

Specification

Hydraulic Services Specification

REPLACEMENT OF THE REVERSE OSMOSIS PLANT AND CHLORINATOR SYSTEM

Building Management and Works

CONFIDENTIAL

Revision: T04
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NDY QA SYSTEM

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0111 SUMMARY OF WORKS**1 GENERAL****1.1 PROJECT SUMMARY****General**

Summary: The town of Eucla in Western Australia has a drinking water supply which is sourced from ground water. A pump located in a bore pumps to four 38 kL tanks via a tank mounted aerator. This water is then pumped through an existing reverse osmosis system and stored in five storage tanks (two x 38 kL and three x 22 kL). A chlorination system is installed. The town uses this water for drinking as well as other uses. In October to December 2015, total water consumption was 993 kL or 10.8 kL per day. In January to March 2016, water consumption was 871 kL or 9.7 kL per day. An Average Day Peak Week consumption has been calculated by others to be 15.4 kL/day. Peak hour demand is calculated by others to be 2.89 kL/h.

This project is the replacement of the existing reverse osmosis and chlorination system. This system must be capable of treating the required volume of water per day and to the required quality. Given the remote location and reliance on the system for town's water supply, the system must be robust with redundancy of critical components and with provisions for remote monitoring and control. The required plant size shall not be of greater size than the existing plant to ensure it fits in the existing shed. Note that the required capacity of the new plant does not need to exceed that of the existing plant.

1.2 HYDRAULIC SYSTEMS SUMMARY**General**

Summary: The hydraulic services are summarised in the following sections.

Replacement of Water Treatment Systems

General: Provide services summarised as follows:

- Design water treatment process/systems
- Supply, install and commission treatment plant in accordance with water quality performance criteria outlined in Schedules
- Interconnecting pipework, valves, drains, sensors and controls
- Provide preventative maintenance
- Provide spares
- Provide a 1 year maintenance contract proposal

Existing Services

General: Undertake:

- Demolition of existing services where no longer required.
- Rerouting/diversion of existing services where required.

Notice: Where existing services are required to be isolated (e.g. cutting-in or diversion), arrange with Superintendent's Representative prior to carrying out the works at a time causing least inconvenience to the end users. Provide 48 hours notice prior to execution of the works.

Service continuity: The existing water treatment system must remain operational during installation of new equipment. Water supply to town must not be interrupted at all. Current storage capacity is adequate for five (5) days only; decommissioning of the existing plant and commissioning of the new plant must be accommodated within this period.

Redundant services: Remove from site.

Extent: The extent of work covered by this document includes the manufacture, supply, installation, testing, commissioning and subsequent maintenance as detailed in this specification.

Electrical Works

- Provide new minimum 63 A, three phase IP56 distribution board, mains and circuits for new equipment.
- Provide isolating switches adjacent the equipment or within the equipment control panel.
- Provide electrical supply to the isolators.

- Provide all interconnecting wiring.
- Terminate and connect cabling.
- Confirm existing electrical provisions are suitable for proposed plant. Including discrimination details, harmonic current details up to the 35th harmonic and maximum and normal running demands of all hydraulic services switchboards and equipment served directly from the electrical services works.

Building Works (to be included in this contractor)

- Undertake cutting, patching, trimming and making good of existing building/shed structures for installation of outlet, pipes, conduits, sleeves and the like.
- Lifting and hoisting of equipment as required.
- Provision of scaffolding as required.
- Provision of structure to support plant and equipment.
- Provision of structure to support pipework when full.
- Preparation ground base for plant and equipment.
- Provision of bunding for chemical storage.

0121 TENDERING

1 HYDRAULICS TENDER SCHEDULES

1.1 TENDER APPORTIONMENT**General**

Tender price shall be apportioned as per the provided Breakdown of Tender Sum form.

Maintenance Contract

Provide price for a 12-month maintenance contract (to run concurrent with the 12-month Defects Liability Period) inclusive of all remote monitoring, consumables, parts and labour and testing to verify proper operation.

Maintenance contract shall include provisional sum cost not exceeding \$30,000 to engage local Eucla Police Representative to carry out daily operational tasks inclusive of all remote monitoring, consumables, parts, labour and, water sampling testing as required to verify proper operation.

0801 HYDRAULIC SYSTEMS**1 GENERAL****1.1 RESPONSIBILITIES****1.2 DESIGN****Hydraulic system design**

General: Design and provide systems as required.

Design & Construct: This specification outlines the general extent of works, quality requirements and estimated overall capacity to enable the establishment of a Design & Construct trade price (D&C) for the works.

Detailed Design: These documents are not intended to represent a fully completed and detailed design. It is the responsibility of the contractor to make all due allowances in its pricing for the provision of a fully completed and functioning services system, irrespective of the fact that the design is not completed or fully detailed in this specification.

Design Intent: In submitting the Tender for this project, the contractor is deemed to have made themselves aware of the design intent and their responsibilities for the design, documentation, co-ordination and construction of the services for this project.

Sizes: Where sizes, quantities and capacities are used in these documents, they are provided to assist in the tendering process only. The contractor is responsible for ensuring that the selection of the final sizes, quantities and capacities meet the design intent for this project and no claim or variation will be entered into where the final design sizes, quantities and capacities differ from the tender documents.

Responsibility: The contractor shall be fully responsible for the complete design of the installation and shall provide calculations and drawings and other documentation as necessary to demonstrate conformance with the design parameters, industry practice, codes, regulations and standards.

Design for durability and maintainability

Design for durability: Develop the design so the systems achieve the documented performance, reliability, service life, energy efficiency and safety requirements, and are easily maintainable.

1.3 PRECEDENCE**General**

Worksections and referenced documents:

- The requirements of other worksections of the specification override conflicting requirements of this worksection.
- The requirements of the worksections override conflicting requirements of their referenced documents.
- The requirements of the referenced documents are minimum requirements.

1.4 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- 0138 *Multiple contracts*
- 0814 *Hydraulic pumps*
- 0827 *Water and wastewater Treatment*
- 0882 *Hydraulic electrical - minor*

1.5 STANDARDS

Water supply: To AS/NZS 3500.1.

Backflow prevention: To AS/NZS 2845.1 and AS 2845.2.

Copper pipe: To AS 1432 and AS 4809.

Microbial control: To AS/NZS 3666.1 and AS/NZS 3666.2 and the recommendations of SAA/SNZ HB 32.

Materials in contact with water: To AS/NZS 4020.

Authorised products

Standard: Listed in the WaterMark Product Database, unless otherwise required by the Network Utility Operator.

WaterMark certification

General: Submit evidence that proposed components are listed in the WaterMark Product Database.

1.6 SUBMISSIONS

Certification

Certification: Submit certification that the plant and equipment submitted meets the tender requirements and capacities of the contract documents except for departures that are identified in the submission.

Electrical loading

Electrical loading: Submit information for all equipment before completion of the main switchboard shop drawings.

Loading and connection: Submit the information for items not supplied from the services switchboards.

Starting characteristics: Submit details for motors with reduced current starting. Ensure starting characteristics are within the characteristics of the respective submain protection devices.

Switchboards: Submit the following information for each building services switchboard:

- Board location and designation.
- For each submain connected to the board, submit the following for each item connected to it:
 - Submain designation.
 - Item designation and name.
 - Power rating in kW.
 - Number of phases.
 - Full load current per phase.
 - Power factor.
 - Total current on each phase for respective sub main.

Maintenance program

General: Submit details of maintenance procedures and program, relating to installed plant and equipment, 1 week before the date for practical completion. Indicate dates of service visits. State contact telephone numbers of service operators and describe arrangements for emergency calls.

Operation and maintenance manuals

General

Authors and compilers: Personnel experienced in the maintenance and operation of equipment and systems installed, and with editorial ability.

Referenced documents: If referenced documents or technical worksections require that manuals be submitted, include corresponding material in the operation and maintenance manuals.

Subdivision: By installation or system, depending on project size.

Contents

Requirement: Include the following:

- Table of contents: For each volume. Title to match cover.
- Directory: Names, addresses, and telephone and facsimile numbers of principal consultant, subconsultants, contractor, subcontractors and names of responsible parties.
- Record drawings: Complete set of record drawings, full size.
- Drawings and technical data: As necessary for the efficient operation and maintenance of the installation.
- Installation description: General description of the installation.

- Systems descriptions and performance: Technical description of the systems installed and mode of operation, presented in a clear and concise format readily understandable by the principal's staff. Identify function, normal operating characteristics, and limiting conditions.
- Systems performance: Technical description of the mode of operation of the systems installed.
- Baseline data: To AS 1851.
- Documentation to AS 1851 including the schedule of essential functionality and performance requirements.
- Digital photographic records.
- Equipment descriptions:
 - . Name, address, email address and telephone and facsimile numbers of the manufacturer and supplier of items of equipment installed, together with catalogue list numbers.
 - . Schedules (system by system) of equipment, stating locations, duties, performance figures and dates of manufacture. Provide a unique code number cross-referenced to the record and diagrammatic drawings and schedules, including spare parts schedule, for each item of equipment installed.
 - . Manufacturers' technical literature for equipment installed, assembled specifically for the project, excluding irrelevant matter. Mark each product data sheet to clearly identify specific products and component parts used in the installation, and data applicable to the installation.
 - . Supplements to product data to illustrate relations of component parts. Include typed text as necessary.
- Certificates:
 - . Certificates from authorities.
 - . Copies of manufacturers' warranties.
 - . Product certification.
 - . Test certificates for each service installation and all equipment.
 - . Test reports
 - . Test, balancing and commissioning reports.
 - . Control system testing and commissioning results.
- 7 day record of all trends at commissioning.
- Operation procedures:
 - . Manufacturers' technical literature as appropriate.
 - . Safe starting up, running-in, operating and shutting down procedures for systems installed. Include logical step-by-step sequence of instructions for each procedure.
 - . Control sequences and flow diagrams for systems installed.
 - . Legend for colour-codes services.
 - . Schedules of fixed and variable equipment settings established during commissioning and maintenance.
 - . Procedures for seasonal changeovers.
- Maintenance procedures:
 - . Detailed recommendations for periodic maintenance and procedures, including schedule of maintenance work including frequency and manufacturers' recommended tests.
 - . Manufacturer's technical literature as appropriate. Register with manufacturer as necessary. Retain copies delivered with equipment.
 - . Safe trouble-shooting, disassembly, repair and reassembly, cleaning, alignment and adjustment, balancing and checking procedures. Provide logical step-by-step sequence of instructions for each procedure.
 - . Schedule of spares recommended to be held on site, being those items subject to wear or deterioration and which may involve the principal in extended deliveries when replacements are required. Include complete nomenclature and model numbers, and local sources of supply.
 - . Schedule of normal consumable items, local sources of supply, and expected replacement intervals up to a running time of 40 000 hours. Include lubrication schedules for equipment.

- . Schedules for recording recommissioning data so that changes in the system over time can be identified.
- . Instructions for use of tools and testing equipment.
- . Emergency procedures, including telephone numbers for emergency services, and procedures for fault finding.
- . Safety data sheets (SDS).
- . Instructions and schedules conforming to AS 1851, AS/NZS 3666.2, AS/NZS 3666.3 and AS/NZS 3666.4.
- Maintenance records:
 - . Prototype service records conforming to AS 1851 prepared to include project specific details.
 - . Prototype periodic maintenance records and report to AS/NZS 3666.2, AS/NZS 3666.3 and AS/NZS 3666.4 as appropriate, prepared to include project specific details.
 - . For hard copies: in binders which match the manuals, loose leaf log book pages designed for recording completion activities including operational and maintenance procedures, materials used, test results, comments for future maintenance actions and notes covering the condition of the installation. Include completed log book pages recording the operational and maintenance activities performed up to the time of practical completion.
 - . Number of pages: The greater of 100 pages or enough pages for the maintenance period and a further 12 months.
- Listings of all entered programmable parameters.
- Information relating to the expected operational life of all major system components.
- Warranty details in excess of the defects liability period.

Format – electronic copies

Scope: Provide the same material as documented for hardcopy in electronic format.

Printing: Except for drawings required in the **RECORD DRAWINGS** clause provide material that can be legibly printed on A4 size paper.

Quantity and format: Conform to **Submissions – electronic submissions**.

Provided on indexed digital media labelled with the following information:

- Project name.
- Service.
- Document or Drawing number/s.
- File type/s.
- Date.

Information format: Provide information in both the original source format and in Unlocked PDF.

Provide a browser based index of the media.

Produce original content in one of the following file formats:

- Microsoft Office
- Adobe PageMaker
- Adobe FrameMaker

Provide preformatted documents produced by other software products for inclusion in the manuals in one of the following formats:

- Adobe Portable Document Format (PDF).
- Postscript File, Level III.

Provide information not available from originators as digital files as follows:

- Include all relevant part of the hard copy document.
- Be at a resolution of 300 dpi when printed full size.
- Be in an Unsecured PDF/A format.
- Confirm readability on computer screen.

Drawings: conform to the following:

- A suitable file format that can be viewed and opened by the latest two versions of AutoCAD or Revit.

- Prepared using one of the latest two versions of AutoCAD with all details of the layers system utilised.
- Prepared as a black and white postscript plot file or Adobe Acrobat PDF file in the same standard as for AutoCAD or Revit printed versions.

Format – hard copy

General: A4 size loose leaf, in commercial quality, 4 ring binders with hard covers, each indexed, divided and titled. Include the following features:

- Cover: Identify each binder with typed or printed title *OPERATION AND MAINTENANCE MANUAL*, to spine. Identify title of project, volume number, volume subject matter, and date of issue.
- Dividers: Durable divider for each separate element, with typed description of system and major equipment components. Clearly print short titles under laminated plastic tabs.
- Drawings: Fold drawings to A4 size with title visible, insert in plastic sleeves (one per drawing) and accommodate them in the binders.
- Pagination: Number pages.
- Ring size: 50 mm maximum, with compressor bars.
- Text: Manufacturers' printed data, including associated diagrams, or typewritten, single-sided on bond paper, in clear concise English.

Number of copies: 3.

- Minor parts: If the applicable component is only a minor part of printed manufacturer's documents, colour photocopy the relevant pages and insert in the manual.
- The same size print sheet for uniformity of all drawings.

Bound drawings set

- Bound in a set with a proprietary binding system that enables easy removal or insertion of drawings.
- Bound in a set with a cover sheet labelled with the project description, service and volume number of the drawing set.
- An index of all drawings in the set.

Date for submission

Draft submission: The earlier of the following:

- 1 week before the date for practical completion.
- 1 week before the commencement of training on services equipment.
- Interim documentation: Provide any interim documentation required for the safe and legal operation of the plant

Date for final submission: Within 2 weeks after practical completion.

Shop drawings

Standard: To AS 1100.101, AS 1100.201, AS 1100.301, AS 1100.401 and AS/NZS 1100.501 as applicable.

Requirement: Submit detail drawings at minimum 1:100 scale, showing the following:

- Pipework and equipment layout and sections showing the work to be installed on the level that the services are installed. Do not submit glass floor drawings.
- Piping and other schematic drawings including numbering of each valve to correspond to valve tags notation.
- Details of control panels including control and power diagrams.
- Insulation of piping, fittings and tanks.
- Location, type, grade and finish of piping, fittings, valves, and pipe supports.
- Site and floor set out points.
- Tank stands and supporting structures.

Products

Before ordering equipment, calculate the respective system pressure losses based on the equipment offered and layouts shown on the shop drawings and submit the proposed selections.

Submissions: Submit technical data for all items of plant and equipment.

Data: Include at least the following information in technical submissions:

- Assumptions.
- Calculations.
- Model name, designation and number.
- Capacity of all system elements.
- Country of origin and manufacture.
- Materials used in the construction.
- Size, including required clearances for installation.
- Certification of conformance to the applicable code or standard.
- Technical data schedules corresponding to the equipment schedules in the contract documents. If there is a discrepancy between the two, substantiate the change.
- Manufacturers' technical literature.
- Type-test reports.

2 PRODUCTS

2.1 COMPONENTS

Line strainers

General: Suitable for the pressure and temperature of the system.

Type: Low resistance, Y-form bronze bodied type, with screen of dezincification resistant brass, corrosion-resistant stainless steel, or monel.

Screen perforations: 0.8 mm maximum.

Size: Line sized.

Strainer size: Provide strainer apertures of a diameter recommended by the manufacturer of the equipment they are serving/protecting.

Pressure drop: Not more than 10 kPa at full flow when clean.

Location: Provide immediately prior to (notwithstanding items with integral built-in strainers) pressure reducing valves, meters, mixing valves and other valves and equipment sensitive to debris.

Construction up to and including 50 mm: Bronze construction with screwed hexagonal ends.

Construction 65 mm and above: Epoxy coated cast iron with full face flanged ends.

Removal: Provide screwed plugs for basket removal for strainers up to 50 mm diameter and a bolted flange fitted with a 20 mm ball valve for strainers larger than 65 mm diameter.

Maintenance: Make sure the design of the strainer provides for even flow through the basket, and the basket section projects well clear of the line of the pipe or the bottom of the flange to allow for servicing without damaging insulation or sheathing.

Pressure gauges

Dial size: 65 mm diameter.

Range and graduations: Scale reading in kPa with a full scale value between 130% and 200% of the working pressure.

Bourdon tube gauges: To AS 1349.

Accuracy grade: Industrial.

Installation: Comply with the recommendations of AS 1349 Appendix B. Isolate from pump pulsations and provide with a gauge cock.

Dial thermometer

Type: Bi-metal type with a multi wound helix direct drive pointer.

Dial size: 65 mm diameter.

Range and graduations: Suitable for the range of temperatures.

Mounting: Vertical or horizontal.

Well: Provide well for gauge removal. Provide pipe enlargement at thermometer well locations in pipes less than 100 mm nominal size to maintain not less than 70% free area of the pipe bore.

Well size: 15 mm nominal size tube of the same material and pressure rating as the pipe, penetrating completely through the pipe.

Well installation: Slope the well and provide a removable cap or plug at the low end to retain oil. Insert a plastic rod into each well to position the thermometer sensing bulb approximately at the centre of the pipe bore.

2.2 VALVES

General

General: Suitable for the pressure, temperature and water quality.

General: Of approved manufacture and conform to the requirements of the Controlling Authority and this specification.

Labelling: Label to indicate the service and the fixtures controlled.

Size: Line sized.

Connection up to and including 50 mm: Screw. Provide demountable connection on downstream side.

Connection 65 mm and above: Flange.

Stamp: Stamp with code to identify materials of body, seats, shaft and liners and the figure number of the valve.

Installation: Install according to the particular manufacturer's written recommendations.

Material: Brass or gunmetal components of a type not subject to dezincification (DZR).

Lead: Lead free.

Stems: Seal and adjust valve stems with packed glands.

Location: Install in readily accessible locations for maintenance or adjustment. Locate at low level wherever practicable.

Isolating valves

Type for 15 mm to 50 mm: Ball valve.

Type for 65 mm to 80 mm: Gate valve.

Type for 100 mm to 300 mm: Lugged wafer type butterfly valve.

Isolating regulating valves

Type for 15 mm to 50 mm: Double regulating valve.

Type for 65 mm to 300 mm: Lugged wafer type butterfly valve.

Limit stops: Adjustable limit stops incorporated into flow regulation valves to enable the valve to be reset to the commissioned position after isolation.

Non return/check valves

Type for 15 mm to 50 mm: Swing or horizontal check.

Type for 65 mm to 300 mm: Double flap spring return wafer type.

Pressure regulating valves

Requirement: Provide a pressure regulating valve wherever the supply pressure to any part of the installation may exceed the maximum acceptable delivery pressure for the fixture and fittings served.

Size: Select pressure regulating valves on design flow and operating pressures (this may not necessarily be the pipe size).

Type for up to and including 50 mm: Provide the following:

- Direct acting diaphragm.
- Maximum working pressure of not less than 2100 kPa.
- Adjustable reduced pressure range from 170 to 520 kPa unless noted otherwise.
- Nominal setting of 350 kPa unless specified otherwise.
- Design flow with a maximum drop off pressure of 50 kPa.
- Replaceable seats.
- Replaceable disc without need to dismantle the valve.

Type for 65 mm and above: Provide the following:

- Pilot operated diaphragm with low flow bypass.
- Epoxy coated ductile iron or stainless steel body with stainless steel internal components, nitrile o-ring and gasket.

2.3 WATER STORAGE TANKS

Level sensors

General: Install level sensors (to all existing and new tanks) so they can be easily accessed for maintenance and testing purposes without the need to enter the tank.

Sensor fixings: Provide for fixing of level sensors and associated control systems (for each tank where multiple installations).

Sensor type: Provide level sensors that are the hydrostatic pressure sensing type or approved equal and are capable of detecting levels in minimum 2% volume increments.

Position and install level sensors: Position and install level sensors in a manner that will minimise the impact of turbulent inflows, foreign material and obstructions on accurate level sensing.

Level data: Provide level data using level sensors to enable the control of associated pumping, equipment and alarms.

Level sensor outputs: Integrate level sensor outputs to control systems and panels that directly control related equipment.

Level increments: Present levels in minimum 10% increments between recognised low and high levels.

Multiple tank or chamber systems: Utilise one level sensor per well, tank or chamber where they are isolatable from each other for multiple well, tank or chamber systems.

Connections

General: Provide flanged connections to the tanks. Locate connections for maximum useable tank capacity and easy access for operation and maintenance.

Inlet boxes: Provide inlet boxes for over top filling where specified.

Inflow control: Provide mechanically controlled high-capacity float valve modulating in response to tank level.

Overflow: Provide overflow(s) capable of discharging maximum possible uncontrolled inflow while maintaining sufficient air gap.

Outlet: Locate to maintain a 50 mm sludge zone.

Tank interconnections: Where more than one tank or tank compartment is provided, provide interconnecting pipework between tanks/compartments with isolation valve at each tank/compartment to allow for individual tank draining or maintenance.

Sludge/scour drain: Provide 50 mm sludge drain with isolation valve at the base of each tank. Arrange discharge with air gap.

Vortex inhibitor: Provide vortex inhibitor.

3 EXECUTION

3.1 GENERAL

Material interfaces

General: Where differing pipe work materials interconnect, a proprietary jointing system approved by both pipe manufacturers is to be used to appropriately interface the materials.

Isolation valve: Where differing water services pipe work materials interconnect, an isolation valve is to be provided at the interface to separate the two systems.

Discharges or connections from dissimilar metals: Do not install discharges or connections from dissimilar metals as they present a risk of adversely affecting downstream/connected components.

Expansion and contraction

General: Make sure that the components of all systems are installed to accommodate the effects of expansion and contraction without any detriment to the system and without any visible distortion or undue stress that may fatigue the system.

Uniformity

General: Maintain the uniformity of type, class and manufacture of pipe, pipe fittings, valves, joints and connections throughout the whole of each piping installation. Where a uniformity substitution is proposed, submit the details and supporting reasons for the uniformity substitution to the Superintendent's Representative.

Substitute approved materials: Do not substitute approved materials without the written approval of the Superintendent's Representative.

Monitoring of systems

General: Monitor each service's system as documented.

List monitoring interfaces: Provide a comprehensive list of all monitoring interfaces and points to be connected to the monitoring system provided by others. Include a list of monitoring interfaces in Operation and Maintenance Manuals.

3.2 WORK ON EXISTING SYSTEMS**General**

General: Coordinate the works with all other services including existing services within the vicinity of the works.

Existing systems

Condition of existing systems:

- If the existing condition does not conform to the requirements in the contract documents, submit proposals to rectify the deficiencies with related costing, time and other impacts in Tender Submission.
- Subject to the rectification works on existing systems, achieve the performance in the contract documents.

Demolition

General: Decommission, isolate, demolish and remove from the site all existing redundant equipment including minor associated components that become redundant as a result of the demolition.

Breaking down: Disassemble or cut up equipment where necessary to allow removal.

Recovered materials: Any recovered material needs to be approved by the Superintendent's Representative.

Drawings

Layout drawings: Provide full documented existing services layout drawings complete with dimensions to locate each service and service type and depth of service and forward these drawings together with the shop drawings for review prior to any excavation works being undertaken on site and off site.

Remedial works

Where necessary, relocate, repair or replace any existing services within the vicinity of the works. If it becomes necessary to relocate, repair or replace any such existing services, obtain all the necessary consents and approvals from the relevant authorities.

3.3 INSTALLATION**Accessories**

General: Provide the accessories and fittings necessary for the proper functioning of the systems, including taps, valves, outlets, pressure and temperature control devices, strainers, gauges and pumps.

Isolating valves: In addition to valves required to meet statutory requirements, provide valves so that isolation of parts of the system for safe isolation of the system in the event of leaks or maintenance causes a minimum of disruption.

3.4 PENETRATIONS**Structural penetrations**

General: All penetrations through structural elements must be approved by a structural engineer in writing prior to any work being carried out.

Waterproofing of penetrations

General: Make watertight all penetrations through building elements that are exposed to weather or water. Provide water proofing details/solutions in accordance with the requirements of the manufacturer of the element or water proofing system being penetrated including the relevant trades installing those elements.

Waterproofing details: Submit all proposed waterproofing details to the Superintendent's Representative for approval prior to any works taking place.

3.5 ACOUSTIC REQUIREMENTS**Pumps and equipment**

General: Provide all pumps and items of equipment with mechanically rotating elements isolated from the structure to minimise noise and vibration from entering the primary structure.

All isolation methods and techniques shall meet the requirements of relevant Australian Standards and WA statutory regulations for noise and vibration.

Upon completion of the works, the contractor shall demonstrate compliance via noise measurement by an independent accredited company.

3.6 IDENTIFICATION AND LABELLING**General**

General: On completion of the works and testing of all systems, treat the installation to enable the service to be identified or integrated with architectural requirements. Make sure treatment does not interfere with the material properties of the relevant system.

Identification markers: After painting has been completed, identify all main piping and equipment with self-sticking identification markers.

Submission: Submit a list of the markers for identification of equipment and piping, for approval by the Superintendent's Representative before ordering. As an alternative to stick-on marking, use approved sign writing. Where material surfaces are not suitable for self-sticking identification markers (i.e. delaminating), retrofit suitable sheathing or surface preparation.

Identify pipework: Identify all pipework (including where concealed) at minimum 3 metre intervals as required by the Controlling Authority. Where pipes run together, group the labels together. Provide labels at all access openings (e.g. access panels).

Nameplates

General: Provide equipment nameplates that indicate as applicable; pressure, temperature, electrical readings, set points for thermostats, all graphic indications, other controls and pertinent data in English language. Provide lettering of the numerical readings in metric SI units.

Mount nameplate: Mount on motor equipment and controller a rectangular brass or plastic nameplate identifying primary control function and individual position indicating pump number. Provide nameplates with black background and embossed white letters 12 mm high.

Mounting brackets: Mount all nameplates with approved brackets.

Submission: Submit details of nameplate material and fixing to the Superintendent's Representative.

Schedule of finishes

General: The following Finishes Schedule is for guidance only. Reference the finish colour numbers in the relevant Standard:

Equipment services	Colour
Domestic cold water	Black or platinum
Electrical switchboard and control panels Electrical switchboard interior	Electric Orange X15 Gloss White
Electrical conduits (exposed to view)	Approved selected colour

Identification

General: Provide brass or approved plastic labels on all pilot lights, indicators and controls to indicate manner and function of controls. Include labelling on isolating switches and starters. Make letter height 4 mm minimum and submit layout of all labels to the Superintendent's Representative for approval before manufacture. Fix all labels with screws.

Nameplate: Provide and mount to each control or isolating valve, a 50 mm rectangular nameplate, with embossed white letters 18 mm high, indicating service and number of valve.

3.7 HOT WORKS**General**

Safety: Make sure all hot works are carried out in a safe manner in accordance with the site safety plan.

Fire precautions

General: Implement precautions to protect equipment, structure and materials against fire and damage due to hot works.

Supervise and inspect: At each location where hot works are to be carried out, supervise and inspect surrounding areas to guard against the possibility of fire starting, and have on hand at least two portable carbon dioxide fire extinguishers.

Soldering, welding and brazing

General: Provide silver soldered joints of the capillary type, soldered with silver alloy hard solders having not less than 5% silver content for copper to copper and copper to brass joints, and having not less than 35% silver for copper to steel joints. Dismantle valves where necessary to avoid damage to seats.

Flux: Use suitable fluxes for all brazing and silver soldering, and properly prepare all fittings and tubes.

Welding: Make sure all welding is done by certified, experienced and competent professionals. For systems not defined as pressure piping, do all welding under the supervision of a welding operator certified as above.

Electric welding: Make sure all electric welding is free of defects such as cracks, lack of fusion, incomplete penetration, undercut, slag inclusion and porosity. Prepare all joints properly by bevelling and the like and preheat prior to welding, all as necessary to avoid stress concentration at the welded joint.

Welding electrodes: Make sure welding electrodes are the type leaving a metal deposit, having yield and ultimate strength not less than and similar to the parent metal.

Forged steel backing/spacer rings: Provide forged steel backing/spacer rings for butt welds in steel pipes where cleanliness and prevention of slag intrusion is necessary.

Oxy welded joints: Make sure all oxy welded joints are free of defects such as cracks, lack of fusion, incomplete penetration and porosity. Use oxy welded joints on steel pipes of 50 mm diameter and smaller in preference to electric welding.

Brazed joints: Use tin bronze filler rods for fillet type joints; copper to brass, bronze and gunmetal, and make sure they are all free of defects such as cracks, lack of fusion, and porosity.

3.8 SUPPORT OF PLANT AND EQUIPMENT

-

Support of ground level plant and equipment

Ground level:

- If the ground slope is 15° or over, or the area of the plant and equipment is extensive, obtain the advice of a professional engineer for the documentation of a suitable slab or platform.
 - In all other cases, provide proprietary plastic or concrete supports installed with falls that achieve a raised, impervious and water shedding bearing surface.
-

0814 HYDRAULIC PUMPS**1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide pumps as required for water treatment.

Duties: Check and recalculate all pump duties against the final system configuration and installation.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- 0138 Multiple contracts
- 0801 Hydraulic systems
- 0827 Water and wastewater Treatment
- 0882 Hydraulic electrical - minor
- 0891 Hydraulic maintenance

1.3 SUBMISSIONS**Products**

Type tests: Required.

Standard: To AS 2417.

Accuracy of measurement: Grade 2 to AS 2417.

Type test records: Submit type test curves for each size and type of pump marked with the duty point.

Technical details: Provide all technical details of pump systems to the Superintendent's Representative for approval prior to the purchase of equipment.

2 PRODUCTS**2.1 COMPONENTS****Control panels**

General: Provide control panels to suit the controls. Mount switches, and indicating lights on the door. Mount motor starters, relays and switchgear and terminals on DIN rails inside the cabinet. Run cables in trunking or looms.

Labelling: Label all components. Number both ends of each cable and number terminal strips to match the circuit diagram. Provide a laminated circuit diagram inside the cabinet.

Metalwork: Vandal proof cabinet constructed from metallic zinc coated steel with powder coat finish. Provide a hinged and lockable door with 2 keys.

Protection: Degree of protection IP54 or better.

Manual operation: Provide the ability to manually operate the pump.

Power failure: Pumps must restart automatically after power failure.

Warning lights: Provide lights to indicate power available, run for pump, fault for pump and other faults.

Controls – dual pump installations

General: Provide controls to alternate the pumps after each cycle of operation, start the idle pump if the other fails, and activate an audible alarm and a flashing warning light to indicate a failure.

Alarm bells: Mount on an external wall. Provide alarm mute.

Meters: Provide an hours-run meter to each motor.

Selector: Provide an auto-off-on selector for each pump.

Warning lights: Provide separate lights to indicate power available, run for each pump, fault for each pump and other faults.

Float switches

Type: Micro switch. Provide one level switch for each liquid level to be detected.

Construction: Double encapsulated hermetic construction designed for long life submerged. Provide a clamp to permit accurate adjustment of levels.

Cable: Low moisture absorption type.

Liquid pressure sensor

Type: Pressure transducer.

Construction: Hermetic construction designed for long life submerged.

Cable: Low moisture absorption type.

Marking

General: Provide a robust label on each pump or pump set showing design flow rate, head, temperature of pumped medium, casing, impeller and shaft materials.

Motors

Dimensions and performance: To IEC 60072-3.

Installation: To AS 60034.7.

Motors Minimum 0.75 kW: Three phase, flange mounted.

Overload protection: Provide each motor with overload protection.

Performance:

- Efficiency: Motors documented as high efficiency to AS/NZS 1359.5 Section 3, all other motors to AS/NZS 1359.5 Section 2.
- Power factor at full rated output: Minimum 0.72 for single phase motors, minimum 0.83 for three phase motors.

Selection: Provide motors selected for the maximum number of starts per hour of the installed system and to provide efficient, non-overloading pumping sets.

Power rating: At least the maximum power required by the pump when projecting the system resistance curve to the maximum impeller size for the pump casing size.

Degree of protection: IP54 or better.

Shaft: If the impeller is mounted directly on the motor shaft use grade 416 stainless steel for the shaft.

Variable Speed Drives

Manufacturer: Danfoss or equal approved

Gauges

Pressure: Provide a pressure gauge to indicate the pressure at the inlet and outlet of the system.

Temperature: Provide a temperature gauge to indicate the temperature at the inlet and outlet of the system.

Electrical installation

See work section *Hydraulic electrical - minor* clause **ELECTRICAL INSTALLATION.**

Motors and drivers

See work section *Hydraulic electrical - minor* clause **MOTORS AND DRIVERS.**

Pressure vessels

Standard: To AS 2971.

Type: Diaphragm pressure tanks of fabricated steel construction, epoxy coated on metal surfaces in contact with water. Precharge the tanks with air.

Valves:

Non-return valves: Provide on the discharge side of each pump.

3 EXECUTION

3.1 INSTALLATION

Connections

General: Arrange pumps, piping and valves so that individual pumps can be removed with minimal drain down and disturbance to the connected piping. Support pipes independently of pumps.

Connections: Install vibration isolating couplings in the connecting pipes at the pumps. Provide couplings selected for a working pressure at least twice the system design pressure.

Vibration mounts

General: Provide corrosion-resistant anti-vibration mounts under each pump. Alternatively, if the pumps are installed on a baseplate the mounts may be installed under the baseplate.

Pressure tapping

General: Provide a pressure tapping on the inlet and discharge of each pump.

Fixing

General: Fix all pumps and pump sets to the supporting structure. Use expanding shield anchors for concrete.

Mounting

General: Mount and align each pump and motor correctly. Factory check the pump alignment.

Pump assemblies: Balance all pump assemblies and include mounting systems that mitigate vibration transfer to supporting structure and connected piping systems.

3.2 COMPLETION

Commissioning

General: Commission to the manufacturers' recommendations.

Packaged pump systems: Commission all pumping systems once they are installed by a qualified representative of the manufacturer. Provide a commissioning report detailing all set points and confirming that the pump set has been commissioned in accordance with the required operating parameters.

Alignment: Arrange for the pump supplier to verify by inspection on site that the alignment is correct after the pumps have been placed in position with pipe connections made and piping filled with water.

Testing: Obtain independent tests of flow rate and duty through independent devices including water meters and pressure sensors/gauges. Include pressure testing under closed head conditions.

Duty range: Where pumping systems are expected to operate over a range of duty points, field test by initiating fluctuating field demands.

Report: Provide a commissioning report detailing all set points and confirming that the pump set has been commissioned in accordance with the required operating parameters.

Testing

General: Provide the following tests for each pump and pump set before the date for practical completion:

- Pump operation: Test for correct pump rotation and operation.
- Automatic changeover: Test changeover sequence under all operational combinations.
- Level controls: Operate pumps, measure levels and adjust if necessary. Verify level sensing systems (the level sensor may be temporarily adjusted manually to initiate necessary system start up and fault. alarms).
- Discharge outlet pressure and flow.
- Verification of time clock operation and settings.
- Undertake the manual operation of the system without shut off to confirm that extended manual operation does not compromise the system (i.e. the system terminates operation prior to running the system critically low/dry).
- Verify that secondary systems such as macerators and agitators are operating during a filling/pre extraction cycle.
- Safety controls: Simulate fault for each safety control.
- Alarms: Simulate alarm condition. Verify correct alarm raised.

- Motors: Measure motor current and adjust motor overloads to suit.

Completion test: Provide a full operational test to verify compliance.

- Pumping and assisted stormwater transportation: Fill pumping systems to initiate an operational cycle of the system to verify the following:
 - . Discharge outlet pressure and flow.
 - . Cycling and staging of primary, secondary and other relevant systems.
 - . Verification of level sensing systems (the level sensor may be temporarily adjusted manually to initiate necessary system start up and fault. alarms).
 - . Undertake the manual operation of the system without shut off to confirm that extended manual operation does not compromise the system (i.e. the system terminates operation prior to running the system critically low/dry).

Documentation

General: Provide testing and commissioning sheets and report.

Manufacturer tests: Where a specific testing procedure is prescribed by the manufacturer, adhere to this procedure and document testing and commissioning results in the Quality Assurance file.

0827 WATER TREATMENT**1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Replace existing water treatment system.

Controlling Authorities: Confirm and conform to the requirements of the Controlling Authorities.

1.2 CROSS REFERENCES**General**

General: For the purposes of this work section the following cross references apply:

- 0138 Multiple contracts
- 0801 Hydraulic systems
- 0814 Hydraulic pumps
- 0882 Hydraulic electrical - minor
- 0891 Hydraulic maintenance

1.3 INTERPRETATION**Abbreviations**

General: For the purposes of this work section the following abbreviations apply:

- LED: Light emitting diode.
- NTU: Nephelometric turbidity units.
- TDS: Total Dissolved Solids

1.4 SUBMISSIONS**Warranties**

General: Submit warranties. Make sure that the Principal is named in any warranty that extends beyond the end of the defects liability period.

2 PRODUCTS**2.1 POTABLE WATER TREATMENT SYSTEM****General**

General: Provide all piping, valves, materials and equipment necessary for the complete potable water treatment system installation and full testing and commissioning of all filtration and water chemistry equipment once installed.

Treatment: Removal of turbidity, suspended and dissolved matter and other contaminants or modification of water chemistry as specified, from/to the water source.

Operating pressure: To suit installation.

Redundancy: Two systems in parallel for each treatment process to enable continued operation during backwashing, failure and/or maintenance. Duty/standby configuration on all pumps.

Automation: Fully automatic filtration and treatment electrically operated with automatic mechanisms for backwashing/rinse.

Bypass: Provide bypasses around system components.

Manufacture: Skid mounted, factory assembled and tested, complete with electrical control panel and mode indicator lights including alarms with monitoring system and remote monitoring and control.

Critical spares for any component and equipment shall be of off-the-shelf and plug-and-play nature to allow easier and prompt replacement.

Pre-Filtration

General: Design and install the pre-filtration system to suit the feed water requirements of the Reverse Osmosis Plant and to accommodate the quality of the water supply at the point of installation.

Incorporate in the pre-treatment system the following components and all other components that may be required to ensure longevity of the plant:

- Multimedia filtration
- Automatic backwashing
- Fault alarms with external contacts connected to the Reverse Osmosis Plant
- Skid mounting of all components

Desalination - Reverse osmosis

General: Provide the reverse osmosis system in duplicate with automatic duty rotation and incorporate:

- Microprocessor control.
- Low inlet water pressure cut out.
- High pump discharge flowrate pump cut out.
- In-line monitoring of permeate conductivity.
- Automatic backwashing.
- Automatic shutdown on out of range conductivity.
- Anti-scalant dosing with pumps in duplicate with automatic duty rotation
- Clean-in-place system
- Touch-screen PLCs (master and slave)
- Automatic switching between units
- Emergency stop
- Skid mounted system

Provide system performance and quality of water produced in accordance with performance criteria outlined in Schedules.

Disinfection - Chlorination

General

- Provide duplicate chemical dosing systems consisting of a storage tank supplying chemicals to a dosing pump automatically activated by a control unit.
- Provide system for recirculation of stored potable water.
- Select and provide chemicals, chemical dosage rates and chemical dosing program.
- Make any alterations to the dosage rate, chemical type and chemical dosage program to make sure that the water treatment requirements of the specification are maintained.
- Bring chemicals required by the treatment program to site.
- Skid mounted system

Storage tanks

Standard: To AS/NZS 4766.

Size: Low density polyethylene construction with lid, sized to hold more than 150% of estimated monthly usage.

Bund: Provide bunds to AS 3780.

Alarm: Provide a low chemical level alarm.

Dosing pumps

General: Electrically direct driven, manually adjustable type. Provide clear plastic suction lines.

Additional Treatment

General: Provide below listed equipment for additional treatment as required to meet the quality parameters of this Specification.

Ozonation/Aeration

Water from groundwater sources generally have lower concentration of dissolved oxygen, which allows growth of nuisance microorganisms (iron/manganese/sulfate/nitrate-reducing bacteria), causing

taste and odour problems, staining, corrosion. There have been no direct health effects caused by low oxygen concentrations in drinking water. The guideline value of more than 85% saturation is based on aesthetic considerations for taste, odour and prevention of corrosion of pipes and fittings. The dissolved oxygen concentration in drinking water can be increased by aeration or ozonation.

Water Hardness Correction

Water hardness correction system to be added downstream of the treatment to ensure water hardness is within the specified range, as soft water can be corrosive to metals such as brass and copper which are present in domestic plumbing installations.

- Automatically alternating duplicate calcite filters
- Automatic backwashing
- Fault alarms with external contacts connected to the Reverse Osmosis Plant
- Skid mounting of all components
- Submit alternative hardness correction system for consideration.

pH Correction

pH correction to be added downstream of the treatment to ensure pH value is within the specified range. The type of pH correction will depend on the pH level of water and chemicals used to chlorinate water.

Monitoring and Control

Remote monitoring: Provide a local and remote monitoring and control system to monitor and control the following:

- Conductivity: on feed to plant
- pH: on feed to plant
- Feed pumps run status and fault (each pump)
- Low feed pressure
- Feed tank level
- RO operation status (normal, rinsing, standby etc.)
- RO 1 in service
- RO 2 in service
- Chlorine: pH/ORP sensor on feed to storage tanks
- Conductivity: on feed to storage tanks
- pH: on feed to storage tanks
- Turbidity: on feed to storage tanks
- Alarm reset
- Transfer pumps run status and fault (each pump)
- Pressures (before and after pumps)
- Flow meters (RO permeate and reject)

Communication: 3G modem with SIM card

Superintendent's Representative shall have access to the onsite/offsite remote monitoring portal for the entirety of plant's life.

3 EXECUTION

3.1 GENERAL

Electrical installation

See work section *Hydraulic electrical - minor* clause **ELECTRICAL INSTALLATION.**

Motors and drivers

See work section *Hydraulic electrical - minor* clause **MOTORS AND DRIVERS.**

3.2 OBJECTIVES

General

General: Provide water treatment as necessary to achieve the following objectives:

- Maintain water quality in accordance with Australian Drinking Water Guideline
- Control microbial contamination of open water circuits in accordance with the requirements of the referenced Standards/Codes and Statutory Authorities.
- Prevent town's supply system deterioration.
- Minimise corrosion, pitting and oxidative stress cracking of existing supply distribution pipework.
- Minimise fouling due to scale, silt and biological growths.

3.3 MONITORING AND SERVICE

Periodic Service

Defects liability period Contractor responsible:

Undertake comprehensive water quality tests in to determine the effectiveness of the water treatment processes, in the control of:

- Corrosion including pitting.
- Scale.
- Fouling.
- Microbiological growths.

Check and adjust:

- TDS.
- Chemical dosing rate.

Water quality: Restore the water quality to design criteria levels and to the requirements of the referenced Standards/Codes and Statutory Authorities.

Submission: Submit a report to the Superintendent's Representative after each test detailing the results, stating whether the systems are in satisfactory condition and the changes and/or adjustments made to the system operation or chemical dosing regimen, together with the monthly water tests, daily logbooks/data collected. Summarise any instructions given to the plant operator and/or work that has to be carried out to restore the water quality to design criteria levels.

Bacteria count: In the event of bacteria count from tests exceeding the specified limits, undertake remedial works and revise disinfection procedures to the requirements of the referenced Specification, Standards/Code and Statutory Authorities.

3.4 CHEMICALS

General

General: Supply chemicals for pre-cleaning, cleaning, flushing and treatment. Make sure of correct use of the chemicals by providing instructions and supervision.

Quantities: Supply sufficient quantities of chemicals to treat the water from the time of initial filling to the end of the 12 month maintenance period

Supply chemicals as required to meet the specified objectives of water treatment. Allow for the scheduled plant operating times:

- Store chemicals on site in sealed drums in an appropriate location to suit plant operation and meets statutory requirements.

3.5 MARKING

Hazard identification

General: Identify piping and storage vessels containing hazardous materials.

Standard: AS 1345.

Safety signs

General: If hazardous chemicals are to be stored, provide safety signs to AS 1319.

3.6 COMPLETION

System Tests

General: Provide routine tests to compliance with the Australian Drinking Water Guidelines before distributing water to town supply.

Test report: Required.

Practical Completion will be granted based on as-built drawings and compliance certificates from relevant authorities (eg Plumbing Licensing Board, EnergySafety WA and Electrical Licensing Board)

3.7 MAINTENANCE

General

Requirement: Conform to the *0891 Hydraulic maintenance* worksection.

0882 HYDRAULIC ELECTRICAL - MINOR**1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Provide hydraulic electrical installations, as documented.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- 0138 Multiple contracts
- 0801 Hydraulic systems
- 0814 Hydraulic pumps
- 0827 Water Treatment
- 0891 Hydraulic maintenance

1.3 ELECTRICAL ACCESSORIES**General**

Responsibilities: Provide accessories as required.

Proprietary equipment: If proprietary equipment is selected by the contractor, the requirements of this specification over-ride the specifications inherent in the selections of a particular make and model of accessory.

Uniformity: Provide all accessories and outlets located in close proximity of the same manufacture, size, finish and material.

Default finish: Select from the manufacturers standard range.

2 LOW VOLTAGE POWER SYSTEMS**2.1 GENERAL****General**

General: Carry out all work in accordance with the requirements of the controlling authority.

Switchgear, control gear, fittings and accessories: Provide switchgear, control gear, fittings and accessories of uniform type and manufacture throughout the whole of the installation.

Test certificates: Coordinate the work and submit ready for test certificates to the controlling authority in time to allow inspection and tests to be completed for the setting into operation of the systems according to the agreed program.

Coordinate with service Contractors: Arrange the works with the relevant service's Contractors to ensure that all details relative to submain cables, maximum demand, voltage drop, fault levels, earth loop impedance, and discrimination details of switchgear, cable terminations and interfacing of controls have been fully coordinated.

Standards

Electrical systems: To AS/NZS 3000 and SAA HB 301.

Selection of cables: AS/NZS 3008.1.1.

Degrees of protection (IP code): To AS 60529.

Electromagnetic compatibility (EMC): To AS/NZS 61000.

Telecommunications systems: To AS/CA S008, AS/CA S009 and AS/NZS 3080.

2.2 PRODUCTS**Wiring systems**

Selection: Provide wiring systems appropriate to the installation conditions and the function of the load.

Power cables

Standard: Polymeric cables to AS/NZS 5000.1.

Cable: Use multi-stranded copper cable generally.

Default insulation: V.75.

Default sheathing: 4V.75.

Minimum size:

- Power sub-circuits: 2.5 mm².
- Sub-mains: 6 mm².

Earthing

General: All equipment, materials and pipe work is to be earthed where required in accordance with the requirements of the controlling authority and any manufacturer recommendations.

2.3 EXECUTION**Power cables**

Straight-through joints: Unless unavoidable due to length or difficult installation conditions, run cables without intermediate straight-through joints.

Individual wiring of extra-low voltage circuits: Tie together at regular intervals.

Tagging: Identify multicore cables and trefoil groups at each end with stamped non-ferrous tags clipped around each cable or trefoil group.

Marking: Identify the origin of all wiring by means of legible indelible marking.

Cable systems: Provide the following:

- Accessible concealed spaces: Thermoplastic insulated and sheathed cables.
- Inaccessible concealed spaces: Cable in PVC-U conduit.
- Plant rooms: Cable in heavy duty PVC-U conduit, or on tray or in duct.
- Plastered or rendered surfaces: Cable in PVC-U conduit.
- Stud walls without bulk insulation: Thermoplastic insulated and sheathed cables.
- Walls filled with bulk thermal insulation: Cables in PVC-U conduit.

Wiring Installation

General: Provide wiring that conforms to the requirements of the controlling authority and is compatible with the equipment and fixtures being served.

Provide the following for all cables:

- Adequately fix and support with purpose made clips, cleats, ties or saddles.
- Install to permit adequate air circulation around each cable.
- Install between equipment without any joints.
- Install on the loop in, loop out principle without the use of connectors for sub circuit wiring.
- Install so that they can readily be withdrawn for the purposes of relocation and/or rewiring.
- Installed so that they are not bent through a radius less than the minimum bending radius recommended by the manufacturer.
- Where installed together, over parallel routes, space apart to provide a gap of one cable diameter, minimum, between adjacent circuit and submain groups.
- Space from communications and other wiring systems in accordance with relevant Standards.
- Segregate from other services to conform to relevant Standards and Authority requirements.
- Carry out all wiring a neat and tidy manner and in accordance with the Wiring Methods Schedule.

3 CABLE SUPPORT AND DUCT SYSTEMS

3.1 GENERAL**Standards**

Cable trunking systems: To AS/NZS 4296.

Conduits and fittings for electrical installations: To AS/NZS 2053.3, AS/NZS 61386.1, AS/NZS 61386.21, AS/NZS 61386.22 and AS/NZS 61386.23.

3.2 PRODUCTS

Where specifying cable enclosures and routes, take into account the building structure and whether or not they are to be concealed from view.

Non-metallic conduits and fittings

Standards: To AS/NZS 2053.3, AS/NZS 61386.21, AS/NZS 61386.22 or AS/NZS 61386.23.

Solar radiation protection: Required for conduits and fittings exposed to sunlight.

Flexible conduit: Provide flexible conduit to connect with equipment and plant subjected to vibration. If necessary, provide for adjustment or ease of maintenance. Provide the minimum possible length.

Ducted wiring enclosures

Ducting: Provide purpose-made ducts. Provide rigid supports. Round off sharp edges and provide bushed or proprietary cable entries into metallic ducting.

Accessories: Provide purpose-made accessories and covers to match the duct system. Provide screw-fixed covers or clip-on covers removable only with the use of tools.

Cable support: Except for horizontal runs where the covers are on top, support wiring with retaining clips at intervals of not more than 1000 mm.

Conduits

General: Provide the following for conduits:

- Install using the loop in system.
- Provide free from conduit fittings other than junction boxes, wall boxes, bends or couplings.
- Provide 20 mm minimum diameter. Oval conduits are unacceptable
- Conceal from view by running in concealed voids, wall cavities, ceiling spaces/cavities, concrete slabs, or chased into masonry elements unless otherwise specified or agreed.
- Contain a maximum of two circuits.

Provide with a 3 mm diameter, minimum, and nylon cord for future wiring or wiring for other trades.

Cable trays

General: Provide cable trays incorporating the following details for multiple runs of cable:

- Perforated sheet steel electro zinc plated with 50%, minimum, of its surface area open for air circulation.
- Amend if hot dip galvanised, painted or PVC coated finishes are required.
- Fit with the manufacturer's standard bends, risers, curves, reducers and fishplates.
- Fix to steel brackets and hangers to provide a rigid fixing.
- Fix so that there is sufficient air space between the structure and the tray to which they are secured enabling natural air circulation to occur and for cable access.
- Support so that the maximum deflection between adjacent supports does not exceed 10 mm when fully loaded to the ultimate capacity provided with a 2:1 safety factor.
- Make free from sharp edges or corners.
- Install parallel or at right angles to the building structure and planning grids.
- Size so that they are loaded a maximum 80% of their capacity width, including spaces between cables for derating purposes without undue bunching.
- Provide with sun screens where exposed to sunlight.
- Provide high sided type for cable loads in excess of 20 kg per metre.
- Locate where maintenance access is readily available.

Where provided to support fire rated cable systems, include the following in cable ladders:

- Install to conform to manufacturer's type test certificates to the relevant Standard.
- Provide similar construction characteristics to that used in the achieved fire rated cable test certificates.

3.3 EXECUTION

Unsheathed cables – installation

General: Provide permanently fixed enclosure systems, assembled before installing wiring. Provide draw wires to pull in conductor groups from outlet to outlet, or provide ducts with removable covers.

Conduit systems – installation

Set out: If exposed to view, install conduits in parallel runs with right angle changes of direction.

Conduits in roof spaces: Locate below roof insulation and sarking. In accessible roof spaces, provide mechanical protection for light-duty conduits.

Expansion: Allow for thermal expansion/contraction of conduits and fittings due to changes in ambient temperature conditions. Provide expansion couplings as required.

4 MOTORS AND STARTERS

4.1 GENERAL

General: Provide motors selected in conformance with AS 60034.1, the application load characteristics, motor manufacturers' recommendations and the following:

- Motors 0.75 kW and over: Three phase.

Rating

Standard: To AS 60034.1.

Maximum power rating: The greater of the documented minimum motor size and next preferred standard frame size above the maximum load of the driven equipment.

Duty: Minimum S1.

Class: Continuous running.

Speed: Maximum 1500 r/min.

Starting performance

Designation: Minimum design N to AS 60034.12.

Speed and torque: To suit the driven equipment. Make sure each motor develops torque relative to the starting load of the driven machine such that it runs up to full speed steadily and within a time period compatible with motor winding temperatures, class of insulation and rating of the starting equipment.

Efficiency

Motors documented as high efficiency: To AS/NZS 1359.5 Table A3 or Table B3.

All other motors: To AS/NZS 1359.5 Section 2.

Environment

Site operating conditions: To AS 60034.1.

Electrical operating conditions: To AS 60034.1.

Enclosure

General: Provide enclosures appropriate to the environment in which the motor operates.

Motor enclosure classification: Minimum IP44 to AS 60529 and AS 60034.5.

Cooling

Standard: To AS 1359.106.

Classification: Minimum IC01.

Marking

Terminals: To AS 60034.8.

Mounting

Standard: International mounting (IM) classification to AS 60034.7.

Noise

Standard: To AS 60034.9.

Vibration

Standard: To AS 1359.114.

Grade: Minimum N (normal).

4.2 STARTERS

Standard

General: To AS/NZS IEC 60947.1.

Electromechanical motor starters: To AS/NZS IEC 60947.4.1.

Selection

General: Provide motor starters selected according to the following:

- Electricity distribution network limitations for starting currents and voltage flicker.
- Torque requirements for the motor load.
- Heating effects on the motor.
- Voltage drop during start due to starting currents.
- Time required to accelerate from rest to full speed.
- Number of starts per hour.

Motor capacity: Select motors of sufficient capacity so that they cannot be overloaded under any normal operating conditions.

Performance

Rated operational current: At least the full load current of the load controlled.

Rated duty: Intermittent class 12.

Utilisation category: AC-3.

Mechanical durability: Minimum 3 million cycles to AS/NZS IEC 60947.4.1.

Electric durability: Minimum 1 million operations at AC-3 to AS/NZS IEC 60947.4.1.

Mounting: Mount with sufficient clearance to allow full access for maintenance, removal and replacement of coils and contacts, without the need to disconnect wiring or remove other equipment.

Auxiliary contacts: Provide separate auxiliary contacts with at least one normally-open and one normally-closed contacts with rating of 6 A at 230 V a.c., utilisation category: AC-1.

Slave relay: If the number of auxiliary contacts exceeds the number which can be accommodated, provide separate slave relays.

Direct-on-line starters

Type: Direct-switching electromagnetic contactor.

4.3 MOTOR PROTECTION

General

General: Provide over-current protection with manual reset giving overload protection in each phase of supply as part of the equipment assembly for each motor starter.

Standard: To AS 60034.11.

Contacts: Provide at least one normally-open and one normally-closed set of contacts rated at the starter control circuit voltage and minimum 4 A. Connect contacts to open the starter at the setting temperature.

- Utilisation category: AC-11.

Mounting: Ensure relays are not affected by the shock of mechanical contactor operation. Provide sufficient clear space for the disconnection, removal and replacement of heaters, without disconnecting other equipment and wiring.

Protection Features

Select and adjust motor protection to provide

- Thermal overload protection.
- Dry running protection.
- Under voltage/over voltage protection.
- Short circuit and earth leakage protection.
- Overload protection at 110% of nominal current.

Single phase motor protection

General: Provide overload units matching the motor heating curve characteristics.

3-phase motor protection

General: Provide thermal overload protection relays for each motor.

Provide the following:

- Triple pole relays with differential trip bar operation for single phase protection, and ambient temperature compensation.
- Thermal overloads connected directly to contactor by means of proprietary links, except where operated separately by current transformers.

Current transformers: Saturating at 10 to 15 times full load current, Class 10P.

Variable Speed Drives

Variable speed drives: Where variable speed drives are specified, provide with harmonic filters to mitigate harmonic interference with the electrical distribution system.

Dynamic speed reduction to avoid overload condition.

0891 HYDRAULIC MAINTENANCE**1 GENERAL****1.1 RESPONSIBILITIES****General**

Requirement: Maintain the hydraulic systems for the documented maintenance period so that the performance, reliability, service life, energy efficiency and safety of the system is equal to or better than that at the beginning of the maintenance period, in parallel with and including:

- Periodic and statutory maintenance, cleaning and replacement of consumables.
- Emergency repairs.

Maintenance period: As documented.

1.2 CROSS REFERENCES**General**

Requirement: Conform to the following worksection(s):

- 0801 Hydraulic systems
- 0814 Hydraulic pumps
- 0882 Hydraulic electrical - minor
- 0827 Water Treatment

1.3 INTERPRETATION**Definitions**

General: For the purpose of this worksection the following definition applies:

- Consumable: Materials or components intended to be replaced within the service life of the associated plant or equipment.
- Periodic maintenance: Planned routine maintenance of plant and equipment (proactive), including fire safety measures and statutory requirements.
- Repairs: Unplanned/corrective maintenance (reactive).
- Replacement: Upgrading of a higher value component on regular cycle, including repainting and replacement of air conditioning equipment.

1.4 SUBMISSIONS**Certification**

Annual certification: Inspect and submit certification for all items required to be inspected annually under statutory requirements including, but not limited to, air handling systems required for fire operation, boilers and pressure vessels.

Records

Periodic maintenance and performance report: At the frequency documented, submit reports summarising the maintenance performed and the performance of the hydraulic installation in the preceding period. Set out the report in a form that permits comparison with previous reports. Include the following as minimum requirements:

- Dates and number of site labour hours for periodic maintenance. Exclude travelling time.
- Dates, number of site labour hours and nature of work for emergency repairs. Exclude travelling time.
- Dates and number of site labour hours for defects liability rectification if within the defects liability period. Exclude travelling time.
- List of any motors for which the motor current varied by more than 10% from the current measured during commissioning.
- For each separately metered item, the water or gas use for each month of the reporting period.

1.5 INSPECTION

Notice

Requirement: Give notice so that an inspection may be held simultaneously with the final programmed maintenance visit.

2 PRODUCTS

2.1 GENERAL

Product selection

Proprietary items: Select products, as consumables or replacement items, of the same make, model and type as those being replaced.

Substitutions: Where the existing product is no longer available, provide products with at least the same performance and construction characteristics.

3 EXECUTION

3.1 PLANT BREAKDOWNS (GENERAL AND EMERGENCY)

General

Any plant breakdown will be attended by the on-site daily plant operator (Maintenance Contractor's engaged Eucla Police Representative) at the first instance. The daily operator will notify the Superintendent's Representative and Maintenance Contractor to establish the best way to deal with situation. Plant breakdown repairs outside of an Defects Liability Period or Warranty obligations shall be discussed with the Superintendent's Representative and a cost additional to the Maintenance Service Period will be negotiated.

Requirement: Respond to call outs for breakdowns or other faults requiring emergency repairs. Rectify faults and replace faulty materials and equipment.

Remedial work: Carry out any remedial work, including temporary work, necessary to restore each system to safe and satisfactory operation. Verify each system is operating correctly before leaving the site. Do not leave the plant in an unsafe condition.

Temporary work: Promptly replace temporary work with permanent rectification.

Contact details

Emergency contract: Provide contact details including after hours and emergency mobile and/or pager details, to permit notification of emergency conditions.

3.2 PERIODIC MAINTENANCE

General

General: The Superintendent's Representative shall be informed immediately by the maintenance contractor when the remote monitoring and onsite daily monitoring gets out of specified quality parameters and advised of corrective procedures that will be put into place.

Routine visits: Make routine service visits at the frequency documented in Table 1 under section 3.5. Service items of equipment in conformance with the maintenance schedules in the operation and maintenance manuals.

Notification of defects: When defects in the installation are identified, give notice.

Requirement: Provide maintenance work including, but not limited to, the following:

- Carry out the manufacturers' recommended maintenance.
- Attend to reported defects and complaints.
- Check for and repair corrosion.
- Check for and rectify any unsafe conditions.
- Replace faulty or damaged parts and consumable components.
- Check anti-vibration supports, brackets and clamps, holding down bolts and flexible connections, for deterioration and for freedom of movement of assembly.
- Identification of pipes, conduits and ducts maintenance: To AS 1345.
- Safety signs maintenance: To AS 1319.

Water Quality Testing

Undertake monthly water sampling and testing at six (6) different locations and any rectification works as required, in accordance with section 3.3 Monitoring and Service under Worksection 0827 – Water Treatment.

Cleaning

Requirement: At the end of the maintenance period:

- Remove waste and clean all parts of the installation.
- Remove temporary protective coatings, packaging and labels.
- Clean screens and strainer baskets.

Piped systems

Tasks: Perform the following:

- Check equipment items and record values for operation, calibration, performance compliance, temperature and energy consumption.
- Rectify all water leaks regardless of size. Clean and repair any water damage.
- Check condition of insulation and repair as required.
- Provide service tags recording inspections and tests.

Cold water

Maintenance of tanks and piping for potable water: To AS/NZS 3500.1.

Leaks and defects: Report if found and rectify.

Strainers: Inspect and clean at least annually.

Hydraulic pumps

Pumps and pump seals: Check and rectify if defective.

Safety and other controls: Check for correct operation and adjust if necessary.

Water filter cartridges and media

Requirement: Replace at the manufacturer's recommended frequency or sooner if flow is reduced or pressure drop is excessive.

Automatic controls

Requirement: Perform the following:

- Check operation and safety controls for variable speed drives. Check and record output frequency. Adjust if incorrect. Rectify defects.
- Record readings of thermometers, gauges, meters, current draw of motors and heaters, sample readings, control set points and controlled space conditions.
- Check sensor calibration. Recalibrate if incorrect.
- Check electrical and control systems, including safety limits for temperature, pressure and humidity. Adjust if incorrect. Rectify defects.
- Provide service tags recording inspections and tests.

Electrical systems

Requirement: Perform the following:

- Check for hot joints, burnt insulation, burn contacts and repair.
- Check electrical connections for tightness. Tighten loose connections.
- Check operation of all electrical components. Rectify defects.
- Check indicating lights and replace defective lamps.
- Check and record motor currents.
- Check overload settings. Adjust if necessary.
- Check and report any changes to controls and wiring.
- Provide service tags recording inspections and tests.

Standards:

- Electrical equipment generally: To AS/NZS 3760.
- Switchboards: To AS 2467.
- Repair and overhaul of rotating electrical equipment: To AS 4307.1.

3.3 END OF MAINTENANCE PERIOD SERVICE**General**

Requirement: Within a month of the end of the maintenance period, undertake all work scheduled to be carried out on an annual basis.

3.4 COMPLETION**Maintenance records**

Service records: Record maintenance undertaken in the schedules in the operation and maintenance manuals.

Maintenance reports: Prepare maintenance reports as documented.

Restitution after maintenance tasks

Requirement: Restore removed, damaged, contaminated or soiled services and building elements when the maintenance task is complete.

Standard: Equal to the condition of the original installation.

3.5 MAINTENANCE CONSIDERATIONS**Plant replacement planning**

General: Make sure the Contractor sets out and arranges plant and pipe work in a manner that allows for easy replacement of individual plant items with minimal disruption to systems operation and/or removal of pipe work and non-effected plant.

Installation: Install all plant items in a manner that allows them to be isolated individually and independently of other plant items.

Maintenance

General: Install plant so that it is maintainable with minimal disruption to the operation of the facility during routine maintenance.

Isolate plant: Make sure plant can be isolated so that individual components can be taken offline without impacting on the operation of other plant items or interconnecting pipe work.

Preventative maintenance period: Make sure the Contractor allows for a preventative maintenance period as specified in the head condition of contract. If no period is stated then apply a period of 12 months.

Preventative maintenance items

General: Include but not limit to the following instructions for preventative maintenance:

Table 1. Schedule of Preventative Maintenance

Item	Action	Frequency
Pumps / Pumping Systems	Check for water leaks, excessive motor or bearing temperature, noise or vibration, evidence of coupling wear, and loose fixings, rectify as necessary. Check glands/seals and adjust, repack or replace as necessary. Check associated valves for leaks and service glands as necessary. Clean drains and drip trays.	Daily
	Clean off any corrosion and touch up paint work as necessary. Lubricate motor bearings in accordance with manufacturer's recommendations. Clean strainers. Check flow and pressure / pump shutoff head against performance curve investigate and correct abnormalities.	6 months
Pipework and Valves	Check for leaks and rectify as necessary.	Daily
	Check pressure control valves for correct delivery	Daily

Item	Action	Frequency
	pressure, adjust as necessary. Check strainers for debris. Test back flow preventers. Ease/cycle all valves to prevent spindles from seizing.	
Controls	Check for any abnormal operation and correct as necessary.	Daily
	Check calibrated devices at least once during the maintenance period and recalibrate if necessary. Include a list of devices checked at each visit in a service report.	6 Months
	Check manual check meter readings against monitoring system readings.	Daily
Electrical	Check for correct operation of indicator lights, abnormal noise or vibration of contactors, odour or other signs of electrical faults, repair if necessary.	Daily
	Clean and adjust contacts of circuit breakers, starters and auto controls. Check tightness of wiring connections. Check and record delay periods of time delays, cut in and cut out conditions on pressure and temperature controls. Check operation of overloads and circuit protection devices. Inspect condition of electrical cabling, replace as necessary.	6 months
Water Treatment Systems	Water quality analysis	Monthly
	Check operation of water treatment systems (remote)	Daily
	Check operation of water treatment systems (onsite)	Daily
	Cleaning of membranes	In accordance with manufacturer's requirements
	Replacement of cartridge filters	In accordance with manufacturer's requirements
	Replenishment of chemicals	In accordance with manufacturer's requirements

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