Christchurch City Council

CITY WATER & WASTE

PRO-FORMA
GENERIC ELECTRICAL AND AUTOMATION SPECIFICATION ISSUE 4.5

TRIM File Ref: 14/1039203

CONTENTS

INTRODUCTION

This specification is intended to be used by CCC staff and External Consultants for project scoping and design and Contractors for installation and design where specifically required.

This document has been compiled from many electrical specifications used within the City Council but does not propose to contain all information that is relevant to electrical work carried out for CWW.

1 PREFERRED SUPPLIERS & EQUIPMENT

1.1 PRELIMINARY

This section identifies preferred suppliers and preferred equipment. Equipment shall be as per the approved list or fully assembled in accordance with the technical requirements herein. Alternatives may only be employed with the prior written specific approval of the CCC Water and Waste Asset Management Electrical Team Leader.

1.2 ELECTRICAL CONTRACTORS

The following contractors are preferred for electrical installations construction.

(a) Melray

(b) Millennium Electrical

(c) Fitzwilliam Electrical

(d) Aotea Electrical

(e) K K Electrical (CWTP)

(f) City Care

1.3 SWITCHBOARDS

The following contractors are approved for construction and supply of electrical switchgear (as defined in the electrical switchgear section).

(a) TLJ Switchgear

(b) IC Switchgear

(c) Bremca Industries

1.4 SYSTEM INTEGRATORS

The following contractors are approved for work involving modification to the CWW SCADA System HMI, RTUs, PLCs and Local HMI panels.

(a) Industrial Controls Christchurch

(b) Millenium Electrical

(c) Control Web

(d) Bremca Industries

1.5 DIESEL GENERATORS

The following contractors are approved for supply of diesel generators

(a) Goughs CAT

(b) QPower

(c) Allight Sykes

(d) Eneraque

(e) Aggreko

(f) Generator Rental Services

1.6 TESTING AND VERIFICATION

The following test and verification suppliers shall be used:

(a) Flow meter installations

- ABB
- NZ Flow

1.7 EQUIPMENT

The following equipment is preferred but alternatives may be offered for approval at time of tender. These are grouped for ease of location only.

Make / Supplier	Model	Application
SCADA System		
Schneider	Archestra 2014R2 System Platform 2017	Network project CWTP project
RTU		
Yokogawa	FCN & FCJ models NFTA4S Analog Terminals	CWW Network
Iota	Onebox	Low Pressure Sewer System controller
PLC		
Schneider	M340 M580	CWTP package plant CWTP process areas
UPS		
Vertiv		
HMI		
Schneider	MagellisVijeo Citect SCADA	Configuration
Schneider	HMIG3U + HMIDT542	550Cd/m Indoor and Outdoor when > 2 Pumps
Schneider	XBTGT2930	1000Cd/m Outdoor when <= 2 pumps
Schneider	10inch 1000Cd/m	Outdoor when available
Pressure Transmitter		
Yokogawa		
ABB		
Siemens		
Pressure Switch		
Saginomiya	Mechanical SNS – automatic reset type	
Flow Meter		
Khrone / Streat Control 2002 Limited		
ABB		
Yokogawa		
Siemens		
Endress & Hauser / EMC Industrial Group Ltd		
Flow Switch		
EGE-Electronik / CSE W Arthur Fisher Limited	SN 450/2-A4-GR	

Level Transducer		
IFM	Hydrostatic	Water & Stormwater
Vega	Vegapuls WL 61	Water and wastewater
Flygt	Flygt LTU401 Pressure Transducer	Wastewater lift stations
Level Switch		
MAC3	TSOND0000	Bore - Probe
Omron	61F-GPN-BC or K8aK LS ??	Bore – choose the higher voltage
Flygt	NM10 13m normally	Wastewater
Nohken	OLV-2A	Reservoir Sumps (flood switch)
Voltage Transducer		
Intech Instruments	XJ2	Battery Voltage Measurement
Cable and Core Labelling		
Raychem	Shrinkmark	
Legrand	Memocad	
Graphoplast	Spark pin crimp	
Panel Sounder		
Askari		
Battery		
Century Commander		
Century Yuasa		
Wireless Modem		
Netcomm	NTC-140-02	When UHF not used
RFI Wireless	TLA4100	Aerial
Pump Temperature		
Motor Manufacturer	Pt100 Class A duplex	
JUMO	eTRON T	Not required for starters which support Pt100 directly
Room Temperature		
Intech	CM XU2 transmitter something .. Pt100 Class A probe	
Cable Duct Seal		
Hilti	CCFS-PL Firestop plug	
Switchgear		
ABB	ACB	Main Incomer >= 800A
Schneider	ACB	Main Incomer >= 800A
All	Withdrawable fitting	All ACBs
Schneider	MCCB	Main Incomer <= 630A
Schneider	Micrologic 5.3E	Incomer ACBs and MCCBs
Schneider	NSX MCCB	Main Incomer <= 630A
Schneider	MCCB	Submain
ABB	MCCB	Submain
All	Auxiliary Padlock Attachment point	
Power Monitors		
Schneider	Power Logic Series PM810	CWTP

Isolator		
GE		
K&N		
Schneider		
Generator Inlet Connection		
IDEC	BN400NWK	Temporary inlet connection 125A< I < 350A
Fuse Switch - Only use if fault rating requires		
General Electric		
Fulos-Lockable		
Stromberg		
RCD		
Merlin Gerin		
GE		
MCBs		
Schneider		
GE		
Phase Fail Unit		
Crouzet	FWA-400	
Fuse Holder		
NZI		
Terminals DIN rail		
Schneider	AB1 – VV435U 4mm²	
ABB		
Weidmuller	Z series	
Phoenix	Andy	
SCADA Analogue Terminals – 4mm blade disconnect		
ABB		
Weidmuller		
Phoenix		
Schneider		
230Vac Socket internal – inside cabinet		
Schneider	PDL 600 series	
230Vac 400Vac Socket external to cabinet		
Schneider	PDL 56 Series	
Lamps		
Telemecanique	LED	
Pushbuttons		
Telemecanique		
Overloads		
Telemecanique	K or D type to suit.	
Reset Solenoid		
Telemecanique	LA-D03 230V AC	
Control Relays		
Finder	60.12 and base 230v with neon and mech	
SCADA Control Relays		
Finder	56.32 and base 24v dc with neon and mech activation (12v where required for	

	existing equipment)	
Contactors		
Schneider	LC1 – Bypass	
Timer		
Schneider	LA2-DT2	
Crouzet		
MCB Chassis		
Merlin Gerin		
Vynkier		
Ammeters/ Voltmeters		
		Use digital type
Smoke Detector		
Intek Security	CVSD142	Photo electric self-resetting
Auto Off Manual Switch		
Kraus & Naimer		
Schneider		
Current Transformer		
Electrade		
	Andy Black and Red ones	
Hour Meter		
Omron	H7EN-front reset disabled	
DC Power Supply		
Enatel	12/24-10/20 amp- RW series Plant model	
Schneider		
DOL Starter		
Schneider	TeSys U 32A rating with auxiliary to indicate fault when isolated Contactor and overload – remote resettable overload	
Schneider	Contactor and overload	
Soft Starter		
Schneider	Altistart 48	
Active Harmonic Filter – match VSD make		
Schneider	PCS Plus	With Schneider VSD
ABB	PQF	With ABB VSD
Variable Speed Drive		
ABB	ACS580-1 ACS880-1 ACS880-31	
Schneider	ATV650 ATV630	
WEG		
All		Without Active Front End preferred. IP55 unless in dedicated cabinet where IP21 is acceptable

EMC Filters		
Schneider		With VSD when not built in
Schaffner	FN 3258-	With AHF when not built in
External Cabinets		
	316 Stainless steel Polycarbonate Glass Reinforced Polyester (UV inhibited) Aluminium Painted	
All	Double Skinned	Any outdoor installation
Cable Support		
	Aluminium, stainless steel, Fibreglass (UV inhibited)	
Fittings and Fixings		
	316 Stainless Steel	For electrical equipment
Valve Actuators		
Rotork	IQ Series	
Earthing		
Wricon	Building frame earth system connections to foundations and rebar	Buildings
Solely stake		Smaller outdoor cabinets
Networking Equipment		
19 inch cabinets	Rittal	
Schneider	DIN rail mount 24Vdc TCSESU083FN0	Unmanaged switches only Pump Stations
Schneider	EGC150	Modbus Gateway to ULP
Schneider	Gateway 485 to Ethernet	

2 GENERAL SITE AND PROJECT REQUIREMENTS

2.1 PRELIMINARY

The following parts of this specification cover the General requirements that apply to any electrical contract carried out for CWW sites.

2.2 SITE INFORMATION

2.2.1 Introduction

All persons performing work on CWW sites are required to undergo a site induction prior to commencing any work.

This induction process is presented by a member of the CCC staff and consists of:

(a) An explanation of the site Health, Safety and Environment rules

(b) The identification of known site hazards

(c) Issue of a Health & Safety Handbook

Those being orientated are required to acknowledge understanding and acceptance of the conditions detailed in this booklet for this site by completing the receipt at the back of the Health & Safety handbook prior to commencing any work on CWW sites. The receipt shall be handed to the CCC staff member undertaking the induction.

Inductions are managed through reception at the CCWwTP site on Shuttle Drive in Bromley.

2.2.2 Site Rules

(a) All persons must sign site visitor registers on arrival at site indicating date and time.

(b) Non-inducted personnel must be accompanied by inducted personnel at all times.

(c) When leaving the site, all persons must sign out in the visitor book and record the exit time.

(d) Always follow instructions given by the Plant Manager and obey all safety signs around the plant.

(e) All workers must wear safety boots. All visitors must wear sturdy closed shoes. Hard hats and hi-viz vests must be used during construction/crane use activities.

(f) Smoking is prohibited on the CWW sites.

(g) Matches, lighters and other sources of ignition are not permitted in hazardous areas.

(h) Horse play and practical jokes will not be tolerated at any time.

(i) All incidents/accidents must be reported immediately to the Plant Manager and an accident form completed.

(j) Check with the Plant Manager prior to working on any site and complete the necessary work clearance forms.

(k) When riding in site vehicles personnel must be seated in proper seating.

(l) Personal Protective Equipment (PPE) must be used where signs and / or common sense dictate its use. Contractors must supply their own PPE.

(m) No drugs or firearms are permitted on site. Personnel who are intoxicated in the opinion of CCC staff will be escorted off the site.

(n) Blasting explosives shall not be taken on site without the prior written approval of the Plant Manager.

(o) Confined Space Clearances must be available at the work site.

(p) No plant equipment is to be operated without the Plant Manager's permission.

(q) The CWW Control Room (at CCWwTP Bromley) is to be briefed on the status of plant at the end of each work session.

(r) No animals are permitted on the CWW sites at any time.

(s) Children are only permitted on CWW sites when formally escorted by CWW or approved CCC staff.

(t) Site documentation is to remain on site at all times.

2.2.3 Work Permits

(a) A "Permit for Work" is required for all work undertaken.

(b) A procedural description of the access and work permit system is documented in the Guidelines for entering and working in Confined Spaces, *TRIM ref: 14/373123*.

(c) All Plant, unless isolated and tagged, must be considered "Live" and may start automatically at any time.

2.2.4 Work Procedures

Site access keys are available for the works duration at the Network Operator at the CCWwTP Bromley. Notify the Network Operator each time entering and vacating the site. Do not leave the door to swing freely as this gives multiple security alarms.

All personnel to enter operating pump stations and treatment plant facilities (currently under City Care's maintenance contract) is required to be inducted by City Care.

All isolation and operation of pumps and generators is to be co-coordinated through the Network Operator. Pumps can be started automatically at any time. Wear ear muffs if pumps or diesel motor are running in the room.

Once the site is handed over, if working alone at one location, contact the Shift Controller every two hours to confirm all is okay. Be contactable by the Network Operator e.g. by cell phone.

2.2.5 Hot Work Permits

Hot Work Permits are required for any work or activity that has the potential to create an ignition source. These activities include grinding, welding, cutting and the use of any power tools.

2.2.6 Water Contamination

Contractors shall identify the specific cross contamination risks from waste water to water supplies that may arise from tools, equipment or work practices. Contractors shall adopt measures applicable to their specific work methodology to eliminate the possibility of cross contamination.

2.2.7 Environmental Issues

CWW sites operate alongside bays and rivers used extensively for recreation by the public. For this reason CCC is very concerned about the impact of the operations of the plant on the environment.

To minimise the risk of environmental damage you are requested to:

(a) Under no circumstances should the Plant or Network operation be compromised, (i.e. bypass or overflow) due to your activities. You will be held accountable for any such breaches of Consents.

(b) Do not compromise the process or collection systems, plant equipment, or structure that would cause a reduction in the quality of the effluent (bypass) or contaminate the immediate area (overflow or spill).

(c) Do not allow any sewage to be drawn into any storm water or water supply system.

(d) No tanks or vessels are to be drained without the expressed permission of the Plant Manager.

(e) All plants and landscaped areas must be protected when carrying out work.

(f) Do not discharge pollutants on site.

(g) Work area is to be left clean and free of rubbish.

(h) Waste is to be disposed of in the bins provided or removed from the work site.

(i) Hazardous waste or pollutants (including oils) are to be removed from site using appropriate containers and/or vehicles and disposed of in accordance with local / national regulations.

(j) Do not light any fires or burn rubbish on any site.

(k) All vehicle movements must be on designated roadways only.

(l) Inform the Plant Manager if you witness an occupational health and safety or environmental incident; or suspect that one may occur.

(m) Immediately contain any spill. Notify the Plant Manager as soon as you see or have any spill.

(n) Only authorised personnel holding a confined spaces certification may enter confined spaces.

2.2.8 Hazardous Areas

Some CWW sites have areas classified as hazardous. Warning signs are generally posted around the areas affected however this is site specific. Familiarise yourself with the issues applicable at the specific site and use appropriate safety measures.

All work in hazardous areas must be in accordance with the requirements of the New Zealand Standard for Hazardous Areas.

Mobile phones, torches and cameras are not intrinsically safe (unless specifically certified) and shall not be used in such areas unless they are intrinsically safe.

All work to be carried out in confined spaces or hazardous areas will be done using a calibrated portable gas detector. If the alarms activate, report the incident to the Plant Manager

No Hot Work is allowed on pipelines that contain flammable gas until they have been purged and proved safe **AND** a 'Hot Work Permit' has been issued.

2.2.9 Chemicals

A range of chemicals are stored at, and are present at CWW sites. Some of these chemicals are corrosive so care should be taken when working with these chemicals or working in close proximity to the storage areas and/or associated pipework. Ensure you are familiar with the relevant material safety datasheets if you are working with any chemicals.

Other hazardous chemicals can occur in wastewater, identify and manage the potential risks at the work site.

2.2.10 Biological Hazards

To prevent disease associated with viruses and bacteria that may be found in the wastewater systems, strict hygiene practices shall be adhered to. These include:

(a) Washing of hands prior to eating

(b) Laundering of contaminated work clothes through a laundry and showering prior to leaving the site if necessary.

(c) Change clothes immediately if they have been splashed with effluent.

(d) Eating in designated areas only (ie lunch rooms).

(e) Ensure that qualified first aiders attend to any cut or abrasion. This is particularly important!

There have been confirmed cases of cellulitis at Wastewater Treatment Plants.

(a) Ensure that **ALL** injuries, including minor cuts and abrasions are reported to the Plant Manager.

(b) Please advise the person conducting this induction if you have any cuts and/or abrasions. These must be attended to before performing the work on sites handling wastewater.

(c) Please advise the Plant Manager if you develop a rash whilst working at a CWW site.

It is STRONGLY RECOMMENDED that you are immunised for Hepatitis A and B, Polio, Typhoid and have had a recent (last five years) tetanus vaccination prior to the commencement of work on any CWW site containing wastewater, biosolids, or sludges.

2.2.11 Environmental Conditions

In the absence of other specific information specification, design and supply of equipment for installation at the plant shall allow for the following environmental conditions at the site without any equipment exceeding manufacturers recommended environmental specifications.

Temperature:

- Highest 35ºC
- Lowest -4ºC
- Humidity 67-90%

2.3 HEALTH AND SAFETY

2.3.1 General

The Contractor shall take all necessary steps to ensure that the obligations placed on principal employers and owners pursuant with the provisions of the Health & Safety in Employment Act 1992, are at all times complied with. The Contractor shall comply with all enactment's, regulations and working rules relating to the safety, and welfare of everyone associated with this contract, as defined by Local Bodies, Christchurch City Council's Health & Safety policy, any other legislation applicable to the work.

Another specific requirement is compliance with the CCC 'Guidelines for Entering and Working in Confined Spaces'. An associated booklet is available from the CCC, and should be provided to all applicable staff.

Personnel involved with working in confined spaces and at above normal heights shall only do so with a suitable qualification. Evidence of this qualification may be asked for by the Engineer.

As part of the CCC Health & Safety requirements all contractors on site shall inform the Network Operator each time he arrives or departs the site. If a contractor is on site alone he must check in with the Network Operator every 2 hours. As part of this contract the contractor will supply a signed Health and Safety Policy as outlined in the contract documentation.

2.3.2 Hazard Identification and Control

All persons performing work at this site shall advise on-duty operators of any new hazards that are identified during the course of or resulting from their activities. Appropriate risk control mechanisms, with respect to these new hazards, must be put in place to minimise, isolate or eliminate such hazards.

To ensure good health and safety outcomes the contractor must ensure that his employees under his authority take measures to safeguard their safety.

Loose clothing and long hair must be restrained to prevent it being caught in moving or rotating plant.

All contractors are responsible for keeping their work area in a tidy, orderly and safe condition. All surplus material and rubbish must be tidied from the work site upon completing work. Failure to keep work areas tidy may lead to expulsion from the site and/or recovery of any costs incurred by CCC in cleaning up work areas.

The Contractor is to update the site hazard board and notify the Plant Manager of any hazards.

Common hazards at CWW sites include:

- Confined spaces
- Flammable / Explosive gas
- Chemicals
- Biological Hazards associated with wastewater
- Rotating and moving mechanical plant
- Manual handling of heavy components
- Slips, Trips and Falls
- Open floor ducts and trenches.
- Floor mounted objects and pipes
- Elevated work areas
- Fumes
- Electricity – low, medium and high voltage
- Rockfall

2.3.3 Fall Protection

Whenever work is performed from an elevated position or location in excess of three metres above the ground, fall protection is required. When work is accessed by the use of a ladder, the ladder shall be tied off at the top and securely footed on a level surface. When work is performed from a ladder appropriate safety measures must be taken.

2.3.4 Scaffolding

Scaffolding of a height greater than three metres must be erected by certified scaffolders or other certified persons (eg riggers). Scaffolding over three metres in height require a guardrail, midrail and

toe-boards. Mobile scaffolds must have the wheels locked when people are working from it. Do not ride on mobile scaffolds under any circumstances.

2.3.5 Forklift and Crane Use

Only licensed operators may operate a forklift or crane on any Christchurch City Council site. Carrying of passengers on a forklift or crane is prohibited unless used with a certified personnel cage and according to an approved procedure.

Use of forklifts and cranes on the site must be conditional upon compliance with Codes of Practices – "Training operators and instructors of powered industrial lift trucks" and "Cranes and lifting appliances"

2.3.6 Excavations

Wherever possible, personnel are not to work in excavated trenches or holes. Where it is necessary to work in such spaces, a permit to work – excavations is to be obtained. These permits can be obtained from the on-duty Plant Manager.

2.3.7 Personal Protective Equipment

The contractor shall supply the following where necessary:

(a) Hi Viz Jackets

(b) Hard Hats

(c) Safety Shoes

(d) Harnesses

(e) Eye wear

(f) Ear Muffs

(g) Any other specialised safety equipment

The Christchurch City Council is not responsible for supplying any safety equipment to the contractor.

2.3.8 Fit for Work

All persons performing work at the site must be "fit for work" they are undertaking. This is to ensure that people are not exposed to risk from themselves or others in the course of their work. Fitness for work can be affected by:

(a) Physical problems

(b) Emotional stress

(c) Use of alcohol or drugs

Contractors whose employees are not fit for work will be asked to leave the site. The terms of the Fit for Work policy will apply to those people whose judgement is impaired at work.

2.4 OPERATIONAL RESPONSE

The Contractor shall provide a 24 hour number for any site at which work is being carried out. This shall be notified to the Network Operator and recorded on site attached to the equipment being altered or on the site board as appropriate.

2.5 GENERAL STANDARDS

2.5.1 Standard Designs

CWW best design standards are continuously evolving. Request a drawing set for the current best practice for a related site type from the Capital Program Group Electrical Engineer and SCADA

Engineer before undertaking a design, designs shall follow these details as appropriate for the project. Details of any differences shall be reviewed prior to tender or construction design issue.

2.5.2 Workmanship

All work carried out under this contract shall be carried out;

(a) By suitably qualified persons skilled in the installation of this type of work.

(b) Under the supervision of a suitably qualified supervisor.

(c) In accordance with all relevant standards and codes of practice.

(d) In a neat and professional manner to the satisfaction of the Engineer.

(e) Using new and high quality materials.

(f) Under a work permit issued by the Shift Engineer or Plant Manager.

(g) In accordance with the relevant Technical Specification.

2.5.3 Materials

Any product or materials supplied for this project shall be supplied to comply with the following;

(a) Be new or used and approved by the Engineer

(b) Be the latest version of the device

(c) Be supplied with appropriate software

(d) Be suitable for the intended use

(e) Have a proven track record in similar installations

(f) Be compatible with other associated equipment

(g) Be supported by local suppliers or agents

(h) Be designed to operate in the environment it is to be installed in

(i) Be suitable for installation in to areas that are accessible for maintenance

(j) Have the manufacturers label attached

(k) Where the material or device is to be hidden from view and is a motor or machine and appropriate name plate duplicate shall be supplied.

(l) Be protected against the electrolytic corrosion due to the action of dissimilar metals

(m) Installed in compliance with the Manufacturers recommended installation requirements

2.5.4 Alternatives and Specification

Materials supplied shall be as specified or an approved equivalent.

Where designed equipment layouts ,types ,positions or installation differs from that shown on generic drawings the contractor shall submit alternative layouts, types and location of equipment for approval by the Engineer before any work is carried out. Alternatives are not permitted without written approval from the Engineer.

2.5.5 Protection and Security

The contractor shall be responsible for protection of the works and the surrounding buildings, machinery, gardens, lawns that could be affected by the contract works. He shall erect barriers, install covers and erect signage where necessary to minimise the risks to the surrounding areas, plant staff and contractors.

Where damage does occur as a direct consequence of contractor negligence he shall rectify the damage and incur all cost in the rectification.

The contractor shall take all reasonable steps to insure the contract works do not infringe on the day to day running of the plant, create excessive noise, dust or odours.

For the duration of the contract works the Contractor shall provide locks and keys for equipment included in the contract works, supplying keys to nominated CCC staff if access is required during the works. At the completion of contract works all locks are to be changed to meet the CCC standard locking standard.

For other equipment with enclosures supplied with keys provide a site key lock box located immediately adjacent the personnel entry door. This is anticipated to include door locks on generator enclosures.

2.5.6 Guarantees

All Contract deliverables, except lamps and tubes, shall be provided with a twelve-month guarantee, from the date of practical completion. Lamps and tubes shall be guaranteed for a period of three months.

During the guarantee period return any defective equipment supplied by others to the source for repair or replacement at the Contractor's expense.

Be available to attend a callout to a station defect within 4 hours of being requested to do so within a normal working day. If a callout is required outside working hours, be onsite within 6 hours of being requested to do so.

2.5.7 Warranties and Licences

It is the contractor's responsibility to:

(a) Provide all warranties in writing at hand over on all hardware supplied. This needs to detail all components, serial numbers, where purchased, date of purchase and length of warranty.

(b) Provide license certificates and documentation on all software supplied.

(c) Minimum warranty on all hardware should be (12 months) from (issue of handover certificate)

2.5.8 Coordination

The contractor shall be responsible for the coordination of the contract work with other contract work, existing plant operation and other plant equipment by:

(a) Coordination with other contractors to ensure that on site excavations, crane usage, temporary power supplies ,disruptions to plant operations are not duplicated by different contracts.

(b) Ensuring that new plant is installed in locations that do not inhibit it's and existing plant maintenance and operation.

(c) Informing the Engineer of any discrepancy existing between the drawings, specification and any site feature that may inhibit the correct installation or operation of any new or existing plant.

(d) Ensuring that the Plant Manager is fully informed of any contract function that will affect the normal operation of the plant process.

2.6 STANDARDS AND REGULATIONS

The installation and all materials used shall comply with relevant statutory regulations, manufacturer recommendations and the following:

- Electricity Act 1992
- Electricity (Safety) Regulations 2010
- AS/NZS 3000 Wiring Rules
- AS/NZS 60079.14 Explosive Atmospheres
- Electrical Codes of Practice ECP34 to ECP 60
- AS/NZS 3820 Essential Safety for low voltage equipment
- AS/NZS 3019 Electrical Installations - In service testing
- All applicable Network Company connection standards

The contractor shall supply 'Producer Statements ' for all specially manufactured equipment and shall supply an Electrical Certificate of Compliance for all electrical work.

2.7 QUALITY ASSURANCE

The contractor shall be responsible for:

(a) Checking that the works are installed and tested in accordance with the specification and relevant codes and standards.

(b) Ensuring that all workmanship and material quality is of the highest standard.

(c) Supplying a basic quality plan at time of tender and a detailed plan 10 days after award of tender or as advised by the Engineers. The plan should outline the method of ensuring that quality of materials and workmanship is monitored at all phases of the project.

(d) Maintaining a written record of the plan and record all compliance checks.

2.8 SPECIFICATIONS AND DRAWINGS

The position of equipment and the layout of equipment inside cabinets and switchboards, as shown on the drawings, are to be considered approximate only and there is no warranty expressed or implied that each and every detail and item to be included is shown. Any reference to dimensions and distances shall be confirmed on site. The drawings and specifications are intended to be mutually self-explanatory and complete but all work called for in one, even if not the other shall be fully executed. Should any contradiction appear to exist between drawings, or between drawings and specifications etc, the Contractor shall notify the Engineer of any such discrepancy and shall not execute any of the work concerned until the Engineer's decision is given in writing

2.9 IDENTIFICATION AND LABELLING

Labelling and identification of equipment shall be in accordance with the treatment plant master Tagging system (*TRIM File Ref: ELEC06/6074 - CWW Tagging Convention*). A copy is attached in Appendix A.

All equipment shall have a label identifying:

- Description of equipment

- Its “Tagname”

Labels shall be white/black/white except danger and warning labels which must be red/white/red traffolyte, with 5mm and 3mm lettering for switchboards and stamped stainless steel with 5mm lettering for field devices. Labels shall be screwed to the device or attached by stainless steel wire or chain so that they can be removed and re-used if the equipment is replaced.. If it is impractical to fix a label to a piece of equipment then the label should be fixed to a surface as close to the equipment as possible.

All cables and individual cores shall be labelled at both ends.

All cores shall be numbered with a unique reference within the switchboard or grouping of equipment provided in this Contract. Core numbering shall change across devices but shall generally not change across terminals, with the exception of PLC/RTU terminals. PLC/RTU I/O labels shall identify type, rack, slot and point at the first terminal, the label out to the field from the first terminal shall change to suit the cabinet labelling scheme.

All components inside cabinets shall be labelled as per the name shown on the label schedule drawings.

All cabinet doors shall be labelled with engraved labels describing the function of the cell. Labels shall be white with black lettering. All warning or danger labels shall be red with white lettering.

2.10 TECHNICAL

2.10.1 Earthing and Bonding

Earthing shall be installed in compliance with the Electricity Regulations 1997, associated Electrical Codes of Practice (particularly NZECP 35), AS/NZS 3000, and Orion Electricity Network Design Standards (particularly NW70.59.01).

A separate instrument earth bar shall be used for termination of instrument earth cables and shields.

Earth bars and wires, etc, shall be of adequate size, thickness and spacing to provide a robust, efficient and electrically sound installation.

All cable sheaths and earthing conductors shall be directly connected to dedicated earth bars or the associated earth electrode. All connections shall be made using appropriate welding methods or compression type lugs (conductor) and bolted connections to the bars.

2.10.2 Cooling and Ventilation

All rooms or interior spaces housing electrical assemblies and equipment shall have sufficient ventilation and/or cooling to limit the maximum temperature (inside the room or space) to 40°C. Should forced ventilation be required, appropriate filters shall be used to limit dust or ingress of other substances (e.g. hydrogen sulphide).

Care shall be taken when installing equipment in locations exposed to direct and prolonged sunlight to ensure that the equipment has been designed (UV stabilised plastics, adequate ventilation, etc) for that type of environment.

Equipment shall not be installed in polluted atmospheres unless special precautions have been taken in the design of the equipment and it is suitable for installation in the particular environment.

2.10.3 Seismic Requirements

Design shall specifically address the requirements for seismic restraint of all fixed plant, equipment, appliances. Seismic design and certification shall be done by the party selecting the cabinet. Load calculations shall then assume the cabinet load capacity on the basis of manufacturer’s information or the design load as identified by the designer.

Fixings must be able to withstand normal operating loads plus seismic forces at 1.0G in a horizontal direction acting through the centre of gravity of the item.

The Contractor shall design and install switchboard and plant securing systems for all switchgear, drives , filters and other electrical equipment to NZS 4219 :1983 Seismic Resistance for Engineering Systems in Buildings' Loadings shall be calculated in accordance with NZS 4203:1992 section 4.12 Application Risk = 1.3. An Engineers design certificate shall be produced as part of the documentation for inclusion within the Operation and Maintenance manual.

The contractor shall confirm locations of seismic joints and allow flexible connections across them. Rigid cable supports shall not be bridged across seismic joints.

2.10.4 Environmental

CWW sites are commonly exposed to corrosive atmospheres. For waste water treatment sites this typically includes the presence of H2S, for waste water sites all exposed copper conductors shall have a complete tinned finish and all circuit boards shall have conformal coating to IEC 60721-3-3 3C3.

2.10.5 Manufacturer's Instructions

Equipment shall be installed, configured, tested and commissioned in accordance with manufacturer's instructions and recommended practices. Configuration details shall be recorded and submitted according to manufacturer's configuration sheets where available, these shall include all user configurable adjustments.

2.10.6 Noise Levels

Acoustic performance of the entire installation shall be considered with respect to compliance with the *City Plan* rules in clause 1.3.3 Noise Standards for all zones outside the Central City or the Banks Peninsula *District Plan* rules in chapter 33 Noise and Environment Canterbury noise control standards.

Acoustic analysis shall include all noise sources including:

- Diesel Generator
- Pumps
- VSDs
- Active Harmonic Filters
- Sine Filters
- HVAC, cooling

2.11 POWER SUPPLY

Allow to provide a power supply to site. Provide load calculations and connection request to the Line Company. Provide mains cables, metering and comply with all power company requirements for the connection of supply. Arrange first power with the CCC nominated Energy Retailer.

Provide all power conditioning equipment required to meet power factor and harmonic standards required by the line company. For VSDs and other active devices this shall include Active Harmonic Filters. For motors and other lagging devices this shall include Power Factor Correction.

For Medium Voltage sites with power measured and 11kV all electrical systems shall have Power Factor Correction fitted to maintain or achieve a Power Factor of .95 lagging minimum. A harmonic impact assessment shall be carried out and the installation approach shall follow line company requirements.

Costs associated with design and alterations within the line company network and on the line company side of the point of connection will be paid by CCC.

2.12 TESTING AND COMMISSIONING

2.12.1 General

Testing is to be carried out and documented by the Contractor prior to Commissioning.

A Commissioning Plan shall be submitted to the Engineer for approval 2 weeks before the start of commissioning. This shall be accompanied by a Preliminary Operations & Maintenance Manual containing data sheets for all items of plant to be commissioned.

Commissioning is carried out by the Contractor and his Sub Contractors.

The correct operation of the plant shall be demonstrated to the Engineer at the completion of Commissioning.

Clauses for related to testing and commissioning of specialist equipment are contained in the relevant Technical Specification.

The contractor is to supply all equipment necessary to test and commission the plant.

Testing and Commissioning shall be carried out using pre-approved written Testing and Commissioning Procedures Sheets.

All results shall be recorded on the Testing and Commissioning Procedures sheets.

Testing and Commissioning shall be carried out in accordance with the Plant Manager's written authority where the plant being tested or commissioned is part of the 'live' plant process.

2.12.2 Testing

Testing is carried out to ensure that basic work has been completed in a specific area before power is applied to a device.

Tests shall include, but are not limited to:

(a) General testing as described in AS/NZS 3000

(b) Continuity of connection between devices

(c) Correct earthing

(d) Correct voltage applied

(e) Device location allows adequate access for maintenance

(f) Correct sizing of cables and power supply

(g) Correct environmental protection

(h) Device is as specified

(i) Installation is to manufacturer's recommendations

(j) Hazardous area classification compliance is correct

(k) Labelling and device tagging is as per the CWW requirements

(l) Drawings are marked up to 'As Built' to include all information relating to the actual installation.

(m) Equipment is installed in a safe, neat and function manner.

(n) Device is setup correctly and any automatic functions are disabled.

(o) Rotation of motors is correct. This test to be carried out in manual.

(p) Transducer calibration and set up.

(q) Primary instrument testing (switch etc)

(r) Analogue and digital and communications I/O testing

(s) PLC I/O set up and calibration sheet marked up with test and calibration results that include confirmation of indication in both the PLC code using the programming tool and the SCADA alarm and mimic displays

2.12.3 Factory Acceptance Testing

Switchboards, control panels, RTUs, PLCs, HMI and SCADA displays shall be Factory Acceptance Tested. Testing will be considered to be complete after the Contractor has successfully demonstrated all functions of the devices in a test environment which allows simulation of all operating parameters of the plan.

All software shall be fully complete prior to Factory Acceptance Testing. Documentation shall be complete to the DRAFT stage, in the form of the final document to allow verification of the operation in accordance with the operating and maintenance manuals and the function descriptions.

Factory Acceptance Testing shall not commence until the Contractor has confirmed that all functions have been tested and that all functions operate correctly. The Contractor shall provide a test list confirming the tests completed and the successful functionality.

2.12.4 Commissioning

Commissioning is carried out to check that the plant performs all of its designed functionality. It shall test automatic functions, manual overrides, emergency functions, compatibility with other plant functions and equipment and enable operation of the plant so that minor adjustments and settings can be made to ensure reliable operation .All adjustments and settings shall be recorded and information handed to the Engineer. Commissioning shall;

(a) Be carried out by skilled and qualified persons

(b) Be coordinated to ensure correct functionality of complete process and interfacing with other plant functions

(c) Demonstrate to the Engineer and CWW staff the complete automatic and manual operation of the plant and process.

Testing and Commissioning shall be carried out by the Contractor prior to Practical Completion. The Engineer shall demonstrate to the Operations Manager's representative that the Works efficiently meet the specified performances, and have been successfully tested and commissioned as a complete and integrated installation, under operating conditions. The Contractor shall allow 10hrs to assist the Engineer.

2.12.5 As Built Documentation

The contractor shall keep a clean set of contract drawings specifically to record any changes to the drawings due to variations, changes in position of equipment, changes in design and any other event which cause the drawing to change.

This set of 'As Built' drawings shall be presented to the originator of the drawings after successful commissioning of the plant for updating prior to providing them for insertion into the Operation and Maintenance Manuals.

Where the contractor has carried out the design he shall present drawings in the latest AutoCAD DWG native format in a form able to be edited and updated.

2.13 SOFTWARE FOR DEVICE CONFIGURATION

Unless specifically agreed otherwise, for all devices able to be configured the Contractor shall supply the software configuration tools and the device configuration settings in a format that is able to be used and modified by CCC. This shall include the right to use common configuration settings and programs across other CCC devices and assets.

Where configuration software is not freely available and not included as a deliverable in this Contract the software required shall be adequately described to allow CCC to independently purchase if they wish.

Configuration files shall be supplied without passwords and both in native application form suitable for editing and loading onto the device and as a pdf document.

2.14 DOCUMENTATION

Original site documentation is to remain on site at all times. Once new documents have been approved the site documentation is to be updated with the new documentation set. Redundant site documentation is to be removed once the updated set has been approved.

Documentation shall include Operation and Maintenance Manual in the City Council City Water and Waste department generic format. This template is for a complete multidiscipline project and it is not expected that the contractor complete a manual such as this but it shall be used as a template for the electrical manual.

Documentation shall adhere to the following requirements:-

(a) Two printed copies and one USB Stick copy of operations manuals describing:

1. Start-up and shutdown of systems
2. Normal operational procedures
3. Fault finding procedures
4. Maintenance activities
5. Spares and consumable requirements
6. Manufacturers manuals and data sheets for all items including but not limited to:
    i. PLC code
    ii. VSD configuration
    iii. Soft Starter configuration
    iv. Instrument setup
    v. Deep Sea Controller configuration
    vi. Micrologic configuration
    vii. Network switch and gateway configuration
7. Drawings
8. A text searchable PDF copy of all documents and drawings

(b) A USB Stick containing all software tools and configuration files including a description on how these are to be used.

(c) All supporting documents must be supplied in formats acceptable to CCC at the time of undertaking such work. Acceptable formats include:

1. Word DOCX
2. AutoCAD DWG

3. Excel XLSX

(d) For all supplied hardware and software, manufacturer manuals, installation and support media including CDROMs or floppy disks must be provided to CCC.

(e) Provide warranty applications (Manufacturer Statements) as appropriate with a copy of all documentation at project completion.

2.15 MEETINGS AND REPORTING

The Contractor shall attend meetings and provide reports as required by the engineer. These shall be monthly during general construction periods and more frequent as may be required during commissioning. Generally the contractor will be expected to give written progress reports to the Engineer covering all aspects of the project including;

(a) Progress to date in comparison to contract program

(b) Any problems with procurement of materials

(c) Health and Safety issues

(d) Variations

(e) Issues effecting future progress

2.16 CLEANUP

The Contractor is responsible for ensuring that the work site is left in a tidy state, that all temporary works are disestablished and removed from the site. The new plant should be thoroughly cleaned to the satisfaction of the Engineer. The Certificate of Practical Completion will not be issued until this work has been carried out.

2.17 OPERATOR TRAINING

The contractor is responsible for caring out any training required to Plant Manager and other selected staff .After handover the Contractor shall arrange a training session or sessions to fully explain the operation of the new plant. A training facility available in the Operations building and this can be booked by contacting reception and booking the facility.

Training should commence during commissioning with formal sessions away from the site if required.

The contractor shall arrange to have the relevant trained personnel available, provide all written materials and manuals and other materials to carry out the required level of training to enable staff to effectively operate the plant.

2.18 ASSET DATA

Asset data collection shall include GPS location of buildings, outdoor panels and any equipment located underground such as flow meters.

The installation and removal of equipment in the plant has implications on the recorded data about that asset. It is very important that the asset data is upgraded when work is carried out at the plant.

Please contact the asset unit within the CCC to obtain the relevant documentation to record any additions/deletions or changes to assets. *TRIM 14/141308 911 Asset Management - CWW - Station Asset Templates*

2.19 OWNERSHIP OF REDUNDANT EQUIPMENT

Ownership of redundant equipment remains with CCC unless explicitly stated otherwise. Allow to remove from site and deliver to a CCC nominated address. Equipment shall be properly disconnected, provided together with all ancillary parts, cleaned, but otherwise in an as-found condition.

2.20 SITE SECURITY

Access to electrical equipment and any controls on electrical equipment shall be by secure access. Secure access may be by site security such as security fences and locked gates, an outer weatherproof and vandalproof enclosure such as provided for roadside pump stations or inside a secure room or building.

Equipment shall be protected from vandalism by selection of robust enclosure systems; galvanized steel ducts, steel cages for light fittings.

3 SITE SPECIFIC REQUIREMENTS

3.1 CCWWTP, SHUTTLE DRIVE, BROMLEY

3.1.1 Operational Staff

Where notifications are required to the Network Operator, at CCWwTP Bromley these shall be to the Shift Operator.

3.1.2 Health & Safety

Refer to the CCWwTP Safety Induction Manual for additional site specific requirements.

3.1.3 Hazardous Areas

This plant has areas classified as hazardous as per the “Hazardous Areas Classification Plan”. Gas zones are indicated by a yellow line on the bottom and a sign.

The site overhead cranes may only be operated by suitable trained operators. Site staff control the use of site cranes. CCWwTP staff trained in the use of the site cranes and will perform lifting operations where necessary.

Gas detection equipment may available for specialist jobs in hazardous areas on site.

3.1.4 Site Rules

(a) Prior to access of plant, all persons must report to the Administration Building and sign in the visitor register provided indicating date and time.

(b) All visitors (including plant inducted personnel) must obtain a pass and record their name, company in the visitor register.

(c) Always follow instructions given by the Shift Engineer.

(d) Do not go outside the fence. If access is required, advise the Maintenance Supervisor.

(e) Site speed limit is 10 km/h.

(f) Confined Space Clearances must be available at the work site. Other permits are held in the control room and signed off at the end of the day. No extension of work beyond one day is permitted without the signed approval of the CCWwTP Engineer.

(g) No plant equipment is to be operated without the Shift Engineer’s permission.

(h) The CCWwTP Control Room is to be briefed on the status of plant at the end of each work session.

3.1.5 Security

The CCWwTP site is a secure site with motorized security gates on the front entrance from Shuttle Drive and the rear entrance from Cuthberts Road. All external and some internal doors are protected and require security cards and codes for access to the site buildings. The main reception area in the Operations Building must be visited to obtain a security visitors pass. Initially contractors will need to be accompanied by a staff member to visit any part of the site. Once a contract is in place and contractors are on site to carry out contract work a revised security clearance system will be used.

3.1.6 Isolations

Plant isolations must only be performed by CCWwTP Shift Engineer or as nominated by the Shift Engineer and as recorded on the Permit to Work.

3.1.7 Chemicals

Hazardous chemicals stored in bulk (refer to location list) and used at the CCWwTP are:

- Diesel Fuel

- Polymer
- Biogas

Other chemicals are stored in lesser quantities on site.

Hazardous chemicals that are produced during the treatment of sewerage and sludge are:

- Hydrogen Sulphide Gas (H_2S)
- Ammonia Gas (NH3)
- Methane Gas (CH_4)

3.1.8 Environmental Conditions

The environment at the CCWwTP is particularly corrosive and all equipment to be supplied under this specification must take this into consideration when designing and building this type of equipment.

Specification, design and supply of equipment for installation at the plant shall allow for the following environmental conditions at the site without any equipment exceeding manufacturers recommended environmental specifications.

(a) Air Contaminants

- Hydrogen Sulphide (H2S) 2 ppm
- Salt laden air

(b) Temperature

- Highest 35ºC
- Lowest -4ºC
- Humidity 67-90%

3.1.9 Switchgear

All bare copper bars shall be Tin coated after all drilling has been completed.

3.1.10 Switchrooms

Generally switchrooms shall be positively pressurized with filtered air to minimize the corrosive effects of H_2S. To this end any user terminals shall be placed outside the protected area in a separate stainless steel cabinet that is positively pressurized using a filtered air supply. Any key board shall have a protective membrane.

3.2 POTABLE WATER SITES

3.2.1 Environmental

Ensure that the risk of Coliform contamination of the water supply is minimised during the works. Any works involving pipes or surfaces designed to come into contact with potable water (including wells) are to be confirmed as sterile by collecting a 100ml water sample and analysing the sample for absence of E. Coli and Faecal Coliforms. Contact the Laboratory Team, City Water and Waste Unit ph 03 941 5711 who will arrange for the samples to be collected and analysed. Allow 48 hours for this process.

3.2.2 Security

Drinking water standards require secured, monitored access to water treatment and storage facilities. All outer access doors and hatches shall have door switches fitted and monitored through the SCADA System. Security inputs shall be grouped into one of two combined security circuits.

3.2.3 Cable Supports

Cable tray may be galvanised mild steel for water pump stations.

Conduit shall be cast in to the roof of tanks to remove any trip hazards.

3.2.4 Emergency Generator Inlet Connection

Fit all stations that do not have permanently installed generators with a three-phase generator inlet plug. Plugs shall generally be mounted on the switchboard, provide a 150mm diameter wall penetration and new polycarbonate access box on the station wall for the entry of portable generator cables. Use a Mennekes 1454A 125A 5 pin plug or 63A, noting that as a minimum the capacity shall be sufficient to run one pump.

Single phase boards shall have a three phase plug inlet.

Note the generator inlet plug, where the inlet pins are exposed, shall have the neutral switched.

For larger main switchboards provide a Generator inlet MCCB with cable entry low at the front of the board, a removable screw fixed panel for indoor boards, busbar tabs with an extensions and 10mm bolt fixing size for temporary connection.

3.2.5 Switchboards

Shall include an integral RCD protected 15A single phase and 32A three phase (when three phase available) general plug outlet on the front or side of the switchboard,

3.2.6 Controls & Instrumentation

Shall have:

(a) Valves with 24Vdc actuators.

(b) Station flooding alarm and a common ventilation fault.

(c) Package equipment installed in pump stations shall be self-contained without need of connection to the RTU for operation.

(d) A single station mechanical over pressure switch for reticulation water delivery pressure connected into the pump control as an external fault for water reticulation pumps. This also applies to bore pumps functioning as reticulation pumps.

(e) Bore pumps pumping to suction tanks shall have the bore flow connected directly to the VSD with flow control integral in the VSD.

(f) Bore pumps shall have dual integral pump thermistor and low water probe protection as provided by the pump manufacturer. Additional low water level protection is not to be provided.

(g) Bore wells shall have level transmitters installed.

(h) Surface pumps shall be fitted with a thermal flow switch. Switch is to operate below the minimum sustainable pump flow.

(i) Where are external box is provided for marshalling to break the cable run between the tank and switchroom, provide a stainless steel termination at the base of the water tank.

(j) Tank level shall be with a hydrostatic transducer supported from a stainless steel ring and D shackle with sufficient cable looped at the top to allow the sensors to be completely removed from the tank without disconnecting the cables.

(k) Tank level shall be with a float tree. Shall be supported with conduit clips with sufficient cable looped at the top to allow the sensors to be completely removed from the tank without disconnecting the cables.

(l) Security switches on each hatch shall be wired in common as secondary security alarms.

(m) Provide differential pressure switches on sand filters.

3.2.7 Suction Tanks

These are filled from bores, either pumped or artesian, and provide potable water to the suction of reticulation pumps.

(a) 110% is defined as the overflow level, 0% defined as empty.

(b) At:

- 110% Overflow level
- 100% + 150mm High float level, turn off all bore pumps in auto
- 100% + 75mm Software high alarm
- 101% Artesian float valves close
- 100% Full
- 85% First pump call
- 80% Second pump call
- 0% + 1075mm Software low alarm
- 0% + 1000mm Low float level, turn on all bore pumps in auto
- 0% + 500mm Stop pumps, interlock auto, permit manual run

3.3 PUMP STATIONS

3.3.1 Security

External cabinets with doors shall have locking hatches at the top and bottom, with a simple “lift-to-unlock” mechanism. House all control equipment in a secure structure, generally adjacent to the pumping station. It could be placed on top of the pumping station, depending on individual site requirements.

External cabinet or building door access shall have door switches fitted and monitored through the SCADA System.

3.3.2 Design Features

Design the electrical installation to provide:

(a) Auto and manual operation of the pumps.

(b) Power supply authority kilowatt-hour metering and where AMR is not possible with addition pulse output.

(c) Wet-well level sensing to give stop/start control for the two pumps, a "high water" alarm, an “overflow” alarm and an analogue 4-20 volt output.

(d) Supervisory Control and Data Acquisition (SCADA) functions to communicate via communications link to a base station. Refer to clause 16 – SCADA.

(e) One single-phase socket and one three phase 20-amp socket, both for very intermittent use.

(f) Lighting in the control cabinet.

(g) Ensure the plant fully resets and restarts itself after power surges, blackouts and brown outs.

(h) Specify high efficiency electric motors from reputable manufacturers. Report the motor efficiency prior to ordering any such equipment.

(i) Detail smoke detectors above switchboards in all switch rooms and alarm through the SCADA, except for installations of less than 50 kW total connected load.

(j) If there is an aerial pole or a vent pole on-site within a three metre radius (top view) of the wet-well, detail a LED light near the top of the pole pointing towards the wet-well. Specify an LED light rated at a minimum 4000 lumens, cool white and housed in a security cage to protect from vandalism. Locate its manual switch inside the cabinet.

(k) Wire the equipment throughout with 250/440 volt cable. Identify the cable termination with suitable permanent markers and mark all outgoing terminals and links with identification symbols. Specify marine grade aluminium cable trays.

(l) Seal ducts between the wet well and the electrical cabinet at the switchboard end. Seal with a removable firestop plug.

(m) Inform the CCC power account manager as soon as a site with a new or reinstalled power meter is ready to be load tested, preferably during planning but as early as possible. The account manager will arrange for the retail connection.

(n) For outdoor electrical cabinets affix a stamped metal label to the outside of the cabinet indicating the pump station name and identifier.

3.3.3 Emergency Generator Inlet Connection

Fit all stations that do not have permanently installed generators with a three-phase generator inlet plug. Plugs shall generally be mounted on the switchboard, provide a 150mm diameter wall penetration and new polycarbonate access box on the station wall for the entry of portable generator cables. Use a Mennekes 1454A 125A 5 pin plug.

For larger main switchboards provide a Generator inlet MCCB with cable entry low at the front of the board, a removable screw fixed panel for indoor boards, busbar tabs with an extensions and common bolt fixing size for temporary connection.

3.3.1 Switchboards

Shall include an integral RCD protected single phase and three phase general plug outlet on the front or side of the switchboard. These shall not be mounted in front of panels that contain safety extra low voltage equipment which are otherwise safe to access.

3.3.1 Controls & Instrumentation

Shall have:

(a) Pump flow sensor:

- Thermal dispersive type
- Set to operate by dead heading the pump just above the minimum cooling flow
- Should indicate full green at design flow
- Wire to EXT FLT, requires a 10 second time delay to permit starting

(b) Battery test functionality shall be provided for the RTU noting:

- Shall only test the RTU battery

- Not to valves providing potable water – preference to avoid testing operation of equipment that may fail to recover

3.4 WASTE WATER SITES

3.4.1 Controls & Instrumentation

Shall have:

(a) Wet well level transducers shall be configured to fail to zero such that backup high level float operation is effective

(b) In commissioning run all pumps at maximum speed from high level float, record the inflow and the time to reach minimum operating level to enable correct setting of the high float level run time – test for dry weather flows

(c) At:

- 100% Set at overflow
- Invert + 200mm High float
- Invert + 100mm Second Pump Call
-
- Invert of lowest gravity incomer First pump call
- first call stop + 100mm Second call stop
- top of volute or motor, lowest as permitted by manufacturer
    - First call stop
- 0% Nominal floor of wet well

(d) Washdown pumps are manual control only, no RTU nor SCADA connection

3.4.2 Wet Well

Equipment shall be installed so it can be maintained, removed and reinstated without requiring entry into the well.

The minimum duct requirements are 2 of 100mm, for power and instrumentation.

Metal components shall all be stainless steel.

3.4.3 Environmental

Standard CCC electrical designs assume the existence of vent stacks as a preferred ventilation path for hydrogen sulphide. Specific design will be required if this is not provided.

3.5 WASTE WATER LIFT STATIONS

3.5.1 General

Cabinet shall have a concrete floor however the cabinet is not to be set in concrete.

Leave excess cable in the base of the cabinet, not the wet well.

3.5.2 Control & Instrumentation

Shall:

(a) Hydrostatic level indication permitted only for lift stations

(b) At:

- Invert First call
- Invert + 100mm High float

4 GENERAL INSTALLATION & TECHNICAL REQUIREMENTS

4.1 GENERAL

This section is for the design of Electrical Equipment Installation.

(a) Electrical Equipment includes but is not limited to;

- Switch room sizes and layout
- Doors and access
- HV switchgear and transformers
- Switch boards, distribution boards, motor load centres
- Control panels, marshalling panels, junction boxes
- Cables and cable support systems
- Lighting
- General power outlets
- Instruments
- Solar panels and power supplies
- Radio and other communication equipment

(b) Only new materials shall be used in construction.

(c) No materials used in the construction of the above shall be inflammable, hydroscopic and subject to deterioration which may compromise the safety of the equipment.

4.2 RATINGS

4.2.1 Low Voltage Equipment

Equipment supplied shall deliver rated output under the stated service conditions.

- Rated voltage 230Vac / 400Vac +10% to -6%
- Insulation voltage 500V
- Frequency 47.5 - 52.5Hz
- Impulse withstand voltage (wave 1.2/50μs) 6.0kV

Such equipment shall be suitable for connection to either of the following supplies, applicable:

- 400VAC, 3 phase, 3 wire, 50Hz.
- 400VAC, 3 phase, 4 wire, 50Hz.
- 230VAC, 1 phase, 2 wire, 50 Hz.
- 12VDC (Being phased out, only use for existing systems using 12VDC)
- 24VDC

4.2.2 11kV High Voltage Equipment

Equipment supplied for connection to high voltage AC systems (nominal system voltage 11kV) shall have the following (minimum) ratings:

- Rated voltage 12kV
- Frequency 50Hz
- Impulse withstand voltage 75/85kV
- Power frequency withstand voltage 28/32kV

The equipment shall be suitable for connection to an 11,000VAC, 3 phase, 3 wire, 50Hz supply.

All high voltage design and installation shall be carried out by an approved Orion contractor. Contact Orion for a list of approved contractors.

4.3 STANDARDS AND REGULATIONS

This Specification shall be read in conjunction with the latest edition of the following Standards or Regulations, which are deemed to form a part of this Specification. In the event of this Specification being at variance with any provision of these Standards, the requirements of this Specification take precedence over the provisions of the Standard.

Reference to any Standard or Regulation shall mean the current issue of the Standard or Regulation and include any amendments thereto or any Standard or Regulation in substitution therefore.

All materials, equipment and workmanship shall comply with the Standards or Regulations detailed in Section A, Clause 2.0 and the following to the extent that they are applicable:

- AS/NZS 2053.1 Conduits and fittings for electrical installations
- NZS 6401 Electric cables PVC insulated for working voltage up to and including 600/1000V
- AS/NZS 2293 Emergency evacuation lighting for buildings
- AS/NZS 2373 Electric cables - Twisted pair for control and protection circuits
- AS/NZS 3008.1.2 Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV
- AS/NZS 5000.1 Electric cables - Polymeric insulated - For working voltages up to and including 0.6/1 kV
- NZECP 35:1993 New Zealand Electrical Code of Practice for Power Systems Earthing

Standards or Regulations other than those listed above and in Section A, Clause 2.0 may also be applicable. In any case all materials and equipment shall comply with an appropriate national (preferably AS/NZS or NZS) or international Standard, and wiring practices shall comply with all applicable New Zealand Acts, Standards, Regulations, Codes, etc.

4.4 CABLES

4.4.1 Low Voltage Cables

Red-sheathed cables shall only be used for fire circuits.

Where abbreviations of cable types are given, they shall have the following meanings:

- Al Aluminium conductor.

- Cu Copper conductor - Unless otherwise stated all conductors shall be plain annealed stranded copper.
- MIMS Mineral insulated, metal sheathed.
- MIMS/PVC Mineral insulated, metal sheathed, PVC covered.
- PILC Paper insulated, lead covered
- PVC/PVC Polyvinyl chloride insulated and sheathed.
- TPS Polyvinyl chloride insulated, tough plastic sheathed, to NZS 6401.
- XLPE/PVC Cross-linked polyethylene insulated, PVC sheathed, to AS/NZS 5000.
- ATA Aluminium tape armoured.
- AWA Aluminium wire armoured.
- STA Steel tape armoured.
- SWA Steel wire armoured.
- COAX Coaxial cable.
- FLEX Flexible cord or cable.
- NS Neutral screened cable.

4.4.2 Conductors

The minimum size for conductors of cables for lighting circuits shall be 1.5mm^2 and 2.5mm^2 for conductors of cables for socket outlets. All conductors shall be copper.

The minimum size for conductors of cables for any other circuits (with the exception of instrumentation or data circuits) shall be 2.5mm^2. All conductors shall be copper.

Larger conductor sizes (cables) shall be used where the loading, voltage drop, situation, etc, dictates. Aluminium or other conductors may be considered, but in general copper is preferred.

All conductors of 1.5mm^2 and above shall be stranded.

4.4.3 Instrument Cables

Instrument cables include all safety extra low voltage devices. Instrument cables shall be twisted pair overall screened and individually screened where analogue and digital signals are mixed.

Instrument cable shields shall be electrically continuous. When two lengths of shielded cable are connected together (at a terminal block(s)) an additional terminal block shall be used for connecting the shields.Shields shall be isolated and insulated except at their selected grounding point. At any point of termination, the shield shall not be stripped back any further than necessary. Shields shall not be used as part of the signal circuit.

Analogue signal circuits shall be grounded at one common point. Digital signal circuits shall be either ungrounded, or grounded only at the power supply.

4.4.4 Installation

The following electrical installation requirements apply:

(a) All cables shall be installed in accordance with the manufacturer's recommendations so as to minimise failure under normal use, and any abnormal conditions that may reasonably be anticipated, including electrical fault conditions.

(b) Analogue and digital data cables and LV DC cables shall be physically segregated from all LV and MV AC power and control cables. A separation of 500 mm or more is desirable, but may be reduced to 300 mm for short distances.

(c) Care shall be taken to prevent cuts or abrasion damage to cable sheaths. Dry lubricant shall be applied to cables during pulling in to prevent welding or scuffing of cable sheaths. No cable shall (at any time) be bent to less than its minimum recommended bending radius.

(d) Cables shall not be installed where they may be subject to damage due to a subsequent work (such as nailing of linings and the like).

(e) Cables shall not be embedded directly in concrete or plaster unless knock outs are allowed for. Where it is necessary to run cable through block walls or concrete slabs and the like, any such cable shall be enclosed within PVC conduit.

(f) Plastic sheathed cables shall not be run in any situation where timbers have been treated with tar oil, creosote or allied products.

(g) Single core cables forming part of a three-phase system shall be rigidly held in trefoil formation by approved cable clamps. Such cable installations shall be capable of resisting the forces arising from any fault current that may flow in any conductor(s) without significant disruption to the cable formation.

(h) When parallel conductors are installed, they shall be of equal length and shall follow substantially identical routes. Trefoil groups of parallel conductors shall each comprise one conductor of each phase. The circuit configuration chosen shall be one of the configurations recommended in Appendix B of the AS/NZS 3008.1.2.

(i) Cable entries to equipment shall be made using appropriate glands, sleeves, or bushes. The degree of protection provided by the equipment enclosure shall not be reduced by the cable penetration(s).

(j) Cabling to equipment that is likely to move and/or vibrate during normal operation (generators, motors and the like) shall be installed with cable slack or loops that allow for the vibration and movement. In severe cases, the fixed cabling shall terminate in a junction box and the final connections completed with flexible cable.

(k) All cables shall be protected where they pass through any openings, gaps, holes, etc, by ensuring that surrounding surfaces are smooth and free of sharp edges. Where necessary holes shall be bushed with close fitting plastic bushes

(l) Cable entries to buildings shall be vermin-proof and shall be sealed to prevent ingress of gases and water.

(m) Where cables pass through fire rated walls or floors an appropriate fire barrier or fire rated sealing compound shall be used in the following (or equivalent) manner.

(n) Seal the penetration with PYROSAFE SVT universal bulkhead system, packing any gaps with FYRFYBA ceramic fibre.

(o) Small penetrations with cables that will not need to be removed for equipment maintenance may be sealed with Fire Research foaming sealant.

(p) Cables shall not be jointed without the (prior) written approval of the CCC. If permitted, joints shall be accessible and made using feed through terminals in proprietary junction boxes, with proprietary jointing kits to the approval of the CCC.

(q) Cables shall be neatly arranged on cable trays, ladder or in trunking. Twisting, unnecessary crossovers, bunching, excessive slack or tightness shall be avoided and where cables join or leave cable trays and the like, unnecessary crossovers and tangling shall be avoided.

(r) TPS wiring shall be concealed. Where this is not possible, the CCC shall approve the cable route.

(s) Where cables are supported on catenary wires, not more than five cables shall be bunched together on any one catenary wire. Cables shall be securely clipped or tied to catenary wires using proprietary clips or ties.

(t) Vertical cable rises exceeding 6 metres shall have loops or offsets to avoid differential movement between cable cores and the sheath. Provision shall be made for longitudinal expansion occurring in long lengths of MIMS cables.

(u) All cables shall have durable, waterproof labels (with unique circuit identification) fixed to them at both ends.

(v) After installation but before connection, all cables are to be tested for insulation resistance using a 500V tester for 230V circuits and a 1000V tester for 400V circuits. The results of the tests shall be recorded and supplied to the CCC.

(w) The colour of the intrinsically safe cable shall be blue, only intrinsically safe cable shall be run inside the blue cable trunking.

4.5 CABLE SUPPORT AND PROTECTION SYSTEMS

4.5.1 General

The following requirements apply:

(a) Cable support systems shall be installed in accordance with the manufacturer's recommendations so as to minimise failure under normal use, and any abnormal conditions that may reasonably be anticipated.

(b) They shall be straight and, to the greatest extent possible, either horizontal or vertical and parallel with building lines. The intent is to produce a tidy installation.

(c) Joints and accessories shall fit closely and shall be correctly matched.

(d) Care shall be taken to avoid corrosion (due to contact between dissimilar metals) at fixings and joints. Fixings and fastenings shall be of a material appropriate to the parts being fixed, the loads imposed and the locations involved. Bolts, screws, nuts, washers and other fixing components shall 316 STAINLESS STEEL ONLY.

(e) Cable support systems shall be complete with matching proprietary bonds, ties, reducers, expansion joints and jointing accessories which shall be employed as appropriate at junctions, changes of level, changes of direction, and changes of size.

(f) Cable trays and trunking shall be installed as required. Cable trays and trunking shall be filled to a maximum of 67% of their capacity.

(g) Cable ladder shall be used where four or more conduits would otherwise be run or where the additional support provided by ladder is necessary.

(h) Cable tray may be used where explicitly permitted.

(i) Conduit shall be used elsewhere.

(j) Exposed unsupported cable is permitted for the final connection to devices with a length not to exceed 150mm for instrument cable. 500mm for power cable.

(k) Conduit runs in areas accessible to the public shall be galvanized steel.

4.5.2 Cable Ladder

Cable ladder shall be fabricated from extruded aluminium sections intended for the purpose.

4.5.3 Cable Tray

Cable tray shall be fabricated from aluminium sheet. All trays shall be perforated or slotted to permit airflow and drainage of liquids.

4.5.4 Cable Trunking and Ducting

Vertical cable trunking shall be fitted with insulated cable supports to support cables at a maximum of 2.5m intervals.

Cable ducts shall be un-plasticized PVC sewer or drainage pipe (100 mm diameter or larger) complying with NZS 7649.

All fixing devices shall be of 316 stainless steel.

4.5.5 Conduit

Conduits shall be manufactured from PVC and comply with the relevant parts of NZS 2053.

Preferred conduit size is 50mm for buried direct. The minimum size of conduit shall be 25 mm and unless otherwise specified all conduits shall be one size larger than required by regulation for the number of conductors to be drawn in.

Conduit for any circuit shall be erected, completed, and swabbed out before any cable is drawn in.

Conduit shall be provided with minimum of 12 mm of cover where embedded in concrete or plaster.

Conduit runs shall be concealed where possible and installed with correctly sized saddle.

Conduits shall be installed either truly vertical or horizontal as appropriate. All runs shall be installed in a neat and tidy manner.

Install suitable draw wires where necessary.

Conduits that penetrate walls or floors of fire resisting construction shall be treated in the following or equivalent approved manner:

Seal all PVC conduit penetrations with fire stop collars.

Seal all steel conduit penetrations with PYROSAFE SVT universal bulkhead system and pack any gaps with FYREFYBA ceramic fibre.

For small penetrations with gaps less than 10 mm, seal with fire resistant foaming sealant.

4.5.6 Catenary Wires

Catenary wires shall be galvanised steel of 2.5 mm diameter (minimum), securely fixed to at each end and supported at intermediate points as required. Catenary wires shall support cables clear of all structures, services and other equipment.

Turnbuckles of a suitable size to permit future adjustment shall be provided.

Separate Catenary wires shall be employed for mains voltage electrical services and for telecommunication, signalling, or data cables. Maintain a minimum distance of 50 mm between catenaries, or 150 mm between mains and other Catenary wires.

4.6 CABLE JOINTING

Cable joints shall only be permitted with the (prior) written approval of the CCC.

All joints and terminations shall comply with the cable manufacturer's recommendations. Joints shall be carried out using:

- Proprietary jointing kits

- Prefabricated junction boxes
- Underground jointing chambers
- Termination pillars
- Compound filled boxes.

Cables shall be supported so that no weight or stress is transferred to the joint. The method of supporting the joint shall be to the (prior) written approval of the CCC.

Only workers experienced in all aspects of the proposed jointing work shall make the joint. A CCC representative may witness the work, and if (in his opinion) the work is unsatisfactory, may require remedial work on all other joints made in a similar manner.

Proprietary bimetallic links or lugs shall be employed where cables of different conductor materials are to be jointed. All components and materials used in a cable joint shall be selected to avoid corrosion due to contact between dissimilar metals.

The enclosure of any completed joint shall be compatible with the location of the joint and in particular shall prevent inadvertent contact with line conductors or the ingress of moisture, vermin or other harmful substances. The use of self-adhesive tape as the sole means of insulating and sealing a joint is not acceptable.

4.7 CABLE TERMINATIONS

4.7.1 Cable Glands

Armoured cable terminations shall be fitted with appropriate metal cable glands that shall grip the cable securely and seal on the outer sheath of the cable. The glands shall be complete with matching lock nuts and shall include provision for securely bonding the cable armour to earth.

PVC/PVC, XLPE/PVC and NS cable terminations shall be fitted with suitable sealing glands. These shall grip the cable securely and seal on the cable sheath.

Cables run in hazardous areas shall be fitted with the appropriated ‘Exe’,’Exd’ and ‘Exn’ gland.

4.7.2 Cable Terminations

Cable terminations shall be made with correctly sized crimp or compression lugs, fitted according to manufacturer's instructions and recommendations using proprietary crimping tools or presses with correctly sized dies.

Torque lug terminations may be made with prior approval and providing the staff carrying out the terminations have specific training regarding the system being used.

Terminals shall not support the weight of cables, and cable terminations shall not be under mechanical stress.

Aluminium conductors shall be terminated using only proprietary bimetallic lugs or links.

All conductors shall be terminated sequentially and (for multi-core control cables) unused conductors shall be terminated so that the sequence is unbroken.

4.8 UNDERGROUND CABLING

4.8.1 Excavation

Underground cable installation shall include all necessary clearing, excavating, disposal of spoils, temporary supports, baling, pumping, the provision of bedding material, cable laying, protection, backfilling, marking and reinstatement.

Prior to the commencement of excavation the locations of all existing services near the proposed cable route shall be marked. Any existing facilities that are damaged during the course of the work shall be repaired and reinstated to the CCC's approval.

4.8.2 Cable Laying

Cables shall be laid in compliance with the requirements of the NZS Wiring Rules (AS/NZS 3000), NZECP 28 and Orion Technical Specification NW72.22.01.

Cables shall be bedded in clean sand with minimum depth of bedding of 50 mm below the cable and minimum cover of sand above the cable of 50 mm. The minimum depth of cable shall mean the perpendicular depth from final finished surface level to the top of the buried cables.

Conduits or ducts shall be provided at the depth(s) shown on the Drawings. Long radius sweeps or bends shall be used for all changes of direction. Elbows will not be accepted. Install draw wire into all ducts.

A PVC cable marker strip shall be placed (during backfilling) along the full-buried length of cables at the depth shown on the Drawings. This shall be coloured orange for all cables in excess of extra low voltage. Other appropriate colours shall be employed for signal, data and telecommunications cables.

Underground cable joints shall be avoided wherever possible. Where unavoidable, underground cable joints shall be permitted only with the (prior) written approval of the CCC.

All exposed ends of underground cables shall be capped and sealed until properly terminated, to prevent the ingress of moisture.

A loop or slack section of cable shall be left at each side of a road or traffic way to allow for settlement of the road without stretching the cable.

Plaques shall be provided to identify the points at which buried cables enter the ground. These shall be securely fixed to the structures or external walls of buildings from which the cables enter the ground.

4.8.3 Backfilling

Backfilling material shall be free of stones, debris, rubbish, etc., and shall be placed, and thoroughly compacted in 200 mm (loose) layers. The surface shall be made good so as to match the original adjacent surface(s) in accordance with CSS: Parts 1-7.

The CCC may inspect Cable joints and installation and Trenches shall not be backfilled until the CCC has given approval.

4.9 CABLE MARKING

All cable and cable cores including marked multicore cables shall be marked with the cable designation and wire number as shown on the cable schedules and device circuit / wiring diagrams.

Markings should be made at each end of the cable and at each termination.

Cable shall be marked on each side of any termination, inside any cabinet or junction box and at any field termination.

The marling system shall be attached by an approved method such cable ties and clear housings threaded onto the cable.

4.10 LUMINAIRES

Indoor Luminaries shall not be installed until the building is weatherproof.

Where luminaries are to be recessed into building work, openings shall be correctly sized and provision made for maintenance access if required.

Luminaries' erected in rows shall be geometrically straight and at the same level except if otherwise shown on the drawings.

Luminaires shall be cast aluminium, plastic, polycarbonate. No outside fitting shall be of ferrous material.

Outdoor luminaires not to be controlled from a PIR, preferred operation from an indoor switch.

Lamps shall be LED.

External light fittings shall be installed in vandal proof cages where publically accessible.

4.11 GENERAL PURPOSE OUTLETS AND ISOLATORS

Shall be mounted in accessible locations. Generally at 1m above finished floor level or ground level.

4.11.1 Socket Outlets

Socket outlets in domestic or commercial situations shall be mounted at a height of 0.30m above finished floor level, or 0.20m above benches. In industrial situations (factories, switch rooms, plant rooms and the like) they shall be mounted 1m above finished floor level.

Mounting shall be directly to walls or in flush boxes or gray polycarbonate mounting blocks as applicable. Where perimeter trunking is installed, socket outlets shall be mounted in the top section.

Three phase switched socket outlets shall be surface mounted.

4.11.2 Fixed Outlets

Fixed outlets shall be installed for permanently connected equipment such as hot water cylinders, auto-doors, roller shutter doors, hand dryers, etc, and shall be mounted 1m above finished floor level, or 0.15m above benches.

Single phase fixed outlets shall be gray polycarbonate, complete with isolator.

4.11.3 Outlet Boxes

In timber-framed walls, switch and socket outlet boxes shall be fixed to dwangs, noggins or studs to provide the necessary support.

Where boxes are in block work or in concrete, steel galvanised boxes shall be used. They shall be sealed to prevent the ingress of cement slurry and securely fixed to prevent movement during concreting. They shall be examined (as soon as possible) after concreting, and cleaned out and protected against corrosion as necessary.

4.11.4 Special Purpose Outlets

A label stating the purpose for which the outlet is intended shall clearly and permanently identify each special purpose outlet.

Outlets which supply at any voltage or frequency other than 230V, 50Hz, shall have pin configurations which will not accept the standard 10A, 230V "crows foot" (AS/NZS 3112) plug most commonly used in New Zealand.

4.12 VARIABLE SPEED DRIVES (VSD)

VSDs shall be installed in IP54 enclosures with integrated EMC filters and conformal coated electronics.

The drive shall be connected to the site Ethernet. Communications shall be Modbus TCP. Communications shall be information only. The drive shall be configured so that failure or disconnection of the Ethernet has no impact on the process operational of the VSD.

All manufacturers' installation recommendations (including those relating to RFI suppression and EMC requirements) are to be followed. These recommendations normally include effective earthing for high frequencies, screening, and the use of specialist VSD cables.

VSD motor cable screens shall be clamped by 360 degree glands or conductive (copper) cable clamps or saddles onto the unpainted steel switchboard equipment trays or VSD chassis. Cable screens shall not be coiled into pig tails.

Non-submersible motors shall have cable screens clamped by 360 degree 'EMC' glands. The gland shall make conductive contact with the motor metal chassis around the entire circumference. Cable screens shall not be formed into a pigtail.

The motor shall have a conductive (EMC) gland fitted to the terminal box, and the cable screen terminated to the gland. The paint shall be stripped from the terminal box to achieve a 360° contact between the gland and the box.

Where a screen also serves as the PE (protective earth) conductor, the cable shall have EMC clamping as described in this specification, and shall also have the screen beyond the camp twisted into a pigtail. A green/yellow sleeve shall be applied to the pigtail. The pigtail shall be longer than the live conductors, so that if the cable is pulled from the equipment the PE conductor shall be the last to be tensioned.

RF emissions shall not cause significant interference to local receivers. RF emission levels shall comply with the requirements of the Radio Communications (Radio) Regulations 1993.

The Electrical Contractor / Systems Integrator shall engage Schneider Electric New Zealand to pre-commission the drives and provide a performance guarantee for the configuration.

Cables shall be terminated at the VSD and at the motor with a metal gland. The cable screen shall be clamped by the gland so that it is bonded to the VSD enclosure and to the motor terminal box around the entire circumference of the cable.

Metal saddles on the VSD are acceptable if the VSD vendor confirms in writing that EMC compliance will be achieved by bonding the screen in this manner.

Motor cable earthing conductors shall be connected to the equipment dedicated earth terminal at both ends of the cable.

Specified Variable speed drive cables shall be glanded using VSD cable glands as specified by the cable manufacturer.

4.13 SWITCHBOARDS & MCCS

Switchboards and MCCs shall be levelled and installed with all vertical surfaces at ninety degrees to the horizontal plane.

Care shall be taken to ensure that mechanical damage does not occur during unpacking and installation. Particular care should be taken to ensure that floor trenches are bridged so that the switchboard or MCC cannot fall in during installation manoeuvres.

Switchboard shall be located to enable ease of cable installation to achieve recommended cable bending radii.

Cable access to the switchgear shall be via aluminium earthed gland plates 5 mm thick. All cables, where practicable, shall be glanded with the correct compression gland. All cable entry point shall be sealed to prevent ingress of vermin and insects.

4.14 VALVE ACTUATORS

Valve actuators will be provided as part of the Mechanical works. All materials to electrically connect**,** control and convey cabling are part of the Electrical contract.

Actuators should be equipped with the following:

- 3 Phase motor (24V DC may be appropriate in particular applications)
- 24v dc controls
- AUTO OFF MANUAL and OPEN, STOP and CLOSE pushbuttons
    - OPEN and CLOSE are latching, stop not required unless valve may need to be operated at an intermediate position
- Open and close limit to terminals
- Open and Close Torque limits to terminals
- Command to Open and Close terminations
- Valve fault change-over relay contacts to terminals

Selected actuators will have position feedback and analogue positioners.

Where actuators are mounted in hazardous areas they shall be connected with the appropriate Ex glands.

4.15 MOTORS

Pump motors shall be 3 phase for pumps 3kW or above.

Motors shall be high efficiency IE3 to IEC 60034-30:2008.

4.16 SWITCHROOMS AND DOORS

4.16.1 General Arrangements

General arrangement drawings shall be produced for switch rooms prior to confirmation of the building layout. These shall include all electrical equipment to be installed in the room including:

- Switchboards – sizing based on site specific load lists
- HMI shall be located adjacent to the personnel entry door
- Starters – Soft Start and Variable Speed Drives
    - Shall be grouped together, not with each pumps
    - Shall be numbered left to right
- Starter Control Stations
- Control System RTU Cabinet
- Lectern / Shelves for site documentation
- Active Harmonic Filter
- Generator inlet point – where a plug inlet is used
- Spare space for any identified future provision
- Spare space, 15% of the wall space
- Any other equipment required in the room

4.16.2 Doors

Switch room doors shall be 200mm higher than the maximum height of any switchboard or item of electrical equipment. Minimum heights are:

- Single door, 2200mm
- Double door, 2550mm

Holdback devices shall be provided for all external doors for switch rooms or switchboard cabinets. These shall automatically latch when the door is sufficiently open and include a manual release to permit closing.

4.16.3 Instrumentation

Switch rooms shall include:

- Analogue temperature sensor, mount so as to avoid unrepresentative readings
- Where H2S conditions may occur:
    - Door limit switch set to alarm after 30 minutes open
    - Analogue differential pressure sensor on clean air supply set to alarm on low (fan off) and high (filter blocked) pressure

4.17 MACHINE SAFEGUARDING – EMERGENCY STOP

Machine Safeguarding shall be assessed according to AS/NZS 4024 to determine the appropriate performance level. Safety systems, specifically Emergency Stop pushbuttons, may only be installed where this is required to meet the safety performance level.

4.18 BATTERIES

Batteries shall be restrained on all three axes.

Battery terminals shall be fitted with insulating caps.

Standard battery sizes are: 40Ah, 80Ah, 120Ah. Select batteries to achieve 30 minute battery backed operation.

4.19 DC POWER SUPPLIES

In general DC power shall be supplied by a battery backed charger. These shall:

(a) MCB rating supplying the charger shall be appropriately sized for initial combined charging and load current.

(b) Float charge at 27Vdc

(c) Alarm at 23Vdc

(d) Shall disconnect load at 21Vdc

(e) DC power supplies without battery backing

    a. shall only be permitted for localised device requirements where communications is not required

    b. shall include minimum power conditioned feed

(f) Fault indication

(g) Provide MCB protected DC circuits to:

a. Each cabinet where the DC supply feeds multiple cabinets

b. Individually within a cabinet to:

    i. RTU or PLC

    ii. Communications devices

    iii. Analog inputs

    iv. Analog ouputs

    v. Digital inputs

    vi. Digital outputs

c. Individually for DC loads outside of a cabinet

4.20 OPERATING PANELS

As a general requirement all operating panels shall be mounted such that the centre-line of the display is at 1600mm AFFL. Note that this also imposes a mounting height requirement on the containing device. For example a VSD with an integrated HMI panel needs to be mounted so that its control panel meets this height requirement.

4.21 EARTHING

Provide a connection to the building foundation reinforcing steel and rebar. Connections to be provided through exothermic welding and connecting earth lead cast in concrete.

Note that soil conditions and foundation size may not be sufficient to meet the maximum earth resistance and additional driven earths may also be necessary.

5 SWITCHBOARDS AND CONTROL PANELS

5.1 GENERAL

Electrical Switchgear includes but is not limited to;

- Main Switchboards
- Main Power Distribution Centres
- Motor Load Centres
- Motor Control Centres
- Distribution Boards
- Control Panels
- Marshalling Boxes
- Junction Boxes

Only new materials shall be used in construction.

No materials used in the construction of the above shall be inflammable, hydroscopic and subject to deterioration which may compromise the safety of the equipment.

Operator controls shall be provided in an otherwise dead front panel, without direct access or exposure to terminals, terminal covers, contactors, etc with the exception of their operating panels designed to protrude through the front of a masking panel.

Switchgear operator panels shall be logically laid out and labelled. Internal components shall be appropriately protected from accidental touch and the whole unit shall form a neat and functional unit.

Switchgear shall not be installed underground.

5.1.1 Switchgear Standards

Switchgear shall be 3 phase, 4 wire with MEN earthing.

All equipment installed shall adhere to the relevant AS/NZS, BS, NZS, NZECPs or IEC standard covering that particular product. In no circumstances shall products or fabricated equipment be installed that is not manufactured to acceptable standard types as quoted in the New Zealand Electricity Regulations and AS/NZS 3000

The following Common standards for this type of work are:

- AS/NZS 3439.1 Low Voltage Switchgear & Control Assemblies
- AS/NZS 3439.3 Low Voltage Switchgear & Control Assemblies
- AS/NZS 3100 Approval and test specification – General Equipment requirements for electrical equipment
- AS/NZS 3760 In-service safety inspection and testing of electrical equipment
- AS/NZS 60947.6.2 Low voltage switchgear and control gear
- AS60529 Degrees of protection provided by enclosures.
- NZS 4203 Seismic Loadings

5.1.2 Exceptions and Deviations

The contractor shall list in his tender all exceptions and deviations from the requirements of this document including any alternative materials or equipment layouts.

The contractor shall provide the following information with the tender;

(a) Switchgear Layout

(b) Weight and dimensions

List of proposed equipment that differs from specified equipment

5.2 TECHNICAL SPECIFICATION

5.2.1 Switchgear Ratings

Switchgear ratings shall be suitable for at least 125% of the maximum demand.

5.2.2 Cabinet Construction

The following general statements apply where switchgear is designed by the contractor or sub-contractors.

(a) Equipment cabinets shall be manufactured from metal.

(b) Main panels are generally floor mounted.

(c) Small wall or field mount panels may be made from a non-metal material.

(d) Small control panels and distribution boards are generally wall mounted.

(e) Switchgear shall be Type Tested Assemblies (TTA) or Partially Type Tested Assemblies (PTTA).

(f) Where a special cabinet base is required it shall be a welded steel 'I' section or channel, galvanized and painted. It shall be supplied with appropriate clamps. Base shall have provision for insertion of 50 mm diameter pipes through the width of the base to assist lifting with fabric strops.

(g) Where required, cabinets shall have anti-condensation heater installed complete with a thermostat.

(h) An exhaust fan and thermostat shall be installed where temperatures are capable of reaching 40°C. Dedicated exhaust ducting shall be provided for equipment capable of generating exhaust temperatures in excess of 45°C. Air conditioning units may be used in lieu of forced ventilation in some cases.

(i) Ventilation design shall be supported by heat calculations including solar gain where this may be an issue.

(j) Cabinets shall be provided with lighting in large control cabinets and be activated by a door mounted microswitch.

(k) The switchgear IP rating shall be suitable for the environment where it is installed.

(l) Design shall include for segregation of voltages where possible including separate cabinets and ducting to segregate 400/230V AC from 24/12v DC circuits.

(m) A Name plate label shall be attached to each main item with engraved text as shown below:

- Manufacturer and contact details

- Serial Number
- Voltage ,Frequency and Current Rating
- Form of Segregation (Form xx)
- Form of Protection (IPxx)

(n) Form of construction per AS/NZS 3439 to be agreed with the Capital Program Group Electrical Engineer or as consistent with the CCC provided Standard Design for the type installation.

(o) All cabinets Doors shall be labelled indicating cell function.

(p) All metalwork shall be painted. Finishing shall include degreasing, etch priming, undercoating and 2 coats of final colour. Final colour is dependant of type of metalwork used if Type Tested equipment is used. PTTA metalwork shall be Cream Ripple.

(q) All metalwork shall be bonded using earth bounding cables.

(r) Cable glanding plates shall be Aluminium.

(s) Equipment Gear Plates shall be painted mild steel or industrial Formica.

(t) Access to Bus Bar chambers shall be though removable panels secured with fixings requiring a tool to remove them.

(u) All Bus Bar and other access panels shall be easily accessible without isolating the switchgear. All panels shall be suitably labelled identifying the danger of removing such panels.

(v) All live metal work shall be suitably shrouded to avoid accidental touch by operators carrying out routine inspection or maintenance work.

(w) Switchgear metal work shall be designed to allow expansion in length and ease of replacement or modification of cabinet configuration.

(x) Cabinets shall be laid out to ensure a logical flow from mains voltage device to low voltage devices.

(y) All doors shall open in the same direction where practicable and be capable of having key locks or latches fitted without changing the door.

(z) Door openings shall allow the withdrawal of any component inside the cabinet without the removal of other components inside that cabinet.

(aa) All terminals for all devices shall be wired to terminals, excepting small light and power circuits wired directly to miniature circuit breakers; these do not count as spare space.

(bb) All cores for all cables shall be wired to terminals; these do not count as spare space.

(cc) Provide for 20% spare space for all elements.

(dd) 24Vdc controls shall be used, not 230Vac.

(ee) Height not to exceed 2200mm.

(ff) Depth shall not be less than 400mm.

(gg) Switchboard design shall include provision for access and maintenance of all components. For single sided boards this included provision for access to all current carrying elements from the front of the board.

(hh) Metering cabinet, integral DB, flow meters and instruments intended to be read shall be located above 1,000 above floor level or surrounding ground level.

(ii) Doors requiring tool access shall use a slot suitable for a large flat-head screwdriver.

(jj) Doors accessing safety extra low voltage (24Vdc), sealed metering equipment, dead front local distribution boards shall use a hand toggle.

(kk) CT chambers shall have a clear cover and be arranged so that CT ratios and connections are visible.

(ll) Dead front MCCB controls shall be accessible at the face of the switchboard.

(mm) Equipment shall not be mounted on the back of doors.

5.2.3 Switchgear Equipment and Installation

The following general statements apply where switchgear is designed by the contractor or sub-contractors.

(a) Switchboards shall be Form 3B, 4A or 4B.

(b) Bars shall have colour coding to identify Phases.

(c) All bus bar mounting shall comply with a type test rating and certification must be provided at time of tender.

(d) All holes shall be de-burred and joints filed flat.

(e) Bus Bar connections shall be secured with constant pressure washers.

(f) All copper bars shall hard drawn high conductivity copper specifically manufactured for this purpose.

(g) Equipment shall be laid out to achieve the best use of the space while maintaining a logical layout and flow.

(h) All equipment shall be Din rail mounted where possible.

(i) Cable trunking shall be open slot type, closed slot will not be accepted. Trunking will be mounted horizontally and vertically to achieve a logical flow of cabling between

(j) Components and trunking spacing shall allow adequate space for cable numbering and attachment of cable ferrules.

(k) Components attached to the gearplate directly shall be by screws in the threaded holes, blind rivet nuts, or bushes. Use only slotted, posi-drive or Philips headed screws. Hex head drive self tappers are not acceptable. Pop riveting is only acceptable to attach PVC trunking systems and DIN Rail.

(l) All components shall be labelled with the name as shown on schematic diagrams. Self-adhesive and engraved labels are acceptable attached to trunking where there it is impractical to attach to gearplate.

(m) Mains voltage and low voltage relays shall have different base configurations. 230v control relays shall be round base pin configuration while low voltage bases shall be rectangular.

(n) All field wiring shall be terminated in terminal blocks mounted on DIN rails. All terminations shall be labelled as per the number shown on the drawings.

5.2.4 Switchgear Equipment Wiring and Cabling

Wiring shall be carried out in a neat and systematic manner and shall not be possible for any cables or wires to contact sharp or rough edges that may damage sheath or wire insulation.

Wiring shall be contained within closed slot trunking open slot trunking will be rejected.

Control cabling inside trunking shall occupy up to 50% of the capacity of the ducting.

All control wiring conductors up to 4mm² shall have Starfix crimp ferrules or similar.

Conductors of PVC insulated panel wiring (other than instrumentation, communications and data circuits) shall be flexible and adequately rated for the circuit loading. In any case conductors will have a minimum cross sectional area of 0.75mm².

Segregation or shielding shall be provided between instrumentation, communications, data, 230VAC, 400VAC, 24VDC and 12VDC circuits and associated terminals.

All terminals for incoming/outgoing circuits for control, data and communications shall be mounted in accessible positions that are also convenient for cable termination.

Cable jointing inside trunking is not permitted. All jointing shall be carried out at terminal blocks.

Solder joints and solder tinned cable ends into terminals are not permitted.

No more than two conductors shall be terminated in any one side of any terminal. Each wire shall be labeled. Whenever possible shorting straps or combs shall be used to bridge identical terminals. Terminal bridging strips shall be insulated or covered.

Wiring to doors shall be anchored at the panel side and be of sufficient length to enable the door to swing fully open without strain on the wiring.

All cables, wires and conductors shall be labelled, with both an overall cable label and individual core ferrules.

Cable colour coding shall be as follows;

- 3Ph/1Ph Red/White/Blue
- 230v control White Appliance wire
- Neutral Black
- Earth Green/Yellow
- RTU inputs Orange
- RTU outputs Purple
- PLC Inputs Orange
- PLC Outputs Purple
- 12v DC Pos Red
- 12v DC Neg Grey
- 24v DC Pos Pink
- 24v DC neg Grey-common with 12v Neg
- 24VAC Phase Brown

- 24VAC return Brown
- 4-20mA Pos – White/red, Neg- Black
- Intrinsically safe Blue

5.2.5 Control Cabinets

Control Cabinets shall be separate to the switchboards. These shall be constructed to facilitate replacement of the control cabinet separately to the replacement of the switchboard.

Designers shall follow CCC standard panel layouts which CCC will provide on request.

Control cabinets shall have no exposed Low Voltage (230Vac) inside the cabinet. The only permissible 230Vac connections inside the Control cabinet are:

- GPO outlet – suitable for connection of programming terminals
- Permanent connection to battery charger terminals

All other electrical connections inside the cabinet shall be Safety Extra Low Voltage (nominally 24Vdc).

5.3 MOTOR STARTERS

5.3.1 General

Motor starters shall be fully operationally functional without communications. Ethernet communications may be provided to add additional information, however it shall not be used for control and control shall continue without.

Detail soft starters if variable speed drives are not used. Ensure variable speed drives don't "hunt" between pumps.

Specify pump motor controls with the ability to ramp the start and stop times to prevent high and low pressures on start-up and shut down. Set the ramp rates from the following conditions excluding under power failure, unless surge transient analysis dictates alternative rates:

(a) Determine the pump's minimum flow and the corresponding minimum operating RPM.

(b) Ensure the pump ramps up to the minimum operating speed at 10% of the total frequency range/sec (5 Hz/sec).

(c) Limit the rate of change above the minimum operating speed to 2% of the total frequency range/sec (1.0 Hz/sec) when accelerating or decelerating.

(d) On shut down, the ramp rate below the minimum operating speed should be approximately 10% of the total frequency range/sec (5Hz/sec).

Confirm any alternative rates are acceptable with the equipment supplier.

All starters shall include:

- A rotary lockable isolator
- A starter control panel including:
    - Motor description and tagname matching a label on or with the motor
    - A copy of the motor nameplate on the control panel door for submersible pumps
    - Auto Off Manual selector (note the order is also prescribed)

        - Auto – Motor starts on a command from PLC, high float (if present) or control circuit
        - Off – Motor does not run
        - Manual – Motor runs
    - Green running indication
    - Red fault indication
    - Blue pushbutton with inset white R, may mechanically reset the fault
    - Remote reset
    - 24v DC Control relays
    - Ammeter – digital
    - Thermistor protection (>10kW)
    - Overload protection
- Starter control panel shall be mounted with the active device, i.e. in a dedicated panel immediately adjacent to the active device. Where space limitations apply these may be installed on the switchboard.

5.3.2 Direct on Line

Note Orion Network code bans DOL starter for motors over 4kW unless agreed with them. Check the specific limit with Orion for the area as in parts of the network a lower limit is applied.

Direct on line starters shall be configured to include the following equipment;

- Fuses or MCB
- 24v DC Contactor
- Adjustable electronic Overload

Or a combination isolator / circuit breaker system.

5.3.3 Soft Starters

Soft starter shall be configured to include the following equipment;

- Bypass contactor
- IP 21 for mounting inside switchboards and IP 54 for wall mounting
    - IP 54 wall mount for motors above 4kW
- Soft Starter Control HMI Pad
    - Shall be provided for motors above 4kW
    - Configure to display current and run hours
- Modbus TCP Ethernet communications
    - shall not be used for control

- control shall continue to work with Ethernet disconnected

- External fault conditions shall be wired to the starter Ext Flt connection

5.3.4 Variable Speed Drives

Variable Speed Drives shall be configured to include the following equipment;

- 24v DC Control relays
- Maximum Transient Current 165% for 2 sec/ 150% for 60 seconds.
- IP 20 for mounting inside switchboards and IP 54 for wall mounting.
- VSD Control HMI Pad
    - Configure to display current, run hours and speed (if 3rd option available) in default display
    - Quarter turn manual speed potentiometer
- Modbus TCP Ethernet communications
    - shall not be used for control
    - control shall continue to work with Ethernet disconnected
- Speed reference to VSD shall be 4-20mA
- Actual speed to RTU shall be 4-20mA
- External fault conditions shall be wired to the starter Ext Flt connection
- Current limiting shall be set no higher than 105% of the motor name plate rating – except during starting when the current limit shall suit starting requirements

5.4 VENTILATION AND AIR CONDITIONING

High temperature point heat sources with integral cooling fans shall be individually ducted outside with an acoustically lined duct with a 90degree turn. This includes:

- Active harmonic filters
- VSDs

All panels containing heat producing devices shall be equipped with ventilation to ensure equipment is not subjected to temperatures above 40ºC. Where cooling air is drawn in from outside attention must be made to the air quality. Filtering of air shall take place where the ambient level of H_2S exceeds 1ppm and electronic equipment is to be installed.

Outdoor equipment shall be installed in vandal proof cages and isolators installed inside the building when the equipment is installed in publically accessible locations.

5.5 FACTORY TESTING

Type Test Certificates shall be available for inspection by the Engineer if requested but should be supplied in the Operations and Maintenance Manual.

Factory Acceptance Testing shall be carried out by the contractor in the presence of the Engineer. However routine testing shall be carried out before the official Factory Test.

Testing shall be carried out in accordance with a written test procedure. A completed copy shall be provided to the Engineer before the start of testing.

Routine Testing shall include, but not be confined to, the following;

5.5.1 Power Off

- Mechanical test to ensure all fixings and fitting are secure and bolts torqued where necessary. Doors open and close freely and all internal equipment is accessible and secured in the correct manner.
- Doors and equipment are able to be locked where required.
- Door interlocks with MCCSs, fuse switches and isolators is effective and interlocks are defeatable.
- Layout check to ensure the panel layouts on and inside the panels are as per construction drawings.
- All connections on power and control circuits are tight and all wiring is protected.
- The ratings of the switchgear is as specified.
- A point to point test has been carried out on all power and control wiring.
- All wiring, internal and door mounted equipment is labelled.
- On a unit with Bus Bars, a HV test as specified has been carried out and results recorded.
- The requirements of metering are as specified.
- The equipment is as specified or approved as an alternative.
- Cable sizes, colours and installation are as specified.
- Earthing is continuous and of the correct size and is labelled as required.

5.5.2 Power On

Power On testing shall only be carried out with all circuit breakers, isolators, Fuse Switches and fuse terminals in the open position. All equipment shall be turned off and all automatic devices and switches turned to OFF.

Power On testing is carried out to ensure that all relevant equipment is supplied by the correct voltage supply. Any damage cause to equipment that is caused by incorrect wiring shall be renewed at the cost of the contractor.

The Contractor shall systematically liven circuits to check that power supply outputs are correct, that any non mains powered equipment has the correct supply and to enable any programmable devices to the set up.

Once Power On testing has been completed all devices shall again be isolated.

5.5.3 Factory Acceptance Test

Factory Acceptance Testing is carried out in the presence of the Engineer or his representative. The contractor shall supply all certification, marked up As Built drawings and completed test sheets.

He shall supply all test equipment and demonstrate the function of the switchgear as required. At the completion of testing the Engineer will present the contractor with a list of defects or sign the test sheet.

At the completion of testing the contractor shall set all devices to OFF and package the switchgear ready for delivery. A set of marked up As Built drawings shall accompany the switchgear.

5.6 DELIVERY

At the completion of testing the contractor shall set all devices to OFF and package the switchgear ready for delivery. A set of marked up As Built drawings shall accompany the switchgear.

The wrapped switchgear shall be labelled as follows;

- Delivery address
- Contact person and phone number on site

Switchgear shall be packaged to suit the delivery and off-loading method.

5.7 APPROVALS

All design drawings shall be approved for construction by at least one of the following

- the CCC Principal Electrical and SCADA Engineer
- the Plant Manager
- the Operations Manager

Approval shall be recorded by way of an Electronic Stamp applied by CCC to each drawing.

6 INSTRUMENTATION

6.1 PRELIMINARY

This specification is for the Supply and Installation of Instrumentation.

6.2 GENERAL

This specification includes for the supply, installation, cabling, labelling, setting up and commissioning of any instrument for measuring plant parameters installed within the plant.

It does not include for the integration of the instrument in the automation system or the inclusion of the instrument output into the SCADA system. It does include for connection to the nearest Network PLC to the instrument.

6.3 DESIGN AND SELECTION

The Process Engineer (PE) will produce a P&ID showing the location of the instrument in the process. The PE will also produce a Functional Description of the instrument for the SCADA Engineer and filing within the Councils Asset management System.

The instrument will be selected by the following criteria;

- Known brand
- Compatibility with other plant instrumentation
- Robustness and durability
- Field wiring accessibility
- IP Rating and or hazardous area rating
- Suitability for the task
- Mechanical construction
- Reliability
- Repeatability
- % Error and accuracy
- Mounting system
- Proven measurement technology
- Industry standard outputs and network communications compatibility.
- Local display and operation
- Programming and local trending capability
- Ease of calibration and self-diagnostics.
- Communications protocol support
- Programmable features such as engineering units displayed

While all of these features are not applicable to all instrumentation they are to be taken into account where applicable when selecting new instrumentation.

6.4 MOUNTING

Field instruments shall be mounted as specified by the manufacturer in an accessible location for installation and maintenance. Instruments shall not be mounted on removable items such as hand rails, vibrating equipment without suitable damping or cable support systems. Instruments shall be mounted in a safe position removed from hazardous, hot, corrosive and high positions where possible. Where this is not possible consideration should be given to the supply and installation of remote transmitters located in 'safe' areas.

Consideration should be given to the location of the instrument to see that it is accessible for calibration, servicing and maintenance without providing special devises to access it.

6.5 STANDARDS

Supplied instrumentation shall comply with the relevant standards related to the type of measurement being carried out. The Engineer shall be aware of what the relevant standards are for the specific instrument being supplied.

Standard Signals

Parameter	Protocol	Output	Power supply	Notes
Level	HART	4-20mA	24v DC or loop	HART where available
Flow	HART	4-20mA	24v DC or loop	HART where available, flow pulse and reverse flow indications
Pressure	HART	4-20mA	24v DC or loop	HART where available
Temperature		4-20mA	24v DC or loop	
Proximity	N/A		24vDC	

Where it is not possible to use 24DC a 230v RCD protected circuit may be used.

6.6 FLOW METERS

6.6.1 General

The installations must follow the manufacturer's installation guidelines allowing for appropriate clear pipe upstream and downstream. Where no data is provided then 5 diameters upstream and 3 diameters downstream shall be provided.

Where practical flow meter installations are preferred above ground in a secure location.

Under normal circumstances, flow meters will be buried direct in the location directed by the Engineer with upstream/downstream clear pipework in accordance with the manufacturer's specifications.

The flow sensor will be installed in the pipeline complete with earthing rings. The sensor earthing shall be bonded to the transmitter in the switchboard (by others) by bringing an additional 6mm2 earth cable back alongside the signal cable.

The flow sensor will be wrapped in 'denso' tape (600), followed by 'denso' PVC overwrap tape (931), ensuring that the body, terminal box, flanges, and bolts are completely covered.

The void around the sensor will be back filled with a packing sand mixture.

If the sensor location is subject to heavy traffic, then a form of 'U' shaped concrete box culvert will be installed above the sensor to avoid any external weight on the coil housing.

The flow sensor installation will be verified and signed off by an Independent Verifier approved by both Christchurch City Council and Environment Canterbury, prior to back-filling for buried flow meters.

Following installation the flow meter accuracy is to be verified while buried by utilising the flow meter manufacturer's proprietary verification tools and software packages

6.6.2 Design Duty

The design maximum flow rate for the pumping station/each of the wells is + m3/hour. The actual flow rate will vary from + m3/hour to maximum flow depending on demand.

The pipework either side of the flow meter will be designed for the maximum station capacity of + m3/hour and is expected to be 250 mm or 300 mm diameter.

6.6.3 Magnetic Flow Meter

The flow meter(s) shall have prior type approval by the Christchurch City Council Assets Management Team for use on Christchurch City Council Wastewater and Water supply pumping stations. The minimum requirements for the flow meter are as follows:

(a) Electromagnetic type.

(b) Supplied with remote head complete with wall mount kit displaying:

- Flow rate in m3/hr - analogue.
- Flow total in m3 – backlit lcd, non-resettable. Read via HART communications
- Flow range 0 - + m3/hr (max flow + 25%)

(c) External connections required for SCADA are:

- 4-20 mA (rate) with HART superimposed over.
- Pulsed output (total) – 5 kHz pulses at flow of 1.2 x flow limit x m3/hr rounded to nearest 100. (Shall be capable of 5 kHz pulses minimum) for pumped wells only. For artesian wells 1 pulse/m3
- One resettable relay (indicating a faulty meter)

(d) Flow meter accuracy to be verified following installation and while buried by utilising the flow meter manufacturer's proprietary verification tools and software packages. A verification certificate shall be supplied with each meter.

(e) HART Foundation registered

(f) Signal converter to be programmed for Empty Pipe and Reverse Flow Detection

(g) Sensor sized to suit pipework (Clause 12.2) or smaller if required to meet accuracy requirements at low flow.

(h) Flanged to AS 4087 PN 16 (check pressure rating below).

(i) Lining shall be EPDM or hard rubber.

(j) Sensor protection rating to IP68.

(k) Signal converter protection rating to IP65

(l) Supply voltage 24 VDC.

(m) Unit accuracy to be +1% or better over flow range + m3/hr to + m3/hr. A calibration certificate shall be supplied with each meter to verify its accuracy.

- Check max flow velocity range is less than 3 m/s..
- Pressure rating greater of 16 bar or 1.5 x maximum operating pressure bar minimum.
- Supplied complete with 30m min of interconnecting cable terminated and sealed to IP68 at the sensor

6.7 EARTHING

Earthing shall be carried out strictly in accordance with the manufacturer's recommendations. A separate instrument earth is to be installed to which all instruments, instrument screened cables and instrument cabinets are to be connected. The instrument earth shall be bonded to the installation main earth with one 16mm² single core cable as a minimum

6.8 CALIBRATION CERTIFICATES

All instruments installed at the plant shall have a factory calibration certificate confirming instrument specifications. Instruments shall be re-calibrated at the discretion of the plant instrument technicians.

6.9 DOCUMENTATION

All new instruments shall be supplied with relevant software CD's and instruction manuals to enable onsite programming, data uplifting and downloading, parameter setting and diagnostic facilities. Summary test sheets shall be provided in addition to manufacturers configuration datasheets. Examples are included in the appendices.

Asset Equipment templates are to be filled out and submitted to council for all new or replaced instrumentation. Refer *TRIM 14/141308 911 Asset Management - CWW - Station Asset Templates*

6.10 PROCESS CONNECTION

Where possible provide quarter turn isolation values to allow instruments to be isolated and disconnected. i.e. for water pressure transmitters and switches and devices with similar process connections. Plus relief valve

6.11 UNITS AND DISPLAYS

Pressure transmitters shall be configured to display pressure in kPa.

Flow transmitters shall be configured to display flow in m^3/hr and m^3.

7 CONTROL SYSTEMS

7.1 GLOSSARY OF TERMS

- SCADA Supervisory Control And Data Acquisition software package
- PLC Programmable Logic Controller
- RTU Remote Telemetry Unit (also known as a PLC)
- HMI Human Machine Interface
- Historian Data warehouse to provide general access to SCADA data

Archestra is used to refer to both the CWW Network and Plant SCADA projects.

PLC is used generically to refer to both Schneider Unity PLCs, either M340 or M580 processors, as installed at CWTP or Yokogawa RTUs as installed in the network.

Note that the primary difference between PLCs and RTUs in CWW projects is that RTUs are typically remote from Archestra and special provisions are required for managing communications.

HMI is used to refer exclusively to the Magellis industrial touch panels.

Water Outlook is the CCC SCADA Historian. Note that this is separate from the Archestra Historian which is a SCADA functional element which is not to be used for reporting. For disambiguation Water Outlook is used to refer to the Historian used to generate reporting information for wider disemmination.

7.2 GENERAL

This specification details mandatory requirements that may NOT be varied without having sought and received the WRITTEN agreement of the CCC SCADA Engineer.

Archestra, PLC and HMI coding practices follow an ‘as-implemented best practices’ approach where Designers and Contractors are required to request relevant to reference designs for each project from the CCC SCADA Engineer. The reference designs are provided subject to detailed design and review as CWW standards continue to evolve.

The overall process of design, development and deployment of automation systems follow this sequence:

- Design
    - Functional Design Specification (FDS – also referred to as a Level 1 FD)
    - Hardware design, as expressed in detailed electrical drawings
- System Integration
    - Functional Design (FD – also referred to as a Level 2 FD)
    - Software Test Plan (STP)
    - Draft Software O&M Manuals and device configuration sheets
- Production System Submission
    - Archestra Standard object instantiation – 5 day notice for deployment
    - Archestra Shell change – 20 day notice for design approval

- Testing & Commissioning
    - Factory Acceptance Test (FAT)
    - Site Acceptance Test (SAT)
    - Production Draft Software O&M Manuals
- Operational Handover
    - Training
    - Handover process varies by project and plant – check project specific requirements
- Final Documentation

Note that the as-implemented best practices examples define the detailed presentation and interaction of elements of the system. These shall be treated as mandatory.

7.3 FUNCTIONAL DESIGN SPECIFICATION (FDS)

This is a design document that shall describe the operation of the plant in terms of the process flow, process interlocks, design capacities, safety requirements, start up and shut down procedures and all normal and abnormal operational work flows.

The purpose of the FDS is to provide a System Integrator, working with a separate set of specific CCC software standards, the information necessary to understand the process control requirements of the PLC needed to meet the process performance requirements. The FDS shall clearly identify the process performance requirements and shall not restate CCC software standards.

The FDS shall address the primary elements of the process covering gas, hydraulic, mechanical, chemical elements and the sensors and actuator requirements necessary to achieve effective control. The FDS shall also identify the performance requirements in terms of operational requirements within measured process variables.

The FDS shall describe the interaction between the plant being introduced and any other elements of new or existing plant to which the process connects. The FDS shall identify power failure and recovery actions and any specific failure or partial operational modes that might be required for resilient operation.

Where software is required to control to a set level or duration and these details are specific to the process, the FDS shall specifically state suitable initial setpoints and setpoint ranges.

7.4 HARDWARE DESIGN

Archestra installations are present only at CWTP Pages Road and Akaroa WTP. These shall be subject to specific detailed design with close engagement with, and approval of the CCC SCADA Engineer.

PLC and HMI installations shall:

(a) Use 24VDC Battery Backed Power supplies

(b) Shall use 24VDC for control and indication

(c) PLC and associated hardware shall be installed in a safety extra low voltage compartment suitable for general access

(d) PLCs shall only use local I/O, remote I/O shall not be used

(e) Local I/O chassis shall be at least 10 slots

(f) CPU selection shall result in 30% free RAM at the completion of commissioning

(g) I/O updates and code cycling shall be faster than 100ms

(h) Provide an instrument / controls earth for all PLC and PLC I/O connections

(i) Spare

1. 20% of installed I/O shall be spare with no I/O terminated at the marshalling terminals
2. 20% of installed I/O chassis shall be spare with no cards installed
3. 20% of marshalling cabinet area shall be spare with no terminals or equipment installed

(j) The grouping and layout of I/O modules shall follow the following format whenever possible,

1. Communications and specialist I/O modules
2. Analogue Input Modules
3. Analogue Output Modules
4. Digital Input Modules
5. Digital Output Modules

(k) Digital I/O:

1. Wire alarms to alarm when 24Vdc is removed from the PLC input
2. Indications, motor running, 24Vdc at the PLC indicates active

(l) Analogue I/O:

1. 4-20mA I/O modules shall be used, these shall be in differential mode
2. Smart instruments are presently limited to Hart communications to flow meters
3. Marshalling terminals shall be a knife disconnect type to permit testing

(m) All I/O on all modules shall be wired to marshalling terminals, these shall be loomed with marshalling terminals grouped by I/O module

(n) Marshalling terminals shall be ‘cage clamp’ type.

(o) I/O shall be fused in groups. Minimum grouping shall separate Analogue and digital and shall separate DC supplies extending outside the cabinet from those inside the cabinet.

7.5 FUNCTIONAL DESCRIPTIONS (FD)

A Functional Description (FD) document shall be produced to provide a concise representation of the detailed implementation of process control described in the FDS.

Functionality must be thoroughly tested during factory acceptance test (FAT) by simulation or other means by the System Integrator before site functional commissioning and acceptance testing can occur. This may be undertaken against a dedicated Test Acceptance Specification (TAS) outlining the various individual tests to be performed or against a more detailed set of functional descriptions commonly referred to as a level 2 FD. A level 2 FD is essentially the integrators software detailed design specification (SDDS) and is sufficiently detailed for the programmer to code against.

The upkeep and Integrity of the FD is the Contractors responsibility until the plant has been handed over.

The Functional Description document is to be treated with the same importance as that of the PLC code.

The CCC have developed generic User Requirements Specifications (URS) for both Water & Wastewater Pumping stations to assist Integrators in their development of a Functional Description and to drive standardisation. A template for documenting the software detailed design Functional Descriptions is freely available and its use is encouraged by Contractors tasked with providing functional descriptions or making changes to existing functional descriptions.

- *TRIM 09/367127* CCC - FD Template.
- *TRIM : 15/615036* CCC - Two Pump Wastewater Station Variable Speed Drive Control - User Requirements Specification
- *TRIM : 13/523632* CCC - Two Pump Wastewater Station Soft Starter Control - User Requirements Specification
- 1*5/626813 CCC* - Water Supply Station - User Requirements Specification

7.6 PLC SOFTWARE

7.6.1 Development Library & Firmware Versions

Developers shall use Archestra and PLC programming software versions, libraries and firmware versions in current use for the specific. The Contractor shall confirm the versions in use with the CCC SCADA Engineer.

Software submitted with incorrect versions shall be resubmitted at no cost or time delay.

7.6.2 Tag Naming

PLC tag names shall use the standard for plant and equipment tagging. Refer “CWW Tagging Convention”, (*TRIM:ELEC06/6074*).

7.6.3 Software Standards

PLC coding shall follow ‘as-implemented best practices’.

For CWTP the following documents shall be used:

- CWW GPL Archestra & Unity Standards (2018)
    - Documents a selection of GPL blocks permitted at CWTP
- CWW GPL Standards Application Guide
    - Identifies the specific Plant Archestra templates based on GPL libraries that have been used on site

For other RTUs request copies of ‘as-implemented best practices’ appropriate for the equipment being used.

The following general requirements apply:

(a) Code shall be grouped such that code sections align with process sections

(b) Code documentation shall include a description of the function of code blocks

(c) Code documentation shall avoid restating generic information about software objects used that are contained in other programming manuals

(d) Electronic PDF exports of the PLC code shall be provided with STP, FAT completion and O&M Manuals

(e) Redundant PLC code shall be removed

(f) Test code (excluding that embedded in standard blocks) shall be removed prior to SAT

(g) Software shall be written to provide an operator with the ability to take remote manual control of individual items of plant while minimising the impact on surrounding equipment. This specifically includes:

1. Bumpless transfer when switching modes

2. Interlocks shall depend on the process feedback as opposed to the devices being in automatic control

7.7 SOFTWARE TEST PLAN

The requirements of the Software Test Plan (STP) are:

(a) Describes testing that will be carried out in FAT and SAT to demonstrate functionality according to the FDS and FD

(b) The Contractor shall have pre-tested the controls in FAT, the STP shall include details of the Contractors pre-testing

(c) Identifies the degree of simulation for each element noting that:

a. Where a block has been tested and is documented in the CWW Software Application Guides that local software loopback testing is acceptable

b. Where the device has new firmware it may be acceptable to use local loopback testing subject to Contractor / Supplier statement regarding the scope of firmware changes

c. Where no prior testing for a specific device is noted in the CWW Software Application Guides at least one real device shall be included for testing

d. Where a device cannot be provided for testing in FAT the STP may propose testing of the functionality in SAT.

(d) Includes a complete list of I/O, alarms and adjustable setpoints

(e) Includes screenshots of HMI and Archestra screens

7.8 FACTORY ACCEPTANCE TESTING

Factory acceptance testing (FAT) shall:

(a) Be carried out within 5 days of the switchboard and control panel completion

(b) Include tests on the completed control panels and switchboards

(c) Demonstrate the functionality as described in the STP

(d) Demonstrate functionality of HMI, Archestra and hard wired controls for the software objects being used

(e) Include structured pre-planned testing as described in the STP and unstructured testing as considered appropriate by the Designer and Principal.

(f) Testing shall include all devices, in manual and automatic operating modes and switching between modes.

7.9 SITE ACCEPTANCE TESTING

Site acceptance testing (SAT) shall:

(a) Include tests of all cables, recorded through markup of IFC (or later) drawings

(b) Include end (device) to end (HMI and Archestra) testing of all I/O

(c) Include all STP tests specifically identified for SAT

(d) Include a sample (1 in 10) of all FAT tests

(e) Demonstrate the functional operation of all elements under real process conditions

(f) Depending on the process the testing may or may not be witnessed, in any event documentation showing successful completion shall be provided by the Contractor

7.10 TRAINING

Training requirements include:

(g) Shall be undertaken before operational handover of the plant

(h) As-built draft O&M manuals shall form part of the training

(i) Training shall include all operational and maintenance activities and be supported by the O&M Manual

(j) Training shall be provided by a person with experience in all the elements installed in the Contract

7.11 DOCUMENTATION

The following documentation shall be provided:

(k) Functional Design Specification (FDS)

(l) Electrical wiring diagrams detailing:

a. all devices

b. all terminals

c. all wires

d. PLC and duct general arrangement inside panels

e. Ethernet cables, patching and connections

(m) Ethernet address schedules

(n) Functional Descriptions (FD)

(o)

(p) Module dip switch settings.

SCADA documentation shall:

(a) Follow existing as-implemented best practices on existing systems

(b) Be explicitly defined in the design phase consistent with the site and CCC practices on existing systems

8 COMMUNICATIONS

8.1 GENERAL

All communications shall use Ethernet.

This section identifies the requirements for forms of Operational Technology (OT) communications networks. Note that Information Technology (IT) networks are managed separately by CCC IT and some CCC sites incorporate both OT and IT networks and that these are governed separately.

Physical installation details associated with IT networks shall follow:

- Christchurch City Council – Infrastructure & Cabling Specification, Version 2.0 2013

OT networks shall also comply with the above specification subject to the differences noted herein.

Any new network equipment or cabling that is required to connect into the existing site automation architecture shall be approved by the CCC Responsible Engineer.

8.2 PANELS

Panels shall:

(a) Cabinets shall be manufactured from metal.

(b) Powder coated colour Cream Ripple.

(c) IP rating shall suit the environment.

(d) Cable and ducts entering the cabinet shall be connected through a gland mounted on an Aluminium gland plate.

8.3 CABLES

8.3.1 Reticulation

(a) Install Ethernet cabling In accordance with the recommendations of the manufacturer so that the warranty is in no way compromised.

(b) On cable trays or ladder within building risers and communications enclosure or where more than 12 cables run together in ceiling and service spaces.

(c) Hung from steel plastic coated catenary tensioned cables in ceiling spaces and in accessible under floor areas for less than 12 cables.

(d) Ensure that cable trays, catenaries and cables generally are installed in straight lines square or parallel to building features such as walls (internal and external) where possible, ie not run diagonally especially across other services.

(e) No horizontally run cable shall be unsupported for more than 500 mm in ceiling spaces or under floors. Cables shall be suitably secured where not on trays, ladders or catenaries.

(f) Cables shall be concealed where practical.

(g) Cables must be installed to ensure minimum-bending radius stipulated by manufacturer is not exceeded.

(h) Where cables cannot be concealed, they shall be run in surface mounted trunking or conduit appropriate to the location with 50% spare capacity. Trunking and conduit shall be run parallel and square to building features both vertically and horizontally.

(i) Run cables with a clear separation distance of 500mm from electrical cables. Where cables cross electrical cables they must be at right angles to the electrical cable and be separated by a physical barrier by at least 500 mm.

(j) Cables installed in trays, trunking or on catenaries shall be securely fixed at 300 mm intervals with cable ties.

(k) Bond all steel, metal trunking, trays and catenaries to the Main Building Electrical Earth with a minimum of 4mm2 bond wire.

(l) Where trunking is used ensure that the correct manufacturers fittings (Glands, bends, flexible couplings etc) are used, and ensure that inspection joints/pull boxes are used. Distances between inspection joints/pull boxes should be no more than 15m apart.

(m) A draw cord must also be left in any trunking or conduit for further use.

(n) Dedicated stainless steel trunking or conduit shall be provided for all communication cabling run within the confines of a manufacturing plant. This trunking or conduit shall be at least 500 mm from any power or signal cables.

(o) Only data cables shall be run in trunking or catenary wires – power, fire cables etc are strictly prohibited from being run or cable tied to data cable.

(p) Install cables in spaces free from protrusion of screws and similar fasteners or where prone to mechanical damage. Remove all sharp edges and allow slack in the cable run.

(q) All cables shall be installed together free of twists and able to be traced without removing other cables.

(r) Provide adequate support at the top of all cabling vertically installed, ensuring that the weight of cables is supported at a maximum distance of 300 mm.

(s) Do not route cabling into horizontal ducting using sharp bends in contravention of cable manufacturer's specified minimum bending radius.

(t) Data cables shall be protected from mechanical damage along their entire length.

8.3.2 Labelling

Labels shall:

(a) Be applied to Copper, Fibre optics, sockets and network devices

(b) Be provided according to the CWW Tag Naming scheme

(c) Use a common unique identifier from the device to the switch

(d) Patch leads shall include both the cable tag and the end device tag

(e) Socket outlets adjacent end devices shall be labelled with the end device tag

(f) Where an end device has multiple ports the tag shall include the port number

For example:

- Network switch label 905.1NQ001
- Patch lead to port 7 on the switch 905.1DJ005_905.1NQ001-07
- Structured cabling socket label 905.1DJ005
- Structured cabling cable label 905.1DJ005
- Structured cabling socket by device 905.1DJ005
- Patch lead to device 905.1DJ005_1050DQ001

- VSD 1050DQ001

8.4 DOCUMENTATION

The following documentation shall be provided for documentation of communications networks.

(a) Network connection diagram

(b) Network device port schedule

Note: Updates to existing Network Port Schedules are to be provided where applicable.

8.5 ETHERNET

The following requirements apply:

(a) Update of existing as-built documentation including:

a. Network schedules

b. Drawings detailing cable routes and all cable connections

(b) Design shall include:

a. Modifications to existing documentation if available

b. Network routing devices

c. Network, subnet and gateway details

d. IP address allocation

e. WAN connectivity

f. Specific requirements that may apply for the type of connection

g. Cable routes, ducting, ladder and support requirements

(c) Switches shall:

a. be DIN mounted

b. have 24Vdc power supplies

(d) Ethernet device connections shall be made with Cat 5e (or better) patch cables.

(e) Permanent solid core Ethernet cables are not permitted to terminate directly to devices.

(f) Structured cabling

a. Shall be provided for all connections where necessary to avoid patch leads in excess of 1.5m long

b. Shall terminate at Cat 5e (or better) RJ45 sockets

c. Where six or less RJ45 sockets are required these may be provided either with an IP20 Din rail mounted socket (when inside panels) or in a wall mounted flush box.

d. Where more connections are required a multi-ganged socket assembly shall be used

e. For connections requiring 12 or more connections 19 inch rack mountings shall be used.

All cables shall be tested for conformance with Cat 5e compliance, test reports shall be included in the documentation.

8.6 ETHERNET VIA UHF

Where Ethernet is carried via UHF the following additional requirements exist:

(a) Routing device shall be configured to restrict transmission of packets via the RF circuit to specifically permitted messages

(b) Application design shall specifically address the bandwidth limitations of the network

(c) Application design shall specifically address the impact on RF networks sharing a frequency, repeater and / or backhaul connection.

8.7 ETHERNET VIA CELLPHONE

Where Ethernet is carried via Cellphone the following additional requirements exist:

(a) Routing device shall be configured to restrict transmission of packets via the RF circuit to specifically permitted message.

(b) Connection shall be made via the CCC APN

8.8 RADIO FREQUENCY PATHS

Radio antenna shall be mounted with a clear visible path to repeater sites. Mounting shall extend above the roof height and on a side of the building to give the best signal strength. This includes UHF, Microwave and Cellular communications.

Radio survey shall be completed for the site. This may be provided as a desktop calculation. Installation shall include signal strength testing as defined in the CWW Communications Standard.

Small masts attached – as typically attached to outdoor cabinets – shall be mounted with the base attachment as a footer with flexible steel conduit into the cabinet arranged so that a single person can lower and raise the mast.

9 GENERATOR AND DIESEL ENGINES

9.1 GENERAL

The generator size shall be selected to suit the installed equipment provided at the site. If the future equipment rating exceeds the rating of equipment initially installed confirm with the CCC Principal Electrical Engineer the appropriate sizing basis for the site.

Sizing calculations shall be based on the assessed maximum demand for the site when operating on generator supply. Minimum and expected load calculations shall also be determined to identify the potential for diesel engine operation at light loads.

Detail an alternator manufactured in accordance with Rotating electrical machines that meets the following requirements:

- Enclosure: screen protected drip-proof
- Prime Rating
- Voltage regulation: inherent ±2%, no load to full load at 0.8 to unity power factor at any voltage within the range setting
- Voltage variation 400-430 volts
- Earthing: multiple earth neutral system. The neutral point to be brought out to a terminal
- Frequency: 50 cycles per second
- Phases: 3 phase 4 wire with switching in active conductors only
- Power factor: 0.8
- Rated voltage: 415 volts
- Excitation: the alternator shall be self-exciting with PMG
- Radio interference: shall be in accordance with the Radio communications Regulations

Directly couple the alternator to the engine by means of a flexible coupling.

Specify a unit capable of powering the largest pump, or enough pumps to allow for the pumping of the Maximum Flow, plus all auxiliary equipment (ventilation fans, battery chargers, lighting etc).

Specify a generator capable of starting and running the pump sets from stand still and zero delivery pressure and that is continuously rated to run at the rated output for several days at a time. Generators should also be rated to allow for the effects of the harmonic load content for a station utilizing variable speed drives or other wave-chopping devices. The harmonic loading can account for up to 25% of a set's rating.

Specify a governor capable of maintaining a steady speed within the limits specified in Reciprocating internal combustion engines. Performance for class A1 governing .

Consider the effect of the air temperature within the building on the engine air intake after prolonged diesel runs.

Vent the exhaust at a height above the roofline conforming to ECAN requirements. Refer to the Ecan Pollution Prevention Guide http://tools.ecan.govt.nz/eppg/. Detail a vermin proof exhaust pipe weather protection cap - not a counter balanced type.

Ensure servicing points such as water and oil levels etc are readily visible and accessible.

9.2 CONTROLS AND CHANGEOVER

Note that communications based primary indication (as listed below), activation of control mode or circuit breaker state is not permitted. Full operational functionality shall be possible without any communications devices connected to the engine management system or circuit breakers.

Engine management system shall:

- Use a Deep Sea 8620 enhanced model controller mounted in the generator package (to aid relocation)
- Disable synchronising for non-export stations.

Unit should be programmed to energise the output shown on the generic drawing when the control mode is NOT IN AUTO. Generic drawings are:

- Emergency stops shall not be installed on publicly accessible outer areas of a generator (note that obvious stop controls are required for inspection and maintenance – see D3.2.4 AS/NZS 3010)
- Auto Mains Fail (AMF) operation shall be provided
- Controls shall be powered by the generator batteries
- A castle key system shall be provided with a **single key** with the following operation:
    - Controller AUTO MANUAL lock
        - Can withdraw key in MANUAL
        - Switching to MANUAL shall open both mains and generator circuit breakers
    - Mains OPEN CLOSE lock
        - Can withdraw key in OPEN position
        - Switching to OPEN or CLOSE forces operation the circuit breaker
    - Generator OPEN CLOSE lock
        - Can withdraw key in OPEN position
        - Switching to OPEN or CLOSE forces operation the circuit breaker

Detail all control equipment in appropriate enclosures ensuring it is visible without the need to open doors, hatches etc.

Design controls that make three attempts at starting with cranking periods of up to 15 seconds, each with an equal rest period between. In the event of the unit failing to start after the last attempt, specify that the controls lock out and energise the remote alarm.

Changeover shall be provided by motorised MCCB or ACB as appropriate for the size. Do not use Schneider communicating coils. Opening shall be provided by 230Vac No-Volt release with 3 second delay. Closing shall use the corresponding supply voltage, generator 230Vac for Generator CB, transformer 230Vac for Mains CB. Interlocks preventing parallel operation may be fitted for non-paralleling units however the design shall make allowance for later removal of any interlocks provided in an Auto Mains Fail only installation.

9.2.1 Instrumentation, Protection and Control

Configure the SCADA radio transmission unit (PLC/RTU) logic to start the engine as required.

Control Period Ripple relay shall be connected via the RTU to the control logic, not directly to the Engine controller.

Engine protection devices linked to a common SCADA alarm shall include:

- Over temperature
- Low oil pressure
- Over speed
- Low coolant flow
- Low coolant level

Local indicators shall include engine running, voltage, current, frequency and faults and of faults in the battery charger.

Provide the following indications:

- Hour meter
- Engine water temperature gauge
- Lubricating oil pressure gauge
- Lubricating oil temperature gauge
- Tachometer
- Boost gauge when engine is not naturally aspirated

Locate all meters and gauges to avoid vibration damage.

Specify voltage-free contacts to give the following indication to the SCADA system:

- Not in Auto [Contacts closed in Remote Auto]
- Engine Running [Contacts closed for running]
- Fail safe common fault including: diesel alarm (low oil pressure, high temperature, over speed, low engine tank water, fail to start) [Contacts open for alarm]
- Fail safe charger fault. [Contacts open for fault]
- Alternator on – equivalent to Generator closed onto bus [Contacts closed for on]
- Diesel running [Contacts closed for running]
- Low diesel tank level, float switch at 25% of diesel tank volume [Contacts closed if > 25% full]
- Generator real power output in kW [4-20mA 0-110% rating]

Specify the supply of an analogue signal to the SCADA that is proportional to the kilowatts being produced. This is from Generator MCCB metering trip unit.

Provide the following controls:

- Remote islanded run [Contact closed to run]

- Remote parallel run at pre-configured output [Contact closed to run]

9.2.2 Starting

The method of starting control shall be selectable between auto and manual. Starting equipment shall be rated for a minimum of 10 starts per hour.

Provide an Auto/Amp SCADA temperature compensated power supply/battery charger if the unit does not have a factory fitted charger. Include a fitted battery:

- of at least the capacity of the manufacturer's recommendation,
- of the largest physical size that will fit the manufacturers battery cradle, and
- with the highest Cold Cranking Amps (CCA) rating for its physical size (CCA varies even with physical size).

9.3 COOLING SYSTEM

Cooling is normally by way of a water-to-air radiator. Special circumstances must apply before Council will accept a water-to-water heat exchanger.

Allow for radiant cooling to the air within the building. Incorporate forced ventilation of the building if required for prolonged diesel runs under full power with the building doors and/or windows closed (see clause 6.6 - Penetrations and watertightness). Consider the conflict between ventilation and noise control when designing this system. Compliance with TA noise plan is required.

Fit the engine cooling system with a low wattage heater and thermostat suitable for operation on 230-volt mains supply and adequate to maintain an engine temperature of approximately 25°C.

When using a water-to-water heat exchanger:

- The cooling system may utilise approximately 14°C water from the reticulated supply.
- Establish a minimum safe quantity of raw water and permanently set this using a flow control valve. The flow control valve must allow the raw water supply to be controlled independently from any pressure changes that would otherwise affect the flow rate i.e. it MUST be pressure compensated.
- Detail a solenoid valve to enable raw water flow only when the diesel is running.
- Mount a pocket type thermometer in an obvious, easily seen position in the raw water discharge to allow monitoring of the discharge temperature.
- Discharge cooling water to a sewer unless this option is totally impractical. Limit the discharge temperature to 20°C if the water is discharged to a waterway. Ensure Resource Consent compliance with allowable flows and temperatures for any discharge to a waterway.
- Detail an RPZ (Reduced Pressure Zone) valve fitted to the cooling system additional to the RPZ required in clause 15.5 – Water Supply, to prevent backflow of potentially contaminated water into the pump station water supply.
- If raw water is not dumped to waste, detail a double wall plate heat exchanger (e.g. Alfa Laval M6-MDFM) to prevent possible contamination of the reticulated supply.

9.4 FUEL SYSTEM

Provide diesel storage using a standard sized tank capable of supplying the engine for 72 hours at the normal operating maximum load. This may be well below the maximum engine/generator's full capacity. Note that some engines use high fuel flows and the fuel tank as injector/pump cooling and the tank minimum capacity may be considerable.

Tank capacity should be sized to provide 15% of the above required fuel volume as maximum free board. Detail the fuel intake from the tank to the diesel generators 100mm above the bottom of the tank, to allow any impurities to settle at the tank bottom.

Provide good access for refuelling, volume indicators and Council's preference for aboveground storage when designing the fuel storage. Integration (inside) the main building will be considered only if beneficial and complying with the Hazardous Substances and New Organisms Act.

Ensure diesel storage is located at the following distances from the boundary (as adapted from Table 4, Schedule 4 of the Summary of Approvals of Substances transferred under the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (As Amended)):

Tank Capacity (L)	**Distance from high intensity land use (m)***	**Distance from low intensity land use (m)**
<600	0	0
1,000	1.5	0
2,500	2	0
5,000	3	2
*Includes residential land uses, and high use roads		

There may be a requirement to obtain resource consent for the storage tank if the site is:

- within 20m of a river, a bore, a wetland boundary; or
- within a 1 in 20 year flood plain; or
- where the depth to unconfined or semi-confined groundwater is less than 30m; or
- within 100m of an active fault and the land is over a semi-confined or unconfined aquifer.
- within 1000m of a community groundwater bore.

A double skinned tank should not require additional secondary containment. A *stationary container test certificate* is required for tanks with a capacity greater than 500 litres.

Provide automatic fuel shut off in case of fire. Provide a black dipstick to facilitate easy level readings.

Ducting to any buried fuel line shall indicate leaks from a telltale or similar. Provide containment of any leak to prevent ground contamination. Provide twin wall PE (Dura pipe). Underground piping has pressure valve on pipe terminations to allow for pressure testing the interstitial space within the pipe. Include in manuals for annual testing. Do not drain to in-ground sumps.

Do not use galvanized steel or sheet metal tanks, pipes or fittings in any diesel fuel storage, delivery, or fuel system. Do not use copper pipe except where the manufacturer has factory fitted it to the engine. Connections to copper pipe shall use a suitable flexible hose that will not cause work hardening and subsequent brittleness of the copper pipe.

9.5 NOISE LEVELS

Design the generator whether used for emergency purposes only or not, its acoustic enclosure and the building combined to limit noise to the level at the property boundary to comply with the *City Plan* rules in clause 1.3.3 Noise Standards for all zones outside the Central City or the Banks Peninsula *District Plan* rules in chapter 33 Noise and Environment Canterbury noise control standards.

Detail service and maintenance access and incorporate acoustically controlled inlet and outlet air louvres in the acoustic enclosure, which could be of a proprietary design.

Specify a residential grade engine silencer and insulate the exhaust pipework, cladding it to at least 3 metres above floor height.

9.6 DOCUMENTATION

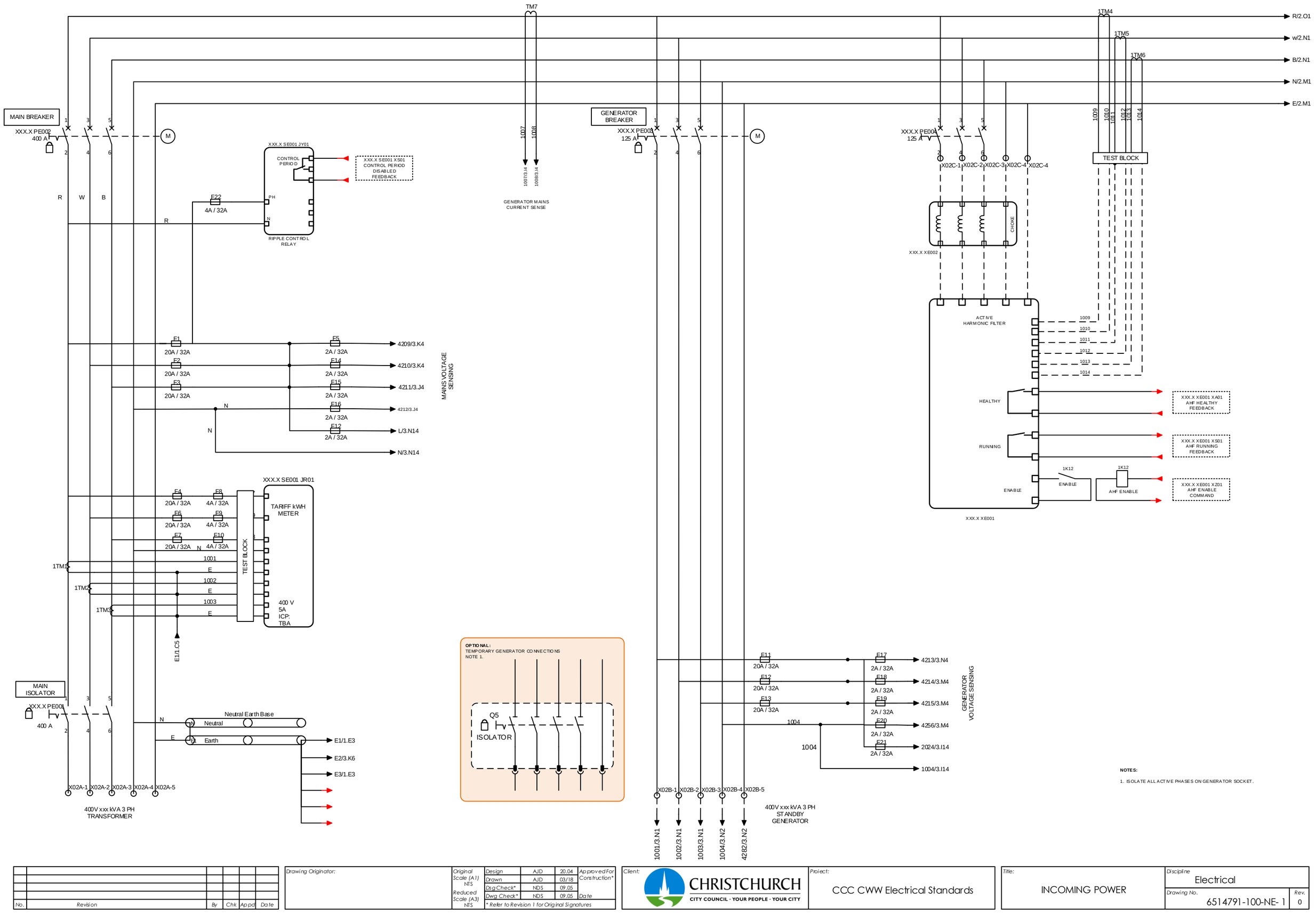
Documentation shall include a shortened section describing the basic manual procedures required to test run and to, on attendance to a faulted site, identify the standard procedure for identifying and clearing faults.

9.7 SWITCHBOARD

Generator and mains switching shall be via motorised MCCB or ACB (as appropriate for current rating) mounted in the switchboard.

Isolation for the generator shall be at a Generator mounted MCCB or ACB. Isolation for the mains shall be at a mains supply isolator upstream of the incoming MCCB / ACB, metering and potential fuses. Both isolators shall be lockable through a permanently affixed locking mechanism.

APPENDIX A – STANDARD WIRING DETAILS



NOTES:

1. ISOLATE ALL ACTIVE PHASES ON GENERATOR SOCKET.

No.	Revision	By	Chk	Appd	Date

Drawing Originator:

Original Scale (A1) NTS
Reduced Scale (A3) NTS

Design	AJD	20.04	Approved For Construction*
Drawn	AJD	03/18	
Dsg Check*	NDS	09.05	
Dwg Check*	NDS	09.05	Date

* Refer to Revision 1 for Original Signatures

Client: CHRISTCHURCH CITY COUNCIL · YOUR PEOPLE · YOUR CITY

Project: CCC CWW Electrical Standards

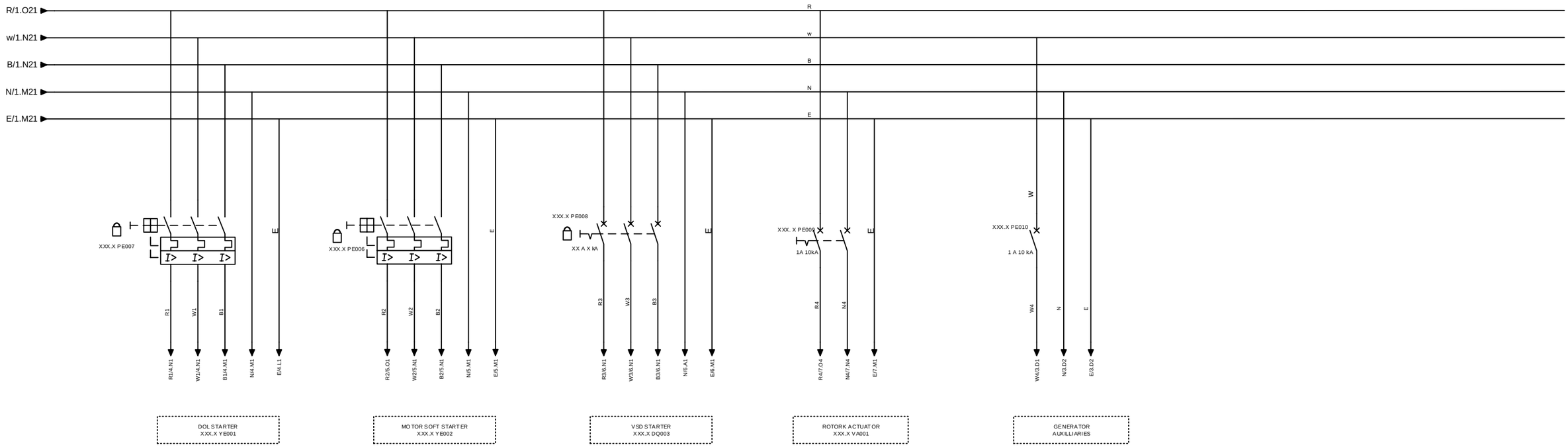
Title: INCOMING POWER

Discipline: Electrical

Drawing No.: 6514791-100-NE- 1

Rev.: 0

File: P:\65\151864\CAD\CWW Electrical Standards Drawings (REV0 - MINOR UPDATES) A1.vsdm - TabINCOMING



NOTES:

1. ALL ISOLATORS SHALL BE ROTARY AND LOCKABLE

No.	Revision	By	Chk	Appd	Date

Drawing Originator:

Original Scale (A1) NTS
Reduced Scale (A3) NTS

Design	AJD	20.04	Approved For Construction*
Drawn	AJD	03/18	
Dsg Check*	NDS	09.05	
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* Refer to Revision 1 for Original Signatures

Client: CHRISTCHURCH CITY COUNCIL · YOUR PEOPLE · YOUR CITY

Project: CCC CWW Electrical Standards

Title: INCOMING POWER

Discipline: Electrical

Drawing No.: 6514791-100-NE- 2

Rev.: 0

File: P:\651\51\86\CAD\CWW Electrical Standards Drawings (REV0 - MINOR UPDATES) A1.vsdm - Tab:3 PHASE DIST.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

N M L K J I H G F E D C B A

1001/1.B11 1002/1.B11 1003/1.B11 1004/1.B12 4282/1.B12

GENERATOR PANEL

MAIN SWITCHBOARD GENERATOR PANEL

4213/1.D15
4214/1.D15
4215/1.D15
4256/1.C15

4118 E2 4120 E4 4122 E2

3TM1 3TM2 3TM3

TEST BLOCK

E2/1.C5

G

825.1 CQ001

43 U/ L1
44 V/ L2
45 W/ L3
46 N
51 CT1
52 CT2
53 CT3

GENERATOR VOLTAGE
GENERATOR CURRENT

MAIN SWITCHBOARD GENERATOR PANEL

4209/1.I6
4210/1.I6
4211/1.I6
4212/1.H6

47 R/L1
48 S/L2
49 T/L3
50 N

MAINS VOLTAGE

1008/1.L9
1007/1.L9

56 S1
57 S2

L1 MAINS CURRENT

825.1 GE001 EH02 ESTOP
825.1 GE001 EH01 ESTOP
825.1 GE001 XZ01
825.1 GE001 XZ02
825.1 GE001 XZ03

ESTOP MAIN SWITCHBOARD 60
RUN ISLANDED MODE 61
RUN PARALLEL BASE LOAD 62
RESET 63
825.1 GE001 XA01 FIRE DETECT SWITCH 64
MAINS BREAKER POSITION 65
24 VDC/3.I16 0.0000/3.H16
24 VDC/3.C16 0.0012/3.B16
GENERATOR BREAKER POSITION 66
67
24 VDC 68
69
70

DIGITAL INPUTS

W4/2.J14 N/2.J14 E/2.J15

MAIN SWITCHBOARD GENERATOR PANEL

Qx 5 A
3H1 ENGINE CASE HEATER

Qx 5 A

G4 GENERATOR BATTERY CHARGER

BATTERY VOLTAGE

24 VDC 1
2

4203/3.C10

OTHER GENSET SUPPLIES AS REQUIRED

NOTES:

1. INTERLOCK KEY SYSTEM – SINGLE KEY FOR THREE LOCKS, REMOVABLE IN 'HAND' AND 'OPEN' POSITIONS ONLY.
2. KM01 KM02 DELAYS COORDINATED WITH ENGINE MANAGEMENT TIME DELAY SETINGS.
3. USE STANDARD COILS. DO NOT USE COMMUNICATING COILS.
4. INTEGRAL ACB OPEN AND CLOSE PUSH_BUTTON ARE TO BE LOCKED.
5. PRIOR TO COMMISSIONING, THE CONTRACTOR SHALL PROVIDE A COPY OF GENERATOR CONTROLLER SETTINGS FOR APPROVAL BY THE CLIENT.
6. ALL GENERATOR STRUCTURES, AUXILLIARIES AND ELECTRICAL COMPONENTS SHALL BE EXPLICITLY CONNECTED TO A GENERATOR EARTH BAR.
7. GENERATOR CONFIGURED TO RUN 'AUTO MAINS FAIL', 'BASE LOAD IN PARALLEL' AND 'ISLANDED MODE' AS PER CONTROL SIGNALS.
8. CONTROLLER CONNECTION AND GENERATOR AVR AND GOVERNOR SHALL PROVIDE SPEED AND VOLTAGE BIAS FOR FULL PARALLEL OPERATION.
9. THIS DRAWING ONLY PROVIDES DETAILS ON INTEGRATION OUTSIDE OF THE DIESEL GENERATOR PACKAGE. THE CONTRACTOR SHALL PROVIDE DETAILED DESIGN AND ELECTRICAL DRAWINGS FOR THE REMAINDER OF THE PACKAGE FOR APPROVAL PRIOR TO CONSTRUCTION.
10. INITIAL CONFIGURATION WHEN IN PARALLEL 80% SYNCHRONISING BUT NOT MORE THAN DEMAND.
11. ETHERNET COMMS TO BE REMOVABLE WITHOUT AFFECTING GENSET OPERATION.
12. TRIGGER LOW WARNING BELOW APPROX 75% OF VOLUME TO PROMPT MAINTENANCE TO TOP UP TANK.

DRAFTING NOTES:
1. EXAMPLES OF BREAKERS SHOWN AS NSX 100~25 AND NSX 400~630 VARIANTS.
2. NSX 100~250 REQUIRE INTERPOSING RELAYS FOR BREAKER STATUS FEEDBACK TO RTU.
3. NO COMMUNICATING COILS TO BE USED.
4. NO BREAKER CONTROL FUNCTIONS OVER COMMUNICATIONS.

GENERATOR PANEL MAIN SWITCHBOARD

LOAD MAINS BREAKER 39 40

FROM MAINS PTFUSES L/1.H6 N/1.H6

6KM2 CLOSE 15 16 18

AUTO/HAND

OPEN/CLOSE

XXX.X PE001 HS01 MAINS BREAKER AUTO FEEDBACK

FROM GENERATOR PTFUSES 2024/1.C15 1004/1.B15

LOAD GENERATOR BREAKER 41 42

6KM3 CLOSE 1004 15 16 18

AUTO/HAND

OPEN/CLOSE

3KM4 AUTO MODE
3KM5 ENGINE RUN
3KM6 HEALTHY

DIGITAL OUTPUTS 8 9 10 11 12 13

4203/3.B7

DEEP SEA GENERATOR CONTROLLER 8620 825.1 CQ001

ETHERNET NOTE 13.

825.1 GE001 XA04 GENERATOR CHARGER FAIL NOTE 11.
825.1 GE001 XA04 GENERATOR CHARGER HEALTHY FEEDBACK

825.1 GE001 LS01 FUEL TANK LEVEL LOW NOTE 11.
825.1 GE001 LS01 GENERATOR FUEL TANK LEVEL OK FEEDBACK NOTE 14.

NOTE: DRAWING DETAILS FOR COMPACT NSX 400/630

XXX.X PE002 MAIN CIRCUIT BREAKER

24 VDC 0 VDC

KM01 3 SECONDS DELAY 12 6 10 2

MICROLOGIC F2+ F1-

D1 D2 MN UNDER VOLTAGE RELEASE

NSX CORD (WAS OF4)

MOTOR MECHANISM L1 A1 A2 A4 B2 B4

MT CLOSE OPEN

INDICATION 81 SDE SD 91 82 92 84 94

OF1 11 12 OF2 21 22 14 24

24 VDC/3.G3
0.0000/3.G4

XXX.X PE002 XA01 MAIN BREAKER HEALTHY FEEDBACK

XXX.X PE002 XS01 MAIN BREAKER CLOSED FEEDBACK

EGX 150 +24 V 0 V Rx - Rx + Tx - Tx + GND RJ-45

24V 0V D3 D4

ETHERNET NOTE 13.

NOTE: DRAWING DETAILS FOR COMPACT NSX 100/160/250

XXX.X PE003 GENERATOR CIRCUIT BREAKER

KM02 3 SECONDS DELAY 12 6 10 2

MICROLOGIC F2+ F1-

D1 D2 MN UNDER VOLTAGE RELEASE

NXS

MOTOR MECHANISM L1 A1 A2 A4 B2 B4

MT CLOSE OPEN

INDICATION 81 SDE SD 91 82 92 84 94

OF1 11 12 14

NSX CORD (Was OF2)

24 VDC/3.F3
0.0012/3.F4

3K2 CLOSE

XXX.X PE003 XS01 GENERATOR BREAKER CLOSED FEEDBACK

XXX.X PE003 XA01 GENERATOR BREAKER HEALTHY FEEDBACK

24V 0V D3 D4

No.	Revision	By	Chk	Appd	Date

Drawing Originator:

Original Scale (A1) NTS
Reduced Scale (A3) NTS

Design	AJD	20.04	Approved For Construction*
Drawn	AJD	03/18	
Dsg Check*	NDS	09.05	
Dwg Check*	NDS	09.05	Date

* Refer to Revision 1 for Original Signatures

Client: CHRISTCHURCH CITY COUNCIL · YOUR PEOPLE · YOUR CITY

Project: CCC CWW Electrical Standards

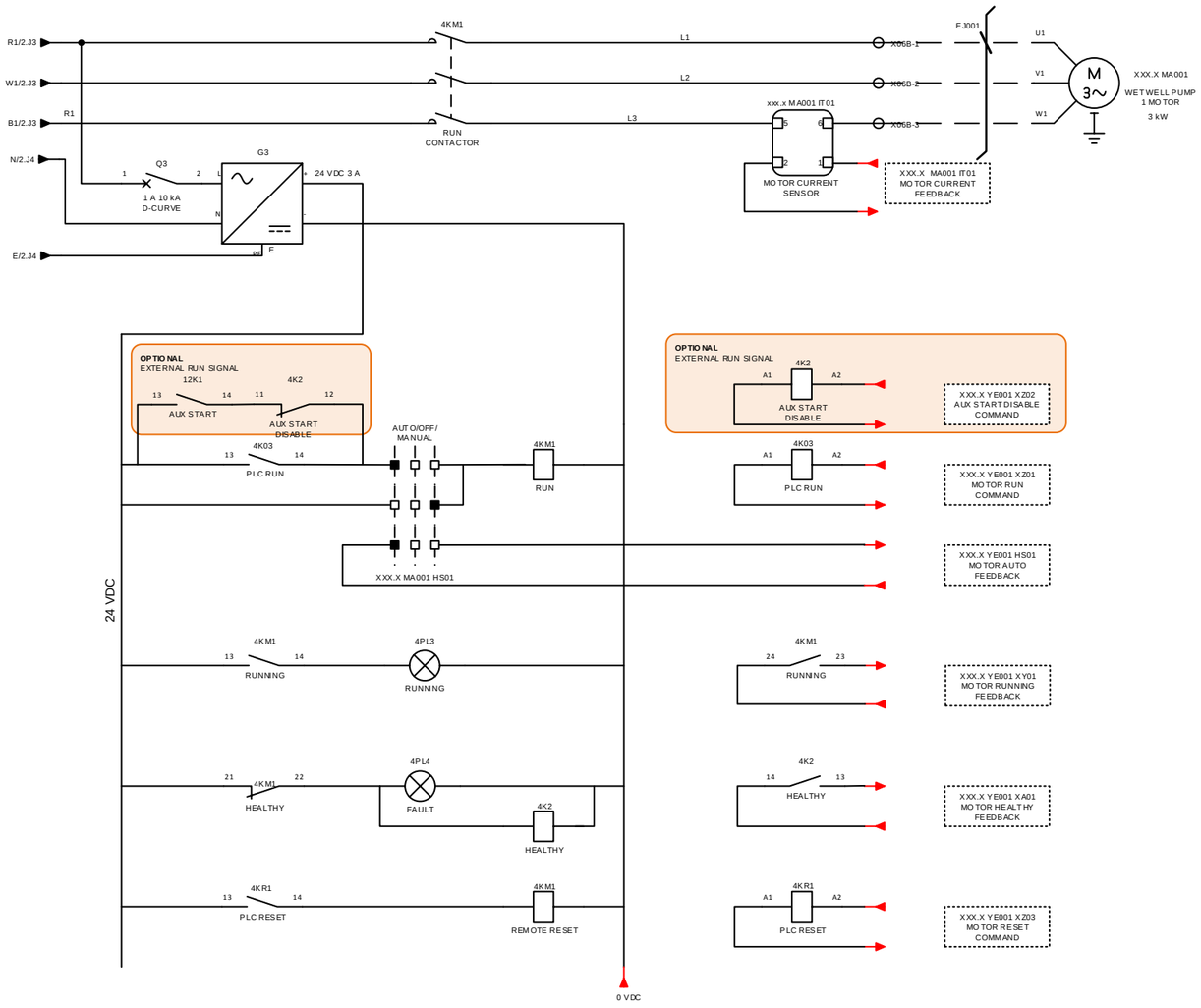
Title: GENERATOR CONTROLLER

Discipline: Electrical

Drawing No.: 6514791-100-NE- 3

Rev.: 0

File: P:\65\15186\CAD\CWW Electrical Standards Drawings (REV 0 - MINOR UPDATES) A1.vsdm - Tab:GENERATOR CONTROLLER



TYPICAL PANEL LABELS

{DESCRIPTION}
XXX.X MA001
AUTO/OFF/MANUAL

{DESCRIPTION}
XXX.X MA001
FAULT

{DESCRIPTION}
XXX.X MA001
RUNNING

{DESCRIPTION}
XXX.X MA001
PUMP MOTOR

No.	Revision	By	Chk	Appd	Date

Drawing Originator:

Original Scale (A1) NTS
Reduced Scale (A3) NTS

Design	AJD	20.04	Approved For Construction*
Drawn	AJD	03/18	
Dsg Check*	NDS	09.05	
Dwg Check*	NDS	09.05	Date

* Refer to Revision 1 for Original Signatures

Client: CHRISTCHURCH CITY COUNCIL · YOUR PEOPLE · YOUR CITY

Project: CCC CWW Electrical Standards

Title: DOL STARTER

Discipline: Electrical

Drawing No.: 6514791-100-NE- 4

Rev.: 0

File: P:\651\651586\CAD\CWW Electrical Standards Drawings (REV 0 - MINOR UPDATES) A1.vsdm - Tab:DOL STARTER

R2

R2/2.J5
W2/2.J6
B2/2.J6
N2/2.J6
E/2.J7

5KM4
BYPASS CONTACTOR

Q2
1 A 10 kA D-CURVE

G2
24 VDC 3 A

E
310.2 YE002

5Q3
1A 10kA

XXX.X YE001 AH02
DOOR MOUNTED DISPLAY

L/L1
L/L2
L/L3
CL1
CL2
COMMS

A1
2/T1
B2
4/T2
C2
6/T3
+24VDC
LO+
STO
RUN
LI3
LI4
R2A
R2C
R1A
R1C
R3A
R3C
PTC1
PTC2
ANALOG OUT 26
MOTOR SOFT STARTER

L1
L2
L3
11 kW
X06B-1
X06B-2
X06B-3
EJ001
U1
V1
W1
M 3~
XXX.X MA002
WET WELL PUMP 2 MOTOR

OPTIONAL
EXTERNAL RUN SIGNAL
12K2
AUX START
11
5K2
12
AUX START DISABLE

XXX.X YE001 HS01
AUTO/OFF/MANUAL
5K1
PLC RUN

5K3
RTU RESET
XXX.X YE001 BH02
RESET BUTTON

OPTIONAL
EXTERNAL FAULT
12K1
FLOWMETER FAULT
12K2
LOW LEVEL FAULT
NOTE: On ATS 48, ENERGISED = FAULT

BYPASS
5KM6
BYPASS

HEALTHY
5K4
HEALTHY
7K5
HEALTHY
5PL4
FAULT

RUNNING
5KM7
RUNNING
5PL5
RUNNING

XXX.X SP001 TS02
Thermistor
NOTE 1.
SJ005

XXX.X YE002 IT01
MOTOR CURRENT FEEDBACK
AO1+/5.G19

OPTIONAL
EXTERNAL RUN SIGNAL
5K2
A1
A2
AUX START DISABLE
XXX.X YE002 XZ02
AUX START DISABLE COMMAND

5K1
PLC RUN
XXX.X YE002 XZ01
MOTOR RUN COMMAND

AUTO/OFF/MANUAL
XXX.X YE001 HS01
XXX.X YE002 HS01
MOTOR AUTO FEEDBACK

5K3
PLC RESET
XXX.X YE002 XZ03
MOTOR RESET COMMAND

5KM4
14
13
HEALTHY
XXX.X YE002 XA01
MOTOR HEALTHY FEEDBACK

5KM7
24
23
RUNNING
XXX.X YE002 XY01
MOTOR RUNNING FEEDBACK

NOTES:
1. THERMISTOR REQUIRED ON MOTORS ABOVE xx kW (See CWW ELEC SPEC). CONTRACTOR TO CONFIRM SPECIFICS OF THERMISTOR CIRCUIT.

2. FRESH WATER PUMPS: PER INSTALLATION, NORMALLY HAVE A FLOW SWITCH, PRESSURE SWITCH AND LOW WELL LEVEL EXTERNAL FAULTS.

3. WASTE WATER PUMPS: PER INSTALLATION, NORMALLY HAVE A PRESSURE SWITCH, AND/OR MINICAS PUMP RELAY.

4. CONTRACTOR SHALL DESIGN ENCLOSURE FOR THERMAL LOAD.

TYPICAL PANEL LABELS

{DESCRIPTION} XXX.X MA001 AUTO/OFF/MANUAL

{DESCRIPTION} XXX.X MA001 RESET

{DESCRIPTION} XXX.X MA001 FAULT

{DESCRIPTION} XXX.X MA001 RUNNING

{DESCRIPTION} XXX.X MA001 PUMP MOTOR

No.	Revision	By	Chk	Appd	Date
A	ISSUED FOR CLIENT REVIEW	AJD	IW	LT	8.05.18

Drawing Originator:

Original Scale (A1) NTS
Reduced Scale (A3) NTS

Design	AJD	20.04	Approved For Construction*
Drawn	AJD	03/18	
Dsg Check*	NDS	09.05	
Dwg Check*	NDS	09.05	Date

* Refer to Revision 1 for Original Signatures

Client: CHRISTCHURCH CITY COUNCIL · YOUR PEOPLE · YOUR CITY

Project: CCC CWW Electrical Standards

Title: SOFT STARTER

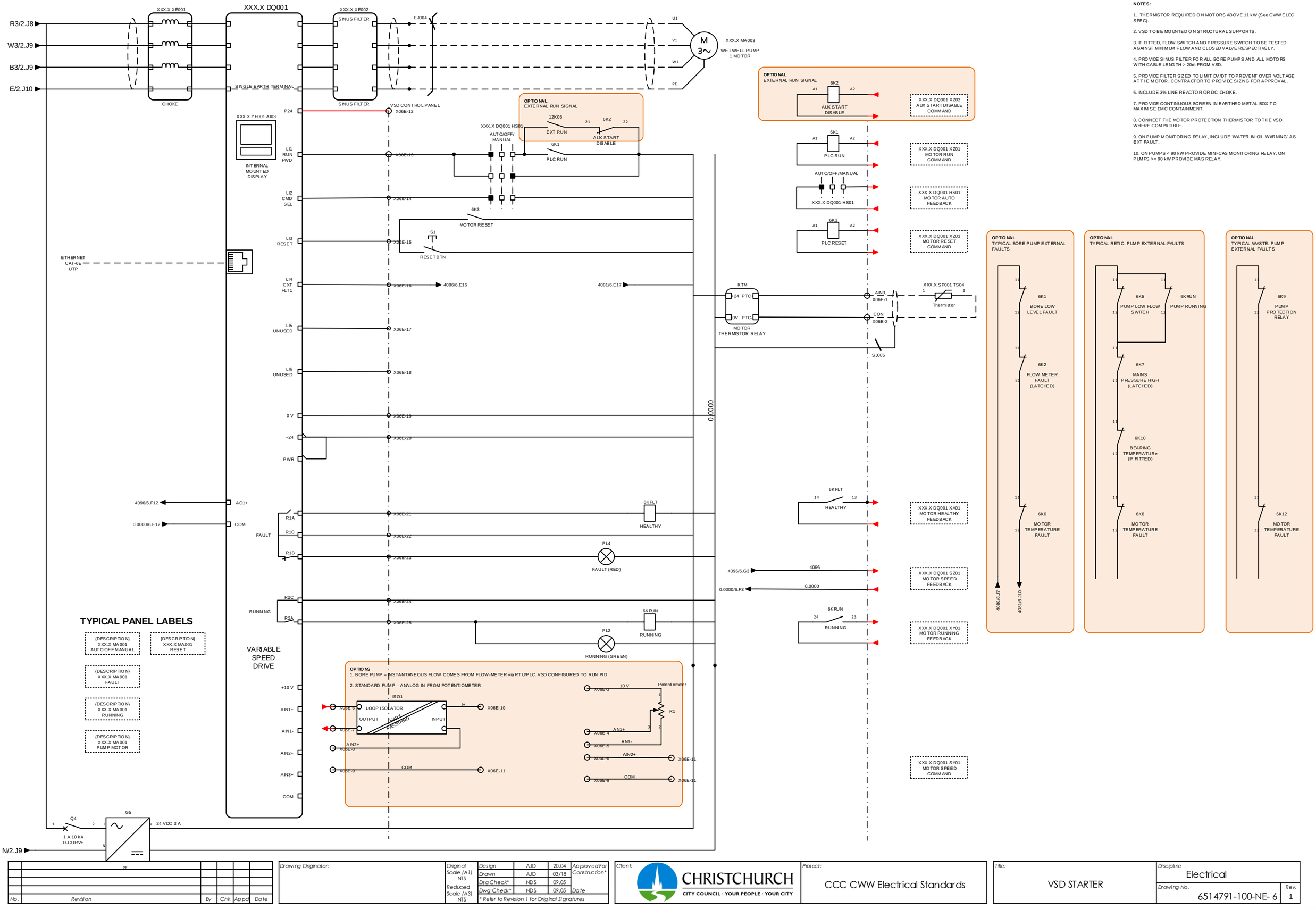
Discipline: Electrical

Drawing No.: 6514791-100-NE- 5

Rev.: 0

File: P:\651\51586\CAD\CWW Electrical Standards Drawings (REV0 - MINOR UPDATES) A1.vsdm - Tab:SOFT STARTER

IF IN DOUBT ASK.



No.	Revision	By	Chk	Appd	Date

Drawing Originator:

Original Scale (A1) NTS
Reduced Scale (A3) NTS

Design	AJD	20.04	Approved For Construction*
Drawn	AJD	03/18	
Dsg Check*	NDS	09.05	
Dwg Check*	NDS	09.05	Date

* Refer to Revision 1 for Original Signatures

Client: CHRISTCHURCH CITY COUNCIL · YOUR PEOPLE · YOUR CITY

Project: CCC CWW Electrical Standards

Title: VSD STARTER

Discipline: Electrical

Drawing No.: 6514791-100-NE- 6

Rev.: 1

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OPTIONS
POWER SUPPLY

STANDBY POWER-TO-CLOSE ROTORKS MAY BE EQUIPPED WITH BATTERY BACKED POWER SUPPLIES. EXTERNAL 24 VDC DEEP CYCLE CELLS.

FIELD

G1 Power Supply

R4/2.J11
N4/2.J11
E/2.J12
X1-1 X1-2 X1-13 X1-14

VALVE CONTROL PANEL

24 VDC
0 VDC
E

ACT1
ROTORK IQ SERIES
BATT
NOTE 1.

1 +24Vdc
2 0Vdc
3 Close
4 Stop/ Maintain
5 Open
6 Common
25 ESD
37 Open Interlock
38 Close Interlock
51 Common

CLOSED S1 — BREAK AT FULLY CLOSED
OPENED S2
S3
S4 — BREAK AT FULLY OPENED
MR
HEALTHY

4054/7.K14 4055/7.K14 4053/7.K14 0 VDC/7.I7
4054 4055 4053 0 VDC
4026 4030 4032 4033 4035
X1-3 X1-7 X1-8 X1-10 X1-9 X1-11 X1-6
0 VDC/7.H2
24 VDC

Valve Actuator

AUTO/OFF/MANUAL
5S5
7K13 PLC OPEN
S2 OPEN BTN
7K01 OPENING
7K14 PLC CLOSE
S3 CLOSE BTN
7K02 CLOSING
7K01 OPENING
7K02 CLOSING
4053 4054 4055
X1-4 X1-5 X1-12
4053/7.I2 4054/7.I2 4055/7.I2

PL1 CLOSED (GREEN)
7K03 CLOSED
PL2 OPENED (RED)
7K04 OPENED
PL3 HEALTHY
7K05 HEALTHY

7K13 PLC OPEN
7K14 PLC CLOSE
AUTO/OFF/MANUAL 5S5
7K03 CLOSED
7K04 OPENED
7K05 HEALTHY

XXX.X VA001 XZ01 VALVE OPEN COMMAND
XXX.X VA001 XZ02 VALVE CLOSE COMMAND
XXX.X VA001 HS01 VALVE AUTO FEEDBACK
XXX.X VA001 XZ01 VALVE CLOSED FEEDBACK
XXX.X VA001 XZ02 VALVE OPENED FEEDBACK
XXX.X VA001 XA01 VALVE HEALTHY FEEDBACK

NOTES:

1. INTERNAL 9 VOLT BATTERY – SHALL BE NEW AT INSTALLATION. REQUIRES REGULAR REPLACEMENT AS PER MAINTENANCE SCHEDULE.
2. CONFIGURE OPEN AND CLOSE COMMANDS TO BE LATCHED IN IQ CONTROLLER.
3. BATTERY-BACKED OPERATION, SET TO HOLD POSITION IN LOSS OF POWER UNLESS SPECIFICALLY COMMANDED TO MOVE.
4. ON POWER LOSS AND RECOVERY START UP IN A MODE THAT RESPECTS COMMANDS.

TYPICAL PANEL LABELS

{DESCRIPTION} XXX.X OV001 AUTO OFF MANUAL
{DESCRIPTION} XXX.X OV001 OPENED
{DESCRIPTION} XXX.X OV001 OPEN (IDLE) CLOSE
{DESCRIPTION} XXX.X OV001 CLOSED
{DESCRIPTION} XXX.X OV001 HEALTHY

No.	Revision	By	Chk	Appd	Date

Drawing Originator:

Original Scale (A1) NTS
Reduced Scale (A3) NTS

Design	AJD	20.04	Approved For Construction*
Drawn	AJD	03/18	
Dsg Check*	NDS	09.05	
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* Refer to Revision 1 for Original Signatures

Client: CHRISTCHURCH CITY COUNCIL · YOUR PEOPLE · YOUR CITY

Project: CCC CWW Electrical Standards

Title: ROTORK ACTUATOR

Discipline: Electrical
Drawing No.: 6514791-100-NE- 7
Rev.: 0

File: P:\651\651586\CAD\CWW Electrical Standards Drawings (REV 0 - MINOR UPDATES) A1.vsdm - Tab:ROTORK ACTUATOR

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APPENDIX B – ACCEPTANCE TEST SHEETS

LIFT STATION

Action	Signed	Date
Control Cabinet		
Battery terminated correctly		
230V AC breakers operating correctly		
12V DC breakers operating correctly		
Pump temperature protection circuit correctly wired and labelled		
Pump correctly wired and labelled		
Hydrostatic level transducer correctly terminated and labelled		
Switchboard factory test sheet attached		
Electrical Certificate of Compliance attached		
Switchboard metering installed correctly		
Cellular aerial mounted and operating correctly		
Switchboard mounted correctly		
10A socket installed correctly		
Cabinet lighting installed correctly		
All wire terminations neat and tidy and labelled correctly		
Batteries installed securely		
CCC padlock not installed, but available inside cabinet		
Pump cabling in separate duct		
Sensor cabling in separate duct		
Pump Controller		
Pump controller configured as per the Electrical Specification and Construction Drawings		
Pump controller language set to English		
Pump controller default set to “NL Default”		
Max current set in Pump Controller as per Motor nameplate		
Pump Controller Comms interface orientation correct		

All fault logs reset and pump in “Auto” mode	
Pump name plate installed on pump controller	
Remote Terminal Unit	
Cellular connection available Configured as per Electrical Specification and Construction Drawings	
CCC Sim card installed in Remote Terminal Unit Connected to CCC network	
Correctly communicating with pump controller Physical I/O test complete	
Remote Terminal Unit has latest firmware installed	
Pump Operation	
Start, Stop and Alarm level configured as per the Construction Drawings Pump starts and stops at correct levels when operating in “Auto” mode	
Pump starts and operates until water level at top of pump when float switch manually activated Pump trips when temperature protection circuit manually broken	