TWEED SHIRE COUNCIL

ELECTRICAL DESIGN SPECIFICATION

EL01

GENERAL REQUIREMENTS AND INFORMATION

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1 CITATION

This document is named "Tweed Shire Council, Electrical Design Specification E01 - General Requirements and Information"

2 ORIGIN OF DOCUMENT, COPYRIGHT

This document was originally produced for Tweed Shire Council. This document is copyright to Tweed Shire Council.

3 VERSIONS

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED (The new version takes effect from this date)	Authorised by the Director of Engineering Services
1.1	Original version		1 November 2005	
1.2	TSC Review		1 February 2007	

4 STANDARDS

The equipment and materials supplied under this Specification must comply with the latest relevant Australian Standards, or, in their absence, with the latest relevant IEC Standards, together with the requirements of competent Authorities having jurisdiction over all or part of their manufacture, installation and operation.

In particular, all equipment and materials supplied must comply with the relevant requirements of the following Regulations, Standards and Reference Specifications.

AS 1319 Safety Signs for the Occupational Environment

AS 1675 Current Transformers - Measurement and Protection

AS 1930 Circuit Breakers for Distribution Circuits (up to and including 1000V ac and 1200V dc)

AS 1939 Degrees of Protection Provided by Enclosures for Electrical Equipment (IP Code)

AS 2184 Low Voltage Switchgear and Controlgear - Moulded Case Circuit Breakers for Rated Voltages up to and including 600V ac and 250V dc.

AS 2700 Colour Standards for General Purposes

AS 2768 Electrical Insulating Materials - Evaluation and Classification based on Thermal Endurance

AS 3000 Electrical Installations (Australian Wiring Rules)

AS 3007 Electrical Installations - Surface Mines and Associated Processing Plant

AS 3439 Low-Voltage Switchgear and Controlgear Assemblies

Part 1:	Type-Tested and Partially Type-Tested Assemblies
AS 3947	Low Voltage Switchgear and Controlgear
Part 1:	General Rules
Part 3:	Switches, Disconnectors, Switch-Disconnectors and Fuse-Combination Units
Part 4:	Contactors and Motor Starters
Part 5:	Control Circuit Devices and Switching Elements
Part 7:	Ancillary Equipment

The requirements of any other body having jurisdiction over any part of the works.

5 GENERAL

This Specification must be deemed to be complementary to the latest editions and revisions of all Statutory Rules and Regulations in force at the time of executing such work.

The intent of the Standard Specifications is to provide a means of ensuring a uniform approach to and standardisation of the design and installation of electrical equipment. All designs, quality of workmanship and materials must be subject to the approval of the Council on the basis of the criteria set down in these Standard Specifications.

6 WORKMANSHIP AND MATERIALS

The workmanship is to be of the highest standard throughout. Skilled labour must be employed in accordance with the requirements of the Electrical Contractors and Electricians Licensing Act, or any other requirements of a Statutory Authority.

Where requested, the Contractor must gain approval for sample fittings, accessories and apparatus before installation.

7 FIXINGS AND FASTENERS

Unless otherwise specified, all bolt heads and nuts provided must be hexagonal in shape and truly faced and to Australian or other accepted international standard.

All bolts for electrical terminations must be high tensile, fine thread and cadmium plated.

Galvanised bolts are not acceptable.

All bolts for non-electrical connections in plant areas must be of stainless steel.

Washers must be provided under nuts and bolt heads where required. Only Belleville washers or flat and spring washers must be used for busbar joints, motor or incoming connections.

Each bolt must show not less than one and not more than three full threads beyond its nut after assembly.

All nuts, bolts and other fastenings on any part of the plant must, where required, be securely locked.

8 SAFETY

The Contractor must work in a safe manner at all times. No work must be carried out on "live" equipment unless specifically authorised by the Council.

The Contractor must observe all local safety procedures, and in particular employ the isolation procedures established for the site.

Prominent notices must be provided in switchrooms and control rooms, after equipment is energised, warning personnel that equipment is alive in the area.

Safety tags must be as nominated by the Council and must be renewed for each and every isolation. Distinct commissioning tags must be employed during commissioning, as nominated by the Council. Tags must be fully filled out with an indelible pen.

All plant, when handed over, must be isolated and tagged by the contractor.

Under all circumstances, isolation procedures must be established only by the Council.

The Contractor must comply with the relevant State Workplace Health and Safety Act and Regulations currently in force.

9 OPERATING CONDITIONS

All electrical work associated with the operation of industrial plants, will be subject to the environmental extremes of dust, dirt, heat, cold and water. All equipment must be capable of operating continuously and without failure through these extremes and, at the same time, be readily accessible for maintenance purposes.

All field mounted equipment is to be dust, weather and hose proof. Field enclosures must be rated to IP65 according to AS 1939 and constructed from 316 stainless steel unpainted number 4 linnish finish or marine grade aluminium.

10 STANDARDISATION

A standardised approach is to be taken with all control circuits and equipment selection. Similar drives are to have similar control circuits and compatible wire numbering systems. Equipment types are to be similar and rationalised as far as possible to minimise spares requirements.

Corresponding parts must be interchangeable wherever possible.

11 INSPECTION AND WORKS TESTING OF EQUIPMENT

The Contractor is required to supply the Council with the following:

(a) Authority to enter the Contractor's works or any works engaged on manufacture of contract plant in order to facilitate the inspection of equipment during and after manufacture.

(b) Facility for the witnessing of tests. As far as is practical at least two (2) weeks notice should be given to the Council for final testing and reasonable notice is to be given of any preliminary tests or testing of components.

The passing of such inspections or tests must in no way excuse the Contractor from complying with the requirements of the Standards and Specifications.

The cost of all inspection and tests, of the preparation of equipment for inspection and tests must be borne by the Contractor who must arrange and carry out such calibration of testing apparatus as is required by the Council.

Copies of all test records and test certificates carried out by the various manufacturers must be supplied to the Council. The number of copies will be as nominated in the contract document (at least four).

The Contractor must carry out, at no extra charge, any tests additional to those specifically referred to herein, which the Council may consider necessary to demonstrate that the plant complies with the Standard or is otherwise satisfactory.

The Contractor must provide all necessary testing facilities and equipment.

12 INSULATION COLOUR CODES

All wiring must be colour coded as follows:

AC Power		
3Φ		
	Phase 1	Red
	Phase 2	White
	Phase 3	Blue
1Φ		
	Active	Red
	Neutral	Black
AC Control		
24 V ac		
	Active	Blue/Red
	Neutral	Blue/Black
240 V ac		
	Active controlled by isolator on the switchboard	Grey
	Active not controlled by isolator on the switchboard	Orange
	Neutral	Black
DC Control		
12 V DC		
	Positive	White/Brown
	Negative	White/Blue
24 V DC		
	Positive	White/Red
	Negative	White/Black
Screened Analog		
	Positive	White
	Negative	Black
Earth & Earth Screens		Green/Yellow
No volt contacts		
	Common	Brown
	Switched	Brown/White
Telemetry		Violet

13 PUSHBUTTONS

All pushbuttons must be provided with silver contacts rated at not less than 10A. They must be of a robust, dust proof, weatherproof, hose-proof and oil tight design. Operators must be interchangeable.

Emergency stop pushbuttons must be of the mushroom head latching type, with manual reset.

The surfaces behind or below (if any) of handles and pushbuttons must be coloured yellow, so that actuators are clearly contrasted e.g. yellow mounting boxes or escutcheon rings.

Colour coding of pushbuttons must be as follows:

RED	Stop; Emergency Stop; Open; Trip; Off
YELLOW (AMBER)	Intervention; Trip Over-ride
GREEN	Start; On; Close; Turn On
BLUE	Reset
BLACK	Forward; Reverse; Test

14 INDICATING LAMPS

Indicating lamps must be adequately ventilated. Lamp holders must be attached to the panel by means other than the bezel.

Lamps must be 23mm LED cluster type, easily removed and replaced from the front of the panel by manual means not requiring the use of extractors.

Lenses must be evenly coloured throughout (not just coated) as follows:

RED	Power On; Control Available; Supply Available; Danger; Dangerous to Enter; Lockout
YELLOW (AMBER)	Caution; Fault; Belt Slip; Earth Continuity Fault; Under voltage Trip; Overload
GREEN	Power Off; Safe; Safe Access
BLUE	Remote Control Selected; Brake Applied; Ready to Start; Motor or Machine Off
WHITE	Motor or Machine Running; Normal Operation

15 TERMINALS

Double deck style terminals must not be used.

Fused terminals should only be used where specified in the Technical Specification.

Terminal strips must be fitted with end plates and end clamps.

Insulated screw in type bridging links must be used in preference to bridging connectors.

All terminal strips must be labelled. Each terminal in a terminal strip must have a marking tag.

Terminal strips must be marked with consecutive numbers from top to bottom or from left to right.

Earth through terminals must not be used.

Voltage segregation must be achieved on terminal strips by using separation plates to separate the different voltages.

16 IDENTIFICATION AND LABELLING

All electrical/instrument equipment supplied or installed as part of this contract must have conspicuous labels fitted to non-detachable parts of the equipment. Labels must not be fixed to removable covers and doors, or to equipment that may be removed or replaced during maintenance.

Labels must meet the following requirements:

Equipment	Type of Label	Minimum Text Height	Remarks / Functions
Switchboard Main Identification	White traffolyte, black lettering	40mm	Main Switch
Switchboard Name/Data Plate	White traffolyte, black lettering	6mm	Main Switch
MCC Incomer / Bus Tie	White traffolyte, black lettering	15mm	Main Switch
MCC Drive Cell	White traffolyte, black lettering	10mm	Drive Description,Tag Name, Drive KW. Refer to thetypical label drawings for sizes etc.
Fuses & Circuit Breaker	White traffolyte, black lettering	5mm	Type, rating and circuit identification. See text for detail on light & power circuit

Equipment	Type of Label	Minimum Text Height	Remarks / Functions
			breakers.
Relays and Contactors	White traffolyte, black lettering	5mm	Relay or contactor identification and function as per drawing reference or relevant schematic.
Pushbuttons and Switches (indoor)	White traffolyte,black lettering	5mm	Circuit and equipment identification and on/off/auto positions
Wire numbering	Grafoplast style wire markers with single element printed wire numbers		Wire number as on wiring diagram. Colour coded ferrules are not to be used.
Switchgear and control panels (indoor)	White traffolyte, black lettering	5mm	Equipment Identification
Local Control Stations (Outdoor)	Stainless steel tag minimum 1mm thick – Laser etched or deep engraved & painted	12mm	Equipment Identification
Instruments and Electrical Equipment	White traffolyte, black lettering (inside panels)	5mm	Function
Instruments and Electrical Equipment	Stainless steel tag minimum 1mm thick– Laser etched or deep engraved & painted (Outside	5mm	Equipment Identification

Equipment	Type of Label	Minimum Text Height	Remarks / Functions
	panels)		
Sub Distribution Lighting & Power Distribution Boards	White traffolyte, black lettering (inside panels)	5mm	See text below for requirements.
Lights, GPO's and Welding Outlets	Stainless steel tag minimum 1mm thick – Laser etched or deep engraved & painted	5mm	MCC Circuit Number & Circuit Breaker Number
Light & Power final subcircuit circuit breakers	White traffolyte, black lettering	5mm	C/B, circuit, rating And description as described this Specification
Miscellaneous equipment	As accepted by the Council		

Each circuit breaker and motor starting equipment group must have an identifying engraved nameplate giving its title and drive number.

All switches and circuit breakers used to isolate, control, or protect electrical or other equipment must be clearly labelled to identify the apparatus isolated, controlled or protected.

All MCC's, switchboards, distribution boards, local isolators, lights and GPO's must be fitted with a label detailing the isolation location.

Label sizes must be appropriate for components.

Each drive or logical group in the marshalling tier must be labelled with a group marker.

Ducts or panels containing electrical wiring must be identified with warning notices where it is not obvious that such wiring exists.

All apparatus must be clearly labelled indicating its purposes and, where applicable, 'on' and 'off' positions. Labels must indicate the function of any ancillary apparatus, such as relays, fuses, etc.

Each phase of alternating current and each pole of direct current, switchgear and connections must be coloured in an accepted manner to distinguish phase or polarity. Colours must, unless otherwise agreed, be in accordance with AS 2067.

Wording on equipment labels must correspond to wording on schematic drawings. Abbreviations may be used where it is impracticable to use the full name on the label, subject to the approval of the Council. In all cases, wording of labels must be such that identification, assessment and operation are unambiguous for all personnel, skilled or unskilled.

Circuit breaker and fuse labels must show the type and rating of the circuit breaker and fuse.

The characters on each label must be deeply engraved on a white background. Lettering must generally be black in colour, except that red must be used for danger labels.

All labels must be fade-free with bevelled edges. Labels exposed to the weather must be of stainless steel. Labels for weather-protected equipment must be of Traffolyte.

Labels must be securely fixed to the equipment using not less than two stainless steel fasteners.

Label fixing must be such as to allow ready replacement without damage to the label or the fixing.

Adhesive type fixings must not be used.

The size, lettering size, fixing position, fixing method and wording of all labels to be provided on electrical equipment or enclosures must be subject to the approval of the Council prior to the manufacture of the equipment or enclosure.

There must be affixed inside each electrical enclosure, a receptacle specifically installed for the purpose of storing a water and dirt-proofed electrical schematic diagram of the electrical equipment.

Doors, removable or hinged panels and covers for control enclosures and modules must be marked with a caution sign depicting the symbol for “caution, risk and electric shock” as defined in AS 1319. This symbol comprises a yellow triangle sitting on its base, with a black border and a black lightning strike symbol striking downwards centred in the triangle.

Isolating switches must be marked to show circuits or equipment to be isolated. If any portion of equipment that could be assumed to be isolated by such a switch, is not isolated by such a switch, then a warning label must be provided.

There must also be attached to the external surface of each switchboard a nameplate onto which data must be engraved as follows (lettering 6mm bold minimum):

- Manufacturer’s name

- Date of manufacture
- Serial number
- Rated fault level, voltage and current capacity
- Gross mass.

Switchboard main identification labels must have 40mm high lettering.

The Contractor must supply and fit labels affixed adjacent to each isolator, light and general power outlet to indicate the circuit breaker number, the circuit number and the circuit description. Refer typical label drawing.

Unused/empty circuit breaker locations must be provided with labels as described above, having only the circuit breaker number engraved.

All electrical equipment and enclosures other than those specified must be fitted with the following notices for the purpose detailed below:

a) In the event that the enclosure is so designed that live parts may be exposed by opening or removal of a cover door or access plate, the cover door or access plate must have fitted a standard Class A reflectorised sign as per AS 1614. Refer typical label drawing.

b) All doors, covers and access plates of any electrical enclosure must be fitted with a standard Class C reflectorised sign as per AS 1614. Refer typical label drawing.

c) There must be fitted to all doors, covers and access plates of all electrical enclosures containing electrical equipment, a standard Class A reflectorised sign as per AS 1614. Refer typical label drawing. In each case the voltage level must be nominated on the label.

d) All isolation points must be identified with a label. Refer typical label drawing – isolation point. Points requiring identification are:

- MCC Isolators / circuit breakers
- Local isolators
- On – off valve / gate pneumatic 3 way ball valves
- Positioner pneumatic 3 way ball valves

All standard reflectorised signs, unless otherwise specified, must be small (230 x 110mm) as per AS 1614. In some instances, signs smaller than standard, may be accepted by the Council, if space restrictions preclude the use of the standard sign. Specific written approval must be obtained from the Council before such signs are used.

Lettering colours for reflectorised signs must typically be:

- RED for stop, fire or prohibition
- YELLOW for caution
- GREEN for safety services
- BLUE for information

Backing colour will generally be white.

Safety signs must be as per AS 1319. Safety signs must be used where required to convey hazard and emergency information. Safety signs must typically include signs as categorised below;

- Regulatory signs (Prohibition and Mandatory signs)
- Hazard signs (Danger and Warning signs)
- Emergency information signs (Signs indicating the location of, or directions to emergency related facilities)
- Fire signs (Signs advising the location of fire alarms and fire fighting facilities)

17 CABLE SCHEDULE

All cable lengths are estimated lengths in metres, point to point, exclusive of any allowance for cutting. Estimated lengths must not be used for tendering.

All cables to be numbered with cable number. Refer to specifications.

Cable scores are shown as, e.g. 3.5E where -

- 3.5 = 3 core plus reduced neutral
- E = laid up earth conductor

All power cable core colours must be as follows -

- 1 core - red
- 2 core - (red, black) or (brown, blue)
- 3 core - red, white, blue
- 3.5 & 4 core - red, white, blue, black

All control cable core colours must be as follows -

- 4 core - white, numbered
- all earths - green/yellow

All instrument cable core colours must be as follows -

- pairs - black, white, with pairs numbered
- triads - black, white, red with triads numbered

18 CABLE SPECIFICATIONS

Type	Specification
CAT5	Category 5 twisted pair data cable
CAT6	Category 6 twisted pair data cable

Type	Specification
COAX	Coaxial Cable (75 OHM)
CPVCSWA	CONTROL cable, multicore circular with insulated earth continuity conductor 0.6/1kV PVC insulated. PVC bedded, steel wire ARMOURED, PVC sheathed to AS 3147, COPPER conductors, 75ºC.
CPVCPVC	CONTROL cable, multicore circular with insulated earth continuity conductor 0.6/1kV PVC insulated. PVC sheathed to AS 3147, COPPER conductors, 75ºC.
EPVCPVC	EARTH cable, PVC insulated to AS 3147, COPPER conductors, 75ºC.
HIL1SWA	High Voltage POWER cable, paper insulated, belted, lead alloy sheathed, PVC bedded, steel wire ARMOURED, PVC sheathed, to AS 1026, COPPER conductors.
HIL2PVC	High Voltage POWER cable, paper insulated, screened lead alloy sheathed, PVC sheathed, to AS 1026, COPPER conductors.
HIL2SWA	High Voltage POWER cable, paper insulated, screened lead alloy sheathed, PVC bedded, steel wire ARMOURED, PVC sheathed to AS 1026, COPPER conductors.
HXLPPVC	High Voltage POWER cable, XLPE insulated, copper wire screened HR-PVC sheathed, coarse fault protection (HEAVY duty) screened, to AS 1429 COPPER conductor.
HXLPSWA	High Voltage POWER cable, XLPE insulated, copper wire individually. screened HR-PVC sheath bedded, steel wire ARMOURED, HRPVC sheathed, coarse fault protection (HEAVY duty) screened to AS 1429 COPPER conductors.
IINDPVC	INSTRUMENT cable, PVC insulated, indiv. screen & drain, overall screen & drain, PVC sheathed. Equivalent to DEKORON type IED184/IGD184.
IINDSWA	INSTRUMENT cable, PVC insulated, indiv. screen & drain, overall screen & drain, PVC bedded, steel wire ARMOURED, PVC sheathed. Equivalent to DEKORON type IEH184/IGH184.
IOVRPVC	INSTRUMENT cable, PVC insulated, overall screen & drain, PVC sheathed. Equivalent to DEKORON type IEC184/IGC184.
IOVRSWA	INSTRUMENT cable, PVC insulated, overall screen & drain, PVC bedded, steel wire ARMOURED, PVC sheathed. Equivalent to DEKORON type IEG184/IGG184.
MIMS	MINERAL insulated metal sheath cable.
PEPRCPE	Power cable 0.6/1kV, ethylene propylene rubber insulation chlorinated polyethylene sheath to AS3116 copper flexible conductors.
POVRXLPPVC	Power cable 0.6/1kW, XLPE insulated, overall copper

Type	Specification
	screened, PVC sheathed, to AS 5000, COPPER conductors, 90ºC.
PPVCPVC	POWER cable 0.6/1kV, PVC insulated, PVC sheathed to AS 3147, COPPER conductors, 75ºC.
PPVCSWA	POWER cable 0.6/1kV, PVC insulated, PVC bedded, steel wire ARMOURED, PVC sheathed to AS 3147, COPPER conductors, 75ºC.
PXLPPVC	POWER cable 0.6/1kV, XLPE insulated, PVC sheathed to AS 3147, COPPER conductors, 90ºC.
PXLPSWA	POWER cable 0.6/1kV, XLPE insulated, PVC bedded, steel wire ARMOURED, PVC sheathed to AS 3147, COPPER conductors, 90ºC.
SFOMSWA	Optical Fibre Cable Multimode 62.5/125µm loose tube jelly filled, PVC sheathed, steelwire armoured, PVC sheathed.
SPEC	SPECIAL cable.
TEL	TELEPHONE cable, multiple twisted pairs, polyethylene insulated, polyethylene sheathed to Telecom Australia standard.
VID	VIDEO coaxial cable, CCTV video, 75 Ohm. (RG59).

19 DOOR HANDLES

19.1 Electrical Panels and Cabinets External to Switchrooms

Doors on electrical panels, distribution boards, switchboards etc which are located external to switchrooms, substations, etc, must be lockable either via a key lock or have facility to fit a padlock.

Contractor to liaise with Council to determine key lock or padlock type. Contractor to supply as appropriate.

19.2 Electrical Panels and Cabinets Inside Switchrooms.

Doors on panels which are located inside switchrooms, substations or fenced electrical enclosures allowing access to escutcheons or extra low voltage equipment (eg. PLC) shall be fitted with ‘Tee’ or ‘L’ handles.

19.3 Access Covers to Busbars and Escutcheons

Access covers to busbars and escutcheons shall be fitted with 7mm square bit tool locks.