.

5.22.26 Indicator lamps shall be industrial type with transformers and extra low voltage lamps. The bezel shall be approximately 25 mm across, flush or nearly flush with the panel. Fault lights shall be amber in colour and run lights shall be green in colour.

5.22.27 Selector switches shall be a robust rotary type, 10 amp rated and complete with an escutcheon plate.

5.22.28 Switchboard and starter wiring including that in the components and accessories thereof, shall be carried out in accordance with the wiring diagram. The circuitry shall be such, in conjunction with the equipment and accessories used, as to prevent recycling and feedback and shall be fail safe.

5.22.29 The wiring shall be of adequate size, a minimum of 10 amp rating, multi-stranded copper

conductors. The minimum size for power cables shall be 2.5 mm^2 and 1.5 mm^2 for control and instrumentation. All wires shall be insulated with different colours for power and control. Each control wire shall be terminated with a pin crimp lug and be numbered with annular plastic bits at the ends which are covered with clear heat shrink.

Corresponding numbers shall be shown on the wiring diagram. Wire marking furniture shall be "Grafoplass" or approved equivalent. Wiring colour coding shall be in accordance with the Pine Rivers Shire Council standard drawing.

5.22.30 Connections to external control wiring and auxiliaries shall be through numbered terminal strips. Every terminal shall be large enough to accept at least 4 mm^2 cable. Terminals for connection of thermistors wiring shall be clearly labelled with the name of the item of equipment and the test voltage. Terminals of strips or equipment shall not bite or indent the wire end, but shall clamp the wire with a plate or use solderless crimp lugs. Every terminal for control wiring shall be capable of accepting at least two control wires.

5.22.31 The switchboard, disconnecter boxes and meter boxes where provided shall be approved weatherproof totally enclosed cubicles manufactured from 3.15 mm thick marine grade unpainted aluminium and shall be securely fixed to the vent pole. Joints in the cubicle and doors shall be continuously TIG welded, ground smooth and free from crevices.

5.22.32 Two lifting / mounting angles shall be fitted to the top and bottom near edges of the switchboard cubicle as indicated on the Pine Rivers Shire Council standard drawings.

5.22.33 The contractor shall fit one legend card holder and one drawing holder, each 300 mm wide x 250 m high x 25 mm deep, tot eh inside of the cubicle door. A suitably sized aluminium or stainless steel fuse receptacle shall also be fitted to the cubicle.

5.22.34 The cubicle shall be accessible from the front by a hinged door secured with latch fasteners, complete with vandal resistant locks and keys to the principal's and / or a Pine Rivers Shire Council engineers requirements. General details shall comply with the Pine Rivers Shire Council standard drawings. The door shall include a neoprene gasket to exclude water and dust. Gaskets shall be fixed to the doors without stressing and retained by means of metal framing. Gaskets shall be protected from direct sunlight. The minimum door width shall be 600 mm.

5.22.35 The electrical wiring shall be mounted behind a hinged panel inside the switchboard. The hinged panel shall be fitted with a door lock. All control equipment shall be mounted on the face of this panel or in a position such that access is available without opening this panel. Stays shall be provided to hold doors open in the 120^o position. Door locks and mechanisms shall be at least Grade 304 stainless steel.

5.22.36 The hinges shall be fastened with Grade 316 stainless steel fasteners.

5.22.37 All panels within the switchboards, excluding the meter panels, shall be 3 mm thick marine grade aluminium, unless otherwise noted on the Pine Rivers Shire Council standard drawings.

5.22.38 The minimum distance between the edge of ducts and terminals of equipment shall be 50 mm. This space is in addition to the spare space requirements in the cubicle.

5.22.39 All ventilating holes in the cubicles shall be covered with stainless steel wire gauze 1.5 mm square openings. The gauze shall be retained by metal framing welded to the inside of the cubicle. The vents shall provide a minimum of 225 cm^2 total inlet and 225 cm^2 total outlet per

cubic metre of internal space, and shall be protected from damage. Four openings shall be provided, as shown on the Pine Rivers Shire Council standard drawings.

5.22.40 For pole mounted switchboards, a separate termination zone compartment shall be provided at the base of the switchboard as shown on the Pine Rivers Shire Council standard drawings, to house the plugs and sockets or terminals for disconnecting the power, thermistor and level control cables.

This compartment shall be sealed off from the main body of the switchboard and shall be accessible from the front by a hinged door, secured with latch fasteners complete with vandal resistant locks as specified in Clause 5.22.34 of this specification. The compartment shall have a minimum height and depth of 450 mm. The width shall match the cubicle. The motor and thermistor cables shall pass through the base of the switchboard into the conduit.

5.22.41 The conduit to the pump well shall be sealed with a tapered rubber plug to prevent sewer gases entering the switchboard cubicle. The tapered rubber plug shall be 50 mm high with a diameter to match the electrical conduit and shall be manufactured from 30 Durometer rubber and shall be split part way across with pre-formed holes for each motor, level probe and any other cable. The sealing arrangement shall be capable of being resealed with a non-setting sealant after pump unit removal or replacement. Two ventilation holes covered with stainless steel wire gauze as specified in Clause 5.22.39 of this specification shall be provided to the termination zone.

5.22.42 A concrete or paved hardstand area of minimum 1.5 m^2 shall be provided directly at the front of each switchboard cubicle at a suitable level to allow easy and safe access and inspection by operations and maintenance staff under all weather conditions.

5.22.43 For switchboards mounted remote from the pump well pole or in a building, the contractor shall supply and install a pump disconnecter box of minimum size 700 mm wide by 400 mm high by 450 mm deep with a front opening door and an internal panel for mounting the terminals or alternatively plugs and sockets for disconnecting the power thermistor and level control cables. A cable support shall be provided in the box. This compartment shall be sealed from the pump well by a tapered rubber plug as specified in Clause 5.22.41 of this specification. The disconnecter box shall be mounted on an appropriate base in accordance with the Pine Rivers Shire Council standard drawings.

5.22.44 The motor and thermistor cables shall be adequately supported within the pump well to avoid interference with access or the normal operation of the station. A bracket together with a cable sock shall be provided for excess cable support.

5.22.45 Wiring external to the switchboard shall be 250 volt grade PVC insulated copper cables conforming to AS 3147.

5.23.0 COMPRESSOR INSTALLATION

5.23.1 The electrical equipment for the compressor when specified in the job specification shall be provided generally in accordance with the previous clauses. The contractor shall provide all wiring between the switchboard and the compressor.

5.23.2 Overload protection shall be provided by thermistors and thermal overload devices in accordance with AS 1023 Part 1 and Part 2 respectively fitted to each motor starter. These devices shall be wired as detailed in Clauses 5.22.9 and 5.22.10 of this specification. This device shall be based on full load current with an adjustment on the current to trip.

5.23.3 The compressor shall be provided with a “on-off, auto" selector switch. In the “off” position the compressor shall stop. In the “on” position the compressor shall start and run until the switch is turned off. In the “auto” mode, a 24 hour time clock with 15 minute increments shall be provided to control the operation of the compressor.

5.24.0 TELEMETRY EQUIPMENT

5.24.1 Telemetry equipment shall be obtained from “Applied Control Systems” unless otherwise approved by the Pine Rivers Shire Council Manager Electrical and Mechanical Services and shall generally consist of:-

i. radios and power supplies as required
ii. multitrode gateway
iii. pulse input modules as required
iv. system gateway

5.24.2 Telemetry is to be provided for the monitoring of the operation of the pumping station through the following signals:-

i. pump units/s available
ii. pump unit/s fault
iii. pump unit/s automatic
iv. pump unit/s running
v. pump well/s levels (4.20 mA)
vi. pumping station overflow level
vii. pump unit/s speed when applicable
viii. pump unit/s water in oil
ix. pump unit/s low insulation resistance when applicable
x. pressure main flow when applicable
xi. air compressor fault when applicable
xii. ventilation fan fault when applicable
xiii. odour control unit fault when applicable
xiv. sump pump unit fault when applicable
xv. phase failure and/or power failure
xvi. pump run hours (pulse input)

All digital inputs shall be provided by voltage free contacts. Analogue inputs shall be isolated from an earth reference.

5.25.0 LABELLING OF COMPONENTS

5.25.1 The contractor shall clearly label the switchboard and switchboard equipment as indicated on the Pine Rivers Shire Council standard drawings and as specified below.

5.25.2 When the switchboard is part of an installation which is to be operated and maintained by the Pine Rivers Shire Council, the following labels shall be affixed to the outside of the switchboard.

i. A standard Pine Rivers Shire Council issue, self-adhesive white light reflecting label worded “Pine Rivers Shire Council” and “Pine Water” in black lettering, followed by Pine Rivers Shire Council “Pine Water” Logo. The label and logo shall be in the colours required by Pine Water.

This self-adhesive label shall be 500 mm wide x 300 mm high and shall be located to face the most appropriate thoroughfare accessing the sewerage pumping station to the satisfaction of a Pine Rivers Shire Council engineer.

ii. A painted label depicting the sewerage pump station number (PUMP STATION NO. NNN) in 150 mm high lettering in matt black paint shall be located beneath the self adhesive label to the satisfaction of a Pine Rivers Shire Council engineer.

5.25.3 The contractor shall attach separate 3 mm thick RWR Traffolyte labels engraved in 150 mm high letters with the pump unit number, 1, 2 and so on for multiple pump unit installations, to the underside of the pump well access cover with either through bolting with four 3 mm diameter Grade 316 stainless steel round head metal threads or four 3 mm diameter Monel blind rivets. The heads shall be on the top of the cover. For twin pump unit single well installations, the pump unit shall be numbered left to right when viewed from the side opposite the guide bars.

5.25.4 The contractor shall attach separate 1.6 mm thick WBW Traffolyte labels engraved with 20 mm high letters with the pump unit number in the form "PUMP UNIT N" adjacent to each pump unit motor lead socket.

5.25.5 Each pump unit shall be provided with a number in the form "SUBNNN" which will be stamped in 10 mm high letters on to a 1 mm thick Grade 316 stainless steel tag permanently attached to the pump volute. The number will be supplied by the superintendent and / or a Pine Rivers Shire Council engineer when requested by the contractor. All test sheets and manuals shall refer to this number as well as the serial number.

5.25.6 The contractor shall provide a 95 mm x 65 mm x 1.6 mm thick WBW Traffolyte label engraved with the pump unit number in 20 mm high letters in the form "SUB NNN". Pump unit details including make, model and serial number shall be engraved on the label in 5 mm high letters after the pump unit number or on the reverse side. The label shall be attached to a stainless steel saddle adjacent to the pump unit "on-off-auto" selector switch using a key ring.

5.25.7 The panel and equipment mounted on the switchboard shall be neatly designated by approved engraved nameplates manufactured from 1.6 mm thick WBW Traffolyte. Minimum letter height shall be 6 mm and 3 mm for major and minor labels respectively in accordance with the Pine Rivers Shire Council standard drawings.

5.25.8 Where ducting is used for electrical cabling on the equipment panels in the switchboards, all labels shall be attached to the duct covers. These covers shall be attached to the duct bases with cable ties or alternatively a numbering system shall be used for the correct location of each duct cover.

5.26.0 NOISE LEVELS

5.26.1 All equipment shall be selected for quiet operation. Items of plant with high noise levels e.g. air compressors, shall be acoustically treated to comply with the specified requirements.

5.26.2 The maximum level of noise permitted and the methods to be adopted in measuring noise levels shall be as set out hereunder.

5.26.3 The contractor shall conduct factory testing of equipment sound pressure levels. Sound pressure levels shall be measured as set out hereunder in tests arranged by and at the contractor's expense. Three copies of all information including readings and graphs taken in these tests shall be supplied to the superintendent and/or a Pine Rivers Shire Council engineer before delivery of the equipment.

5.26.4 The contractor shall guarantee that the sound pressure levels of all motors and mechanical plant shall not exceed the figures specified hereunder.

5.26.5 The superintendent and / or a Pine Rivers Shire Council engineer may check the delivered equipment on site under operating conditions and any equipment exceeding the guaranteed noise level figures or the specified requirements shall be modified or replaced by the contractor at the contractor's expense.

5.26.6 Noise level tests shall be carried out in accordance with the relevant Australian standards with due notification being given by the manufacturer to allow tests to be witnessed. Where plant is manufactured and tested overseas, full details of testing procedures shall be submitted with test results for approval. Where such testing procedures are deemed to be unacceptable, the equipment shall be tested at the contractor's expense in accordance with the specified requirements.

5.26.7 Noise levels of electric motors shall be measured in accordance with AS 1081.

5.26.8 Noise levels of mechanical plant shall be measured in accordance with the relevant parts of AS 1217.

5.26.9 Noise levels out of doors shall be measured in accordance with the relevant parts of AS 1055.

5.26.10 Noise levels indoors shall be measured at a height of 1.2 to 1.5 m above floor level not closer than 1.2 m to any wall or reflective surface using equipment complying with AS 1259.

5.26.11 Test measurements for motors and plant shall be analysed into 8 octave bands of centre frequencies 63, 125, 250, 500, 1000, 2000, 4000 and 8000 Hz. Overall noise levels indoors and out of doors shall be measured on the A weighted scale.

5.26.12 The following noise levels shall not be exceeded. Levels are specified on the "A" weighting scale with respect to 2×10^{-5} N/m^2 and measured in a hemisphere above a reflecting plane for items i., ii., and iii. below:-

i. **electric motors** - the sound pressure level of each motor at each speed for both steady and transient noise shall not exceed 85 dBA at 1 m radius

ii. **compressors** - the sound pressure level of each unit for both steady and transient noise shall not exceed 85 dBA at 1 m radius

iii. **mechanical plant - miscellaneous** - the sound pressure level of any plant other than compressors shall not exceed 80 dbA at 1 m radius

iv. **overall noise levels** - the overall noise level for all equipment which would normally operate under peak capacity conditions shall not exceed 85 dBA

5.26.13 Equipment offered with soundproofing devices shall not be considered unless:-

i. the soundproofing devices form an integral part of the equipment

ii. the soundproofing devices are well designed and manufactured using first class materials and workmanship, and are neat fitting around the equipment, and do not impede the flow of cooling air such that the motor temperature will rise to an unsafe level during normal load conditions

iii. easy access for connection/inspection of terminal box, and for maintenance of bearings and brush gear (if applicable), shall be provided

5.27.0 QUALITY ASSURANCE AND TESTING

5.27.1 All pump units, compressors, pipes and switchboard shall:-

i. be manufactured, inspected and tested in compliance with the relevant standard and branded accordingly by the manufacturer in terms of a standards mark licence granted by the Standard Association of Australia; or

ii. be manufactured, inspected and tested in compliance with the relevant standard and branded accordingly by the manufacturer having in place a quality system accredited to ISO 9001, 9002 or 9003; or

iii. be manufactured, inspected and tested in compliance with the relevant standard and branded accordingly by the manufacturer under the supervision of the testing organisation nominated by the contractor and approved by the superintendent and / or a Pine Rivers Shire Council engineer.

5.27.2 The superintendent and / or a Pine Rivers Shire Council engineer reserves the right to further inspect and / or test at their expense, the whole or any portion of the articles on delivery to the site of their works. If, due to damage during delivery, offloading and stacking, or due to any modification or alteration by the contractor subsequent to any previous test, an article fails to withstand the site inspection and / or test it will be rejected and shall be replaced by another, which shall fulfil all requirements of this specification, without additional charge.

5.28.0 PUMP UNIT TESTS

5.28.1 Prior to despatch to the site the pump units and switchboards shall be inspected during manufacture and tested separately at the manufacturer's works.

5.28.2 The contractor shall furnish to the superintendent and / or a Pine Rivers Shire Council engineer certified calibration schedules from a recognised authority for the meter and other measuring devices used in the tests. Energy, power and flow (where applicable) instruments shall be calibrated no more than six months before the tests. Pressure gauges shall be calibrated immediately before and after the tests.

5.28.3 All switchgear assembled on switchboards with starters shall be inspected and tested before despatch with such additional equipment as necessary to test the automatic functioning of this equipment as assembled and wired, including the protective devices, relays etc.

5.28.4 Motor tests shall first be carried out at the manufacturer's works to prove conformance with contract guarantees of rating and efficiency and other aspects comprising performance tests according to AS 1359 and the records of observation shall be entered on test sheets. Tests for vibration and insulation shall also be included on the test sheets. Type tests are acceptable for motors less than 100 kW.

5.28.5 Following tests on motors, the contractor shall supply to the superintendent and / or a Pine Rivers Shire Council engineer duplicate certified copies of the records of the motor manufacturer's tests.

5.28.6 The tests on the pump units shall be carried out in accordance with AS 2417 Part 2 and a record of observations kept including kW.h / kl, in accordance with the test sheet forming part of that specification and as herein modified. Additional information shall be included, such as test pressure, duration of pump unit operation, motor winding insulation to frame at the beginning and end of tests, temperature, vibration and such other information as herein called for. The electric motors used shall be those to be supplied under this contract. The pump units shall be run long enough for the temperature to reach a nearly steady state. Where the temperature rise of the bearings exceeds 50°C, authorisation for despatch will be refused. Motor winding insulation shall be a minimum of 15 megohms before and after the tests.

5.28.7 A minimum of five tests shall be made with the pump and motor coupled together including one at the guaranteed operating condition, and four at points suitably spaced including the shutoff head. The extent shall include the condition of flow to give the maximum power input to the pump. The characteristic curves for head, pump efficiency, brake power and kW.h / kl against discharged quantity shall be accurately plotted in accordance with AS 1686.

5.28.8 The total duration of the works test for each pump unit shall be not less than two hours continuous running at the specified head for pump units in excess of 7.5 kW or one hour for smaller units. Longer periods may be required at the discretion of the superintendent and / or a Pine Rivers Shire Council engineer. The actual commencement and completion times for this part of the test, and for the whole test period, shall be shown on the test sheets.

5.28.9 The “schedules of guaranteed technical information” show the figures to be obtained at works tests before the approval for despatch to site shall be given. In addition, despatch shall not be given if the kW.h / kl figure at the duty head obtained at works exceeds that guaranteed figure, without authority from the superintendent and / or a Pine Rivers Shire Council engineer.

5.28.10 Immediately after certification, the reports and test sheets of the pump unit test shall be forwarded together with copies of the amended characteristic curves to the superintendent and / or a Pine Rivers Shire Council engineer, as also shall reports on switchboards and, if called for, test sheets and/or reports on motors and other items of plant.

5.28.11 The equipment shall not be despatched from the works until permission in writing has been obtained from the superintendent and / or the testing organisation, who shall be satisfied that the specification requirements and guarantees have been met.

5.28.12 After the whole of the equipment has been erected and is ready to run, the contractor shall notify the superintendent and / or a Pine Rivers Shire Council engineer. Thereafter, the contractor will be given two days within which to carry out any preliminary tests and make any necessary adjustments to ensure its compliance with the specification.

5.28.13 After such preliminary running, the equipment shall be subjected to the following tests during which no adjustments shall be made unless approved by a Pine Rivers Shire Council

engineer. These tests shall be conducted by the contractor at the contractor's expense to the satisfaction of and in the presence of the superintendent and / or the Pine Rivers Shire Council Manager Electrical and Mechanical Services.

5.28.14 Each pump unit shall be run for at least two hours at the duty head or actual pumping head if higher than duty head. The time may be extended or reduced at the discretion of the Pine Rivers Shire Council Manager Electrical and Mechanical Services and the tests shall include a thorough check of the mechanical functioning, temperature rise, vibration, noise, alignment etc. Readings of pressure gauges, flowmeter, ammeter, voltmeter and kilowatt hourmeters, shall be taken at appropriate intervals during the tests, and volumetric checks shall be made, if possible by the contractor.

5.28.15 Where a flow measuring device is not available, the Pine Rivers Shire Council Manager Electrical and Mechanical Services will require a minimum of six tests based on pumping out the pump well between two fixed levels with no inflow to the pump well during the test. Measurements of power consumed will be taken and the superintendent and/or the Pine Rivers Shire Council Manager Electrical and Mechanical Services will compute the apparent rate of flow. The power consumed at the duty flow shall be compared with the guaranteed power consumption.

5.28.16 Together with the above tests, tests as directed shall be made to prove the automatic control functions and that the switchgear, safety devices and protective devices are operational.

5.28.17 During all tests, accurate records of the observations shall be made by the contractor and / or their representative.

5.28.18 The certified pressure gauges installed by the contractor in the position/s approved shall be the basis of head measurements while the kilowatt hours used during the tests shall be measured by the meters calibrated and provided by the electric supply authority or calibrated submeters as the case may be.

5.28.19 The kW.h / kl figure for the duty head condition or actual pumping head if higher shall be calculated from the electricity consumption and the flow measurements as ascertained during tests. No tolerances will be allowed. Should the system resistance prove to be higher than was specified i.e. if actual pumping head exceeds the head indicated by the intersection of the specified system resistance curve and the works test H-Q curve, then the acceptance or otherwise will be subject to the approval of a Pine Rivers Shire Council engineer.

5.28.20 The principal will provide the electric energy required for the preliminary running, also the energy for the tests, but should further tests be necessary through failure of the equipment to fulfil the specified requirements, then the costs of the superintendent's and / or a Pine Rivers Shire Council engineer’s attendance, and the electricity used shall be paid by the contractor.

5.29.0 DEFECTIVE EQUIPMENT

5.29.1 Should the temperature rise of the motors or any other unit under the operating conditions set out in this specification be exceeded or should the kW.h / kl at site exceed that guaranteed, or if any unit of the equipment proves to be defective in any other respect, the contractor shall alter, repair or replace the defective unit or any part thereof, so that it shall conform in every respect with the specification and with the guarantees.

5.29.2 Should the discharge at the specified head be less or the kW.h / kl pumped more than those guaranteed, then the contractor shall alter, repair or replace the whole or any part of the equipment so that it shall conform in every respect with this specification and the guarantees.

5.29.3 Such further tests as may be necessary will be made to prove the conformance of the equipment with the specification and guarantees after it has been altered, amended or replaced, the cost of which shall be borne by the contractor.

5.29.4 If the tests on completion be delayed or prove unsatisfactory due to nonfulfillment of the guarantees or to faults in the equipment or the workmanship supplied under the contract, then the principal shall have the right to use the equipment, subject to permission in writing by the contractor, until these tests are successfully carried out, but such use shall be at the contractor's risk, provided the equipment is used in a proper and normal manner, and shall not prejudice any other rights of the principal under the contract.

5.30.0 PROVISION OF TESTING WATER

5.30.1 The contractor shall provide all water as necessary for site testing as required by the contract. This water may be obtained from the town water reticulation system, subject to approval from a Pine Rivers Shire Council engineer. A stand-pipe may not be used on a hydrant until such time as the contractor has applied for and been granted a permit by the Pine Rivers Shire Council to do so.

5.30.2 Any fees which the Pine Rivers Shire Council may impose for the use of the stand-pipe shall be paid by the contractor and the contractor shall make allowance for this when pricing the tender.

5.31.0 OPERATION AND MAINTENANCE MANUAL

5.31.1 At the time of commissioning of each pumping station and undertaking site testing, a draft manual in A4 format contained in a fully labelled heavy duty plastic folder shall be provided to the superintendent and / or a Pine Rivers Shire Council engineer. Should the manual not be provided, then the pumping station will not be tested or accepted as having reached Practical Completion. The manual shall contain information for the operation and maintenance of each item of mechanical and electrical equipment installed under the contract including air compressors, soft starters and pump unit controllers where provided.

5.31.2 As part of its asset management system, the Pine Rivers Shire Council will require details of all installed equipment to be entered into its maintenance management register. To facilitate this entry, a Pine Rivers Shire Council engineer will supply blank proforma, on to which the contractor shall enter the details sought. The completed forms shall be handed to the superintendent and / or a Pine Rivers Shire Council engineer for transmission to the Pine Rivers Shire Council Manager Electrical and Mechanical Services.

5.31.3 Within two weeks of the return of the draft manual with comments therein by the Pine Rivers Shire Council Manager Electrical and Mechanical Services the contractor shall provide three copies of the final operation and maintenance manuals in A4 format in fully labelled heavy duty plastic folders. A copy of the manual in PDF electronic format is also to be provided.

5.31.4 Each operation and maintenance manual shall contain the Pine Rivers Shire Council standard cover sheet, duly completed by the contractor. The standard cover sheet is contained in Appendix A attached to this specification.

5.31.5 A list of recommended spare parts shall be included in each manual so provided together with their current price list.

5.31.6 Suitable provision shall be made for information regarding the lubrication of all bearings and moving parts. A complete schedule of lubrication points, showing location of point, type of lubricant and period of lubrication (minimum one month) shall be supplied in each manual.

5.31.7 The contractor shall provide sectional drawings or sectional illustrations of the pumps, motors, compressors, etc., to assist in maintenance work, and a book listing parts and part numbers where available in each manual.

5.31.8 Data shall be provided detailing mean time between failures (MTBF) for items of equipment supplied. This information will be used for comparison purposes and for the programmed maintenance procedures on takeover of the pumping station.

5.31.9 The contractor shall provide an A1 transparency of each of the as constructed wiring and cubicle construction detail electrical drawings and all mechanical equipment drawings and include a copy of each drawing reduced to A3 or A4 format in each manual.

5.31.10 Copies of all “as constructed” drawings shall also be provided in DWG electronic format compatible with the latest or latest less one version of AutoCAD. Drawings are to include all files (including font, linetype, plot control files etc.) necessary to permit the drawings to be printed in the manner in which they were intended.

5.31.11 All transparencies and electronic copies of “as constructed” drawings are to be supplied to the Pine Rivers Shire Council Manager Electrical and Mechanical Services at the time of supplying the operation and maintenance manuals.

5.32.0 DOCUMENTATION

5.32.1 The contractor shall supply guaranteed technical information regarding the nature and performance of equipment to be supplied under the contract.

5.32.2 The guaranteed technical information shall be supplied on the following schedules contained in Appendix B attached to this specification:-

Schedule No 1 - Submersible Pump

Schedule No 2 - Motor and Power Consumption

Schedule No 3 - Switchboard

Schedule No 4 - Pump Capacity and Efficiency

Schedule No 5 - Contract Period

APPENDIX A

Operation and Maintenance Manual Cover Sheet

PINE RIVERS SHIRE COUNCIL
PUMP OPERATION AND MAINTENANCE MANUAL
COVER SHEET

CLIENT

Customer :

Project : ……..

Pump Station : ……..

Contract No : ……..

PROJECT DETAILS

Pump Model : ……..

Pump Make : ……..

Motor : ……..

Project Drawings : ……..

Pump Serial Number : ……..

PERFORMANCE DETAILS

Duty : ……..

Pump efficiency : ……..

Motor efficiency : ……..

kW.h/kl : ……..

SPECIAL CONSTRUCTION DETAILS

Pump wear ring numbers
- Impeller: ……
- Housing: ……

Pump mechanical seal number :

Pump bearing numbers
- Top: ……
- Bottom: ……

Pump O-Ring kit number : ……..

Pump frame number : ……..

Motor cable size : ……..

Motor cable length : ……..

Thermistor fitted : ……..

Water sensor fitted : ……..

Cable connection : ……..

APPENDIX B

Schedules of Guaranteed Technical Information

PINE RIVERS SHIRE COUNCIL
SCHEDULE OF GUARANTEED TECHNICAL INFORMATION
SCHEDULE NO 1 - SUBMERSIBLE PUMP

Project:	
Contract Number:	
Supply and Installation of Submersible Pumping Equipment for Pumping Station Number:	

1. Country of manufacture	
2. Manufacturer's name	
3. Manufacturer's type number	
4. Speed	
5. Diameter of impeller for tender duty	
6. Maximum diameter impeller that can be fitted to this pump	
7. Output of pump with maximum diameter impeller when driven at above speed against maximum system resistance	
8. Power required by pump with full diameter impeller at any condition of discharge	
9. Size of spheres	
10. Diameter of delivery	
11. Composition of impeller	
12. Composition of shaft	
13. Composition of casing	
14. Composition of wear ring	
15. Composition of casing bolts and nuts	
16. Total weight (pump and motor)	

I/We hereby guarantee the above technical information:

Name of Tenderer: .....

Address:.....

Signature of Tenderer: …….. Witness: .....

Date: .....

PINE RIVERS SHIRE COUNCIL
SCHEDULE OF GUARANTEED TECHNICAL INFORMATION
SCHEDULE NO 2 - MOTOR AND POWER CONSUMPTION

Project:	
Contract Number:	
Supply and Installation of Submersible Pumping Equipment for Pumping Station Number:	

1. Manufacture		
2. Place of manufacture		
3. Frame designation (AS 1359.10)		
4. Cooling classification (AS 1359.21	IC	
5. Enclosure classification (AS 1359.20)	IP	
6. Duty rating (AS 1359.30	S	
7. Output rating (AS 1359.30	kW	
8. Voltage rating (AS 1359.30)	V	
9. Speed at rated input	rpm	
10. Insulation class (AS 1359.32)		
11. Efficiency at rated output	%	
12. Efficiency at ¾ rated output	%	
13. Efficiency at ½ rated output	%	
14. Power factor at rated output		
15. Power factor at ¾ rated output		
16. Power factor at ½ rated output		
17. Current at rated output	A	
18. DOL starting current	A	
19. Locked rotor current	A	
20. Locked rotor torque	Nm	

I/We hereby guarantee the above technical information:

Name of Tenderer: .....

Address:.....

Signature of Tenderer: . . . . . .Witness: .....

Date: .....

SCHEDULE NO 2 - CONTINUED

21. Breakdown torque	Nm	
22. Pull out torque	Nm	
23. Maximum locked rotor time	s	
24. Sound power level at 1 m at 415V sinusoidal (AS 1359.51)	dBA	
25. Minimum insulation resistance at end of defects liability period	MΩ	
26. Maximum power consumption for 24 hours continuous operation under working conditions	KW.h	

I/We hereby guarantee the above technical information:

Name of Tenderer: .....

Address:.....

Signature of Tenderer: . . . . . .Witness: .....

Date: .....

PINE RIVERS SHIRE COUNCIL
SCHEDULE OF GUARANTEED TECHNICAL INFORMATION
SCHEDULE NO 3 - POWER BOARD

Project:	
Contract Number:	
Supply and Installation of Submersible Pumping Equipment for Pumping Station Number:	

SWITCHBOARD	
1. Maker	
2. Place of manufacture	
3. Materials of construction	
4. Size of cubicle	

MAIN SWITCH	
1. Maker	
2. Model Number	
3. Rating	

CIRCUIT BREAKERS	
(a) Pump Motor	
1. Maker	
2. Model Number	
3. Rating	
(b) Control Circuit	
4. Maker	
5. Model Number	
6. Rating	

I/We hereby guarantee the above technical information:

Name of Tenderer: .....

Address:.....

Signature of Tenderer: . . . . . .Witness: .....

Date: .....

SCHEDULE NO 3 - CONTINUED

STARTERS	
1. Country of manufacture	
2. Maker and type	
3. Full load-current rating	
4. Duty rating (AS 1202.5)	
5. Acceleration and deceleration ramp time	
6. Bypass contactor rating (AS 1202)	

MISCELLANEOUS	
1. Maker and type of overload relay (AS 1023 Part 2)	
2. Make and type of level control	
3. Maker and type of selector switch	
4. Make and type of push button station	
5. Make and type of alarm light	
6. Make, type and range of hour meters	

I/We hereby guarantee the above technical information:

Name of Tenderer: .....

Address:.....

Signature of Tenderer: . . . . . .Witness: .....

Date: .....

PINE RIVERS SHIRE COUNCIL
SCHEDULE OF GUARANTEED TECHNICAL INFORMATION
SCHEDULE NO 4 - PUMP CAPACITY AND EFFICIENCY

Project:	
Contract Number:	
Supply and Installation of Submersible Pumping Equipment for Pumping Station Number:	

1.	Capacity in l/s against max head system resistance	vs	m head
2.	Pump efficiency at above conditions of discharge		
3.	Motor efficiency at above condition of discharge		
4.	Overall efficiency at above condition of discharge		
5.	Electrical energy consumed by pumpsets at above condition of discharge and this shall bear an exact mathematical relationship to the above guarantees.		per kL

ALTERNATIVELY:

6.	Capacity in l/s against maximum head system resistance with maximum diameter impeller	vs	m head
7.	Pump efficiency at above condition of discharge		
8.	Motor efficiency at above condition of discharge		
9.	Overall efficiency at above condition of discharge		
10.	Electrical energy consumed by pumpsets at above condition of discharge and this shall bear an exact mathematical relationship to the above guarantees		per kL

Notes:-

1. Works test will refer to Conditions Nos 1 to 5 or 6 to 10 on page 1 of this schedule, depending on whether or not the tendered pumps are ordered with reduced or full diameter impellers.

2. Tolerances in accordance with AS 2417 - 1980 Part 2 will be applied to guarantee kilowatt hour per one thousand litres figures for comparison with test results.

I/We hereby guarantee the above technical information:

Name of Tenderer: .....

Address:.....

Signature of Tenderer: . . . . . .Witness: .....

Date: .....

PINE RIVERS SHIRE COUNCIL
SCHEDULE OF GUARANTEED TECHNICAL INFORMATION
SCHEDULE NO 5 - CONTRACT PERIOD

Project:	
Contract Number:	
Supply and Installation of Submersible Pumping Equipment for Pumping Station Number:	

PART	WORK	COMMENCES	PERIOD	VALUE
(a)	Preparation of drawings	Date of letter of acceptance of tender		
(b)	Manufacture, supply and delivery	Date of letter to commence manufacture		
(c)	Installation and setting into operation	Date of letter to commence installation		
			TOTAL:	

I/We hereby guarantee the above technical information:

Name of Tenderer: .....

Address:.....

Signature of Tenderer: . . . . . .Witness: .....

Date: .....