GLADSTONE REGIONAL COUNCIL	**ENGINEERING STANDARD**			
	Field Control Panels			
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REVISION HISTORY

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TABLE OF CONTENTS

1 PURPOSE

The purpose of this Engineering Standard is to describe the requirements for the design, manufacture, supply, testing and delivery to site of Field Control Panels for use in low voltage and extra low voltage electrical systems for Gladstone Regional Council.

2 SCOPE

This Engineering Standard is applicable to all Field Control Panels, for indoor and outdoor areas supplied for use at Gladstone Regional Council sites, where the primary supply is 415V three phase or less.

Field Control Panels are free standing equipment panels that may be installed in public areas.

They may include the following equipment:

- Circuit breakers and fuses.
- Motor starters.
- Lighting and power circuits.
- Power supplies.
- Instruments.
- Programmable logic controllers, their input and output cards and networking equipment.
- Radio telemetry equipment.
- Operator control stations and HMI panels.

3 RESPONSIBILITIES

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

Any variations proposed that are contrary to the requirements of this Engineering Standard shall be specifically identified and referred to GRC, in writing, for approval.

The Purchaser shall complete the attached Field Control Panel data sheet for each panel required.

4 DEFINITIONS

Term	*Definition*
Council	Gladstone Regional Council or its nominated representative or agent.
CT	Current transformer.
FCP	Field control panel.
GRC	Gladstone Regional Council or its nominated representative or agent.
HMI	Human Machine Interface.
Hz	Hertz.
LCP	Local control panel.
LV	Low voltage, exceeding 32VAC or 115VDC but not exceeding 1000VAC or 1500VDC.
Manufacturer	The corporation or business that manufactures and/or assembles the equipment described by this Engineering Standard.
MCB	Miniature circuit breaker.
MCC	Motor control centre.
MCCB	Moulded case circuit breaker.
MEN System	Multiple Earthed Neutral. A system of earthing in which the parts of an electrical installation required to be earthed in accordance with AS/NZS 3000 are connected to the general mass of earth and, in addition are connected within the electrical installation to the neutral conductor of the supply system.
PLC	Programmable logic controller.
Purchaser	The individual or corporation responsible for purchasing the equipment described by this Engineering Standard on behalf of GRC.
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.
Supplier	The individual or corporation with whom GRC enters an agreement to purchase the equipment described by this Engineering Standard. Note that in some instances, the Supplier may also be the Manufacturer.
TOL	Thermal overload.

5 REFERENCE DOCUMENTS

All equipment shall be designed, manufactured and tested in accordance with the latest edition of the following GRC Engineering Standards, Australian Standards, Acts and Regulations.

5.1 GRC Engineering Standards

Standard	*Title*
GRC-ES001	Electrical Work.
GRC-ES002	Preferred Electrical Components.
GRC-ES005	Light & Power Distribution Boards.
GRC-ES008	Equipment Identification.

5.2 GRC Standard Drawings

Drawing	*Title*
GRC-ED-010	Typical Schematic < 4kW DOL Starter.
GRC-ED-011	Typical Schematic 4-40kW Soft Starter.
GRC-ED-012	Typical Schematic > 40kW VSD.
GRC-ED-013	Typical MCC DB, UPS, 24VDC Power Supply.

5.3 Australian Standards

Standard	*Title*
AS 1319	Safety Signs for the Occupational Environment.
AS 2700	Colour Standards for General Purposes.
AS/NZS 3000	Wiring Rules.
AS/NZS 3008	Electrical Installations – Selection of Cables.
AS/NZS 3017	Electrical Installations – Testing and Inspection Guidelines.
AS/NZS 3820	Essential Safety Requirements for Electrical Equipment.
AS 60529	Degrees of Protection Provided by Enclosures (IP Code)
AS/NZS 60947	Low-voltage Switchgear and Controlgear.
AS/NZS 61439	Low Voltage Switchgear and Controlgear Assemblies.
AS 62103	Electronic Equipment for Use in Power Installations.
AS 60044	Instrument Transformers.

5.4 Acts and Regulations

Title
Electrical Safety Act 2002.
Electrical Safety Regulation 2002.
Work Health and Safety Act 2001.
Work Health and Safety Regulation 2011.

6 TECHNICAL REQUIREMENTS

6.1 General

6.1.1 Quality Assurance

The Manufacturer shall have an integrated quality assurance system in place at the locations where the field control panels are designed, manufactured and assembled. The system shall be 'third party accredited' to AS/NZS ISO 9001:2000 and frequently audited for compliance. The Manufacturer shall provide documentation proving any claims made with respect to the above if requested by the Purchaser.

6.1.2 Prohibited Materials

Components that contain asbestos, mercury, 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 during normal and reasonable use are not permitted in electrical equipment to be used on the Purchaser's site.

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

6.1.3 Standardisation of Parts and Equipment

The Supplier shall select all components, parts and equipment used in the construction and fabrication of the Field Control Panel from the Preferred Electrical Components List GRC-ES002.

If the Supplier wishes to utilise items not included in the preferred components list, approval shall be obtained from GRC in accordance with the requirements of GRC-ES002.

6.1.4 Service Conditions

The Field Control Panels shall be designed to operate continuously, 24 hours per day, 365 days per year.

All components and equipment within the Field Control Panels shall have an ambient temperature rating of not less than 55°C. The thermal design shall be such that the maximum temperature within the enclosure when operating under an ambient temperature of 45°C shall not exceed 55°C.

The thermal design shall be based on natural heat dissipation. Ventilation openings shall not be used unless specified.

6.2 Construction

a) This specification is intended to apply to diverse types of Field Control Panels. The enclosures may include any of the following equipment:

- Power distribution circuit breakers and busbars.
- PLC equipment.
- Operator controls and HMI.
- 24VDC power supplies (Single or dual-redundant)
- Battery backup equipment.
- Motor starters.
- Lighting supply and control.
- Instruments.

b) The Field Control Panels shall consist of a single metal enclosure. The enclosure shall be configured in an arrangement suitable for free standing installation on a concrete pad for outdoor installation and plinth mounted for indoor installation. Doors shall open 120º. The Field Control Panel height shall not exceed 2000mm. The Field Control Panel width shall be at least 800mm.

c) Field control panels shall be constructed as follows:

- External hinged lockable door.
- Internal hinged escutcheon fitted with operator controls (Push-buttons, control switches and HMI).
- At least 240mm clear internal space shall be provided between the escutcheon and the equipment gear tray inside the enclosure.
- Low voltage compartment, if specified. A separate low voltage compartment shall be fitted behind the escutcheon. The compartment shall be fitted in the lower section of the enclosure. The front of the compartment shall be fitted with a 3mm clear cover. The compartment shall provide a minimum enclosure rating of IP2X. Low voltage terminal blocks shall be fitted at the bottom of the low voltage compartment. Circuit breaker operating handles shall protrude through the clear cover, but shall remain behind the escutcheon. Electrical equipment in the low voltage compartment shall use Form 1 internal separation to SA/SNZ TR 61439.0 Annex B. Where a circuit breaker isolates power to the FCP, the incoming terminals of the circuit breaker shall be fully shrouded.
- 150mm vertical clear space shall be allowed in the bottom of the panel below the low voltage compartment for termination of cables.
- Internally on each side of the panel a vertical wiring duct shall be fitted to enclose internal wiring.
- Extra low voltage controls, power supplies, PLC and instruments shall be mounted on horizontal DIN rails above the low voltage compartment. Where equipment has a low voltage supply the low voltage terminals shall be fully shrouded.
- Horizontal wiring ducts shall be fitted adjacent to terminal blocks and instruments to enclose wiring. Ducting shall be fitted at least 50mm clear of terminals and equipment to allow room for termination and labelling of wires.
- All cables shall be bottom entry through a plated brass gland plate. At least 300mm clear space shall be provided below all gland plates for the termination of cables.

- The space under the panels shall be completely enclosed with screw on or similarly secured covers to prevent any unauthorised access to the cable zone.

d) Equipment and terminals shall be readily accessible and shall require a minimum of disturbance of associated and adjacent equipment for access.

e) Terminals, busbars and any components carrying voltages greater than extra low voltage shall be protected against accidental contact by personnel to an IP rating of IP2X to AS 60529. This shall be achieved by fitting proprietary shrouds or fabricating clear barriers. Shrouds shall be used on cable terminals in the cable zones.

f) The complete Field Control Panel shall be vermin and insect proof.

g) Facilities shall be provided for lifting transportable sections without distortion.

6.2.1 Indoor Field Control Panels

Field Control Panels designated on the Data Sheet as indoor service, which will be installed within a dedicated electrical switchroom building shall be constructed from powder coated mild steel at least 1.6mm thick and shall have a minimum degree of protection of IP52. Refer to section 9 for paint protection requirements.

6.2.2 Outdoor Field Control Panels

Field Control Panels designated on the Data Sheet as outdoor service, which will be installed external to a building or within a corrosive and/or wet environment shall be constructed from powder coated 316 stainless steel at least 1.6mm thick or marine grade aluminium at least 3mm thick, and shall have a minimum degree of protection of IP56. Refer to section 9 for paint protection requirements. In addition, outdoor Field Control Panels shall also incorporate the following features fitted:

a) Full height outer doors. Doors shall be provided with lift of pintle hinges. Hinges shall permit the door to move through an arc of at least 120°.

b) Internal escutcheon for mounting of operator accessible controls.

c) Roof heat shields mounted on 50mm C section supports.

d) Side heat shield mounted on 20mm stand-offs.

e) Rear heat shield mounted on 20mm stand-offs, if the rear of the cabinet faces west.

6.2.3 Doors

a) The Field Control Panel shall be provided with hinged doors having lift off, chromium plated, brass block hinges with stainless steel hinge pins. Concealed stainless steel hinges may be offered with stainless steel enclosures. Hinges shall permit the door to move through an arc of at least 120°.

b) Doors shall be lockable, with a DIRAK type 207-9295 stainless steel handle or equivalent with lock No. 92268. Two keys shall be provided, attached to the handle.

c) Doors 900mm high or less shall have single point locking. Doors greater than 900mm high shall have multiple point locking.

d) Doors on panels between 1000mm and 1600mm in height shall be provided with two handles and two-point locking. Doors on panels greater than 1600mm in height shall be provided with three handles and three-point locking.

e) The doors shall be of fully folded construction with sealing by a neoprene gasket in a metal channel. All seams shall be welded.

f) A top hat bracing section shall be fitted on the inside of each door to provide stiffening. Doors on panels greater than 1800mm in height shall be provided with three hinges.

g) A drawing holder shall be provided and fixed to the inside of the door on the door stiffener. The document holder shall be suitable for A4 documents up to 20mm thick.

6.2.4 Escutcheons

a) A hinged escutcheon and supporting frame manufactured from the same material used for the main enclosure shall be provided to cover wiring and prevent access to internally mounted components by non-electrical personnel.

b) The escutcheon shall be hinged with a minimum of two pintle-type hinges mounted on the same side of the enclosure as the door hinges, and shall be removable without requiring removal of the door.

c) The escutcheon shall be secured in the closed position with a minimum of three 6mm chrome plated acorn nuts and washers.

d) A top hat bracing section shall be fitted to the inside of the escutcheon to prevent deflection when the escutcheon is securely closed.

e) The escutcheon may be opened with circuit breaker lock out devices in place.

6.3 Fault Rating

The Field Control Panel shall have a fault current rating as specified on the attached Data Sheet. Where no fault current rating is specified, the Field Control Panel shall have a minimum fault current rating of 10kA.

6.4 Busbar System

a) If specified, the Field Control Panel shall include a single phase or three phase, fully insulated busbar assembly.

b) Busbar connections shall be provided for all circuit breaker pole positions whether they are filled or not. Busbars shall be fully insulated, with unused poles capped with insulating material.

c) The busbar rating shall be as specified on the Data Sheet.

6.5 Neutral and Earth Bars

Tunnel type neutral and earth terminal bars shall be provided.

a) The number of neutral and earth terminals in each Field Control Panel shall be not less than the number of circuits specified for that panel.

b) Neutral bars shall be insulated from earth and rated for 100% or the phase busbar rating.

c) Tunnels shall be numbered and able to accommodate 16mm^2 cables.

d) Neutral and earth bars shall each be provided with two 10mm hexagon head studs and spring washers to permit connection of the supply neutral and earth cables.

e) Tunnels shall use two-screw fixing for each tunnel, or one screw fixing where the screw outside diameter is not less than 80% of the tunnel diameter.

f) All wires and pins inserted into tunnels with two screw fixing shall be long enough to ensure that both screws secure the conductor.

g) All metallic non-current carrying parts of the Field Control Panel shall be bonded together and connected to the earth busbar.

h) Earth straps on the front door shall be secured using a method which allows the removal of the earth from the door without using a tool.

6.6 Instrument Earth Bars

a) Instrument earth bars shall be fitted adjacent to analog I/O cards.

b) Instrument earth bars shall be insulated and of similar design to the neutral earth bars.

c) The number of earth terminals shall be greater than the total number of analog inputs and outputs available on the installed PLC cards.

d) The earth connection for the instrument earth bar shall be detailed in the Drawings and Data Sheet.

6.7 Switchgear and Controlgear

6.7.1 Main Isolation Switch

a) Where an enclosure contains equipment at voltages in excess of extra low voltage, an isolating switch shall be provided, mechanically interlocked with a door-mounted operating mechanism to prevent access into the enclosure with the switch closed. The interlock shall be capable of being defeated externally with a tool such as a screwdriver.

b) Any metalwork within the enclosure which remains energised above extra low voltage with the door open shall be shrouded against inadvertent contact to IP2X as per AS 60529 and danger labelling installed.

c) The isolating switch shall be an isolator or circuit breaker in accordance with the drawings and data sheet.

d) The isolation switch operating mechanism shall have ‘on/off’ indication and be lockable in the ‘off’ position.

e) The isolating switch handle shall be located on the escutcheon.

f) The isolating switch handle shall allow opening of the escutcheon when in the ‘OFF’ position.

6.7.2 Miniature Circuit Breakers

a) Circuit breakers shall be C curve type, 10 kA fault rating unless otherwise specified on the Data Sheet.

b) Circuit breakers shall comply with AS 3111 and AS 60947.2 as applied by the definition given in AS 3111, Appendix A, Type Tested in accordance with Schedule B.

c) Circuit breakers shall provide full Selectivity with the upstream circuit breaker or fuse, up to the fault rating of the Field Control Panel as specified on the Data Sheet.

d) Circuit breakers from more than one manufacturer shall not be mixed within the same Field Control Panel.

e) Circuit breakers shall protrude through the escutcheon to allow manual operation.

6.7.3 Circuit Breaker Lock-out Devices

a) Each miniature circuit breaker shall be fitted with a means of padlocking it in the OFF position. The lock-out device and padlocking shall prevent the movement of the operating toggle from the OFF to the ON position.

b) The means of padlocking shall be achieved by the operation of a captive device fixed to the circuit breaker or escutcheon that is not supplied loose and does not require the use of a tool to attach it.

c) Sufficient space shall be provided so that when a six-way padlocking scissor and three padlocks are attached to a lock-out device, it will still be possible to completely close and lock the escutcheon without contact being made with the locks and the door.

d) This may be achieved either by making the enclosure deep enough to provide the necessary clearance or by recessing the breaker assembly.

e) This assembly shall be located clear of the circuit breakers so that lock-out scissors and padlocks when attached to the devices at the same time do not interfere with each other.

f) It shall still be possible to completely close and lock the enclosure door without contact being made with the attached scissors and locks and the door.

6.7.4 Earth Leakage Circuit Breakers

a) Circuit breakers for all lighting and power outlets, or other circuits requiring RCD protection shall be the RCBO type providing overload, short circuit and earth leakage protection, with a rated residual operating current of 30mA.

b) RCBO's for single phase applications shall be single pole width.

c) RCD protected zones, where a whole section of the bus system or a number of individual circuits are protected by an upstream single or multi-phase RCD shall NOT be used on any Field Control Panel.

6.7.5 Surge Diverters

Surge diverters where specified shall be three phase and neutral, plug in type Shunt Surge diverter with a minimum protection level of 1200V with a short time withstand capacity (8/20 us) of 40kA.

Surge diverters are only required on certain Field Control Panels as specified on the Data Sheet.

6.7.6 Control Power Supply

The FCP may incorporate a separate control power supply including the following, where specified on the data sheet:

a) Dual 24VDC switchmode power supplies with a size specified on the data sheet.

b) The 24VDC power supplies shall incorporate an appropriate redundancy module allowing parallel operation.

c) Single 20A 24VDC battery backed power supply where PLC equipment is fitted.

d) Where the FCP includes a PLC system, the power supplies shall incorporate voltage free contacts for fault status indication to the PLC system.

6.7.7 Motor Starter Circuits

All motors shall be protected against short circuit and over current. Motor protection circuit breakers incorporating both short circuit and over current protection are the preferred protection device. Motor starters shall provide Type '2' short circuit coordination in accordance with AS 61947.4. Contactors shall be suitable for AC-3 utilisation category in accordance with AS 61947.

Contactor coil voltage shall be as per the drawings. Control circuits for switching or sensing devices located external to the enclosures shall be extra low voltage.

6.7.8 Control Equipment

Field Control Panels shall be provided with all necessary manual control equipment such as STOP/START push buttons, selector switches, ON/OFF, tripped or other indicating lamps as required for safe operation of the equipment.

Control relays, PLC's, control switches, alarm and indicator equipment, etc. shall be, segregated from power equipment components.

6.7.9 Relays

Relays shall be Finder 55 series plug-in type or equivalent. Relays shall have 24VDC coils as indicated on the drawings.

Each relay shall have a sufficient number of N/O and N/C contacts and incorporate flag indication and built in suppression for DC coils.

6.7.10 HMI

Where specified on the data sheet a HMI panel shall be provided. The HMI shall be mounted on the escutcheon and must be accessible without opening the escutcheon.

6.7.11 Indicating Lights

Indicating lights shall be 22mm diameter, LED flush mounted type suitable for 24VDC.

The functions of the indicating lights shall be:

a) Green – closed, running, ON.

b) Red – open, stopped, OFF.

c) Amber – tripped, fault.

6.7.12 Control Switches

Control switches shall be K&N CA10 series with a sufficient number of N/O and N/C contacts.

6.7.13 Pushbuttons

Pushbuttons shall be NHP D7 series. Except for emergency stop pushbuttons, all pushbuttons shall be mounted on the escutcheon.

Where externally accessible emergency stop pushbuttons are required, they shall be mounted on a fixed forward-facing surface of the enclosure. The surface shall be obtained by either reducing the dimensions of the door and escutcheon to permit the pushbutton to be mounted or fixing a metal enclosure to the side of the LCP.

The functions of the pushbuttons shall be:

a) Green – Start.

b) Red – Stop, Emergency stop.

c) Blue – Reset.

6.7.14 PLC Section

Where a PLC is specified for control of the equipment or process, the PLC system and associated equipment shall be selected in accordance with GRC-ES002 – Preferred Electrical Components. The following minimum requirements shall apply:

a) PLCs shall be Allen-Bradley CompactLogix type unless specified otherwise, incorporating Ethernet/IP communications capability.

b) Power supplies shall be suitable for 24VDC operation.

c) Digital inputs shall be 24VDC current sinking type.

d) Digital outputs shall be 24VDC current sourcing type.

e) Analogue inputs and outputs shall be 4-20mA type suitable for 24VDC operation.

f) All PLC inputs and outputs shall be wired to marshalling terminal strips within the enclosure for the termination of field cabling. This includes all unused inputs and outputs.

6.7.15 Lighting Control Circuits

A lighting control circuit is required for Field Control Panels where a proportion of lighting is only required at low levels of natural light.

a) Where specified, lighting circuits shall be switched by a three-pole contactor in response to the operation of a photo-electric (PE) switch, which operates a changeover contactor when the outside light level falls below a threshold.

b) A three-way selector switch shall enable the PE cell controlled contactor to be BYPASSED (always on), AUTOMATIC (PE cell controlled) or OFF (contactor de-energised).

c) The minimum contactor size shall be 32A.

d) The contactor shall be mounted in the low voltage compartment.

e) The externally mounted PE cell shall be terminated to DIN rail mounted terminals mounted in the low voltage compartment.

f) The lighting control circuit shall be supplied from a 6A MCB.

6.8 Cable Entries

Sufficient space shall be provided for the glanding, spreading, routing and termination of the number of field cables to be terminated in the Field Control Panel.

Gland plates shall be provided for all cable entries. Gland plates shall be 5mm thick plated brass and shall be fixed to the enclosure with a minimum of 10 external equi-spaced M6 316 stainless steel bolts and washers into threaded inserts, welded nuts or captive nuts. For enclosures greater than 800mm wide, two gland plates shall be fitted.

6.9 Internal Wiring

Wiring shall be in accordance with AS 3000 and the following requirements:

a) Different wiring systems, e.g. control, transducer output, CT, VT, 110V AC, 240/415 V AC. shall be segregated and separated in accordance with the requirements of AS 3000.

b) All internal wiring shall be carried out in flexible copper cables, 0.6/1 kV, V75 grade PVC and terminated with insulated compression type lugs or connectors.

c) The minimum size of flexible cable shall be as follows:

- Control Wiring 1.5 mm^2
- Protection 4.0 mm^2
- Metering 2.5 mm^2

d) All internal wiring shall be neatly arranged and wherever practicable, shall be contained in capped plastic ducting. Elsewhere, groups of wires shall be strapped together with nylon or other strong plastic ties or spiral binding to form neat wire bundles.

e) Wiring identification shall be by numbered and/or lettered ferrules, of insulating material adjacent to the terminals. Wires shall be identified in accordance with IEC 60445. The ferrules shall be indelibly marked and removal without disconnecting the wire from its terminal shall not be possible.

f) All wiring for external connections shall be brought out to individual terminals on a readily accessible terminal block.

g) All busbar and wiring colours shall be as follows:

Voltage	*Active Conductor*	*Common Conductor*	*Earth Conductor*
415/240V AC	Red/White/Blue	Black	Green/Yellow
12/24V DC Supply	Brown	Grey	-
12/24V DC Switched	Violet	-	-
CT Wiring	Red/White/Blue	Black	Green/Yellow

6.10 Terminations

a) Cable terminating facilities and terminals shall be suitable for the cable type, gland and conductor size.

a) DIN rail mounting moulded polyamide terminal blocks shall be provided for termination of all control wiring external to switchboards. Terminals shall carry numeric designation in accordance with the Drawings and shall be segregated according to function and voltage.

b) Terminal groups shall be arranged and spaced to facilitate easy connection of wiring and cables. Spare space shall be available on each terminal rail to accommodate additional terminals.

c) A separate terminal shall be provided for the connection of each individual wire. Bridging links as supplied by the terminal manufacturer shall be used to interconnect 'common' terminals.

d) Terminal blocks shall avoid obstruction of other cable terminations, removable covers, etc. and positioned to afford easy access for carrying out external cable termination, testing, inspection and maintenance. There shall be clear space allowed between the terminals and the gland plate for the spreading and termination of external conductors.

e) Terminal blocks shall be mounted in a single deck arrangement.

f) The panel wiring shall be connected to one side of the terminal block only.

g) Terminals serving voltage circuits exceeding "Extra Low voltage", as defined in AS 3000, shall be segregated from other terminals, shrouded, voltage identified and Danger labelled. All other differing voltages shall be separated by partitions.

h) Cable supports shall be provided (where practicable) to avoid undue strain on the cable termination.

i) Separate terminal arrangements shall be provided for power and control cables.

j) All access to wiring shall be from ground level. Terminals shall not be located on top of equipment.

6.11 Identification Labels

Identification labels shall be provided in accordance with the requirements of Engineering Standard GRC-ES008 – Equipment Identification.

a) All labels shall be engraved traffolyte using black upper-case characters on a white background unless otherwise indicated.

b) Labels for emergency equipment (e.g. fire alarms, emergency lighting etc.) shall be engraved traffolyte using white upper-case characters on a red background.

c) All labels shall be fastened to the metalwork with stainless steel M3 metal threads and nuts or stainless steel self-tapping screws.

d) Adhesive or double-sided adhesive tape shall not be used as a means of fixing labels.

e) Each Field Control Panel shall have a 220 x 40mm label mounted externally and centrally on the door 300mm from the top edge of the door.

f) Each earth and neutral bar shall have a 40 x 10mm label mounted adjacent to it indicating 'EARTH' and 'NEUTRAL' as appropriate.

g) Each component in the FCP shall be have a Device Identification Label indicating the number of the component in accordance with GRC-ES008.

h) Control equipment mounted on the escutcheon for operator use shall be identified by both the device number and its description.

i) On circuit breaker busbar systems, a number shall identify every circuit breaker. This shall be achieved by vertically mounting two long strips of traffolyte 20mm wide on the escutcheon plate adjacent to the two rows of circuit breakers and engraving the breaker number opposite the appropriate circuit breaker in 6mm high characters. All pole positions shall be numbered. This means that two and three-pole circuit breakers shall have a number opposite each pole. The numbering shall match the numbering shown on the Drawings. The traffolyte shall be screw fixed in several positions along its length to prevent it from buckling.

j) Each RCD test outlet, its protection circuit breaker and each RCD test selector switch shall be provided with labels as detailed on drawing GRC-ED-005.

k) All other electrical control components such as the incoming main circuit breaker/s, contactors, timers, relays, etc. contained within the enclosure shall be provided with an identifying traffolyte label with 6mm high characters.

6.12 Fastenings

Nuts, bolts and other fastenings for panels designated on the Data Sheet as indoor service shall be cadmium plated. Nuts, bolts and other fastenings for panels designated on the Data Sheet as outdoor service shall be stainless steel. All nuts, bolts, screws and studs shall have ISO metric threads. Washers shall be fitted under bolt heads and nuts to prevent damage to the surface in contact with the bolt head or nut. The threads of all bolts shall project beyond the nut by at least one full thread.

6.13 PVC Cable Ducts

Grey slotted PVC cable duct such as the Iboco T1 series complete with covers shall be installed internally down both sides of each Field Control Panel and elsewhere as required to contain internal control, test circuit wiring and cables to be connected by others to the outgoing circuit breakers.

a) Field Control Panels shall be fitted with minimum 60mm wide grey slotted PVC wiring ducts complete with covers on the left and right-hand side of the Field Control Panel to accommodate incoming and outgoing cables and internal wiring.

b) Each duct shall stop 200mm short of the bottom of the enclosure to permit entry of cables to the board. The ducts shall be positioned sufficiently clear of the side walls for easy removal and replacement of covers.

7 INSPECTION AND TESTING

7.1 Verification Testing

Test certificates shall be supplied for all tests that have been carried out on the FCP as applicable in accordance with the requirements of AS/NZS 61439.1.

7.2 Routine Testing

The FCP supplier shall carry out all routine tests or any tests required to prove compliance with this specification, the drawings and the relevant standards. The testing shall include the following as a minimum:

a) Standard 50Hz high voltage withstand test on the complete assembly including the circuit breakers. Insulation resistance tests shall be conducted before and after the high voltage test.

b) Standard 50Hz insulation test on all small wiring, including switchboard and instrument transformer secondary wiring, at 2000V to earth for one minute.

c) Continuity and polarity tests on all coils and circuits.

d) Verification of current transformers; terminal markings, determination of errors, magnetising curve, CT polarity test and CT ratio test using primary current injection.

e) Functional tests on all relays, control circuits and interlocks.

f) Checking of electrical and mechanical interlocks.

g) Mechanical operation of circuit breakers, interlocks, auxiliary switches, manual devices, etc.

The FCP supplier shall have suitably qualified labour readily available to rectify any defects or errors identified during testing, such that there is no delay in testing.

The FCP supplier shall provide instructions for final installation inspection and tests after the switchgear has been installed. The instructions shall include a schedule of recommended site tests to establish correct operation, procedures for any adjustments to obtain correct operation, instructions for final inspection and putting in service.

7.3 Test Certificates

The supplier shall provide test certificates for all routine testing carried out. These shall be forwarded to the purchaser within 7 days of completion of the tests.

7.4 Witnessing

In addition to the Routine Testing outlined above, the Field Control Panel manufacturer shall make allowance for factory acceptance testing (FAT). These tests shall be carried out to the satisfaction of, and if necessary, in the presence of the purchaser's representative. The supplier shall provide 7 days' notice to enable the purchaser's representative to witness such tests.

8 TRANSPORTATION AND STORAGE

a) Preparation for shipment shall protect the Field Control Panels against corrosion, dampness, breakage or vibration injury during transportation and handling.

b) Each Field Control Panel shall be wrapped in heavy duty clear plastic and weatherproofed and then contained in a wooden framed crate and shall be securely bolted to the floor of the crate.

c) Packing shall include a suitable desiccant to prevent corrosion of equipment during shipment and storage.

d) The base of the crate shall be suitable for forklift handling.

e) Each shipping package shall be clearly and indelibly identified with the contents, purchase order number and item number.

9 PAINTING AND SURFACE PROTECTION

Steelwork surface preparation, anti-corrosion protection and the surface coating system shall be to Australian Standards. Evidence shall be provided that these items meet Australian Standards.

The painting system used for the Field Control Panel shall be powder coated to a total thickness of 70 microns. The standard painting system of the switchboard supplier may be used provided details of the system are submitted and approval for use is received from the Purchaser.

a) The colour and finish of Field Control Panels for indoor service shall be X15 Gloss Orange.

b) The colour and finish of Field Control Panels for outdoor service shall be X15 Gloss Orange.

c) Escutcheon panels shall be Gloss White.

10 MANUALS AND DRAWINGS

The Supplier shall provide full drawings and documentation for the equipment. This shall include:

a) General arrangement drawings showing the overall dimensions and equipment arrangement.

b) Circuit diagrams and schematic drawings for all equipment installed in the Field Control Panel.

c) Full parts list of every component in the equipment.

d) Recommended spares list.

e) Internal and External label drawings.

f) Certified Inspection and Test Plans and results.

g) All verification test certificates.

h) Equipment data sheets and manuals.

i) Installation, Operating and Maintenance Manuals.

Final copies of all documentation shall be provided within two weeks of Factory Acceptance Testing.

The Supplier shall provide 2 paper copies of all documentation in hardbound folders, plus an electronic copy on CD in a structured folder arrangement.

All drawings shall be provided in AutoCAD electronic file format (.dwg) and in PDF format.

11 DATA SHEET

This Engineering Standard shall be read in conjunction with the attached Field Control Panel data sheet. The Purchaser shall complete an individual data sheet for each Field Control Panel. Each Field Control Panel data sheet shall be provided to the Manufacturer in Microsoft .xls format for completion.