GLADSTONE REGIONAL COUNCIL	**ENGINEERING STANDARD**			
	Preferred Electrical Components			
	Document:	**GRC-ES002**	Revision:	**2**

REVISION HISTORY

Rev	*Date*	*Description*	*Prepared By*	*Approved By*
1	10/09/2011	Original Issue	J. Hickey	C. Swanton
2	24/01/2017	Revised and Updated	B. James	C. Swanton

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1 PURPOSE

The purpose of this Engineering Standard is to describe preferred electrical, instrumentation, control system and data communications equipment in various categories to promote a consistent approach to system design.

2 SCOPE

This Engineering Standard is applicable to all Gladstone Regional Council projects where it is necessary to select electrical, instrumentation, control system and data communications equipment.

This document includes components currently available as new equipment that shall be used for new installation work. Many components currently in use at GRC sites may not appear in the component lists. This may be because they are no longer available (obsolete), no longer meet the design criteria for modern installations, or are no longer commercially attractive (too expensive).

Where existing components fail or associated systems are to be modified or replaced, these components shall be replaced, when it is practical to do so, with the modern equivalents provided in this document.

This document is not an exhaustive list, and provides details of commonly used components only. Where is it necessary to select equipment for which there is no preferred type, approval shall be obtained from GRC for the proposed components prior to implementing a design or purchasing components.

3 RESPONSIBILITIES

All persons involved in the purchasing, specifying, design, fabrication and supply of electrical components for use on any GRC site shall comply with this Engineering Standard.

Specifiers shall ensure that manufacturers of electronic equipment to be integrated with power equipment have designed their equipment to meet the requirements of AS 62103 – Electronic Equipment for use in Power Installations where no other specific product standard applies.

Any items of equipment that have not been nominated in this standard, or any variations proposed that are contrary to the requirements of this standard shall be specifically identified and referred to GRC, in writing, for approval.

The purchase or use of any proposed alternatives to the nominated components shall not proceed without the written approval of GRC.

4 DEFINITIONS

Term	*Definition*
ACB	Air Circuit Breaker
Council	Gladstone Regional Council or its nominated representative or agent.
Distributor	The corporation or business appointed by a Manufacturer to sell some of the components described by this Standard.
FOBOT	Fibre Optic Breakout Tray
GRC	Gladstone Regional Council or its nominated representative or agent.
Manufacturer	The corporation or business that manufactures and/or assembles some of the components or equipment described by this Standard.
MCB	Miniature Circuit Breaker
MCCB	Moulded Case Circuit Breaker
MCC	Motor Control Centre
PLC	Programmable Logic Controller
RCBO	Residual current Circuit Breaker with Overload protection
Specifier	Any individual specifying equipment for use in electrical installations on a GRC site.
Superintendent	Person authorised to act on behalf of GRC with respect to the Contract works.
VSD	Variable Speed Drive
UPS	Uninterruptible Power Supply

5 GENERAL REQUIREMENTS

5.1 Component Selection

Users of this Engineering Standard shall note that the nomination of a standard component for general plant use, or for a specific application does not relieve the Specifier of the responsibility to select components that are suitable for use in their particular application.

If a standard component is not suitable, it is the responsibility of the Specifier to identify a suitable component and obtain approval for its use as specified in Section 3 above.

5.2 Catalogue Details

The full catalogue number of a component has not been provided in many instances due to the extensive range of options available for some products. In these instances, the Specifier of a component shall select a suitable product from the approved manufacturers range and specify the required options.

GRC assumes no responsibility for the accuracy of Vendor provided catalogue numbers that are subject to uncontrolled changes or the availability of nominated components.

5.3 Alternatives

When alternatives from different manufacturers are specified for an item of equipment, this shall not be interpreted that it is permissible to mix alternative components from different manufacturers within an assembly. When adding components to an existing assembly every attempt shall be made to match the existing components unless the existing components are obsolete and/or are no longer available.

5.4 Exemptions

Exemptions from using the nominated components are subject to the written approval of GRC, normally through the Superintendent for that particular Contract.

Persons seeking exemptions shall provide technical details to support their reason for claiming exemption as well as complete details of the proposed replacement component.

Exemptions will be considered under the following situations:

a) The component forms part of a proprietary item of equipment and changing to the GRC nominated component may:
   - Seriously impact on the cost and/or delivery of the equipment.
   - Affect the manufacturers guarantee on the equipment.
   - Negate the validity of any type test certifications on the equipment.
   - Prevent the equipment from performing at peak efficiency.
   - Compromise the safe operation of the equipment.

b) The GRC preferred manufacturer does not have a component that meets the required functional or performance requirements.

Claims for exemptions based purely on cost for a possibly inferior or unproven component or the applicants' personal preference will not be granted.

5.5 Prohibited Items

Components that contain asbestos, mercury, lead, cadmium, PCB's, silica gel containing the indicating agent cobalt chloride or any other products either known to or suspected of having carcinogenic or other detrimental long or short term effects on the health of personnel if they are inhaled, ingested or otherwise contacted shall not be supplied for use in electrical equipment or installations on any GRC site.

This requirement shall also apply to all fabrication tools and equipment used in the construction of the components covered by this Standard that could leave dangerous dust particles or other residues inside the components.

6 PREFERRED COMPONENTS

6.1 Cables and Accessories

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	Building Penetration Sealants	KBS Fire Protection	KBS Motor Seal or KBS Sealbags for temporary sealing	
		Hilti (Australia)	CP620	
2	Cable Coatings for Fire Protection	KBS Fire Protection	KBS Coating	
3	Cables – LV Power	Olex, Prysmian Australia, General Cable Australia	Orange circular 0.6/1kV V90 PVC/PVC	XLPE/PVC may also be used, minimum size 2.5mm2
4	Cables – LV Control	Olex, Prysmian Australia, General Cable Australia	Black circular 0.6/1kV V90 PVC/PVC control cable, white numbered cores	Minimum size 1.5mm2
5	Cables – 11kV	Olex, Prysmian Australia	Black 6.35/11kV 3 core XLPE insulated, screened PVC sheathed	
6	Cables – 3.3kV	Olex, Prysmian Australia	Black 3.8/6.6kV 3 core XLPE insulated, screened PVC sheathed	
7	Cables – Screened VSD	Olex, Prysmian Australia	Black circular 0.6/1kV 3 core + 3 earth VSD/EMC screened XLPE/PVC	
8	Cables – Instrument	Olex, Prysmian Australia	V90 PVC insulated, black/white twisted pairs, individual and overall screened PVC sheathed	
9	Cables – Fibre Optic	Optimal Cable Services	Single Mode, Polyethylene Sheathed, Loose Tube	Minimum 6 cores
10	Cable Markers	Laserit Ph: (07) 4972 4212	Laser etched 316 stainless steel cable tags	5mm text
11	Cable Core Markers	Brady	30mm Durasleeve wiremarker insert and transparent carrier	

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
12	Cable Skirting Ducts	Panduit	T70 Series surface raceway, off-white	
13	Cable Ducts (Solid)	NHP	Iboco TA series	
14	Cable Ducts (Slotted)	NHP	Iboco T1/T1E series	Grey for general electrical applications, Blue for communications wiring.
		Panduit	Type G	
15	Cable Clamps (high fault level cables)	Intertec Engineering	Torgy Atlantic ASEPlas cable cleats types C, U or T. KOZ Clamps type TS and STC	
		Slagboom Electric	Dutchclamp Unifix IM 4 type	
16	Cable Ties (Nylon)	Various	Black, heavy duty, UV stabilised nylon for indoor & outdoor applications	
17	Cable Ties (Stainless Steel)	Panduit	Stainless steel type	
		Cabac	Stainless steel type	
18	Cable Glands (EMC Type)	Wattmaster	Alco ALCEMC EMC Premium	
		Siemens	EMC cable glands, nickel plated brass	
		CCG Cable Terminations	CCG Posi Braid	
19	Cable Glands (General Purpose)	CMI Electrical Products	Surefit GWPSS and GWPMSS stainless steel and Surefit GWP and GWPM nickel plated brass	Use stainless steel glands for all HV installations. Do not use unplated brass glands externally. Do not use aluminium or nylon/plastic cable glands. All external glands must have shrouds.
		Wattmaster	Alco UW/HUW nickel plated brass series	
		CCG Cable Terminations	CCG A2 and A2EX nickel plated brass, and Posi Grip Exe brass with non-corrosive body	

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
20	Cable Lugs and Links	Cabac	Aluminium lugs – AL series	
			Aluminium links – ALK series	
			Bi-metal lugs – BL series	
			Bi-metal crimp links – BLK series	
			Bi-metal stalk lugs – BS series	
			Copper crimp lugs – CAL series	
			Copper crimp links – CAS series	
		Utilux	Aluminium lugs – H15100 series	
			Aluminium links – H15200 series	
			Bi-metal lugs – H15300 series	
			Bi-metal crimp links – H15400 series	
			Bi-metal stalk lugs – H15500 series	
			Copper crimp lugs – H1400 series	
			Copper crimp links – H1400 series	
21	Bootlace Crimps	Cabac		
22	Cable Splice / Termination Kits	Raychem	To suit application	
		3M	To suit application	
23	Cable Ladder	Unistrut Australia		In accordance with GRC-ES001
24	Underground Conduit	Various	Orange HD PVC	
25	Flexible Conduit (non-metallic)	Adaptaflex	Type RF non-metallic	Use nickel plated brass or stainless steel fittings instead of nylon fittings.
26	Flexible Heavy Duty Hose	Various	Nylon spiral reinforced grey PVC	

6.2 Cable Pits

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	Light Duty Applications (Minimum vehicular traffic)	ACO Australia	HDPE Plastic with steel lid (Class B)	
2	Medium Duty Applications (Light vehicular traffic, parking areas)	ACO Australia	Polymer Concrete with steel lid (Class B)	
3	Heavy Duty Applications	ACO Australia	Polymer Concrete with Load Class to suit application	Consult manufacturer for cover and lid requirements to suit load class

6.3 Communications and Data Equipment

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	Ethernet Switch (Rack Mount)	Cisco	Catalyst 2960-X series	
		Allen-Bradley / NHP	Stratix 5410 series	
2	Ethernet Switch (Din Rail Managed)	Allen-Bradley / NHP	Stratix 8000 series	
3	Ethernet Switch (Din Rail Unmanaged)	Allen-Bradley / NHP	Stratix 2000 series	
4	FOBOT (DIN / Panel Mount)	Optical Fibre Systems	OFS-MOD-12	
5	FOBOT (Rack Mount)	Optical Fibre Systems	OFS-900	
6	FOBOT (Wall Mount	Optical Fibre Systems	OFS-200	

6.4 Control and Indication Equipment

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	Ammeters	IME / NHP	72mm square, full current, 5x overload scale, 0-1A moving iron movement, quadrant scale	
		Crompton Instrument		
2	Indicating Lights	Sprecher & Schuh / NHP	D7 series, integrated LED lamp block, 24VDC, plastic	
3	Pushbuttons	Sprecher & Schuh / NHP	D7 series, 22.5mm flush, momentary push button, plastic, non- illuminated	Colour and contact arrangement to suit application
4	Emergency Stop	Sprecher & Schuh / NHP	D7 series, 22.5mm twist to reset, plastic, non-illuminated	
5	Pushbutton Stations	NHP	Type SS, Size 1, 2 or 3	
6	Selector Switches	Kraus & Namier	CA10 series	Label and selector switch configuration to suit application
7	Control Relays	Finder / NHP	55 series + base	
8	Timer Relays	Carlo Gavazzi / NHP		Selected to suit application
9	Monitoring Relays	Carlo Gavazzi / NHP		Selected to suit application
10	Sirens (Motor Driven)	NHP / Klaxon	KL2108	
11	Sirens (Electronic)	NHP / Klaxon	KL980552, KL980546	

6.5 Conveyor Protection Devices

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	Lanyard Switches	R&D Technology	Pull-Safe pull wire switch with lanyard kit & poly coated stainless steel lanyard	

Item	Description	Manufacturer / Distributor	Type / Model / Requirements	Comments
2	Drift Switches	R&D Technology	Safe-T-Drift	Heavy duty applications
		Schneider Electric	Square D 9007C62J multi-directional head with J type delrin extension	Light duty applications
3	Under Speed Detection	Pepperl+Fuchs	KFD2-DWB-1.D Rotation Speed Monitor	

6.6 Enclosures

Item	Description	Manufacturer / Distributor	Type / Model / Requirements	Comments
1	Small Indoor	B&R Enclosures	Monarch IP – Zinc Coated Steel	
		Rital	AE Series – Zinc Coated Steel	
2	Small Outdoor	B&R Enclosures	Monarch IP – Stainless steel with IPRH series stainless steel rain hood	
		Rital	AE Series – Stainless steel with rain hood	
3	Large Indoor	B&R Enclosures	Universal DD – Zinc Coated Steel or iLINQ bayable	
		Rital	ES5000 or TS8 bayable	
4	Junction Boxes (Lighting Stanchions and Columns)	CCG Cable Terminations	CCG Utility Box	
5	Junction Boxes (General Purpose)	CCG Cable Terminations	CCG Utility Box	
		Clipsal	56JB series (grey)	
6	Key Locking Handles	Schneider	TEELU9-AP11, lock code no. 92268	

6.7 High Voltage Switchgear

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	11kV Outdoor RMU			
3	11kV Indoor Metal Clad Switchboards			
4	3.3kV Indoor Metal Clad Switchboards			
5	Protection Relays (3.3kV Motors)			
6	Protection Relays (11kV Motors)			
7	Protection Relays (11kV Circuit Breakers)			
8	Protection Relays (Generator Protection)			
10	Bus Duct	ABB	SC-R Cast Resin IP68	

6.8 Instrumentation

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	Differential Pressure Transmitters	Endress & Hauser	Deltabar	
2	Flow Switches	IFM Efector	SI5000	
3	Limit Switches (Electro-mechanical)	Schneider Electric	Telemechanique (Square D) heavy duty types to suit application	
4	Limit Switches (Magnetic)	Ramelec	Go Electroswitch	
5	Magnetic Flow Meters	ABB	Watermaster	Potted Cable with fixed length

Item	Description	Manufacturer / Distributor	Type / Model / Requirements	Comments
6	Pressure Gauges	Wika	233.50 series bourdon tube pressure gauge, stainless steel, 100mm	
7	Pressure Switches	Schneider Electric	Class 9012 to suit application	
		NHP	IPS Series to suit application	
8	Pressure Transmitters	Endress & Hauser	Cerabar	
9	Proximity Switches	Pepperl & Fuchs / Control Logic	NCN15 Series, NJ10 Series	
10	Temperature Gauge	Wika	Model 53 bimetal thermometer, stainless steel	
11	Temperature Transmitter	Endress & Hauser	Omnigrad M	
12	Temperature Switches	IFM Efector	TN2000 series	
13	Signal Isolators	Critech	DSD120	
14	Submersible Level Transmitters	Endress & Hauser	Waterpilot FMX21	
15	Ultrasonic Level Transmitters	Endress & Hauser	Prosonic FMU40/41	
16	Radar Level Transmitters	Endress & Hauser	Micropilot FMR50/51	
17	Vibrating Level Switches	Endress & Hauser	Liquiphant FTL51	

6.9 Low Voltage Switchboards and Motor Control Centres

Item	Description	Manufacturer / Distributor	Type / Model / Requirements	Comments
1	415 Switchboard / Motor Control Centre (> 400A)			In accordance with GRC-ES004
2	415V Switchboard / Motor Control Centre (< 400A)			In accordance with GRC-ES004

6.10 Lighting and Power Distribution

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	Light & Power Distribution Boards	NHP	Concept Premier Panelboard with Terasaki Din-T MCBs.	In accordance with GRC-ES005
2	ELV Distribution Boards	NHP	Concept Premier Panelboard with Terasaki 2 pole 10kA Din-T MCBs.	In accordance with GRC-ES005
3	Load Centres	NHP	NLC series surface mounted metal load centre with door	
4	Single Phase GPO (Office Building)	Clipsal	White 2000 Series double GPO	
5	Single Phase GPO (Plant Area)	Clipsal	56C310HD, RO / 56C315HD, RO	Use round earth pin for UPS distribution
6	Single Phase GPO (UPS)	Clipsal	Red 2000 Series double GPO 2025LRD	
7	3 Phase Outlet up to 50A (Plant Area)	Clipsal	56 Series, RO, 4/5 pin to suit application	
8	3 Phase Outlet 63A (Plant Area)	Clipsal	66CV Series, RO, 4/5 pin to suit application	
	Lighting Switch (Office Building)	Clipsal	White 2000 Series	
8	Lighting	Eye Lighting		
		Pierlite		

6.11 Motors

Item	Description	Manufacturer / Distributor	Type / Model / Requirements	Comments
1	240V Single Phase	N/A	N/A	Single phase motors are not approved for any process/production related application.
2	415V 3 Phase	Teco	Cast iron TEFC type to suit application	4, 6 or 8 pole preferred
		Toshiba		
		WEG		
3	3.3kV 3 Phase	Teco	Cast iron TEFC type to suit application	4, 6 or 8 pole preferred
		Toshiba		
		WEG		

6.12 Power Supplies

Item	Description	Manufacturer / Distributor	Type / Model / Requirements	Comments
1	Power Supply – 24VDC	Allen-Bradley / NHP	1606-XL Series	
		Puls / Control Logic	Dimension Q Series	
2	Power Supply – 12VDC UPS	Snaptec Australia	SRU Series	Individual sewerage pump stations

6.13 Programmable Logic Controllers and HMIs

Item	Description	Manufacturer / Distributor	Type / Model / Requirements	Comments
1	PLC System (Large PLC > 150 IO Points)	Allen-Bradley / NHP	ControlLogix Series	
2	Processor (Large PLC)	Allen-Bradley / NHP	1756-L72 – 1756-L7x	Processor selected to suit application requirements

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
3	Digital Input Module (Large PLC)	Allen-Bradley / NHP	1756-IB32	
4	Digital Output Module (Large PLC)	Allen-Bradley / NHP	1756-OB32	
5	Analog Input Module (Large PLC)	Allen-Bradley / NHP	1756-IF16	
6	Analog Output Module (Large PLC)	Allen-Bradley / NHP	1756-OF8	
7	Ethernet Communications Module (Large PLC)	Allen-Bradley / NHP	1756-EN2T, 1756-EN2TR	
8	Modbus Communications Module (Large PLC)	Prosoft Technology / NHP	MVI56E-MNET	Modbus TCP/IP communications interface with Pump Station RTU
9	PLC System (Small PLC < 150 IO Points)	Allen-Bradley / NHP	CompactLogix Series	
10	Processor (Small PLC)	Allen-Bradley / NHP	1769-L30ER	Processor selected to suit application requirements
11	Digital Input Module (Small PLC)	Allen-Bradley / NHP	1769-IQ16	
12	Digital Output Module (Small PLC)	Allen-Bradley / NHP	1769-OB16	
13	Analog Input Module (Small PLC)	Allen-Bradley / NHP	1769-IF8	
14	Analog Output Module (Small PLC)	Allen-Bradley / NHP	1769-OF8C	

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
15	Modbus Communications Module (Small PLC)	Prosoft Technology / NHP	MVI69-MNET	Modbus TCP/IP communications interface with Pump Station RTU
16	RTU System (Remote Pump Stations)	Schneider Electric	SCADAPack 357E Part No. 5209 with I/O Expansion Module 5606	
17	PLC and I/O Communications Network		Ethernet/IP	
18	PLC to RTU Communications Network		Modbus TCP/IP	
19	Field I/O System	Allen-Bradley / NHP	Flex IO Series	
20	Field I/O Communications	Allen-Bradley / NHP	1794-AENT, 1794-AENTR	
21	Field I/O Digital Input	Allen-Bradley / NHP	1794-IB16 + 1794-TB3	
22	Field I/O Digital Output	Allen-Bradley / NHP	1794-OB16 + 1794-TB3	
23	Field I/O Analog Input	Allen-Bradley / NHP	1794-IE8 + 1794-TB3	
24	Field I/O Analog Output	Allen-Bradley / NHP	1794-OE4 + 1794-TB3	
25	HMI	Allen-Bradley / NHP	Panelview Plus 7 series colour touchscreen terminal	Sized to suit application, minimum size 15 inch

6.14 Switchgear and Controlgear

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	Air Circuit Breakers	Terasaki / NHP	Tempower 2	
2	Current Transformers	Crompton	Rating & specification in accordance with drawings	
		Stemar		
3	Decontactors	Marechal Australia	DS Decontactor Range, 30° inclined wall box type	
4	Isolating Switches (up to 63A)	Clipsal	56SWH Series, Resistant Orange with Red/Yellow Operator/Collar	
5	Isolating Switches (25A – 200A)	NHP	ISO Switch 3 or 4 pole with Red/Yellow Operator/Collar	Polycarbonate for general purpose, stainless steel for heavy duty applications
		Terasaki / NHP	LY7 Series, polycarbonate enclosure with Red/Yellow Operator/Collar	
6	Isolating Switches (25 to 315A)	Kraus & Naimer	KG Series with Red/Yellow Operator/Collar & padlockable handle	Polycarbonate for general purpose, stainless steel for heavy duty applications
7	Moulded Case Circuit Breakers (MCCB)	Terasaki / NHP	Tembreak 2	
8	Miniature Circuit Breakers (MCB)	Terasaki / NHP	Din-T10, C Curve type unless specified otherwise	Supplied with captive lock dog
9	Motor Circuit Breaker	Terasaki / NHP	KT7 Series	
10	RCBO	Terasaki / NHP	Din-Safe 10kA	
11	Fuses (HRC)	IPD	HRC Type, 660V bolt in for power applications, 415V NS clip in type for control applications	

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
12	Fuse Holders (HRC)	IPD	Red Spot for bolt in fuses, Safe Clip for NS clip in type	
13	Power Meter	Electrex / Control Logic	Electrex Flash D PFE430-00 with RS485 modbus communications	For connection to RTU systems
		Allen-Bradley / NHP	Powermonitor 500 with Ethernet/IP communications	For connection to PLC systems
14	Contactors	Sprecher & Schuh / NHP	CA 7 and CA6, 24VDC coil	Shall be fitted with coil suppressor except for light and power DB's.
15	General Purpose Relays	Sprecher & Schuh / NHP	CS 7C, with CRV 7-55 suppressor module	Contact arrangement to suit application.
16	Overload Relays	Sprecher & Schuh / NHP	CEP 7-EE	
17	Thermistor Relays	Sprecher & Schuh / NHP	RT7-E2	
18	Phase Failure Relays	Carlo Gavazzi / NHP	DPA-01-D-M48	
19	Electronic Motor Protection Relays	Allen-Bradley / NHP	E300 series	
20	Test Links	Wago / NHP	282 series	
21	DOL Motor Starters (< 4kW Only)	Sprecher & Schuh / NHP	CAT 7S series	Only to be used where there is no local MCC option available
22	Resistor Banks	Fortress Systems	Stainless steel enclosure type	

6.15 Transfer Switches

Item	Description	Manufacturer / Distributor	Type / Model / Requirements	Comments
1	Automatic Transfer Switches	Terasaki / NHP	Tembreak 2 MCCB type with ATL610NHP controller	
2	Manual Transfer Switches	Terasaki / NHP	Tembreak 2 MCCB type	
		Socomec / NHP	SCOM series	

6.16 Transformers

Item	Description	Manufacturer / Distributor	Type / Model / Requirements	Comments
1	11kV / 3.3kV	Wilson Transformers		
		Schneider Electric		
2	415V Distribution	Wilson Transformers		
		Schneider Electric		
		ABB		
3	Neutral Earthing Resistors	Fortress Systems	Stainless steel enclosure type	

6.17 Terminals and Accessories

Item	Description	Manufacturer / Distributor	Type / Model / Requirements	Comments
1	Feed Through Terminals	Sprecher & Schuh / NHP	V7-W4 + accessories	
2	Fused Disconnect Terminals	Sprecher & Schuh / NHP	V7-WFB4 + accessories	
3	Disconnect Terminals	Sprecher & Schuh / NHP	V7-WKD3 + accessories	
4	Double Decker Feed Through Terminals	Sprecher & Schuh / NHP	V7-WD4 + accessories	
5	Power Terminals (> 10mm2)	Sprecher & Schuh / NHP	V7-W35 + accessories	

6.18 UPS and Battery Chargers

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	UPS > 1000VA	APC		
2	UPS < 1000VA	APC		
3	DC Battery Chargers (Tripping Power Supplies)	Magellan Power	MCRII	
		Exide Technologies	GNB24/48/110VDC Series	

6.19 Variable Speed Drives and Soft Starters

Item	*Description*	*Manufacturer / Distributor*	*Type / Model / Requirements*	*Comments*
1	415V Electronic Soft Starters	Schneider	Altistart 48	
2	415V Variable Speed Drives	Fuji Electric	Frenic Mega with Modbus communications	