DEPARTMENT OF ELECTRICAL SERVICES

PRIME MINISTER'S OFFICE, BRUNEI DARUSSALAM

EIR

Electrical

Installation Requirements

2011 — First Edition

Guide to Electrical Installation in Public Buildings, Commercial Buildings and Domestic Premises in Brunei Darussalam

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FOREWORD

The Electrical Installation Requirements (EIR) is part of the initiative by the Department of Electrical Services (DES) to be the National Standards for all electrical installation in Brunei Darussalam pursuant to the authority of the Department of Electrical Services in accordance with the Electricity Act, Chapter 71. The EIR incorporates the principles and engineering practices for the application of electrical installation in public buildings, commercial buildings and domestic premises in Brunei Darussalam.

The EIR is a document to guide the designers/installers of electrical systems and operators of electrical plants and installations; and compliance with the EIR is a prerequisite to the supply of electrical energy by the Department of Electrical Services. Any electrical installation requirement not addressed by the EIR shall be referred to the 17th Edition IEE Wiring Regulation. However, the EIR shall take precedence should there be any conflict between these two documents.

The EIR is subject to periodical review to keep abreast with the development of technology and suit the changing needs of the local industries and consumers. Any suggestion for changes and any comments are most welcomed and shall be submitted to Department of Electrical Services. These will be recorded and brought to the notice of the committee concern for consideration.

COMMITTEE MEMBERS

The Technical Committee was formed with the sole purpose to prepare the Electrical Installation Requirements. The Technical Committee comprises of the following members:

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Section I
INTRODUCTION

1. Scope

1.1 The Electrical Installation Requirements (EIR) apply to the design, erection and verification of electrical installations such as those of residential premises, commercial premises, public premises, industrial premises, construction sites, agricultural/horticultural premises and other installations for temporary purposes. Any ambiguity shall refer to Department of Electrical Services (DES) for clarification.

1.2 The Electrical Installation Requirements (EIR) include for :

- circuit supply at nominal low voltage up to and including 1000V a.c. at 50/60 Hz
- circuits other than the internal wiring of equipment
- wiring systems and cable not specifically covered by the standards for appliances
- all customer installations external to buildings
- additions and alterations to installations and also part of the existing installation.

1.3 The Electrical Installation Requirements (EIR) is generally intended to be applied to electrical installation but in certain cases, they may need to be supplemented by other requirements and standards from Brunei Standards / International Standards such as IEC and British Standards or equivalent.

1.4 The Electrical Installation Requirements (EIR) shall be followed or adhered by all person(s) who carry out design, erection and verification of electrical installations. Approval shall be obtained from the Department of Electrical Services (DES) for any deviation of the requirements. Failure to do so will result to appropriate action taken to individual or installation such as revoke of Register of Worker (REW) license or disconnection of supply.

1.5 The Electrical Installation Requirements (EIR) do not apply to the high voltage transmission and distribution of electricity to the public.

Section II
INSTALLATION REQUIREMENTS

1. General

1.1 Good workmanship and the use of proper materials shall be employed throughout any electrical installation and they must not be compromised by the electrical worker(s)/engineer(s) in charge of the installation.

1.2 Every piece of electrical equipment or accessory that is a part of an electrical installation shall comply with the relevant requirements of the latest and current BS7671 edition of the applicable BS/PBD-IEC/IEC Standards or its equivalent.

1.3 To assist the electrical designer or installer, DES has compiled a list of approved electrical equipment and accessories, which is available from DES Headquarters at Old Airport Berakas. If in doubt, whether or not a proposed item for an electrical installation complies with DES requirements, the contractor is advised to seek clarification from DES before the material is purchased and installed.

1.4 The nominal supply voltage use in Brunei Darussalam is 400V, 50Hz, 3-phase, 4-wire AC or 230V single-phase, 2-wire AC.

1.5 DES adopts and implements the TNS and/or TT system network configuration with PME (protective multiple earth) for the low voltage distribution system.

2. Electrical Drawings

2.1 For the application of electricity supply, all electrical drawings submitted to Department of Electrical Services (DES) must be clear and with appropriate font size. Unclear and messy drawings will not be accepted. Each drawing shall carry a title-block showing the description and location of the project, name and address of the customer. Computer generated single-line diagrams and power & lighting layouts will be preferred. Two sets of A3 size minimum shall be submitted, one set of which shall be returned to the electrical contractor after DES has vetted and approved it.

2.2 The Registered Electrical Worker (REW) who is responsible for a particular project shall endorse (with company stamp) all the electrical drawings that are submitted to DES. He / She shall only commence the electrical works when the proposed drawings have been vetted and approved by DES.

2.3 DES recommended electrical symbols and legends shall be used in all schematic drawings, single line diagrams, wiring diagrams, power and lighting layouts. The symbols are shown in Appendix 1. If there are items that do not have symbols in the DES list then the consultant/contractor may use other appropriate symbols that refer to BS7671-2008 and IEC 60617:2009.

2.4 When single line diagrams are submitted, the main drawings shall show a clear and bold note.

The Electrical Installation shall be carried out in compliance with:

(a) The latest edition of IEE Wiring Regulations for Installation of Electrical Wiring and

(b) General List of Products/Manufacturers for Mechanical and Electrical Installations / Equipment.

2.4.1 In the single line diagram (SLD), the following technical details shall indicate the:

- incoming cable size and type (specification)
- meter type
- protection type (MCCB or MCB or fuse)
- MSB / DB

2.4.2 The SLD for the main switchboard (MSB) shall show the total connected load and the expected maximum demand in kW. If at the design stage, the expected connected load and maximum demand are not known or available; the design load per unit area shall be specified.

2.4.3 The drawings shall identify and show the source of supply which shall be from one of the following:-

-
- DES L.V Mini/ Distribution Feeder Pillar or overhead lines
- Main Feeder Pillar/ in substation.
- MSB in switch-room.
- Direct from Transformer in Substation.

Note: Final source of supply shall be determined by DES

2.4.4 For incoming supply greater than 100A, the customer must provide a proper switchboard with respective protection devices and accessories:

- Exceeding 100A and less than 400A:
  - Earth leakage relay
  - MCCB with thermal magnetic trip
  - Ammeter complete with selector switch
  - Voltmeter complete with selector switch
  - Incoming and outgoing indicator lamps

- 400A and above:
  - Over-current relay
  - Earth-fault relay
  - MCCB / ACB
  - Ammeter complete with selector switch
  - Voltmeter complete with selector switch
  - Incoming and outgoing indicator lamps

2.5 Technical details required in a Single Line diagram (SLD) for a main distribution board or meter-board not exceeding 100A

2.5.1 Indicate the locations of the distribution board, meter-board that comprises the kWh meter and a set of cut-outs or sealing chamber.

2.5.2 Indicate the locations of the sealing chamber or service cut-outs board and the prepaid meter if a prepaid meter is used.

2.5.3 Indicate size & type of cable and methods of installation for incoming cables, and all submains, e.g. meter-board to distribution board or sealing chamber to prepaid meter.

2.5.4 Specify the rating of incoming and outgoing MCCBs and MCBs, and including the breaking capacity.

2.5.5 Specify rating of Residual Current Device (RCD).

2.5.6 The locations of all the electrical points or final circuits shall be shown in the single line diagrams and layout drawings. The points and the corresponding final circuits may be tabulated separately showing the types of outgoing circuits, number, size and type of cables used, circuit numbers and their corresponding MCB ratings, number of power and lighting points and their locations. Refer to Appendix 1A for typical example for the load demand estimates form.

2.5.7 When a single phase supply is tapped from a MSB to sub-DB, a double-pole circuit breaker shall be provided. This requirement is exempted when the MSB also acts as the final distribution board.

2.5.8 Each floor of a building shall not have more than one source of supply. For example, one tenant occupying a floor of a multi-storey building, electricity supply to that floor may not be taken from two different risers or from tap-off units of two different floors.

2.6 Technical details required in a Single Line diagram (SLD) for main switchboard (MSB) exceeding 100A

2.6.1 Indicate ratings of all incoming and outgoing circuit breakers, the number of poles, including their short circuit withstand rating, interrupting/breaking capacity (making - Icm, ultimate breaking - Icu, service breaking – Ics) etc and the approved load.

2.6.2 Indicate the switchboard copper busbars rating, insulating level, dimensions, the index of protection (IP) and the type of internal separation of the MSB (e.g. Form 2, Form 3, Form 4).

2.6.3 Show the positions of kWh meter, its metering current transformers (CTs) and voltage signal. The metering CTs shall be placed before the consumer incoming breaker except when the incoming supply is directly from the distribution transformer. In the latter arrangement, the metering CTs shall be placed after the Protection Relay CTs and the incoming breaker. Voltage signal shall be fuse/MCB protected and sealed.

2.6.4 Show the position of all current transformers, CT ratios, Class of accuracy and VA burden of CTs for metering and protection relays. CTs shall be segregated for protection and metering purposes.

2.6.5 Protection shall be provided for the incoming and outgoing circuits. MCB shall be provided with thermal magnetic trip.

2.6.6 Indicate provision of pilot lamps with labels before and after the incoming circuits and outgoing circuits (if applicable).

2.6.7 Indicate size and type of incoming and outgoing cables/sub-main by and method of cable installation.

3. Short-Time Withstand Current Ratings of Switchgear Fault Levels

3.1 Where a main switchboard (MSB) in any installation is connected directly from the LV side of a transformer or transformers in an adjacent substation, the complete MSB shall be manufactured/fabricated to comply, in total, with the following fault levels:

Supply Transformer Rating (KVA)	Short time withstand current rating of MSB in kA, 1 seconds for one (1) transformer
300	25
500	36
800	36
1000	36
1500	50

Note: If two transformers are parallel then the short circuit withstand current shall be doubled.

3.2 The ratings in the above table shall apply to the whole switchboard including the incoming ACB / MCCB, main busbars, interconnection busbars, all outgoing MCCBs, fuses, contactors and other equipment used in the main switchboard.

3.3 If the outgoing MCCBs / ACBs installed do not meet the required fault levels, additional current limiting circuit breakers or HRC fuses shall be installed upstream and in series with the underrated MCCBs, such that the required fault levels are achieved with the cut-off devices.

3.4 For electrical installation taking electricity supply directly from DES low-voltage network, the consumer's main supply incoming circuit breaker shall incorporate means of isolation / switching and protection against overcurrent and earth-leakage.

3.5 The incoming breaker for a main distribution board shall be a 2-pole MCB or MCCB for single phase and a 3-pole MCB or MCCB for 3 phase. The MCB / MCCB shall incorporate means for isolation. It shall have a marking on the MCB / MCCB represented by **X** . The toggle or the flag of the MCB / MCCB shall indicate the true position of the contacts inside the circuit breaker. The MCB / MCCB must also comply with the following short-circuit current ratings: -

(a) For single phase 230V, the incoming 2-pole MCB shall have 10kA (minimum), Type C, based on IEC 60898-1, for supply up to 24kVA (100A). Alternatively, a 2-pole MCCB may be used.

(b) For 3-phase 400V, the incoming 3-pole MCB shall have 10kA (minimum), Type C, based on IEC 60898-1 or 15kA (minimum) based on IEC 60947-2, for supply capacity up to 72kVA (100A). However, the use of a MCCB is highly recommended.

3.6 For 3-phase 400V supply that exceeds 72kVA (100A), the MCCB / ACB shall have the following short-circuit current ratings:-

- 25kA (minimum), for supply capacity more than 72kVA and up to 300kVA (420A).
- 36kA (minimum), for supply capacity more than 300kVA up to 1000kVA.
- 50kA (minimum), for supply capacity more than 1000kVA up to 1500kVA.

3.7 The minimum short-circuit rating for MCBs controlling the final lighting and power circuits in a distribution board shall be 6 kA (minimum) Type B or Type C, based on IEC 60898-1.

4. Installation Requirements for Main or any Distribution Board

4.1 A distribution board (DB) or switchboard shall NOT be installed in any of the following locations:

- Kitchen
- Bathroom / Toilet
- Above and below sink / below a water-heater
- Below a staircase where insufficient height exists (refer item 4.6)
- Non-ventilated and storage area and cabinet

4.2 Labels or other suitable means of identification shall be provided to indicate the purpose of circuit breakers and control gears in the DB / MSB. Such labels are to be properly glued or fixed by screws. Also, all live cables (including neutral) and earth of all outgoing final circuits terminated in the distribution board shall be properly labelled using appropriate cable markers. A danger warning sign (**DANGER 400V**) shall be installed on all cover.

4.3 Switchboard or DB shall be provided with insulated busbar to reduce the risk of arc flash or flashover. Where doors/lids of distribution boards or switchboards can be opened without the use of a tool or key, all live conductive parts such as terminals which are accessible if the door/lid is opened shall be behind an insulating barrier which prevents persons from coming into contact with those "**LIVE**" parts. This insulating barrier shall be flame retardant and provide a degree of index protection of at least IP2X and be removable only by use of a tool. Covers shall be provided for the empty spaces of the MCB slots.

4.4 A set of 'as built' single line diagrams and lighting & power layouts that have been approved and endorsed by DES shall be kept within the DB / MSB or properly kept in a plastic envelope for protection and hanged near the DB / MSB for future reference and maintenance use.

4.5 Each distribution board shall only supply final circuits on the same floor where the board is located. However, this requirement needs not apply to individual, small, two or three storey residential houses with a maximum capacity not exceeding 100 Amp, 3-phase.

4.6 All distribution boards shall be either surface or recessed mounted at a height not lower than 1.6 metres and not exceeding 2.0 metres measured to the bottom of the distribution board from the finished floor level.

4.7 The electrical contractor who is responsible for the electrical installation shall install an aluminium / stainless steel nameplate (approx.120mmx80mm) on the MDB / MSB using self-tapping screws or rivets. On the top portion of the plate, the contractor's details shall be engraved with lettering of at least 3mm in height and shall include the name of the contractor, their address, telephone number. At the bottom of the same plate, DES will inscribe the recommended period (years or months) when the new installation is required to be re-inspected and re-tested. The plate's details are shown in Appendix 2.

4.8 For domestic premises it is mandatory for all final circuits in the distribution board to be protected by a Residual Current Device (RCD), having a fixed sensitivity of 30mA and operating time not exceeding 40ms at a residual current of 5 $I_{\Delta n}$.

4.9 For industrial and commercial premises where there are 13A power socket outlets, a 30mA rated RCD must also be used to protect these final circuits in the distribution board.

4.10 The final circuits for the compound / gate / decoration lighting provided separately and independently shall be protected by a 30mA or a maximum of 100mA RCD.

4.11 A type S RCD that incorporate a filtering device (built-in) for delay tripping can only be installed for an independent circuit **upon recommendation and approval from DES**. This type of RCD reduces the risks of undesired tripping due to transient voltages (lightning, line disturbances) and transient currents (from high capacitive circuits).

4.12 Where an installation incorporates a RCD, a notice shall be fixed in a prominent position at or near the origin of the installation. The notice shall be in indelible characters not smaller than those illustrated and shown below: -

> This installation, or part of it, is protected by a device, which automatically switches off the supply if an earth fault develops. Test quarterly by pressing the button marked 'T' or 'Test'. The device should switch off the supply and can be switched on to restore the supply. If the device does not switch off the supply when the 'T' button is pressed, please seek expert advice.

4.13 For electrical installation that distributes more than one distribution board, a separate connection block for each phase with appropriate current rating shall be provided, for terminating incoming and outgoing sub-mains or main distribution board as shown in Appendix 3.

4.14 Unless otherwise advised and approved by DES, with the exception of ring circuits, only one cable shall be terminated in each outgoing terminal of a MCB or MCCB.

4.15 Where a submain cable feeds more than one distribution board or sub-board, its size must not be reduced when feeding a second or subsequent board. The submain cable must have a current rating greater than the circuit breaker protecting it. However, if a circuit breaker is inserted at the point where a reduction cable size is proposed, then the protective device (circuit breaker) must be rated to protect the cable.

4.16 All circuit protective conductor (CPC) shall be provided for each individual final outgoing circuit. No looping of CPC is permitted between outgoing final circuits.

5. Power and Lighting Circuits

5.1 The minimum sizes of cables and the corresponding maximum ratings of MCBs for final circuits shall be as follows:-

Item	Type of Final Circuits	Cable Size	Rating of MCB
(a)	Lighting	3 x 1C 1.5-sq. mm.	6A/10A
(b)	13A socket outlet (radial)**	3 or 4 x 1C 2.5-sq. mm.	16A/20A
(c)	13A socket outlet (ring)	6 x 1C 2.5-sq. mm.	32A
(d)	15A/20A outlet	3 x 1C 4.0-sq. mm.	20A
(e)	32A outlet	3 x 1C 6.0-sq. mm.	32A
(f)	Ceiling fan	3 x 1C 1.5-sq. mm.	6A

**- refer to BS 7671: 2008, Section 543.1 for cross sectional area for protective conductor sizing.

5.2 Generally, the current rating of a cable in a circuit shall be greater than the current rating of the corresponding protective device at the origin of the circuit.

5.3 Cables used for final circuits should be colour coded according to the 17th Edition IEE Wiring Regulation BS7671:2008.

5.4 At terminations, cables shall be terminated and tightly fitted in the terminals. The insulation of the wire shall have a gap less than 1mm from the metal part of the terminal.

5.5 Mark and label on each cable of every circuit at terminations using slip-on marker in the DB as well as at the sockets, switches, isolators, lighting, earthing, control and protective devices etc.

5.6 Maximum number of 13A socket outlets allow in a radial or ring final circuit.

5.6.1 For domestic premises which comprises a room(s) that is not a kitchen, the maximum number of 13A socket outlets allow are :-

- Six (6) 13A-outlets for a radial circuit using 2.5-sq. mm. PVC cables and protected by a 20A MCB.
- Ten (10) 13A-outlets for a radial circuit using 4.0-sq. mm. PVC cables and protected by a 32A MCB.

- Ten (10) 13A-outlets for a ring circuit using 2.5-sq. mm. PVC cables and protected by a 32A MCB.

For domestic premises for a kitchen or pantry area, the maximum number of 13A socket outlets allow are: -

- Four (4) 13A-outlets for a radial circuit using 2.5-sq. mm. PVC cables and protected by a 20A MCB.
- Six (6) 13A-outlets for a radial circuit using 4.0-sq. mm. PVC cables and protected by a 32A MCB.
- Six (6) 13A-outlets for a ring circuit using 2.5-sq. mm. PVC cables and protected by a 32A MCB.

5.6.2 For commercial premises that is not a kitchen, the maximum number of 13A socket outlets allow are :-

- Six (6) 13A-outlets for a radial circuit using 2.5-sq. mm. PVC cables and protected by a 20A MCB.
- Ten (10) 13A-outlets for a radial circuit using 4.0-sq. mm. PVC cables and protected by a 32A MCB.
- Ten (10) 13A-outlets for a ring circuit using 2.5-sq. mm. PVC cables and protected by a 32A MCB.

For commercial premises for a kitchen or pantry area, the maximum number of 13A socket outlets allow are: -

- Two (2) 13A-outlets for a radial circuit using 2.5-sq. mm. PVC cables and protected by a 20A MCB.
- Four (4) 13A-outlets for a radial circuit using 4.0-sq. mm. PVC cables and protected by a 32A MCB.
- Four (4) 13A-outlets for a ring circuit using 2.5-sq. mm. PVC cables and protected by a 32A MCB.

NOTE: - Each twin 13A-socket outlet shall be regarded as two (2) single socket outlets, when used in the above application.

5.7 All final lighting circuits protected by a 6A or 10A MCB shall be installed with a maximum permissible electrical load of 900 or 1500 Watts respectively. Lighting circuits using 2.5 sq. mm PVC cable and protected by a 16A MCB shall be installed with a maximum permissible load of 2400 Watts. The maximum electrical loading applies to tungsten lighting and discharge lighting shall include all control gear losses.

5.8 **CPC** shall be provided for all final lighting circuits from the DB to all switches, termination points and lighting points. Where termination point is not available for fully insulated electrical devices, the **CPC** shall be terminated with an end terminal.

5.9 Every stationary electric cooker shall be controlled by a cooker control unit, which shall be installed within 2 metres of the cooker. The cooker control unit, which may incorporate a 13A-switch socket outlet, shall be fitted at an approximate height of 300mm above the working surface and to the side of the cooker position. From the cooker control unit, a minimum sized 6 sq. mm cable shall be run in concealed conduit to a 45A rated flush cooker connection unit, which shall be mounted approximately 600mm above the floor level, located behind the cooker position. If the cooker is of the split-level type, either both parts of the cooker (hob and oven units) shall be within two (2) metres of the cooker control unit or two separate controls shall be installed.

5.10 Every water-heater up to 3 kW single phase shall be supplied from a final radial circuit and controlled by a 20A double-pole switch with neon indicator and marked "**Water-Heater**". A connection unit (switched or un-switched) but fitted with a 13A fuse-link shall be installed as near as practicable to the water-heater. A flexible connection to the water-heater from the connection unit shall be made with a 2.5-sq. mm flexible cord. If the water-heater is located in a bathroom or shower room or a toilet, the water-heater switch shall be located immediately outside the room. The storage water heater must be earthed, and all relevant metal parts shall have supplementary bonding.

5.11 The water heater shall not be installed below a sink and the switch shall be located where it is easily accessible.

5.12 All instantaneous water heaters shall be protected by an external 10 -30mA RCD. (Built-in RCD is not acceptable).

5.13 Every window or split-type air-conditioning unit shall be supplied from a final radial final circuit with a contactor or electronic starter to prevent instantaneous automatic restarting after a resumption of power supply. In certain circumstances where auto restart is required for critical equipment, then a time staggered start up sequence shall be used. A minimum cable size of 4.0 -sq. mm and 15A switched socket outlet or 20A double pole switch complete with 20A MCB type C shall be used.

5.14 A single-pole switch and a regulator shall control every ceiling fan. A **CPC** shall be connected to the regulator.

5.15 Every domestic water-pump or motor for auto-gate shall be supplied from a separate radial final circuit and protected by an appropriate overload protective device. If it is located in a position remote from the protective device at the origin of the circuit, it shall have a local isolator installed adjacent to the pump or motor. This isolator shall be weatherproof (minimum IP54) if it is exposed to the weather. A minimum cable size of 2.5-sq.mm with 20A MCB shall be used. A **CPC** shall be connected to the end devices.

5.16 No socket outlets shall be permitted in bathrooms, shower rooms, or toilets in any circumstances. All light switches controlling the lighting within each of these rooms shall be located outside the room unless ceiling mounted pull cord operated switches are used when they may be located immediately inside the access door.

5.17 Shaver socket outlets may be installed in bathrooms, and must be incorporated with double-wound isolating transformers, complying with BS EN61558-2-5.

5.18 Pendant type and suspension light fittings shall not be permitted in bathrooms.

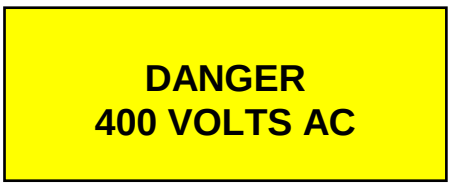
5.19 No socket outlet shall be mounted within 600mm of edge of sink or basin.

5.20 No socket outlets shall be mounted directly below a window.

5.21 A radial or ring circuit serving 13A socket outlets in the kitchen shall not serve any socket outlets in other rooms using the same radial or ring circuit.

5.22 For domestic premises having 3-phase supply, unless otherwise advised, all lighting and power circuits in a room shall be wired using the same phase. If this cannot be avoided, then a minimum distance of 2 metres is required between any outlet, accessory or appliance connected to different phases of supply. However, in no circumstances will more than one phase be permitted in bathrooms, toilets or washrooms.

5.23 When a situation exists, where there is a presence of voltage in excess of 230V between two points and they are within two (2) metres of each other, a warning notice similar to that shown below must be affixed using proper screws adjacent to the circuit points or switches/outlets. The plate shall be made of aluminium/stainless steel or other approved material, which measures approximately 80mm x 30mm with a yellow background and the engraved lettering shall be in black and shall not be less than 5mm in height.



5.24 The above warning notice shall be displayed in the lighting and power layout at the location where the above condition exists.

6. Protection Requirements for LV Main Switchboard (MSB)

6.1 Air Circuit Breaker (ACB) for a LV Main Switchboard (MSB)

6.1.1 Incoming air circuit breaker (ACB) shall be draw-out type where it is fed directly from a transformer rated 800 kVA or more. A MCCB may be used as an incoming breaker if the transformer's rating is 500 kVA or less.

6.1.2 The incoming ACB or MCCB shall be a 3-pole or 4-pole type.

6.1.3 For two or more incoming supplies to a main switchboard, the incomer and the bus-bar couplers shall be provide with 4-pole type ACB / MCCB and interlocking system to prevent parallel operation of the incoming supplies. Where a standby generator is installed, an electrical and mechanical interlocked 4-pole change-over device shall be used for interconnection between the normal and standby sources. The interlock is to ensure that they cannot operate in parallel. The 4 pole ACB / MCCB is to prevent any neutral unbalance and fault currents to flow from the source of supply to the isolated circuit via the neutral. Any special requirement for parallel operation shall be submitted to DES for reviewed and approved specifically.

6.1.4 An incoming circuit breaker selected shall be equipped with minimum number of built-in protection (time-current) elements, such as protection against overload (long time & adjustable), short time and instantaneous for overcurrent and earth fault protection. Alternatively, external protection relays for overcurrent and earth fault protection is acceptable.

6.1.5 The recommended guidance for a typical incoming circuit breaker overcurrent protection settings with respect to the various ratings or capacities of transformers and incoming breakers of the MSB are shown below:-

Rating of Transformer (kVA)	Rating of Incoming Breaker of MSB (In) (A)	Short Circuit Rating of Breaker (Icu)min. (kA)	Incoming Breaker Overcurrent Protection Setting		
			Ir = % x In (A)	Im = 6 x Ir (A)	tm (ms)
300	500	25	420	2520 *	300
500	800	36	700	4200 *	300
800	1200	36	1120	6720 *	300
1000	1600	36	1400	8400 *	300
1500	2500	50	2100	12600 *	300

Note: If the load is highly inductive, the setting of Im may need to be increased. (e.g. where there is central air-conditioning or several large sized motors in use). For parallel incomers and outgoing feeder circuits, the client is required to submit a protection relay settings studies to DES for review and approval.

In = Incoming Breaker Rating

Ir = Long Time Current Setting

Im = Short Time Pick-up

tm = Short time Delay

6.1.6 Where an ACB or MCCB is provided with adjustable current rating plugs or tripping units (thermal rating), the maximum plug or trip settings shall be set to less than or equal to the primary current rating of the conductors.

6.2 Additional Protection Associated With Incoming ACB Directly Feed From A Transformer

6.2.1 Additional Over-current and Earth Fault protection relays shall be connected externally to the shunt trip coil of the ACB from a set of protection current transformers or they may be incorporated or built-in in the ACB.

6.2.2 In general, MSB above 800A capacity shall be provided with Overcurrent Relay with Inverse Definite Minimum Time Lag Relay (IDMTL) characteristic (e.g. Standard Inverse (SI)) Curve and the Earth Fault Relay with Definite Time Lag (DTL) characteristic curve (e.g. definite time). The Overcurrent and Earth Fault Relay shall be electromechanical or electronic type.

6.2.3 When electronic or digital protection relays are provided, it may comprise of various characteristic curve settings such as definite time (DT), extremely inverse (EI), very inverse (VI), standard inverse (SI) and long time inverse (LTI). DES shall have the

right to select the curve characteristic of the over-current and Earth Fault relay and the settings to ensure proper relay discrimination requirements.

6.2.4 Typical single line diagrams for various rating of the MSBs, showing typical protection relays and the associated current transformers, including the type, class and burden are shown in Appendices 4, 5, 6, 7 and 8.

6.2.5 For a MSB having an incoming MCCB rating from 400A to 800A, and is fed direct from a 300kVA transformer or a distribution feeder pillar, an electronic type of Definite Time Lag (DTL) over-current and earth-fault relays shall be installed. However, if the load is highly inductive with high inrush current, e.g. air-conditioning chiller, an IDMTL Overcurrent relay shall be recommended. If a MCCB cannot cater for this requirement, then an ACB shall be selected.

6.2.6 The switchboard manufacturers or the Approved Testing (specialist) Contractors shall calibrate and set the protection relays to the protection relay settings after testing and commissioning of the Main switchboard. **The contractors shall perform the protection relay setting studies and submit to DES for review and approval prior to final energization and commissioning of the MSB for service.**

<u>For Over-Current (typical setting),</u>

- using IDMTL relay with *Standard Inverse (SI)* Characteristics
- Plug setting = 100% of rated current
- TMS = 0.3

OR

- Using DTL relay
- Plug setting = 100% of rated current
- Delay Time Setting = 0.5 s

<u>For Earth Fault (typical setting),</u>

- Using DTL relay
- Plug Setting = 10% to 20% of approved load subject to a maximum of 120A for incoming breaker up to 1600A.
- Plug setting = 5% to 10% of approved load for incoming breaker more than 1600A.
- Delay Time Setting = 0.5s

6.3 Protection associated with outgoing MCCBS or ACBS

6.3.1 Earth fault protection is mandatory for all outgoing circuits equal or greater than 400A using the DTL characteristic. Proper discrimination must be maintained with the incoming breaker's protection.

<u>Typical settings for Earth Fault,</u>

- Using DTL relay
- Plug setting = 10% - 20% of approved load subject to 120A maximum
- Delay Time setting = 0.3s

6.3.2 For outgoing circuits from 100A to 400A, earth-leakage protection relay shall be installed.

6.3.3 MCCBs or ACBs when use to control and protect outgoing circuits shall be selected to match the rated current of the outgoing circuits. The designer shall ensure that there is correct application and grading with the main incoming ACB / MCCB so that discrimination margin of 0.3 - 0.4 second is achieved.

6.3.4 Prior to placing any MSB and circuit breaker into service and operation, the REW/Engineer responsible for the installation shall ensure that commissioning check sheet for the testing of the MSB and ACB / MCCB and protection relay settings are completed and signed off with the final review and approval from DES.

7. Installation Requirements for Temporary Supply

7.1 The tapping of supply from DES LV network to the meter-board/sealing chamber/MSB shall be by underground service cable (PVC/SWA/PVC) or (XLPE/SWA/PVC) which shall not exceed 50 metres. The meter shall be prepaid meter for application of 60/80A and 100A, and CT meter for application exceeding 100A.

7.2 This cable will be supplied and installed by the customer at his/her own cost.

7.3 Where the meter-board/sealing chamber/MSB is more than 50 metres from DES power source, the customer shall use aerial PVC insulated cables, which are installed on 75-mm diameter x 6 metre-high galvanised iron (G.I) poles. However, 75-mm (min) diameter x 10 metre poles shall be used for road crossing.

7.4 The maximum span between poles shall be 20 metres.

7.5 The connection from the overhead lines to the meter-board shall be by underground service cable as described above.

7.6 DES will perform the termination works at the power source.

8. Earthing

8.1 The consumer's Main Earthing Terminal shall be connected using a suitably sized Earthing Conductor to an effective Earth Electrode(s). The Earth Electrode shall be copper bonded steel cored rod or solid copper rod and it shall be driven into the ground at least 2 metre deep at a practical position near to the consumer's Earthing Terminal.

8.2 Only DES approved earth rods (complying with BS6651) shall be used. For domestic premises, having 3-phase supply not exceeding 100A, 16mm diameter Earth Electrode(s) shall be used.

8.3 A minimum of two (2) earthing connections shall be installed from the MSB, sub-main, DB or earthing bar to the earth pit(s) to ensure high reliability and integrity of the earthing and bonding system for personal safety requirements.

8.4 All water pipe or gas pipe to any building or premises shall NOT be used as an Earthing Electrode. However, all metal pipe shall be bonded for personal safety requirements.

8.5 The installation of an Earth Electrode shall be made in a concrete Earthing Inspection Pit, measuring approximately 300mm X 300mm X 300mm. The connection of the Earthing Conductor and the electrode shall be soundly made by a soldered "Furse" / "Cadweld" joint or by a proper heavy duty "Furse" / "Cadweld" cable to rod or tape to rod clamp. A permanent label "**SAFETY ELECTRICAL CONNECTION – DO NOT REMOVE**" shall be installed at the earth pits and earthing connection bars. The pit shall be filled with sand and covered with a removable heavy-duty cover.

8.6 For every LV earthing installation, the Earth Electrode Resistance shall not exceed one (1) Ohm. For HV equipment earthing in the substation, the Earth Resistance shall not exceed 0.5 Ohm.

8.7 Any MSB that obtains supply directly from a transformer, the REW shall submit a Earth Test Report to DES. A typical test report format for MSB earthing is shown in Appendix 9.

8.8 All CPC and earthing loops from the DBs including consumer units to the power points, socket outlets, devices, lighting points etc shall be measured and shall comply with BS7671:2008 minimum acceptable value.

9. Testing on Main Switchboard (MSB)

9.1 For a new main switchboard (MSB) that is fed directly from a 11/0.425 kV transformer, it is mandatory that the MSB be tested and commissioned on-site by the switchboard manufacturer/assembler or a DES approved independent tester (Specialised Approved Contractor). The testing shall be witnessed by an officer-in-charge from DES. As a minimum, the following tests and checks shall be carried out on-site to ensure that the switchboard meet the minimum acceptable readings and is safe to "Turn-On": -

- Insulation test (2kV for one minute).
- Polarity, ratio test and saturation test for current transformers
- Polarity and ratio test for voltage transformers (if any).
- Primary and secondary current injection test for over-current and earth-fault relays.
- Testing of protection relays such as under-voltage relay, over-voltage relay, motor thermal overload protection relay, phase failure protection relays, etc
- Function test the mechanical and electrical interlocks of the (motorised) incoming breakers and transfer scheme (if any), etc.
- Continuity (ductor) test on all busbar joints, connections and terminations
- Earthing and earth loop impedance test
- Phase sequence rotation (for 3 phase only)

9.2 The testing and commissioning check sheets and reports shall be submitted to DES.

9.3 Example of a typical test report formats are shown in Appendices 10 and 11.

10. Maintenance and Periodic Testing & Inspection of Installation

10.1 All new electrical installations shall be inspected by DES authorised persons or DES Approved (Specialised) Contractor/Inspectors. The Inspector shall complete the **Electrical Installation Certificate** and submit to DES prior to connection to supply. The typical **Electrical Installation Certificate** is shown in Appendix 11A.

10.2 The electrical installation shall be tested and results recorded in the **Schedule of Test Results** shown in Appendix 11B. Any deviation or non conformance shall be recorded and shall inform the owner for corrective action. A re-test shall be carried out after the remedy work and recorded in the **Schedule of Test Results** to proof that the installation is fit for use.

10.3 All electrical installations shall be regularly inspected, maintained and safety precautions shall be observed at all times to prevent danger to personnel. The Inspector shall complete and submit to DES the typical **Periodic Inspection Report for Electrical Installation** shown in Appendix 11C.

10.4 The owner or management of the premises or properties shall be responsible for the technical and safety integrity of the electrical system and the safe use of electricity in his/her installation.

10.5 The building or property owners shall ensure that their building installations are periodically inspected and tested by DES approved testing personnel or DES Approved (Specialised Testing) Contractors that are registered with DES.

10.6 The recommended intervals for periodic inspection and testing on the following types of installation unless other Competent Authorities specifically require shorter intervals, are as follows:-

- 10 years interval for domestic installation (private houses, flats).
- 5 years interval for commercial properties (shops & offices), educational establishments (schools colleges & universities), hotels & boarding houses.
- 3 years interval for factories, workshops and agricultural installation.
- 1 year interval for petrol filling stations, public entertainment areas (theatres & cinemas), public launderettes, places of worship.
- 6 months interval for construction sites and temporary installation.
- Change of occupancy or owner

10.7 Where a MSB is fed directly from a transformer, the owner or management of the premises or properties is strongly advised to have the MSB comprehensively maintained and tested every three (3) years by DES registered switchboard manufacturer or DES Approved (Specialised Testing) Contractors.

10.8 All maintenance and inspection reports shall be submitted to DES for review and approval. Any readings or records that are not within the minimum acceptable limit, the Approved Inspectors who perform the inspection shall inform the owner for immediate corrective work. DES shall have the right to disconnect the power supply to the consumer(s) unless the owner rectifies the defects within 2 weeks from the date of the previous inspection date.

Section lll
KILOWATT-HOUR (kWh) AND PREPAID METER INSTALLATION REQUIREMENTS

1. General

1.1 The conventional kWh meter / prepaid meter shall be located near the termination of the service cable, which is easily accessible to DES personnel. It shall be installed in a location that will not cause damage to the meter. The location shall be clean, dry and not exposed to weather, mechanical damage, vibrations, and extremes of temperature and dampness.

1.2 The customer shall provide and maintain the meter board and its enclosure, including the purchase and installation of the meter at his/her own expense. However, DES will maintain the meter from the first day it is commissioned and supply energised.

1.3 Where a telephone line is required for use with the latest CT electronic kWh meter / split-configuration prepaid meter, the customer shall provide the line at his/her own cost.

1.4 For domestic premise, all energy meter shall not be installed inside the house. Should there be a renovation that will affect the existing conventional meter board located inside the house, then it is required to relocate that meter board and its relevant services (service cable and sealing chamber) outside the house, in a location that is easily accessible to DES personnel. (Refer to item 1.1 above). All expenses shall be borne by the customer.

1.5 Every conventional kWh meter / prepaid meter shall be installed inside a standard DES approved enclosure that will also house the service cable sealing chamber if underground cable is used or the service cut-outs if aerial service cable is used.

1.6 Every energy meter shall be mounted on a standard PVC meter mounting board or chemically treated teakwood board.

1.7 For termination onto DES direct connection meter, circular, multi-stranded copper conductors shall be used. Sector-shaped conductors are not accepted.

2. Standard Enclosure For Single And Three-Phase Conventional Kilowatt-Hour Meter And Sealing Chamber Or Cut-Outs Not Exceeding 100A.

2.1. Installation At Gate Post/Pillar

2.1.1 The enclosure shall be fabricated for flush and surface mounting using aluminium sheet and shall have a minimum index of protection of IP54. The main dimensions and other details of the approved standard enclosure are shown in the drawings in Appendices 12A and 12B.

2.1.2 When installed (flush) in the concrete pillar, the pipe sleeves for the incoming and outgoing service cables shall be laid up to about 100mm from ground level.

2.1.3 The enclosure shall have a provision for drain and to prevent any stagnation of water due to condensation and ingress within it.

2.1.4 A minimum space of 210mm (w) x 650mm (h) shall be allowed for the installation of meter and sealing chamber. Pre-drilled and tapped holes c/w screws shall be provided for the mounting of sealing chamber.

2.1.5 A customer's earthing terminal shall be provided in the enclosure.

2.1.6 A hinged door (detachable) shall have a clear glass viewing window which measures approximately 120mm(w) x 160mm(h) x 6 mm (thickness) and shall be positioned directly in front of the meter location. Clear plastic / Perspex material is not acceptable. The door shall be given provision for padlocking as well as for wire sealing.

2.1.7 The enclosure shall be installed and positioned with a minimum height of 450mm from ground level to the bottom end of the enclosure.

2.1.8 Two 75mm diameter UPVC lead-in pipes shall be provided for incoming and outgoing service underground cables. The pipes shall be laid up to 100mm from ground level and shall be under any drain in front of the enclosure.

2.1.9 There shall be adequate standing space in front of the enclosure to facilitate meter reading, installation and maintenance work. Where there is a drain in front of the enclosure, a suitable concrete platform or a galvanised steel grating shall be provided.

2.1.10 When installing the incoming and outgoing service underground cables, proper and suitable cable glands shall be used.

2.1.11 The Registered Electrical Contractor (REC) shall submit to DES the proposed shop drawing of the meter enclosure for approval before fabrication.

2.2 Installation On Wall Outside House

2.2.1 The meter shall be installed in a DES approved enclosure (IP54) which will also house the sealing chamber if underground cable is used or the service cut-outs if aerial service cable is used.

2.2.2 The main dimensions and other details of the enclosures for single-phase and three-phase kWh meters including sealing chamber or service cut-outs are shown in the drawings in Appendices 13, 14, 15 and 16.

2.2.3 Each enclosure and its front panel cover / door shall be fabricated using minimum 1.2-mm thick Electro-galvanised sheet or other approved material.

2.2.4 A hinged front panel / door shall have a transparent glass-viewing window. The viewing window measuring approximately 180mm (w) x 200mm (h) x 6 mm (thickness) for both single-phase and three-phase shall be positioned directly in front of meter location. Clear plastic/ Perspex material is not acceptable.

2.2.5 Sufficient ventilation shall be provided to avoid high humidity and condensation within each enclosure.

2.2.6 A customer's earthing terminal shall be provided in each enclosure.

2.2.7 The height of a meter installation in each enclosure shall be about 1.8 metres measured from ground level.

2.2.8 There shall be a minimum space of 210mm (w) x 650mm (h) for the installation of meter and the service sealing chamber or cut-outs. Pre-drilled and tapped holes c/w screws shall be provided for the mounting of sealing chamber.

2.2.9 For supply using service underground cable, one 75mm diameter UPVC lead-in pipe-sleeve shall be provided for DES incoming underground cable (PVC/SWA/PVC or XLPE/SWA/PVC). The pipe sleeve shall be laid up to about 100mm above ground level located next to the wall where the meter and service cable enclosure is going to be located.

2.2.10 Appropriate size of aluminium capping or PVC trunking shall be provided and installed to cover the service cable from the pipe sleeve (near floor level) to bottom of meter and sealing chamber enclosure.

2.2.11 When installing the underground cable in the enclosure, proper and suitable cable gland shall be used.

2.2.12 If incoming supply is by aerial service cable, submain in appropriate sized PVC or metal trunking between the meter board enclosure to the end of the aerial service line shall be provided and installed.

2.2.13 In some cases where the meter and the sealing chamber are proposed to be located in a room but outside the house, approval may be given if:

- The room will only be used as a meter room.
- The room shall be sufficiently ventilated.
- The door shall not be locked.
- The meter and sealing chamber enclosure shall be as specified in clause 2.2.1 to 2.2.10 and in accordance with the drawings in Appendices 13, 14 and 15.
- The meter and sealing chamber enclosure shall be mounted so that the front is facing the door.
- The panel cover/door of the enclosure can be fully opened without obstruction.

2.2.14 The REW shall submit to DES the shop drawings of the proposed meter enclosure for approval before fabrication.

3. Installation Of Prepayment Meter

3.1 For split-configuration prepayment meter:

- The main meter must be installed in an appropriate location outside the building or premises and be protected from sunlight and rain.

- The “Keypad Unit” must be installed inside the building, where it is easy to be accessed.
- The “Communication Cable” must be provided between the meter and the keypad unit and must not exceed 50 meter in length (Please refer to Appendix 17)

3.2 The recommended height of the prepaid meter shall be about 1.8 metre from the floor level to the top of the meter.

3.3 If the incoming supply is by underground service cable the sealing chamber can be housed in an enclosure as shown in the drawings in Appendices 18A and 18B. The technical requirements are as stated in clause 2.1 and 2.2.

3.4 The sealing chamber shall be located outside the house.

3.5 The REW shall submit to DES the shop drawings of the proposed enclosure for approval before fabrication.

4. Grouping Of Service Cut-Outs (Using Prepaid Meters not Exceeding 100A For Each Meter)

4.1. For multi-tenanted premises (big apartments) where prepaid meters are used and service cut-outs shall be grouped together in easy accessible centralised enclosure or a distribution enclosure in a room.

4.2. These cut-outs are to be grouped on the same floor as the tenant units and in the case of shop houses, and small apartments and flats, they may be grouped at the ground floor.

4.3. There may be more than one group of service cut-out location on each floor.

4.4. The room used for housing the service cut-out enclosure shall have adequate lighting to facilitate maintenance work.

4.5. The room shall also have adequate ventilation.

4.6. Service cut-outs shall be installed in the enclosure facing the room door.

4.7. The service cut-out enclosure shall be clearly and permanently labelled. Tenant units or shop-lot numbers on permanent labels must be fixed adjacent to the respective sets of service cut-outs.

4.8. The service cut-outs and neutral links are to be mounted neatly such that each set can be visually identified with its associated tenant unit number. The labels used shall be engraved lettering in plastic or other approved material.

4.9. Access clearance in front of the service cut-out compartment shall not be less than 700mm.

4.10. The service cut-out enclosure’s room must not be used as a storeroom.

4.11. The layout of the above room and tenant units together with the electrical single line diagrams shall be submitted to DES for approval.

4.12. For shop houses, only approved standard panel enclosures are to be used. Two typical enclosures with dimensional details are shown in drawings in Appendices 19 and 20. There are also applicable for multi-tenanted flats or apartments.

4.13. For multi-tenanted flats or apartments and commercial complexes where cables are used as risers, special tap-off units shall be used. An approved standard wall-mounted tap-off unit as illustrated in Appendix 21.

4.14. For multi-tenanted flats and apartments, an approved standard wall-mounted service cut-outs panel to be used with a tap-off unit as illustrated in Appendix 22.

5. Meters For 3 Phase Supply Exceeding 100A

5.1. General

5.1.1. Only DES approved electronic kWh meters shall be used.

5.1.2. An electronic kWh meter for supply exceeding 100A per phase is operated from metering current transformers which are to be fixed on a pre-wired metering panel either on the customer's main switchboard or on an incoming panel board c/w kWh meter compartment. The pre-wired metering panel c/w wiring to current transformers, busbars, Test Terminal Block (separately locked), MCBs or HRC fuses, pilot lamps, kWh meter and telephone point shall be provided by the customer.

5.1.3. Facilities for wire sealing the current transformers and kWh meter compartment including the S1 & S2 terminals shall be provided.

5.1.4. All current transformers used shall comply with BS7276 (1993). The current transformers used with the kWh meter shall be of class 0.5 with 15VA burden (minimum) and they shall not to be shared with other instruments. Normally, the ratio shall be selected to match incoming breaker rating. The following sizes of current transformer and the corresponding burden are applicable:-

- 200/5A ---------- 15VA
- 400/5A ---------- 15VA
- 600/5A ---------- 15VA
- 800/5A ---------- 15VA
- 1000/5A ---------- 15VA
- 1200/5A ---------- 15VA
- 1600/5A ---------- 15VA
- 2000/5A ---------- 15VA
- 2500/5A ---------- 15VA

5.1.5 13 way type test terminal block to be used.

5.1.6 For the protection of the meter voltage wiring circuits, a sealable 3- pole MCB in the 'ON' position shall protect them. No sharing of the MCB with other instrument is allowed. For a main switchboard, the MCB shall be rated 10A Type C with a breaking capacity of not less than 15kA according to IEC 60947-2. The 3-pole MCB shall be permanently labelled - "For kWh Meter".

5.1.7 A 6.0mm tap-hole plus a sealable screw/washer/nut on each busbar shall be provided to facilitate connection of the voltage supply to the meter voltage coils. All busbars provided shall be fully insulated.

5.1.8 Prior to the fabrication and installation of the MSB, the Electrical Contractor shall submit to DES the shop drawings of MSB showing CT panel and kWh meter arrangement to DES for approval.

5.2 kWh Metering Current-Transformer Panel and Its Installation

5.2.1 The metering current transformers shall be mounted using Bakelite clamps and adequate insulation between the metering current transformers and the busbars must be provided. All busbars shall be fully insulated.

5.2.2 The terminations of the secondary S1 and S2 of the current transformers shall be covered with prefabricated plastic or other insulating material with provision for wire sealing.

5.2.3 The metering current transformer panel shall be fabricated from mild steel plate of 1.6mm minimum thickness, welded on to the switchboard main structural frame. The panel shall be provided with facilities for sealing. Also sealable transparent Perspex or other approved insulating material shall be installed inside the panel covering the busbars/CTs.

5.2.4 For a main switchboard or other incoming switchboard panel where the supply is coming from a distribution transformer, a feeder pillar or other sources, the metering current transformers shall be installed before the incoming breaker. The construction of a typical kWh current transformer panel is shown in Appendix 23 and Appendix 24.

5.3 kWh Metering Panel Installation

5.3.1 The meter panel compartment where it is to be incorporated in the wall mounted and floor standing main switchboard, shall be fabricated using minimum 1.6mm thick mild steel sheet.

5.3.2 Two standard meter-mounting boards shall be mounted in the panel for the installation of kWh meters. But only one meter shall be used. A Check Meter may be installed in due course. The meter panel shall be sealable.

5.3.3 The other accessories that are to be installed in the metering panel are: -

- 1 No. Test Terminal Block
- 1 No. 3-pole 10A MCB (15kA based on IEC 947-2)), Type C, for meter voltage wiring. The terminals of the breaker shall be sealed using proper terminal shields.
- 2 Nos. Termination blocks
- 1 No. Telephone socket (when required)
- 1 Lot PVC cable duct or flexible casing
- 1 No. Incoming termination block (not required if metering panel is incorporated in Main switchboard).
- 1 Set Supply indicating lights

5.3.4 The wiring and termination from the current transformers and kWh meters to the above accessories are to be pre-wired. The standard pre-wiring of the metering panel is illustrated in Appendix 26. The wiring from the insulated busbars and the secondary terminals of the current transformers to the test block must be installed in flexible conduit.

5.3.5 The standard metering panel that is incorporated in a wall mounted or floor standing main switchboard is illustrated in Appendix 26. The wire-sealable front panel (cover) shall have a transparent glass viewing window measuring approximately 250mm (h) x 400mm (w).

5.3.6 When access to the metering panel is difficult, DES may request that the kWh meter be located outside the switch-room. In this case, the kWh meter shall be installed in a standard outdoor meter panel (IP55) which is as shown in Appendix 27. The wiring from the current transformers to the outdoor meter panel will be via a terminal block and a 10A 3-pole MCB (15kA minimum to IEC 60898-1) located in a lockable compartment, which is in the main switchboard. A 10 core minimum 2.5-sq. mm. PVC/SWA/PVC cable or minimum 2.5-sq. mm PVC cable in surface PVC conduit shall be used. In cases where the secondary circuit wiring is more than 10 metres, the size of the cable and the burden (VA) of the related current transformers shall be increased to 4-sq. mm accordingly. The terminal block and MCB compartment incorporated in the main switchboard is illustrated in Appendix 28.

5.3.7 The height of the meter on the outdoor meter panel shall be about 1.8 metre measured from ground level to the bottom of the panel.

5.3.8 If a CT operated kWh meter is proposed to be located at a gatepost, a flushed mounted meter panel shall be used. The details of such a panel are shown in Appendices 29A and 29B.

GENERAL SYMBOLS

V	VOLTS
A	AMPERES
Hz	HERTZ
W	WATTS
kW	KILOWATTS
F	FARADS
p.u.	PER UNIT
ph	PHASE
p.f.	POWER FACTOR
L	LINE
N	NEUTRAL
h	HOURS
min	MINUTES
s	SECONDS
⎓	DIRECT CURRENT
~	ALTERNATING CURRENT
2~	TWO-PHASE ALTERNATING CURRENT
2N~	TWO-PHASE ALTERNATING CURRENT WITH WITH NEUTRAL
3~	THREE-PHASE ALTERNATING CURRENT
3N~	THREE-PHASE ALTERNATING CURRENT WITH WITH NEUTRAL
IPXX	IP NUMBER, INGRESS OF PROTECTION
	FAULT (INDICATION OF ASSUMED FAULT LOCATION)
	CLASS II APPLIANCE EQUIPMENT IN WHICH PROTECTION AGAINST ELECTRIC SHOCK DOES NOT RELY ON BASIC INSULATION ONLY BUT IN WHICH ADDITIONAL SAFETY PRECAUTIONS SUCH AS SUPPLEMENTARY INSULATION ARE PROVIDED, THERE BEING NO PROVISION FOR THE CONNECTION OF EXPOSED METALWORK OF THE EQUIPMENT TO A PROTECTIVE CONDUCTOR AND NO RELIANCE UPON PRECAUTIONS TO BE TAKEN IN THE FIXED WIRING OF THE INSTALLATION, REFER BS 2754
	CLASS III APPLIANCE EQUIPMENT IN WHICH PROTECTION AGAINST ELECTRIC SHOCK RELIES ON SUPPLY AT SELV AND IN WHICH VOLTAGES HIGHER THAN THOSE OF SELV ARE NOT GENERATED, REFER BS 2754
	SAFETY ISOLATING TRANSFORMER CLASS III EQUIPMENT MUST BE SUPPLIED FROM A SAFETY ISOLATING TRANSFORMER TO BS EN 61558-2-6. THE SAFETY ISOLATING TRANSFORMER WILL HAVE THIS IDENTIFYING MARK UPON IT.
	ISOLATING TRANSFORMER

ELECTRICAL DIAGRAMS

- TRANSFORMER, GENERAL SYMBOL
- GENERAL WIRING, WITH JOINT
- PHASE CONDUCTOR WHERE STRIPES OR N DENOTES NUMBER OF PHASES
- NEUTRAL CONDUCTOR
- PROTECTIVE CONDUCTOR
- COMBINED PROTECTIVE AND NEUTRAL CONDUCTOR (PEN)
- OPERATING DEVICE, GENERAL (COIL)
- MAKE CONTACT (NO)
- BREAK CONTACT (NC)
- MANUALLY OPERATED SWITCH
- OPERATED BY TURNING AND WITH PADLOCKING FACILITY
- THREE PHASE WINDING (DELTA)
- THREE PHASE WINDING (STAR)
- RECTIFIER POWER CONVERTER AC/DC
- INVERTER POWER CONVERTER DC/AC
- DC CONVERTER POWER CONVERTER DC/DC
- BATTERY OF PRIMARY OR SECONDARY CELLS
- FUSE LINK RATED CURRENT IN AMPERES WHERE STRIPES DENOTES NUMBER OF FUSE
- FUSE LINK RATED CURRENT IN AMPERES WHERE "N" DENOTES NUMBER OF FUSE
- CAPACITOR, GENERAL SYMBOL
- INDUCTOR COIL, WINDING OR CHOKE
- INDUCTOR COIL, WINDING OR CHOKE WITH MAGNETIC CORE
- SEMI-CONDUCTOR DIODE GENERAL SYMBOL
- MOTOR STARTER GENERAL SYMBOL
- DIRECT-ON-LINE STARTER
- STAR-DELTA STARTER
- AUTO-TRANSFORMER STARTER
- EARTH (GROUND), GENERAL SYMBOL
- CLEAN EARTH
- PROTECTIVE EARTH
- MACHINE, GENERAL SYMBOL * FUNCTION M = MOTOR G = GENERATOR

- CABLE GLAND OR CABLE ENTRY
- CABLE SEALING END BOX
- RESISTOR, GENERAL
- VARIABLE RESISTOR
- PHOTO-ELECTRIC CELL
- PHOTODIODE PHOTO-CONDUCTIVE DEVICE WITH ASYMMETRICAL CONDUCTIVITY
- HEATING ELEMENT (e.g. ROOM HEATER)
- REMOTE CONTROL UNIT WITH AMMETER CONTROLLED BY ROTARY STACK SWITCH
- REMOTE CONTROL UNIT WITHOUT AMMETER CONTROLLED BY ROTARY STACK SWITCH
- SAFETY SWITCH
- EMERGENCY SWITCH
- VOLTAGE TRANSFORMER, SINGLE PHASE
- CURRENT TRANSFORMER, GENERAL
- CURRENT TRANSFORMER SURROUNDING THREE CONDUCTORS (CORE BALANCE)

ISOLATING

- ISOLATOR (DISCONNECTOR) GENERAL SYMBOL
- DISCONNECTOR-FUSE (FUSE COMBINATION UNIT)
- FUSE-DISCONNECTOR
- CIRCUIT BREAKER SUITABLE FOR ISOLATION

MAKING, BREAKING AND ISOLATING (ON LOAD)

- SWITCH
- SWITCH-FUSE
- FUSE-SWITCH

CIRCUIT BREAKERS

- CIRCUIT BREAKER, GENERAL WHERE STRIPES OR N DENOTES THE NUMBER OF PHASES
- RESIDUAL CURRENT CIRCUIT BREAKER (RCCB)
- MINIATURE CIRCUIT BREAKER (MCB)
- RESIDUAL CURRENT CIRCUIT BREAKER WITH OVERCURRENT PROTECTION (RCBO)
- CONTACTOR
- TWO-WAY SWITCH WITH CENTRE-OFF POSITION

ABBREVIATIONS CODE

- INTEGRATING INSTRUMENT OR ENERGY METER
- INDICATING INSTRUMENT, GENERAL
- RECORDING INSTRUMENT, GENERAL

CODE LETTERS FOR USE IN METERS :

V	VOLTMETER
A	AMMETER
W	WATTMETER
kWh	KILOWATT-HOUR METER
var	REACTIVE VOLT-AMPERE METER
Varh	REACTIVE VOLT-AMPERE HOUR METER
Hz	FREQUENCY METER, HERTZ
SYN	SYNCHROSCOPE
COS ϕ	POWER FACTOR METER
MVA	MAXIMUM DEMAND METER
t°	THERMOMETER

- MEASURING RELAY OR RELATED DEVICE, GENERAL

DEVICE NUMBERS FOR USE WITH RELAYS AND RELATED DEVICES :

2	TIME-DELAY STARTING OR CLOSING RELAY
3	CHECKING OR INTERLOCKING RELAY
4	MASTER CONTACTOR
12	OVERSPEED DEVICE
14	UNDERSPEED DEVICE
23	TEMPERATURE CONTROL DEVICE
25	SYNCHRONIZING OR SYNCHRONISM-CHECK DEVICE
27	UNDER-VOLTAGE RELAY
32	DIRECTIONAL POWER RELAY
37	UNDERCURRENT OR UNDER-POWER RELAY
40	FIELD RELAY
46	REVERSE-PHASE OF PHASE-BALANCE CURRENT RELAY
49	MACHINE OR TRANSFORMER THERMAL RELAY
50	INSTANTANEOUS OVER-CURRENT OR RATE-OF-RISE RELAY
50n	INSTANTANEOUS EARTHFAULT RELAY
51	AC TIME OVER-CURRENT RELAY
51G	TIME DEPENDENT STANDBY EARTHFAULT RELAY
51n	TIME DEPENDENT EARTHFAULT RELAY
51V	VOLTAGE RESTRAINED AC TIME OVER-CURRENT RELAY
52	AC CIRCUIT BREAKER
52a	AC CIRCUIT BREAKER OPEN STATUS
52b	AC CIRCUIT BREAKER CLOSE STATUS
59	OVER-VOLTAGE RELAY
60	VOLTAGE OR CURRENT BALANCE RELAY
62	TIME-DELAY STOPPING OR OPENING RELAY
63	LIQUID OR GAS PRESSURE OR VACUUM RELAY
64	EARTH-FAULT PROTECTIVE RELAY
67	AC DIRECTIONAL OVER-CURRENT RELAY
67n	AC DIRECTIONAL EARTH-FAULT RELAY
81	FREQUENCY RELAY
86	LOCKING-OUT OR INTERTRIPPING RELAY
87	DIFFERENTIAL PROTECTIVE RELAY
94	TRIPPING OR TRIP-FREE RELAY
94b	BUCHOLZ ALARM AND TRIP RELAY
94t	WINDING TEMPERATURE ALARM AND TRIP RELAY

LAYOUT DRAWINGS

POWER LAYOUTS

- SWITCHGEAR
- SWITCHBOARD
- CONSUMER UNIT
- SKID MOUNTED MOTOR
- REMOTE CONTROL UNIT WITH AMMETER
- REMOTE CONTROL UNIT WITHOUT AMMETER
- SAFETY SWITCH
- EMERGENCY SWITCH
- SOCKET OUTLET, GENERAL
- SOCKET OUTLET, MULTIPLE WAY e.g. FOR TWO PLUGS
- SOCKET OUTLET WITH PROTECTIVE CONTACT e.g. CONNECTION TO EARTH
- PLUG
- PLUG AND SOCKET ISOLATOR n = NO. OF POLE
- WIRING GOING UPWARDS
- WIRING GOING DOWNWARDS
- UNDERGROUND CABLE
- STRAIGHT-THROUGH JOINT
- CABLE SEALING END BOX

EARTHING LAYOUTS

- EARTH WIRE BRANCH CONNECTION
- EARTH BAR
- EARTHING BOSS
- EARTH POINT
- EARTHING ROD
- EARTHING ROD WITH INSPECTION BOX
- EARTH PIT

LIGHTING LAYOUTS

- LIGHTING OUTLET POSITION, SHOWN WITH WIRING
- DISCHARGE LAMP (e.g. Hg = MERCURY, Na = SODIUM)
- AUXILIARY APPARATUS FOR DISCHARGE LAMP (e.g. BALLAST)
- FLOOD LIGHT
- SPOT LIGHT
- HELIDECK PERIMETER LIGHT
- NAVIGATION LAMP
- EMERGENCY LIGHTING LUMINAIRE ON SPECIAL CIRCUIT
- SELF-CONTANIED EMERGENCY LIGHTING LUMINAIRES
- LUMINAIRE WITH TWO FLUORESCENT TUBES
- FLUORESCENT LAMP ON SPECIAL CIRCUIT, e.g. EMERGENCY CIRCUIT
- FLUORESCENT LAMP WITH BATTERY BACK-UP
- PULL SWITCH, SINGLE-POLE
- SWITCH, SINGLE-POLE
- SWITCH, DOUBLE-POLE
- SWITCH, TWO-WAY, SINGLE POLE
- SWITCH, INTERMEDIATE
- JUNCTION BOX

MISCELLANEOUS

- PUSH BUTTON WITH INDICATING LAMP
- LAMP OR SIGNAL LAMP GENERAL SYMBOL
- CLOCK GENERAL SYMBOL
- ACOUSTIC SIGNALLING DEVICE GENERAL SYMBOL (e.g. BELL)
- BUZZER
- TELEPHONE HANDSET GENERAL SYMBOL
- MICROPHONE
- AUDIBLE ALARM
- ANTENNA
- STATIC GENERATOR
- CEILING FAN
- EXHAUST FAN WHERE ARROW INDICATES THE DIRECTION OF AIR FLOW

REV	DESCRIPTION	DATE	DWN	CHK	APPR
01	STANDARD TEMPLATE	15.03.10	TE	TE	

GENERAL NOTES | DRAWING No | REFERENCE DRAWINGS

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR-E001 CADFILE NAME: APP1EIRE001

TITLE: ELECTRICAL LEGEND AND SYMBOLS TO BS 7671 AND IEC 60617

SIZE: A1 SCALE: NTS REV: 0

Load Demand Estimates

Name:
Location:
Voltage Uo: 230 V **Frequency:** 50 Hz **No. of Phase:** 3 **Power Factor:** 1.0

Circuit No.	MCB (A)	Load Description	Wire Size & Type (sq. mm, XLPE/PVC)	Power (W)	Current Demand (A)	Diversity Factor (%)	Phase L1 Current Demand (A)	Phase L2 Current Demand (A)	Phase L3 Current Demand (A)	Remark
1L1										
2L1										
3L1										
4L1										
5L1										
6L1										
7L1										
8L1										
9L1										
10L1										
11L1										
12L1										
1L2										
2L2										
3L2										
4L2										
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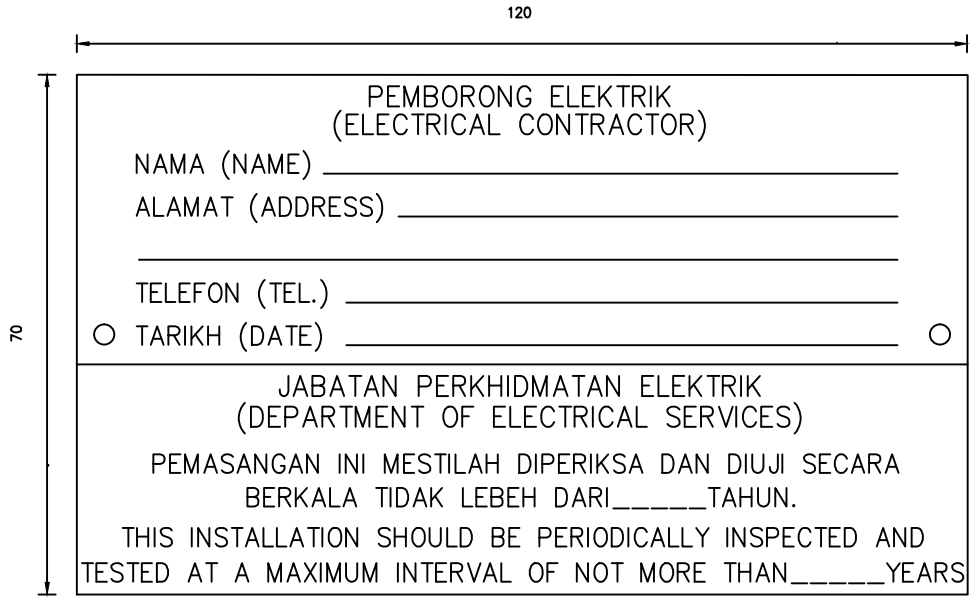
9L2										
10L2										
11L2										
12L2										
1L3										
2L3										
3L3										
4L3										
5L3										
6L3										
7L3										
8L3										
9L3										
10L3										
11L3										
12L3										
						Sub total in A				
						KW per phase				

Total KW Demand	



GENERAL NOTES	DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
ALL DIMENSIONS ARE IN MILLIMETRES			0	STANDARD TEMPLATE	01.09.10	PT	TECO CSS	HNA

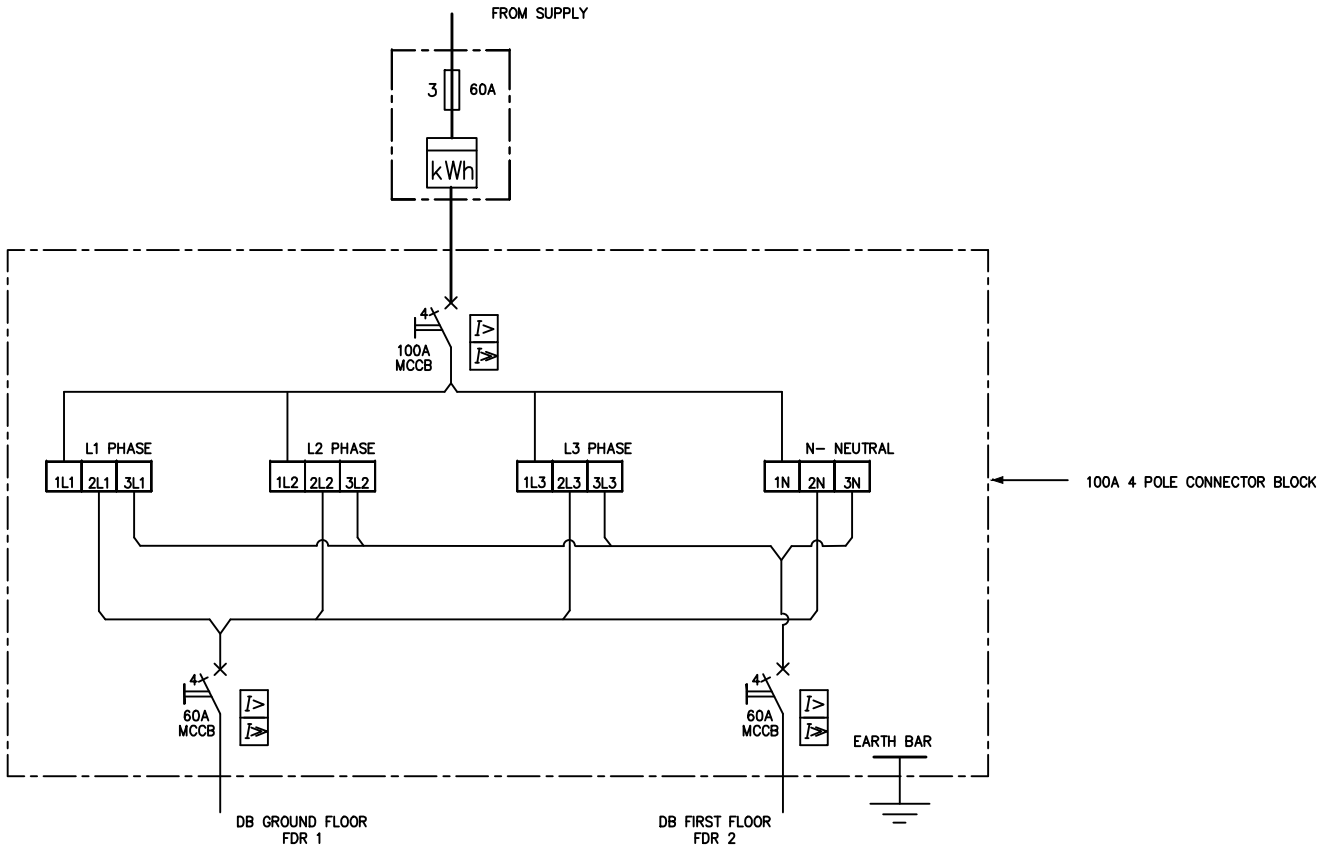
JABATAN PERKHIDMATAN ELEKTRIK
JABATAN PEMBANGUNAN MENTERI
Kerajaan Dan Negeri
Negara Brunei Darussalam

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–S22 CADFILE NAME: APP2EIRS22

TITLE: CONTRACTOR NAME PLATE

SIZE: A3
SCALE: AS SHOWN
REV: 0



GENERAL NOTES	DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
			0	STANDARD TEMPLATE	01.09.10	PT	TECO CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

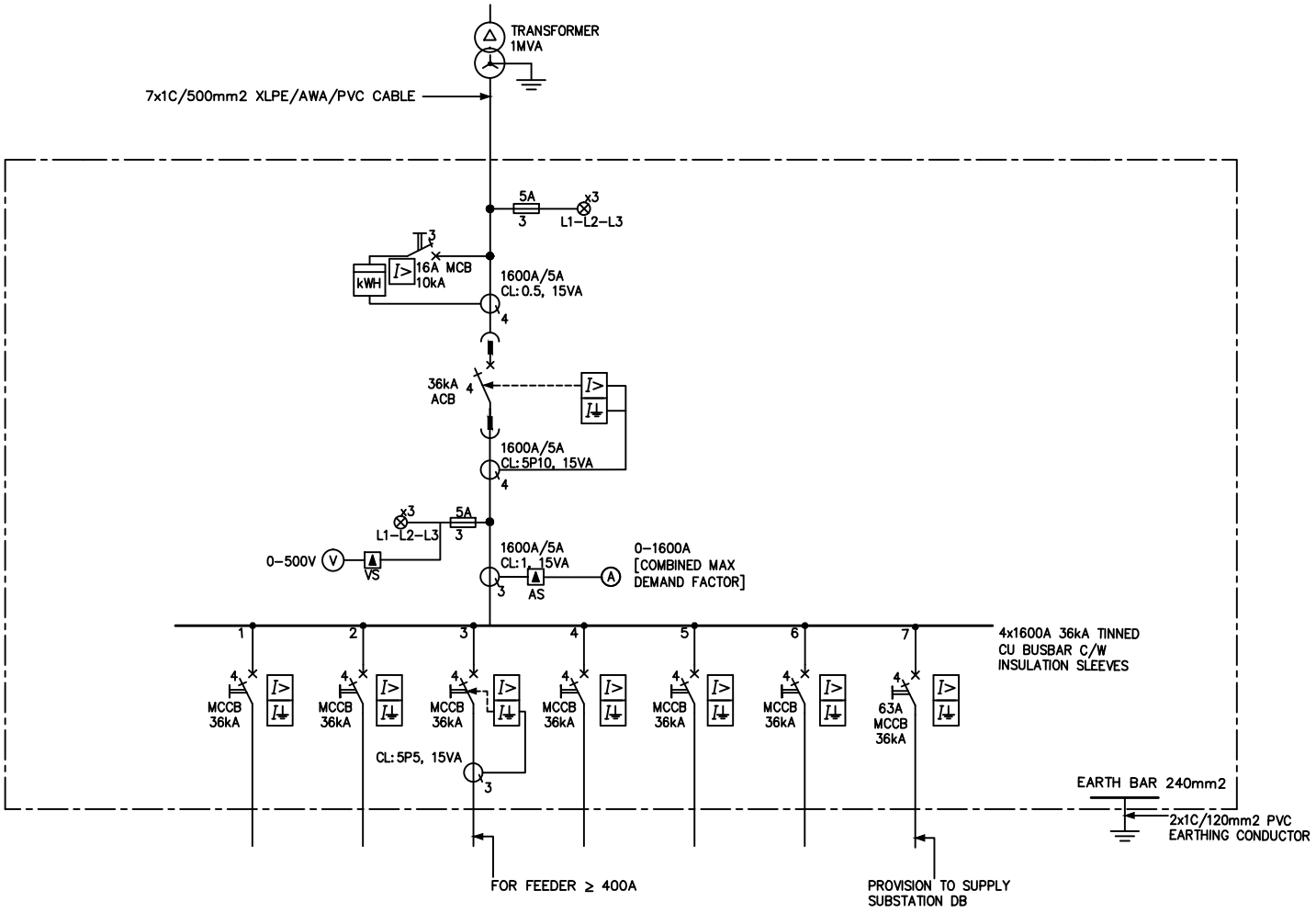
DRAWING No. EIR-S21 CADFILE NAME: APP3EIRS21

TITLE: STANDARD TAP-OFF FOR 100A MAIN SWITCHBOARD WITH 2 NOS. OUTGOING SUB-CIRCUITS

SIZE: A3

SCALE: AS SHOWN

REV: 0



THE ELECTRICAL INSTALLATION SHALL BE CARRIED OUT IN COMPLETE COMPLIANCE WITH THE CURRENT EDITION OF THE WIRING REGULATION FOR INSTALLATION OF ELECTRICAL WIRING AND EQUIPMENT AND DEPARTMENT OF ELECTRICAL SERVICES

GENERAL NOTES

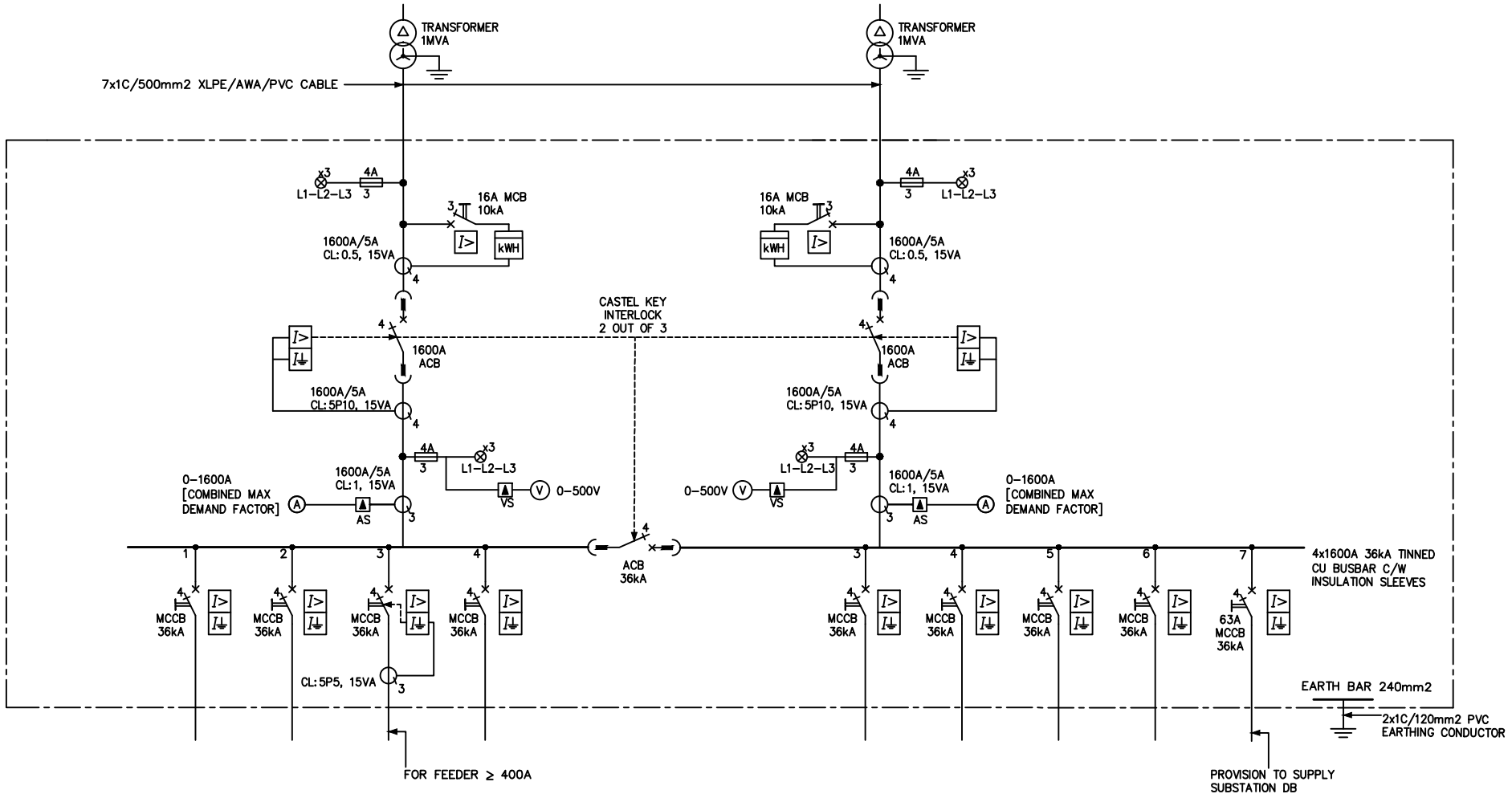
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–E002 CADFILE NAME: APP4EIRE002

TITLE: TYPICAL SINGLE LINE DIAGRAM OF MAIN SWITCHBOARD – FOR ONE TRANSFORMER (1MVA)

SIZE: A3
SCALE: AS SHOWN
REV: 0



THE ELECTRICAL INSTALLATION SHALL BE CARRIED OUT IN COMPLETE COMPLIANCE WITH THE CURRENT EDITION OF THE WIRING REGULATION FOR INSTALLATION OF ELECTRICAL WIRING AND EQUIPMENT AND DEPARTMENT OF ELECTRICAL SERVICES

GENERAL NOTES

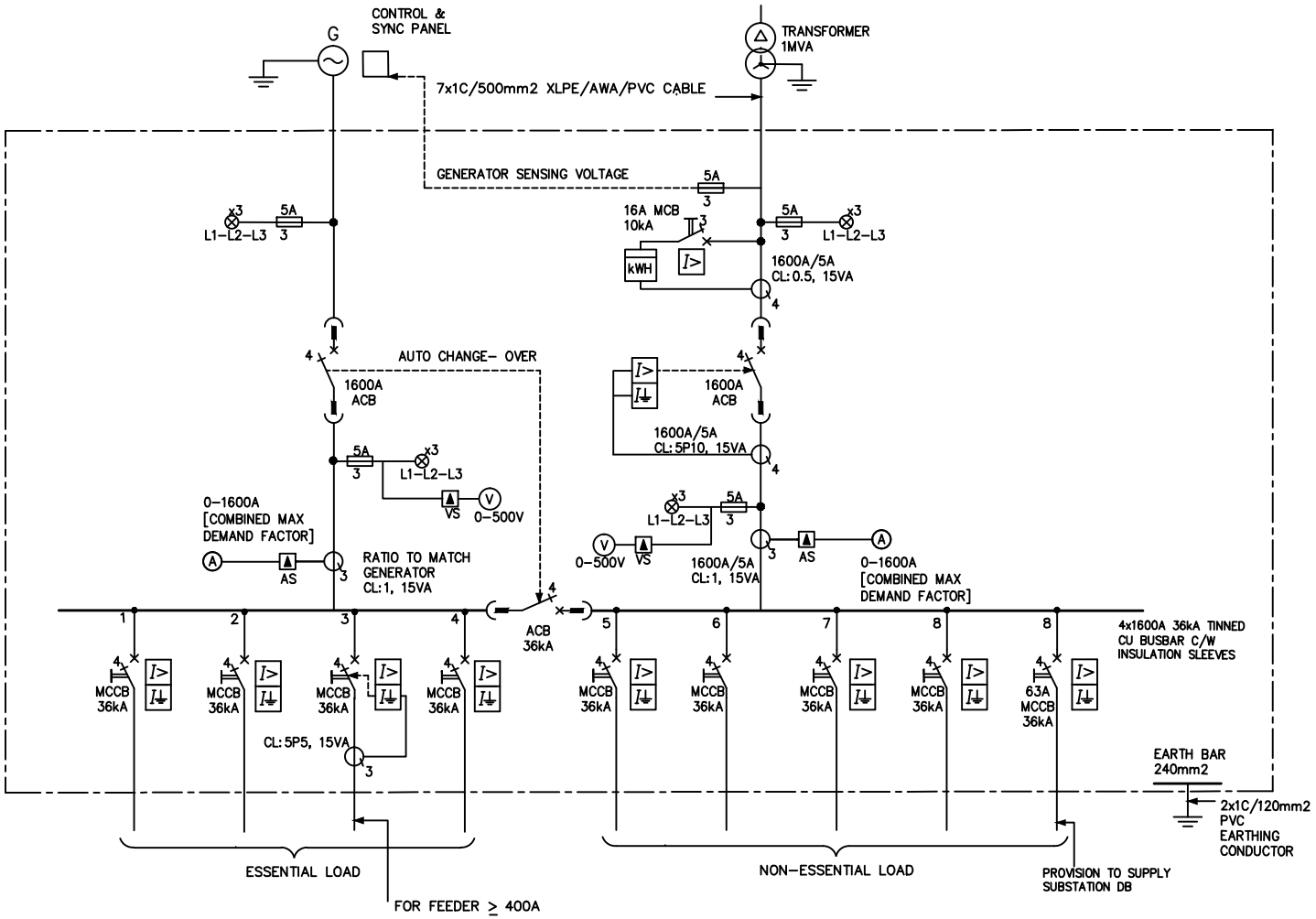
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–E003 CADFILE NAME: APP5EIRE003

TITLE: TYPICAL SINGLE LINE DIAGRAM OF MAIN SWITCHBOARD – FOR TWO TRANSFORMERS (1MVA)

SIZE: A3
SCALE: AS SHOWN
REV: 0



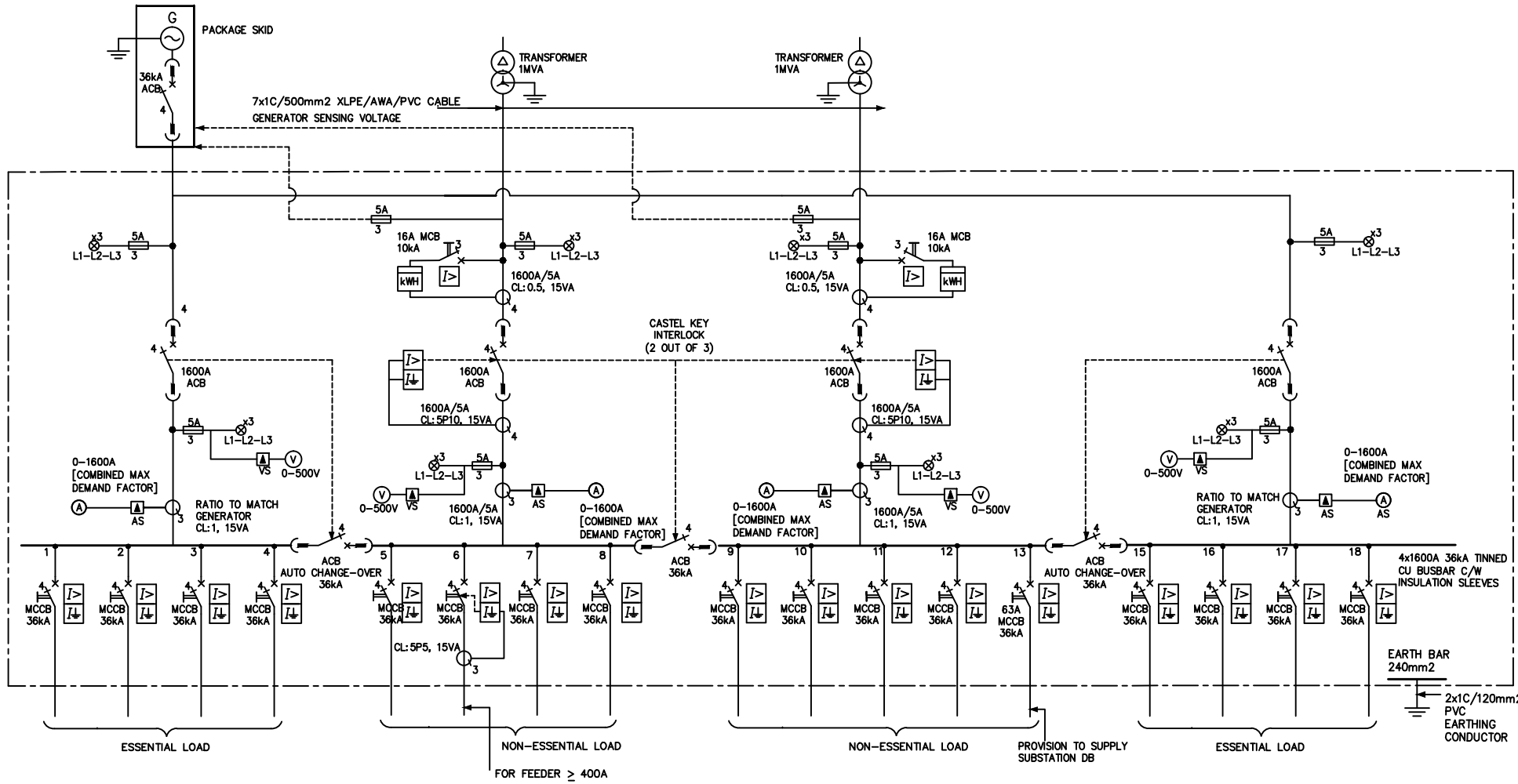
GENERAL NOTES	DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
THE ELECTRICAL INSTALLATION SHALL BE CARRIED OUT IN COMPLETE COMPLIANCE WITH THE CURRENT EDITION OF THE WIRING REGULATION FOR INSTALLATION OF ELECTRICAL WIRING AND EQUIPMENT AND DEPARTMENT OF ELECTRICAL SERVICES			0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR-E004 CADFILE NAME: APP6EIRE004

TITLE: TYPICAL SINGLE LINE DIAGRAM OF MAIN SWITCHBOARD – FOR ONE TRANSFORMER AND ONE STANDBY GENERATOR

SIZE: A3
SCALE: AS SHOWN
REV: 0



THE ELECTRICAL INSTALLATION SHALL BE CARRIED OUT IN COMPLETE COMPLIANCE WITH THE CURRENT EDITION OF THE WIRING REGULATION FOR INSTALLATION OF ELECTRICAL WIRING AND EQUIPMENT AND DEPARTMENT OF ELECTRICAL SERVICES

GENERAL NOTES

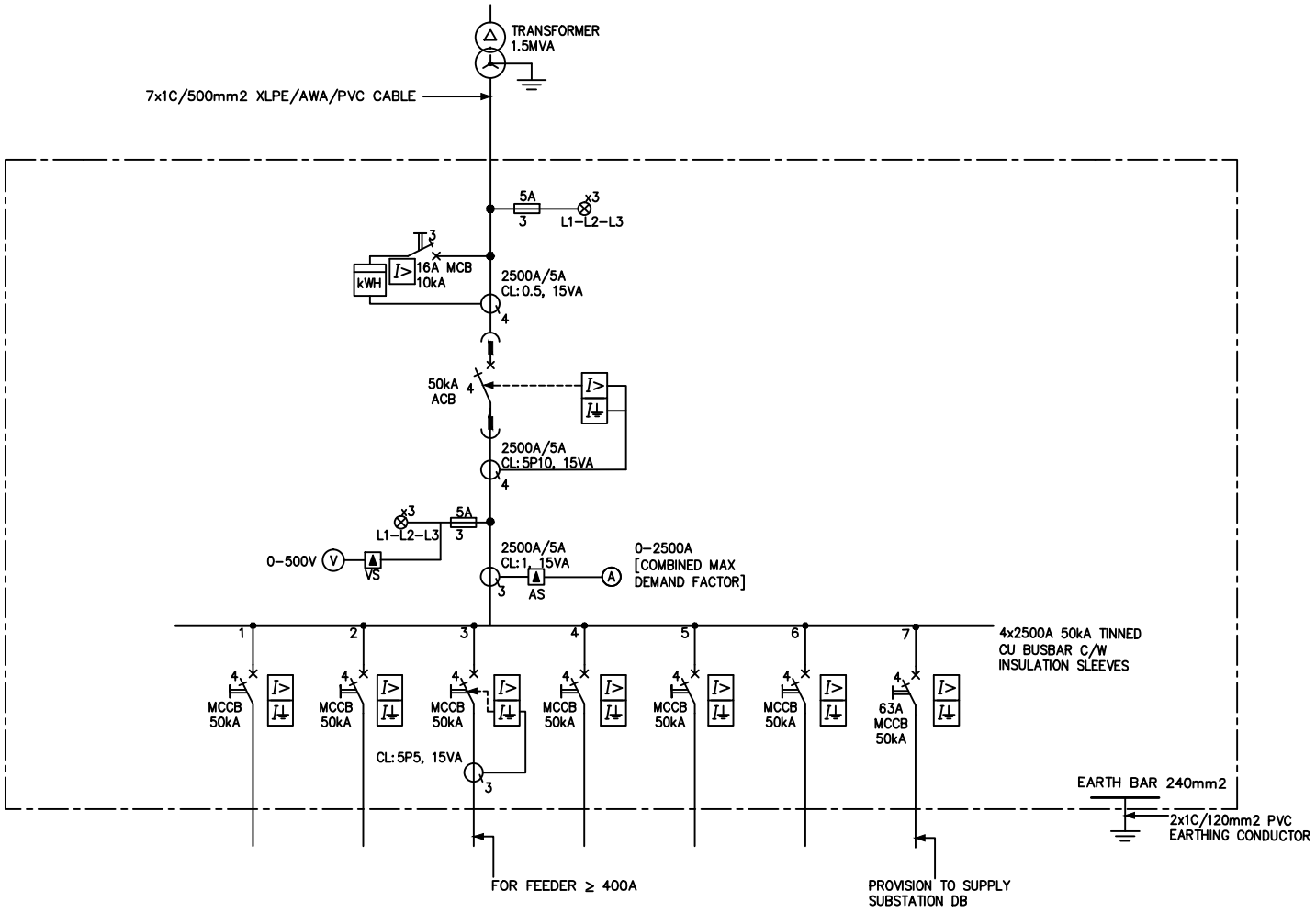
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–E005 CADFILE NAME: APP7EIRE005

TITLE: TYPICAL SINGLE LINE DIAGRAM OF MAIN SWITCHBOARD – FOR TWO TRANSFORMERS AND ONE STANDBY GENERATOR

SIZE: A3
SCALE: AS SHOWN
REV: 0



THE ELECTRICAL INSTALLATION SHALL BE CARRIED OUT IN COMPLETE COMPLIANCE WITH THE CURRENT EDITION OF THE WIRING REGULATION FOR INSTALLATION OF ELECTRICAL WIRING AND EQUIPMENT AND DEPARTMENT OF ELECTRICAL SERVICES

GENERAL NOTES

DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–E006 CADFILE NAME: APP8EIRE006

TITLE: TYPICAL SINGLE LINE DIAGRAM OF MAIN SWITCHBOARD – FOR ONE TRANSFORMER (1.5MVA)

SIZE: A3
SCALE: AS SHOWN
REV: 0

EARTHING SYSTEM TEST

PROJECT **:** Electricity Supply to_____

_____

REGISTRATION NO. :_____

DATE OF TEST :_____

PARTICULARS OF EARTHING MATERIALS

Earth - Electrode :	Rod _____(Make)	Plate _____(Make)
Earthing Clamp :	Make _____	Type _____
Electrode Coupler :	Make _____	Type _____

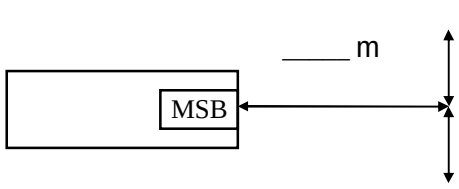
TEST RESULTS

Overall Resistance Value : _____ ohm (without copper tape)

No. Of Earthing Points : _____

Earthing Point	Number of Rod	Resistance Value (ohm)	Earthing Point	Number of Rod	Resistance Value (ohm)

Layout of Earthing points with reference to MSB.



Pt 1 to Pt 2 = _____ohm

Pt 2 to Pt 3 = _____ohm

Cu Tape = _____ohm

TEST INSTRUMENT

Type : _____

Range : _____

Serial No. _____

Manufacturer : _____

DECLARATION OF THE EARTHING SYSTEM

I certify that the earthing system at the above installation has been installed under my supervision and is in accordance with the British Standards/ the latest edition of the IEE Wiring Regulations.

I declare in particular that :-

a. The earth system is not connected to any other Service System.

b. The earth system is / is not* connected to building structure.

c. Only approved earth electrodes and earthing clamps are used.

d. Every joint is properly done by using copper bolt / caldweld.

e. Salt and other non-approved materials are not used to improve the earth resistance.

f. The earth resistance value is _____ ohm.

g. The earth system has been tested on _____ (date).

_____
Signature of Electrical Worker

Name : _____ Worker Registration No. _____

Tel No. _____

- Delete where inapplicable.

INJECTION TESTS FOR OVERCURRENT AND EARTH FAULT RELAY

PROJECT : Electricity Supply to_____

_____

REGISTRATION NO. :_____

DATE OF TEST : _____

CIRCUIT BREAKER DETAILS

BREAKER TYPE		MAKE	
RATED VOLTAGE	V	SERIAL NO.	
RATED CURRENT	A	BREAKING CAPACITY	kA

CURRENT TRANSFORMER DETAILS

RATIO		MAKE		CLASS		BURDEN	
TEST CONNECTION		PRIMARY CURRENT (A)		SECONDARY CURRENT (A)		SPILL CURRENT (mA)	
L1 - NEUTRAL							
L2 - NEUTRAL							
L3 - NEUTRAL							

PROTECTIVE RELAYS DETAILS

RELAY	MAKE	PART NO.	SERIAL NO.	TRIPPING CHARACTERISTIC	PLUG/CURRENT SETTING
OVERCURRENT					
EARTH FAULT					

PROTECTIVE RELAYS TEST RESULT

OVERCURRENT RELAY						**EARTH FAULT RELAY**			
TM/TIME SETTING	CURRENT INJECTION SETTING	OPERATION TIME (s) L1	L2	L3	STD TIME (s)	TM/TIME SETTING	CURRENT INJECTION (A)	OPERATION TIME (s)	STD TIME (s)
PLUG / CURRENT SETTING		PICK UP CURRENT (A) L1	L2	L3		PLUG / CURRENT SETTING		PICK UP CURRENT (A) L1	L2	L3
HIGH SET SETTING (IF ANY)		PICK UP CURRENT (A) L1	L2	L3		HIGH SET SETTING (IF ANY)		PICK UP CURRENT (A) L1	L2	L3
SECONDARY WIRING INSULATION RESISTANCE										M.ohm

Test conducted by:		Witnessed by:	
Name	: _____	Name	: _____
Signature	: _____	Signature	: _____
Date	: _____	Date	: _____

ENDORSEMENT BY DES INSTALLATION INSPECTOR

The above test results are satisfactory / unsatisfactory and acceptable / unacceptable to me.

Name : _____

Signature : _____

Date : _____

INSULATION TEST RESULT

PROJECT **:** Electricity Supply to_____

_____

EQUIPMENT UNDER TEST **:** _____

REGISTRATION NO. :_____

DATE OF TEST : _____

TEST CONNECTION	**INSULATION READING (M-Ohm)**		**APPLIED VOLTAGE (kV)**	**LEAKAGE CURRENT (mA)**	**RESULT**		**REMARK**
	BEFORE L.V INJECTION	AFTER L.V. INJECTION			PASSED	FAILED	
L1 - E							
L2 - E							
L3 - E							
N - E							
L1 - N							
L2 - N							
L3 - N							
L1 – L2							
L2 – L3							
L3 – L1							
L1 – L2L3NE							
L2 – L1L3NE							
L3 – L1L2NE							
N – L1L2L3E							
E – L1L2L3N							

	MAKE	SERIAL NO.	VOLTAGE
INSULATION TESTED USED			
AC PRESSURE SET USED			

Test conducted by:

Name : _____

Signature : _____

Date : _____

Witnessed by:

Name : _____

Signature : _____

Date :_____

ENDORSEMENT BY DES INSTALLATION INSPECTOR

The above test results are satisfactory / unsatisfactory and acceptable / unacceptable to me

Name : _____

Signature : _____

Date : _____

ELECTRICAL INSTALLATION CERTIFICATE

(REQUIREMENTS FOR ELECTRICAL INSTALLATIONS – BS 7671 [IEE WIRING REGULATIONS])

DETAILS OF THE CLIENT

_____

INSTALLATION ADDRESS

_____

_____

DESCRIPTION AND EXTENT OF THE INSTALLATION Tick boxes as appropriate

Description of installation:

Extent of installation covered by this Certificate:

(Use continuation sheet if necessary) see continuation sheet No:_____

New Installation ☐

Addition to an existing installation ☐

Alteration to an existing installation ☐

FOR DESIGN

I/We being the person(s) responsible for the design of the electrical installation (as indicated by my/our signature below), particulars of which are described above, having exercised reasonable skill and care when carrying out the design hereby CERTIFY that the design work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with BS 7671:2008, amended to _____ (date) except for the departures, if any, detailed as follows:

Details of departures from BS 7671 (Regulations 120.3 and 120.4):

The extent if liability of the signatory or the signatories is limited to the work described above as the subject of this Certificate

For the DESIGN of the installation: **(Where there is mutual responsibility for the design)

Signature:_____ Date:_____ Name (IN BLOCK LETTERS):_____ Designer No 1

Signature:_____ Date:_____ Name (IN BLOCK LETTERS):_____ Designer No 2**

FOR CONSTRUCTION

I/We being the person(s) responsible for the construction of the electrical installation (as indicated by my/our signature below), particulars of which are described above, having exercised reasonable skill and care when carrying out the construction hereby CERTIFY that the construction work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with BS 7671:2008, amended to _____ (date) except for the departures, if any, detailed as follows:

Details of departures from BS 7671 (Regulations 120.3 and 120.4)

The extent of liability of the signatory is limited to the work described above as the subject of this Certificate

For the CONSTRUCTION of the installation: **(Where there is mutual responsibility for the design)

Signature:_____ Date:_____ Name (IN BLOCK LETTERS):_____ Constructor

FOR INSPECTION & TESTING

I/We being the person(s) responsible for the inspection & testing of the electrical installation (as indicated by my/our signature below), particulars of which are described above, having exercised reasonable skill and care when carrying out the inspection & testing hereby CERTIFY that the work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with BS 7671:2008, amended to _____ (date) except for the departures, if any, detailed as follows:

Details of departures from BS 7671 (Regulations 120.3 and 120.4)

The extent of liability of the signatory is limited to the work described above as the subject of this Certificate

For INSPECTION AND TESTING of the installation: **(Where there is mutual responsibility for the design)

Signature:_____ Date:_____ Name (IN BLOCK LETTERS):_____ Inspector

NEXT INSPECTION

I/We the designer (s), recommend that this installation is further inspected and tested after an interval of not more than _____ years/months.

PARTICULARS OF THE SIGNATORIES TO THE ELECTRICAL INSTALLATION CERTIFICATE

Designer (No 1)

Name:_____ Company:_____

_____

Address:_____

_____ Postcode:_____ Tel No :_____

Designer (No 2)

Name:_____ Company:_____

_____

Address:_____

_____ Postcode:_____ Tel No :_____

Constructor

Name:_____ Company:_____

_____

Address:_____

_____ Postcode:_____ Tel No :_____

Inspector

Name:_____ Company:_____

_____

Address:_____

_____ Postcode:_____ Tel No :_____

SUPPLY CHARACTERISTICS AND EARTHING ARRANGEMENTS Tick boxes and enter details, as appropriate

Earthing arrangements		**Number and Types of Live Conductors**				**Nature of Supply Parameters**	**Supply Protective Device Characteristics**
TN-C	☐	a.c	☐	dc	☐	Nominal voltage, U/U_o (1) _____V	Type: _____
TN-S	☐	1-phase, 2-wire	☐	2-pole	☐	Nominal frequency, f (1) _____Hz	Rated current_____ A
TN-C-S	☐	2-phase, 3-wire	☐	3-pole	☐	Prospective fault current, I_{pf} (2) _____kA	
TT	☐	3-phase, 3-wire	☐	other	☐	External loop impedance, Z_e (2) _____ Ω	
IT	☐	3-phase, 4-wire	☐			(Note: (1) by enquiry, (2) by enquiry or by measurement)	
Alternative source of supply (to be detailed on attached schedules	☐						

PARTICULARS OF INSTALLATION REFERED TO IN THE CERTIFICATE Tick boxes and enter details, as appropriate

Means of Earthing

Distributor's facility ☐

Installation earth electrode ☐

Maximum Demand

Maximum demand (load)_____kVA/Amps Delete as appropriate

Details of Installation earth Electrode *(where applicable)*

Type (e.g. rod(s), tape etc)	Location	Electrode resistance to earth
_____	_____	_____ Ω

Main Protective Conductors

Earthing Conductor:	material _____	csa_____	connection verified ☐
Main protective bonding/conductors	material _____	csa_____	connection verified ☐

To incoming water and/or gas service To incoming gas service ☐ To other elements:_____

Main Switch or Circuit-breaker

BS, Type and number of poles_____ Current rating _____ A Voltage rating _____ V

Location_____ Fuse rating or setting _____ A

Rated residual operating current $I_{\Delta n}$ =_____mA, and operating time of _____ ms (at $I_{\Delta n}$) (applicable only where an RCD is suitable and is used as a main circuit circuit-breaker

COMMENTS ON EXISTING INSTALLATION (in the case of an addition or alteration see Section 633)

_____

SCHEDULES

The attached Schedules are part of this document and this Certificate is valid only when they are attached to it

_____ Schedules of Inspections and _____ Schedules of Test Results are attached

(Enter quantities of schedules attached)

SCHEDULE OF TEST RESULTS

Contractor:
Test Date :

Address/Location of distribution board:

Type of Supply: TN-S/TN-C-S/TT

Z_e at origin: ..... Ω
PFC:.....kA
Confirmation of supply polarity: ☐

Instruments:
Loop Impedence:.....
Continuity:
Insulation:
RCD tester:

Signature:

Method of fault protection: .....

Equipment vulnerable to testing: .....

Description of Work: .....

Circuit Description	Overcurrent Device Short-circuit capacity: _____kA		Wiring Conductors		Test Results									
					Continuity			Insulation Resistance		Polarity	Earth Loop Impedance	Functional testing		Remarks
	Type	Rating I_n	Live	CPC	(R1+R2)*	R2*	Ring	Live/Live	Live/Earth		Z_s	RCD time	Other	
		A	mm^2	mm^2	Ω	Ω		MΩ	MΩ		Ω	ms		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Deviation from BS 7671: IEE Wiring Regulations and special notes:

* Complete column 6 or 7

PERIODIC INSPECTION REPORT FOR AN ELECTRICAL INSTALLATION
(REQUIREMENTS FOR ELECTRICAL INSTALLATIONS – BS 7671 [IEE WIRING REGULATIONS])

DETAILS OF THE CLIENT

Client:

Address:

Purpose for which the report is required:_____

DETAILS OF THE INSTALLATION Tick boxes as appropriate

Occupier:

Installation:

Address:_____

Description of Premises: Domestic ☐ Commercial ☐ Industrial ☐
Other ☐

Estimated age of the Electrical Installation: _____ years

Evidence of Additions or Alterations: Yes ☐ No ☐ Not apparent ☐

If "Yes", estimate age: _____ years

Date of last inspection: _____ Records available Yes ☐ No ☐

EXTENT AND LIMITATIONS OF THE INSPECTION

Extent of electrical installation covered by this report:_____
_____
_____

Limitations (see Regulation 632.2): _____
_____
_____

This inspection has been carried out in accordance with BS 7671:2008 (IEE Wiring regulations), amended to _____
Cables concealed within trunking and conduits, or cables and conduits concealed under floors, in roof spaces and generally within the fabric of the building or underground have not been inspected.

NEXT INSPECTION

I/We recommend that this installation is further inspected and tested after an interval of not more than _____ months/years, provided that any observations 'requiring urgent attention' are attended to without delay.

DECLARATION

INSPECTED AND TESTED BY

Name:_____ Signature:_____
For and behalf of:_____ Position:_____
Address:_____
_____ Date:_____
_____

SUPPLY CHARACTERISTICS AND EARTHING ARRANGEMENTS

Tick boxes and enter details, as appropriate

Earthing arrangements		Number and Types of Live Conductors				Nature of Supply Parameters	Supply Protective Device Characteristics
TN-C	☐	a.c	☐	dc	☐	Nominal voltage, U/U_o (1) _____V	Type: _____
TN-S	☐	1-phase, 2-wire	☐	2-pole	☐	Nominal frequency, f (1) _____Hz	Rated current_____ A
TN-C-S	☐	2-phase, 3-wire	☐	3-pole	☐	Prospective fault current, I_{pf} (2) _____kA	
TT	☐	3-phase, 3-wire	☐	other	☐	External loop impedence, Z_e (2) _____ Ω	
IT	☐	3-phase, 4-wire	☐			(Note: (1) by enquiry, (2) by enquiry or by measurement)	

PARTICULARS OF INSTALLATION REFERED TO IN THE REPORT

Tick boxes and enter details, as appropriate

Means of Earthing

Distributor's facility ☐

Installation earth electrode ☐

Details of Installation earth Electrode *(where applicable)*

Type	Location	Electrode resistance to earth
(e.g. rod(s), tape etc		
_____	_____	_____ Ω

Main Protective Conductors

Earthing Conductor: material _____ csa_____

Main protective bonding/ conductors material _____ csa_____

To incoming water service ☐ To incoming gas service ☐ To incoming oil service ☐ To structural steel ☐

To lightning protection ☐ To other incoming service(s) ☐ (state details_____)

Main Switch or Circuit-breaker

BS, Type and number of poles_____ Current rating _____ A Voltage rating _____ V

Location_____ Fuse rating or setting _____ A

Rated residual operating current $I_{\Delta n}$ =_____mA, and operating time of _____ ms (at $I_{\Delta n}$) (applicable only where an RCD is suitable and is used as a main circuit circuit-breaker

OBSERVATION AND RECOMMENDATIONS

Tick boxes as appropriate

Referring to the attached Schedule (s) of Inspections and Test Results, and subject to the limitations specified at the Extent and Limitations of the Inspection Section

Recommendations as detailed below

☐ No remedial work is required ☐ The following observations are made:

_____

_____

_____

_____

_____

_____

_____

One of the following numbers, as appropriate, is to be allocated to each of the observations made above to indicate to the person(s) responsible for the installation the action recommended.

1 requires urgent attention 2 requires improvement 3 requires further investigation

4 does not comply with BS 7671:2008 amended to _____

This does not imply that the electrical installation inspected is unsafe

SUMMARY OF THE INSPECTION

Date(s) of the inspection:_____

General condition of the installation:_____

_____

_____

_____

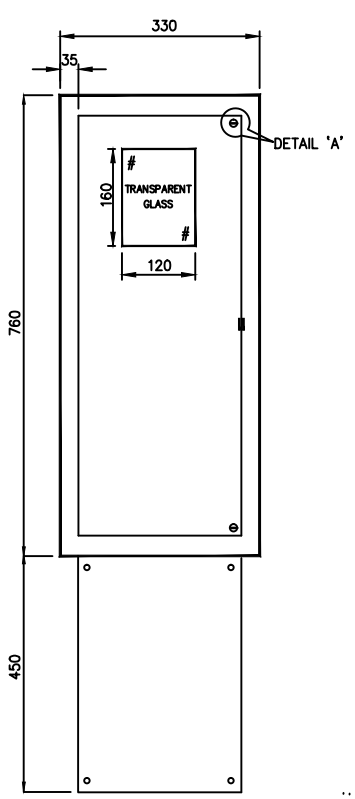
Overall assessment: Satisfactory/Unsatisfactory

SCHEDULES (S)

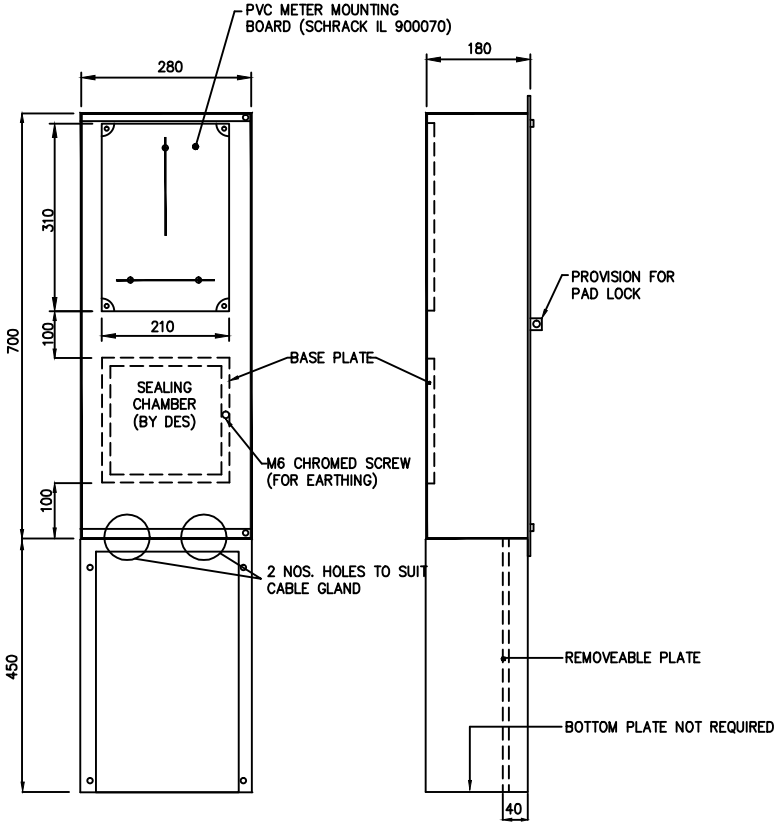
The attached Schedules are part of this docment and this Report is valid only when they are attached to it.

_____ Schedules of Indpections and _____ Schedules of Test Results are attached.

(Enter quantities of schedules attached)

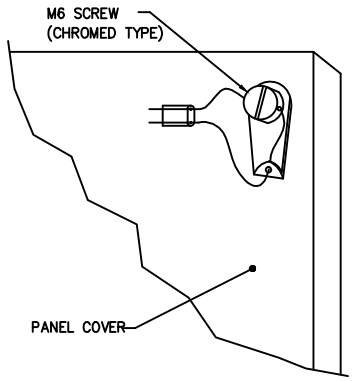


OUTER DOOR c/w FRAME
(DETACHABLE)



INNER BOX
(TO BE CONCEALED INTO CONCRETE PILLAR)

SIDE VIEW



DETAIL 'A'

NOTES:-

1) SUITABLE FOR 100A (MAX.) SPN & TPN KWH METER.
2) MAX. CABLE SIZE TO SPN KWH METER – 35 Sq.mm.
3) MAX. CABLE SIZE TO TPN KWH METER – 50 Sq.mm.
4) ONLY ONE CABLE IS ALLOWED TO BE CONNECTED TO EACH TERMINAL OF KWH METER.
5) INCOMING & OUTGOING CABLES MUST BE BOTTOM ENTRY.
6) PVC METER MOUNTING BOARD SHOULD SUIT ALL MAKES OF KWH METER (STANDARD FABRICATED MOUNTING)
7) DEGREE OF PROTECTION : IP 54
8) ENCLOSURE MUST BE ABLE TO BE CONCEALED INTO CONCRETE GATE PILLAR
9) ENCLOSURE MATERIAL: 2mm ALUMIMIUM SHEET
10) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032

RECOMMENDED APPLICATION:

1) RESIDENTIAL HOUSES WITH GATE POST

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

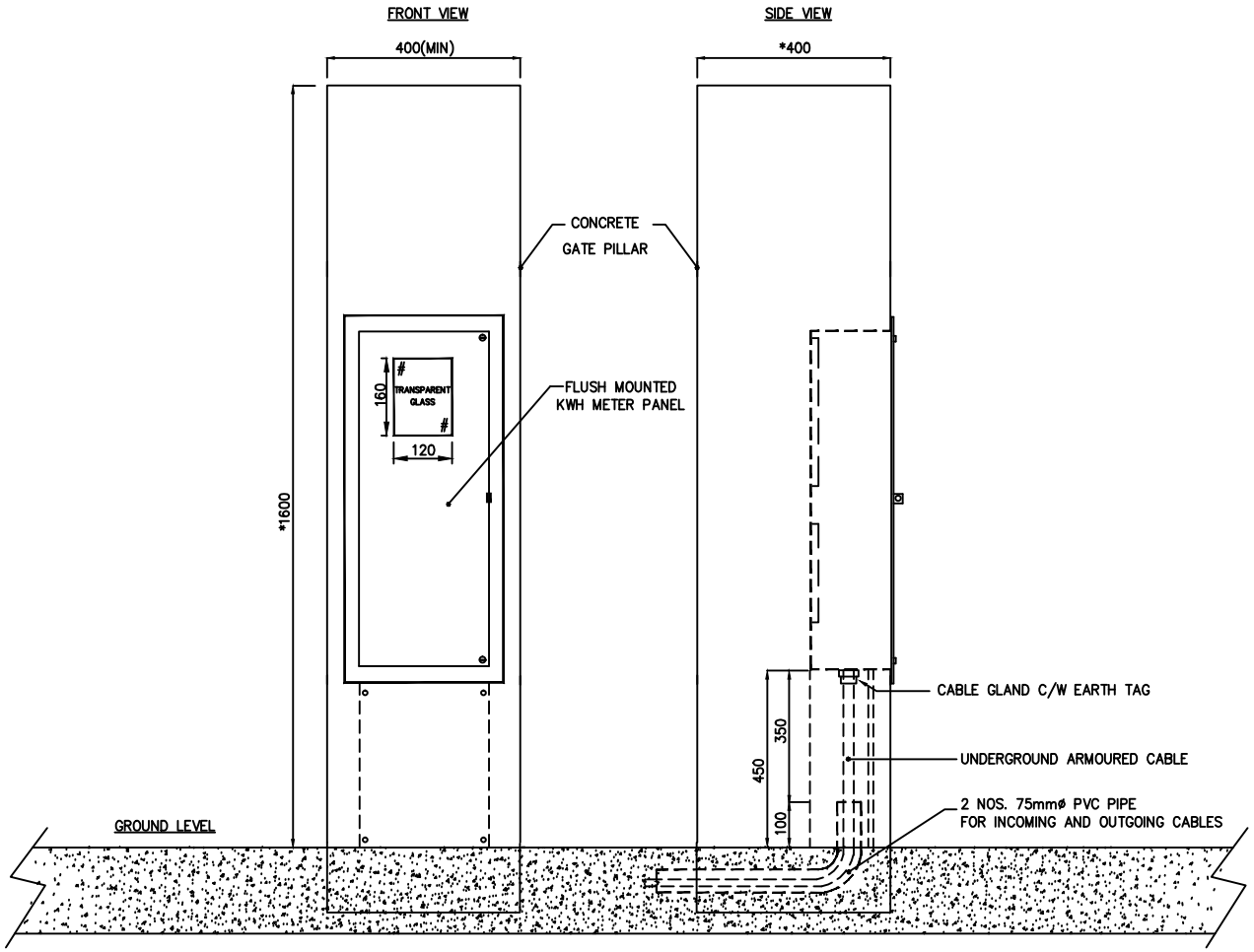
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–S3 CADFILE NAME: APP12AEIRS3

TITLE: STANDARD FLUSH MOUNTED SINGLE/THREE PHASE KWH METER PANEL FOR GATE POST

SIZE: A3
SCALE: AS SHOWN
REV: 0



ALL DIMENSIONS ARE IN MILLIMETRES

* – HEIGHT AND DEPTH VARIES ACCORDING TO ARCHITECT'S REQUIREMENTS

GENERAL NOTES

DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

SURUHANJAYA PENGKOMPAUNAN ELEKTRIK
SURUHANJAYA PERKHIDMATAN MENTERI

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–S3A

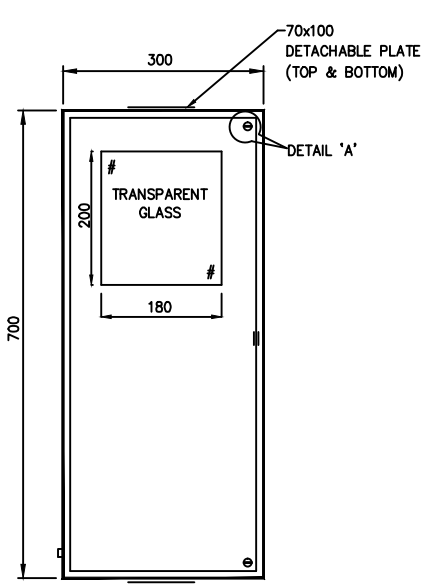
CADFILE NAME: APP12BEIRS3A

TITLE: TYPICAL MOUNTING FOR FLUSH MOUNTED KWH METER PANEL

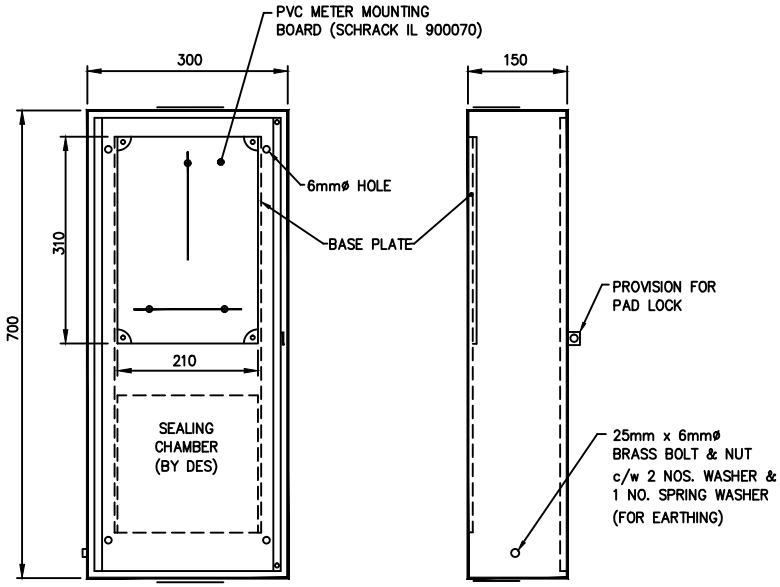
SIZE: A3

SCALE: AS SHOWN

REV: 0

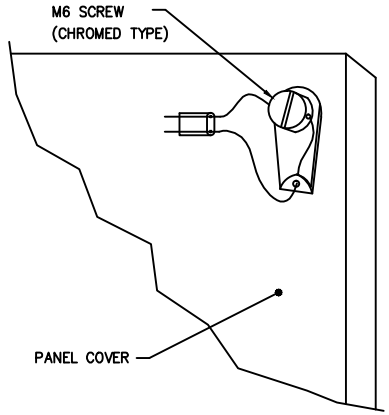


PANEL FRONT
(WITH COVER)



PANEL FRONT
(WITHOUT COVER)

SIDE VIEW



DETAIL 'A'

NOTES:–

1) SUITABLE FOR 100A (MAX.) SPN KWH METER ONLY.
2) MAX. CABLE SIZE TO KWH METER – 35 Sq.mm.
3) ONLY ONE CABLE IS ALLOWED TO BE CONNECTED TO EACH TERMINAL OF KWH METER.
4) INCOMING CABLES MUST BE BOTTOM ENTRY.
5) OUTGOING CABLES CAN BE TOP OR BOTTOM ENTRY.
6) PVC METER MOUNTING BOARD SHOULD SUIT ALL MAKES OF KWH METER (STANDARD FABRICATED MOUNTING)
7) DEGREE OF PROTECTION : IP 54
8) ENCLOSURE MATERIAL: 1.2mm ELECTROGALVANIZED SHEET
9) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032

RECOMMENDED APPLICATION:

1.) RESIDENTIAL HOUSES
2.) LANDLESS HOUSING SCHEME
3.) RESETTLEMENT HOUSING SCHEME.

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

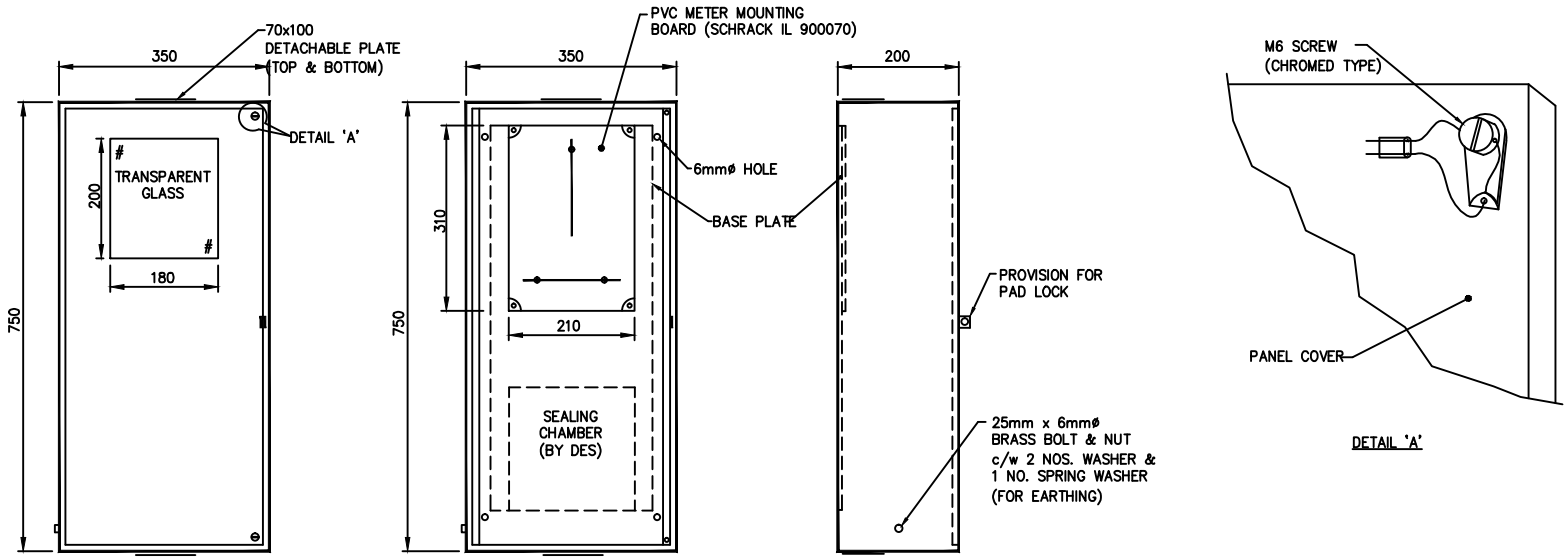
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–S1 CADFILE NAME: APP13EIRS1

TITLE: STANDARD WALL MOUNTED SINGLE PHASE KWH METER PANEL

SIZE: A3
SCALE: AS SHOWN
REV: 0



PANEL FRONT
(WITH COVER)

PANEL FRONT
(WITHOUT COVER)

SIDE VIEW

DETAIL 'A'

NOTES:–

1) SUITABLE FOR 100A (MAX.) TPN KWH METER ONLY.
2) MAX. CABLE SIZE TO KWH METER – 50 Sq.mm.
3) ONLY ONE CABLE IS ALLOWED TO BE CONNECTED TO EACH TERMINAL OF KWH METER.
4) INCOMING CABLES MUST BE BOTTOM ENTRY.
5) OUTGOING CABLES CAN BE TOP OR BOTTOM ENTRY.
6) PVC METER MOUNTING BOARD SHOULD SUIT ALL MAKES OF KWH METER (STANDARD FABRICATED MOUNTING)
7) DEGREE OF PROTECTION : IP 54
8) ENCLOSURE MATERIAL: 1.2mm ELECTROGALVANIZED SHEET
9) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032

RECOMMENDED APPLICATION:

1) RESIDENTIAL HOUSES
2) LANDLESS HOUSING SCHEME
3) RESETTLEMENT HOUSING SCHEME

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

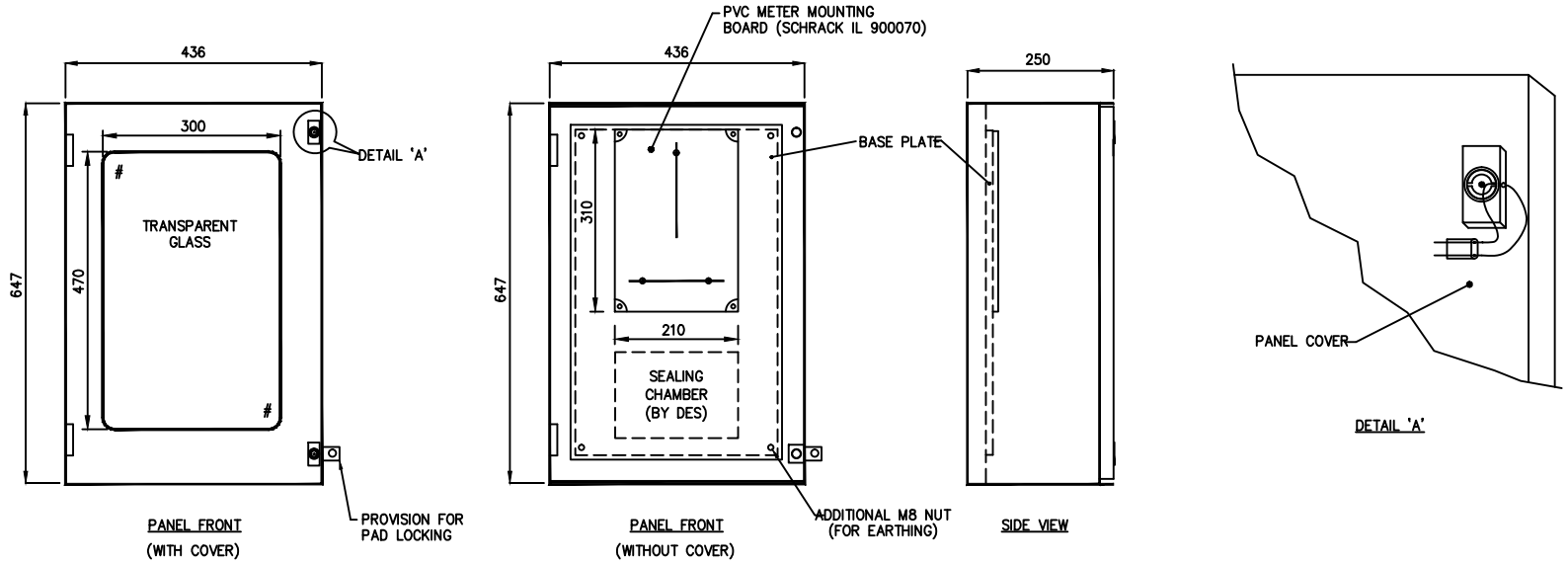
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–S2 CADFILE NAME: APP14EIRS2

TITLE: STANDARD WALL MOUNTED THREE PHASE KWH METER PANEL

SIZE: A3
SCALE: AS SHOWN
REV: 0



NOTES:-

1) SUITABLE FOR 100A (MAX.) SPN & TPN METER.
2) MAX. CABLE SIZE TO SPN KWH METER – 35 Sq.mm.
3) MAX. CABLE SIZE TO TPN KWH METER – 50 Sq.mm.
4) ONLY ONE CABLE IS ALLOWED TO BE CONNECTED TO EACH TERMINAL OF KWH METER.
5) INCOMING & OUTGOING CABLES MUST BE BOTTOM ENTRY.
6) PVC METER MOUNTING BOARD SHOULD SUIT ALL MAKES OF KWH METER (STANDARD FABRICATED MOUNTING)
7) DEGREE OF PROTECTION : IP 54
8) ENCLOSURE MATERIAL : POLYESTER
9) COLOUR – RAL 7032

RECOMMENDED APPLICATION:

1) RESIDENTIAL HOUSES
2) LANDLESS HOUSING SCHEME
3) LANDLESS HOUSING

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

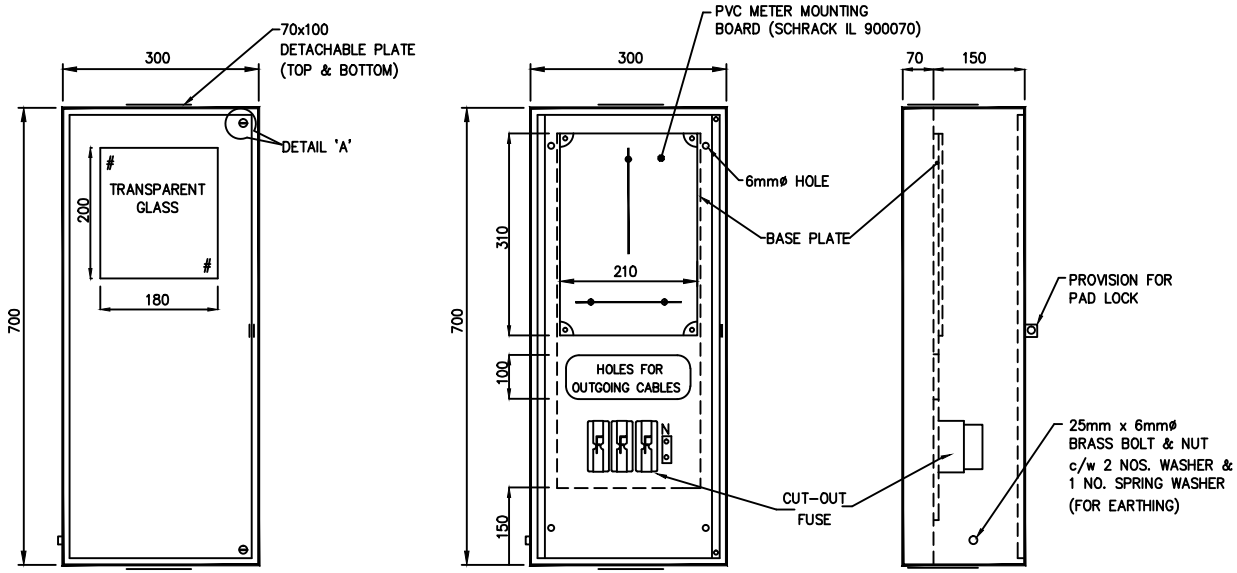
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	TECO CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–S5 CADFILE NAME: APP15EIRS5

TITLE: STANDARD WALL MOUNTED SINGLE PHASE/ THREE PHASE KWH METER PANEL

SIZE: A3
SCALE: AS SHOWN
REV: 0



PANEL FRONT
(WITH COVER)

PANEL FRONT
(WITHOUT COVER)

SIDE VIEW

NOTES:-

1) SUITABLE FOR 100A (MAX.) SPN & TPN KWH METER ONLY.
2) MAX. CABLE SIZE TO KWH METER – 50 Sq.mm.
3) ONLY ONE CABLE IS ALLOWED TO BE CONNECTED TO EACH TERMINAL OF KWH METER.
4) INCOMING CABLES AND OUTGOING CABLES CAN BE TOP OR BOTTOM ENTRY
5) PVC METER MOUNTING BOARD SHOULD SUIT ALL MAKES OF KWH METER (STANDARD FABRICATED MOUNTING)
6) DEGREE OF PROTECTION : IP 54
7) ENCLOSURE MATERIAL: 1.2mm ELECTROGALVANIZED SHEET
8) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032

RECOMMENDED APPLICATION:

1) RESIDENTIAL HOUSES WITH OVERHEAD SERVICE CABLE
2) FLATS AND APARTMENT

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR-S6 CADFILE NAME: APP16EIRS6

TITLE: STANDARD WALL MOUNTED SINGLE/THREE PHASE KWH METER PANEL FOR APARTMENT AND RESIDENTIAL HOUSE USING O/H SERVICE CABLE

SIZE: A3
SCALE: AS SHOWN
REV: 0

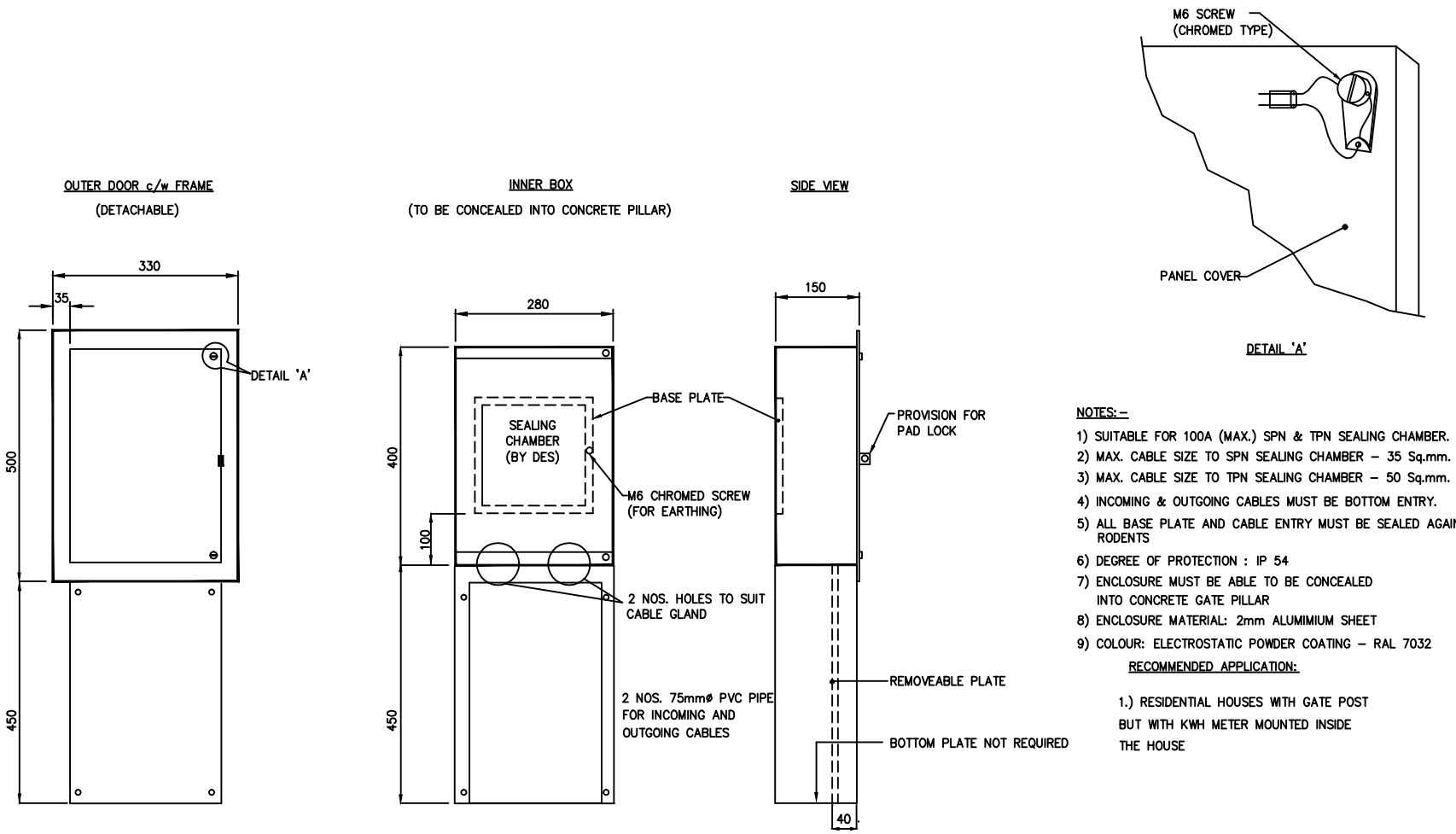
COMMUNICATION CABLE SPECIFICATION

Nomenclature : PVC Insulated, Copper braid screened PVC Sheathed Cable

Size : 0.63mm x 2 pairs

Construction

Item		**Details**
Conductor	Material	Annealed Copper wire
	Nominal O.D	0.63mm
Insulation	Material	PVC (white x blue, white x orange)
	Nominal thickness	0.60mm
	Nominal O.D	1.83mm
Twisting		2C
Cable and Assembly	Centre	2P
	1st Layer	-
Wrapping Tape		Polyester Tape
Shield	Material	Annealed Copper wire
	Composition	16.7/0.14, coverage 75% approx.
Jacket	Material	PVC (Black)
	Nominal thickness	1.3mm
	Nominal O.D	9.3mm



NOTES:–

1) SUITABLE FOR 100A (MAX.) SPN & TPN SEALING CHAMBER.
2) MAX. CABLE SIZE TO SPN SEALING CHAMBER – 35 Sq.mm.
3) MAX. CABLE SIZE TO TPN SEALING CHAMBER – 50 Sq.mm.
4) INCOMING & OUTGOING CABLES MUST BE BOTTOM ENTRY.
5) ALL BASE PLATE AND CABLE ENTRY MUST BE SEALED AGAINST RODENTS
6) DEGREE OF PROTECTION : IP 54
7) ENCLOSURE MUST BE ABLE TO BE CONCEALED INTO CONCRETE GATE PILLAR
8) ENCLOSURE MATERIAL: 2mm ALUMIMIUM SHEET
9) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032

RECOMMENDED APPLICATION:

1.) RESIDENTIAL HOUSES WITH GATE POST BUT WITH KWH METER MOUNTED INSIDE THE HOUSE

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

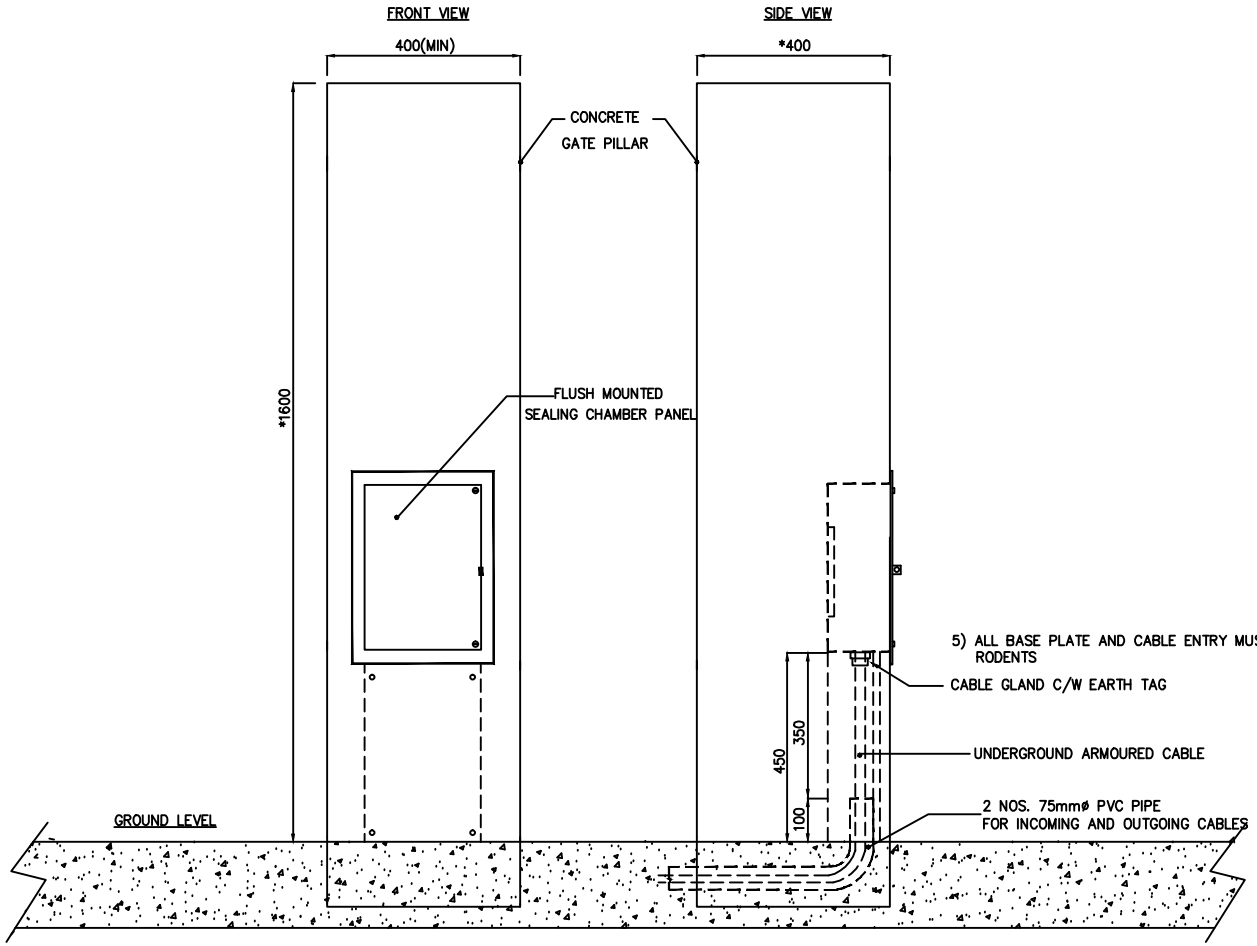
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–S4 CADFILE NAME: APP18AEIRS4

TITLE: STANDARD FLUSH MOUNTED SINGLE/THREE PHASE SEALING CHAMBER PANEL FOR GATE POST

SIZE: A3
SCALE: AS SHOWN
REV: 0



ALL DIMENSIONS ARE IN MILLIMETRES

* – HEIGHT AND DEPTH VARIES ACCORDING TO ARCHITECT'S REQUIREMENTS

GENERAL NOTES

DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR-S4A

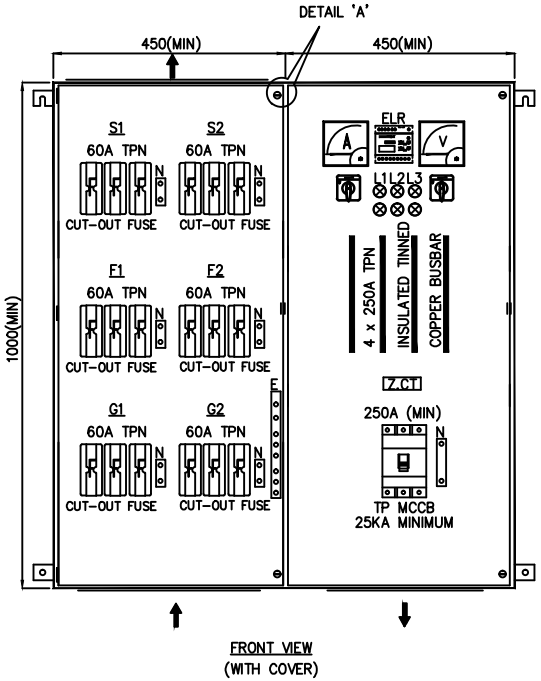
CADFILE NAME: APP18BEIRS4A

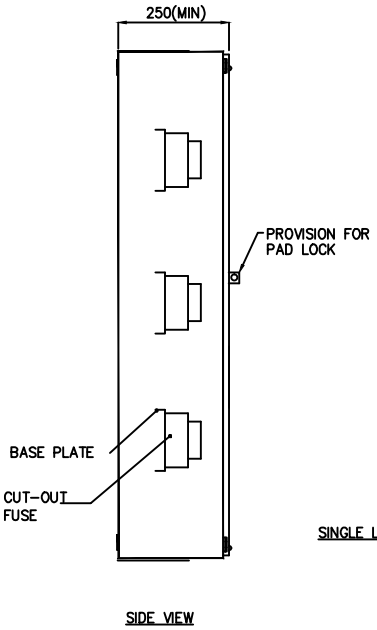
TITLE: TYPICAL MOUNTING FOR FLUSH MOUNTED SEALING CHAMBER PANEL

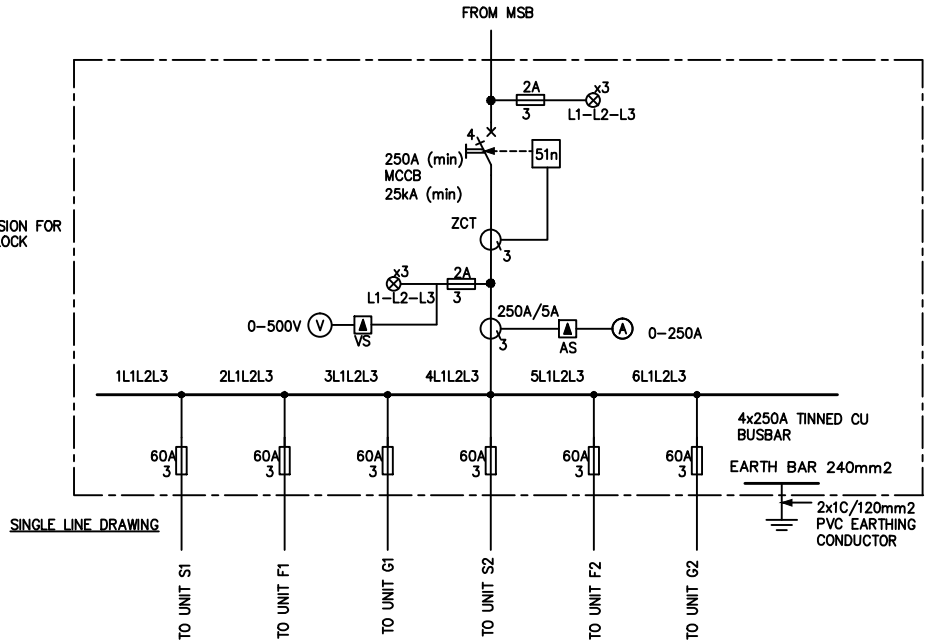
SIZE: A3

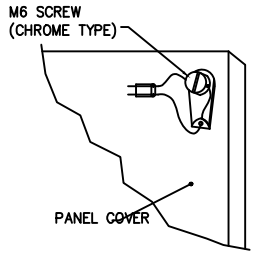
SCALE: AS SHOWN

REV: 0









DETAIL 'A'

NOTES:-

1.) DEGREE OF PROTECTION : IP 54

2.) ENCLOSURE MATERIAL: 1.6mm ELECTROGALVANIZED SHEET

3.) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032

RECOMMENDED APPLICATION:

1.) 3 STOREY SHOPHOUSES

2.) FLATS AND APARTMENTS

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	TECO CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

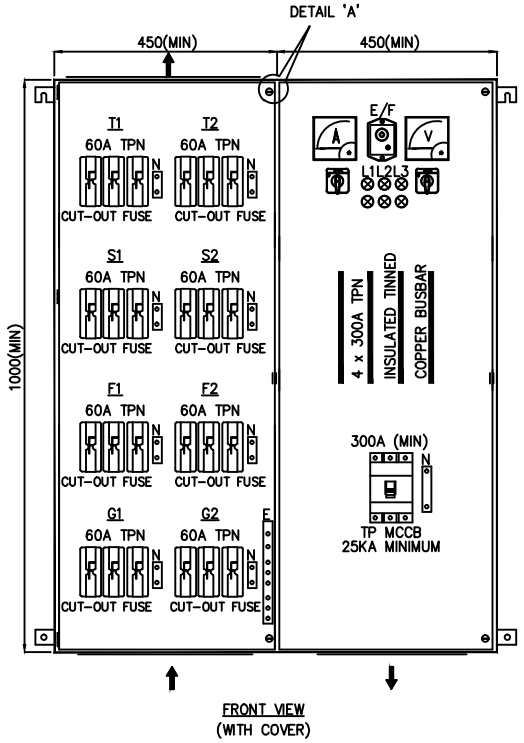
DRAWING No. EIR-S14 CADFILE NAME: APP19EIRS14

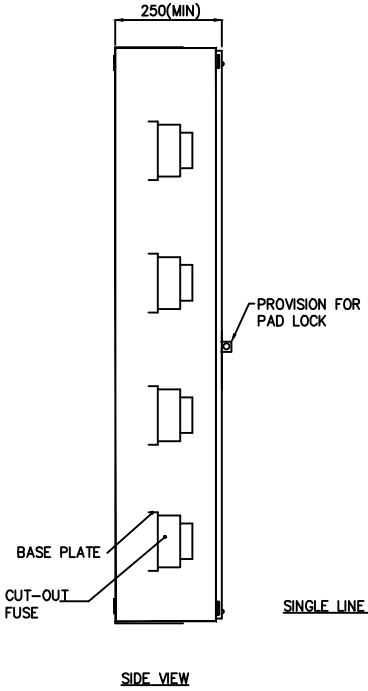
TITLE: STANDARD WALL MOUNTED SERVICE CUT-OUT FUSE PANEL FOR 2 UNITS 3 STOREY SHOPHOUSES

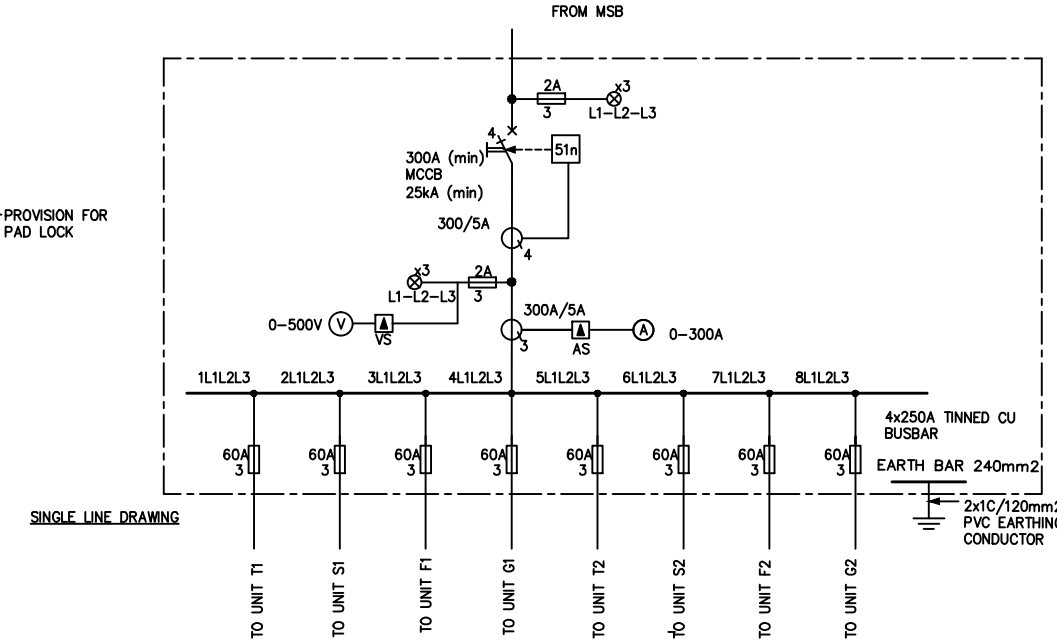
SIZE: A3

SCALE: AS SHOWN

REV: 0





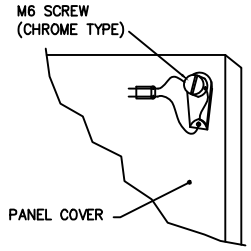


NOTES:-

1.) DEGREE OF PROTECTION : IP 54
2.) ENCLOSURE MATERIAL: 1.6mm ELECTROGALVANIZED SHEET
3.) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032

RECOMMENDED APPLICATION:

1.) 4 STOREY SHOPHOUSES
2) FLATS AND APARTMENTS



DETAIL 'A'

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

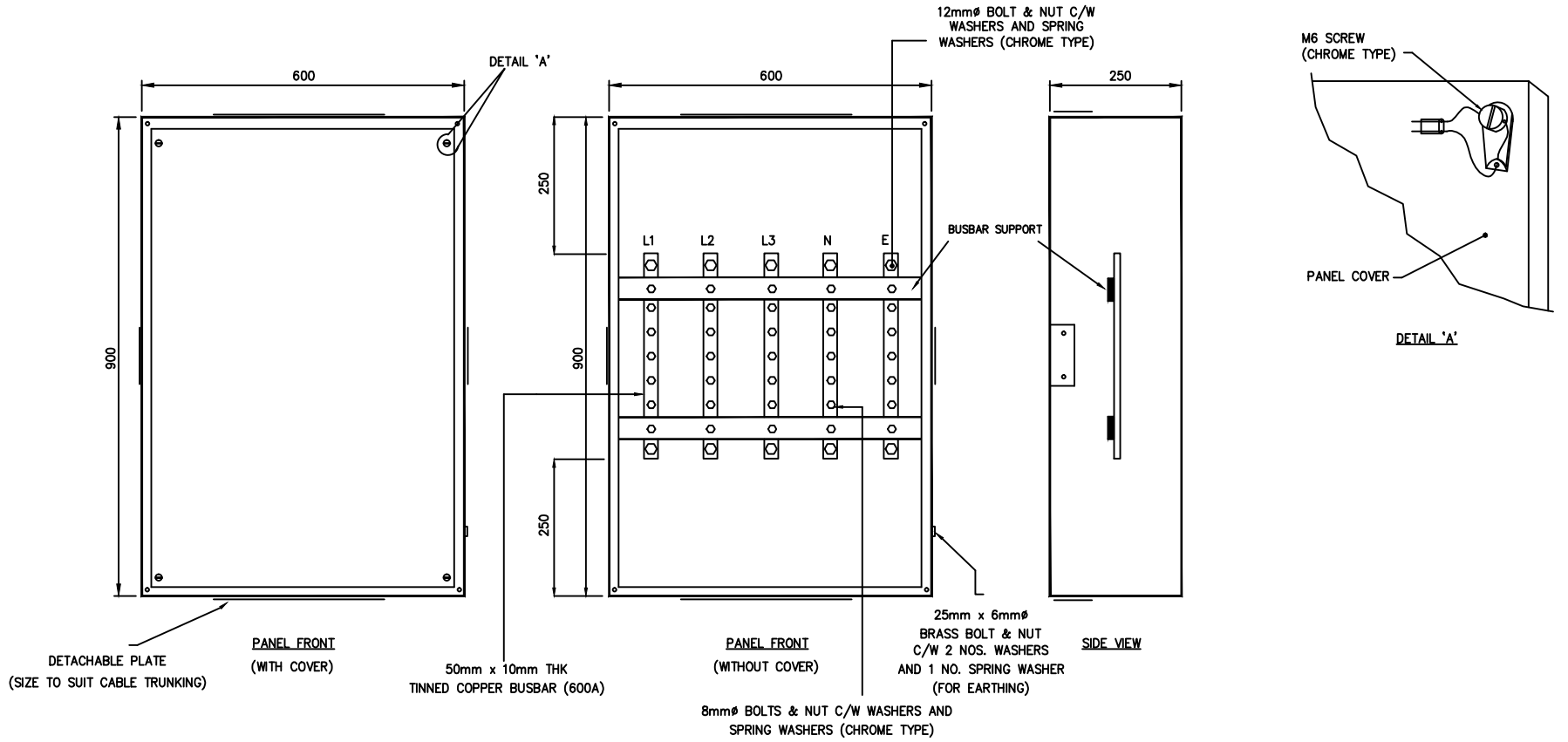
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR-S15 CADFILE NAME: APP20EIRS15

TITLE: STANDARD WALL MOUNTED SERVICE CUT-OUT FUSE PANEL FOR 2 UNITS OF 4 STOREY SHOP-HOUSES

SIZE: A3
SCALE: AS SHOWN
REV: 0



NOTES:–

1.) DEGREE OF PROTECTION : IP 54
2.) ENCLOSURE MATERIAL: 1.6mm ELECTROGALVANIZED SHEET
3.) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032

RECOMMENDED APPLICATION:

1.) FLATS AND APARTMENTS (AT RISER)

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

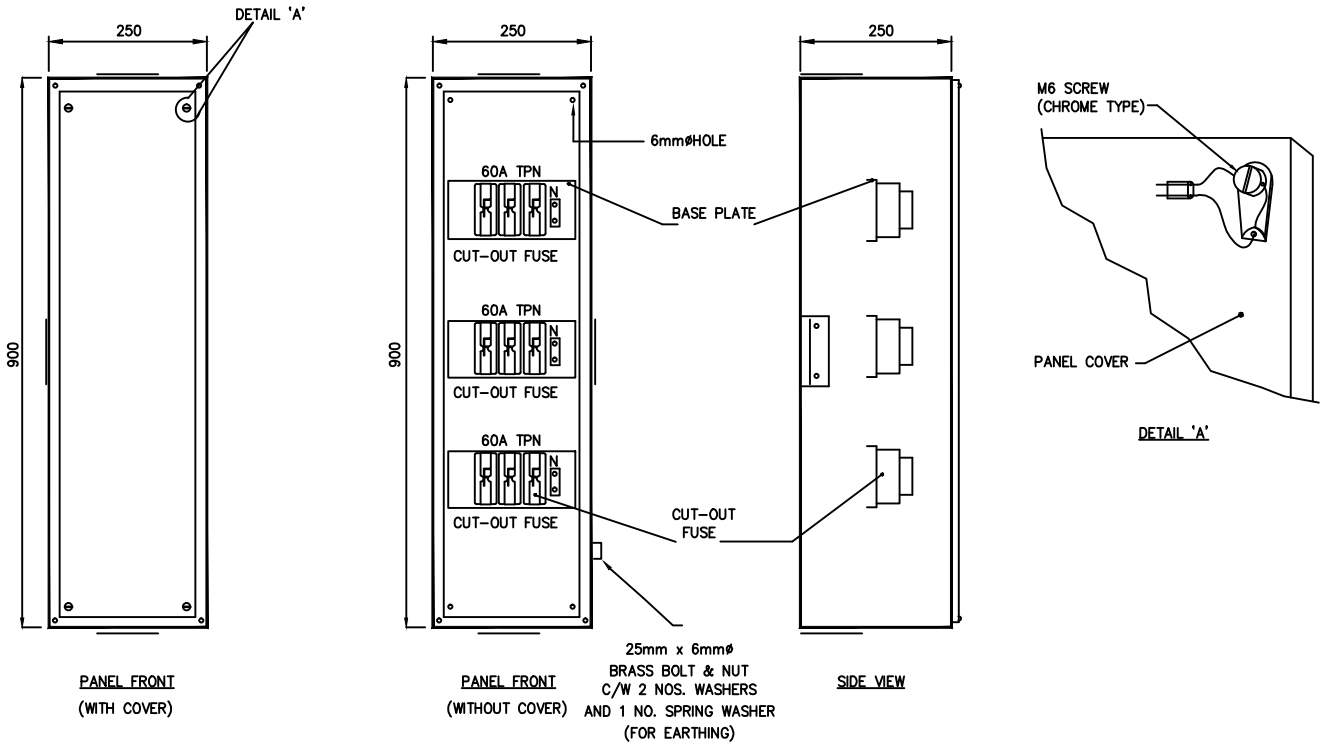
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–S16 CADFILE NAME: APP21EIRS16

TITLE: STANDARD WALL MOUNTED 600A TAP–OFF UNIT SUITABLE FOR 6 NOS. 60 – 100A OUTGOING

SIZE: A3
SCALE: AS SHOWN
REV: 0



NOTES:–

1.) DEGREE OF PROTECTION : IP 54
2.) ENCLOSURE MATERIAL: 1.6mm ELECTROGALVANIZED SHEET
3.) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032

RECOMMENDED APPLICATION:

1.) FLATS AND APARTMENTS (AT RISER)

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

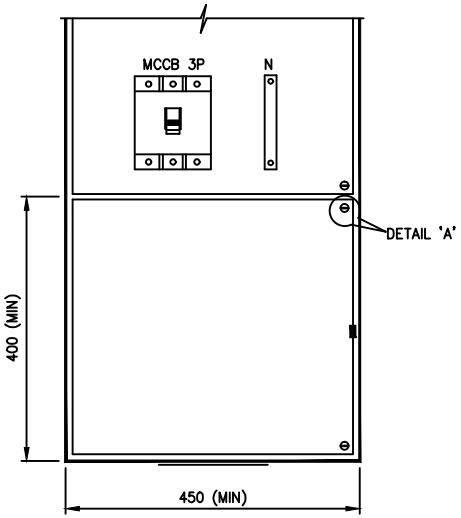
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

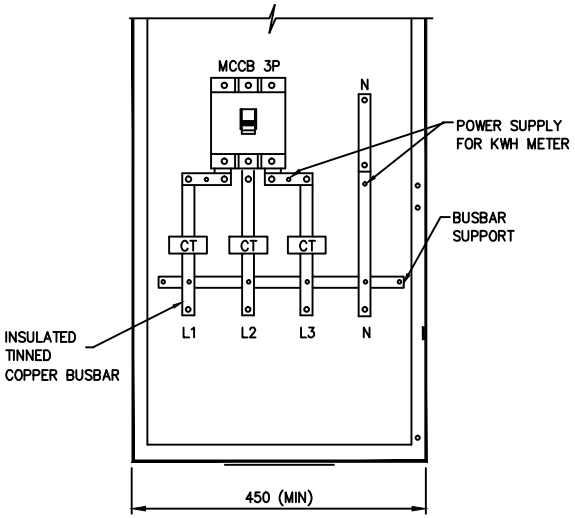
DRAWING No. EIR–S17 CADFILE NAME: APP22EIRS17

TITLE: STANDARD WALL MOUNTED SERVICE CUT–OUT FUSE PANEL FOR 3 NOS. 60 – 100A OUTGOING

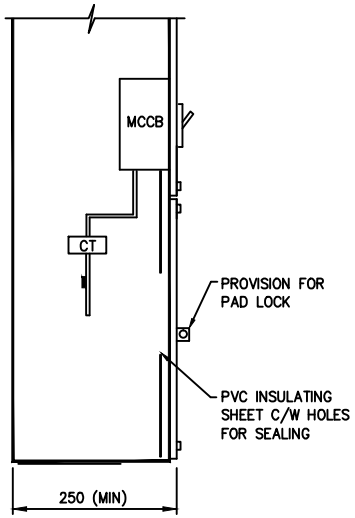
SIZE: A3
SCALE: AS SHOWN
REV: 0



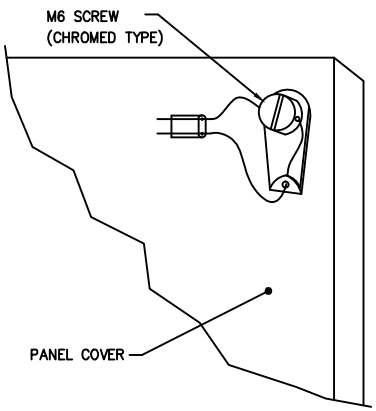
PANEL FRONT
(WITH COVER)



PANEL FRONT
(WITHOUT COVER)



SIDE VIEW



DETAIL 'A'

NOTES:-

1) ALL C.Ts & POWER SOURCE FOR KWH METER MUST BE INSTALLED AT INCOMING SIDE
2) ALL C.Ts MUST BE CLASS 0.5 & MINIMUM 15VA
3) ENCLOSURE MATERIAL: 1.6mm ELECTROGALVANIZED SHEET
4) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032

RECOMMENDED APPLICATION:

1) INCORPORATED IN WALL-MOUNTED MAIN SWITCHBOARD

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR-S9 CADFILE NAME: APP23EIRS9

TITLE: STANDARD KWH C.T COMPATMENT FOR WALL MOUNTED MAIN SWITCHBOARD

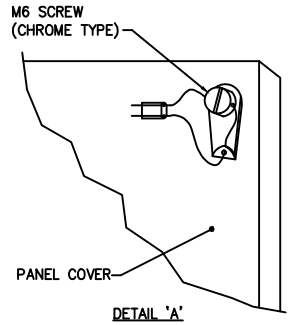
SIZE: A3
SCALE: AS SHOWN
REV: 0

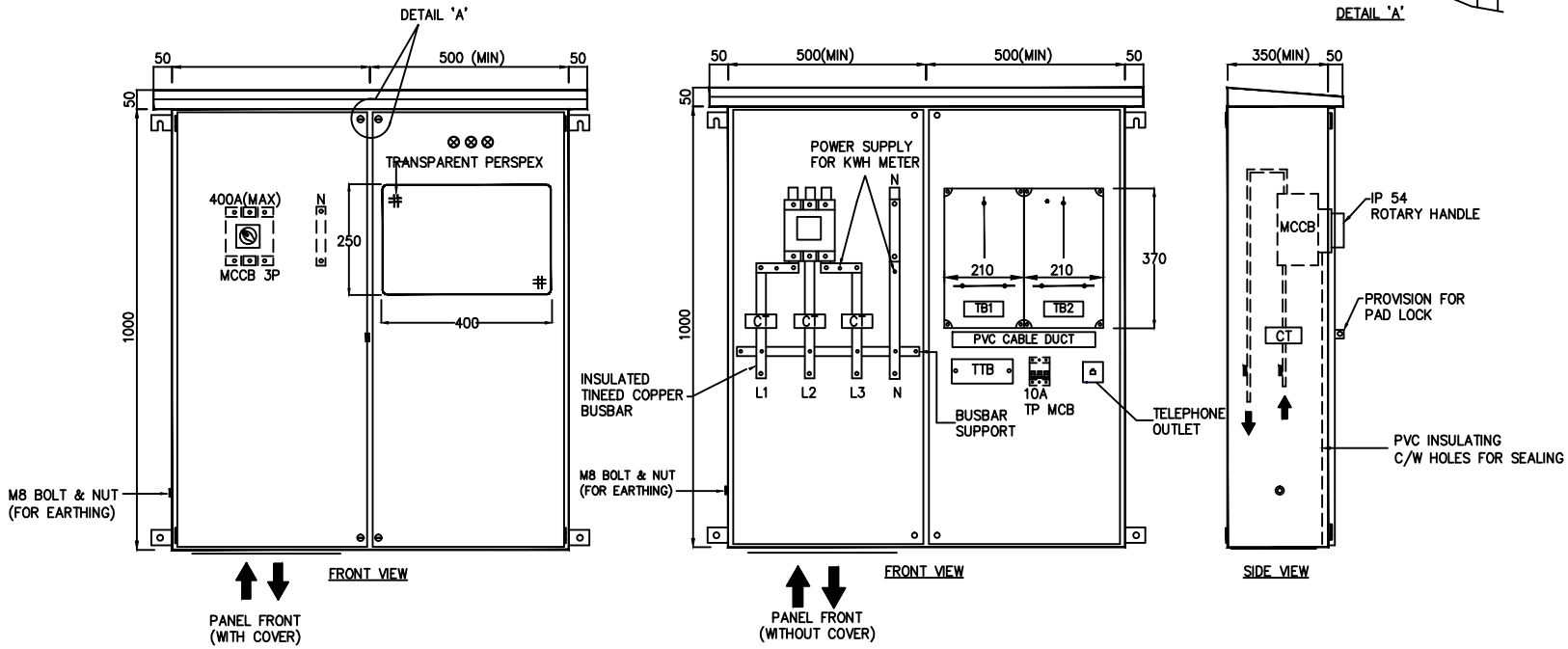
NOTES:-

1) ALL C.Ts & POWER SOURCE FOR KWH METER MUST BE INSTALLED AT INCOMING SIDE
2) ALL C.Ts MUST BE CLASS 0.5 & MINIMUM 15VA
3) DEGREE OF PROTECTION : IP54
4) ENCLOSURE MATERIAL: 1.6mm ELECTROGALVANIZED SHEET
5) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032
6) REFER CONTROL CIRCUIT IN APPENDIX 28.

RECOMMENDED APPLICATION:

1) OUTSIDE RESIDENTIAL HOUSES
2) OUTSIDE COMMERCIAL BUILDING





ALL DIMENSIONS ARE IN MILLIMETRES									
			0	STANDARD TEMPLATE	01.09.10	PT	TECO CSS	HNA
GENERAL NOTES	DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

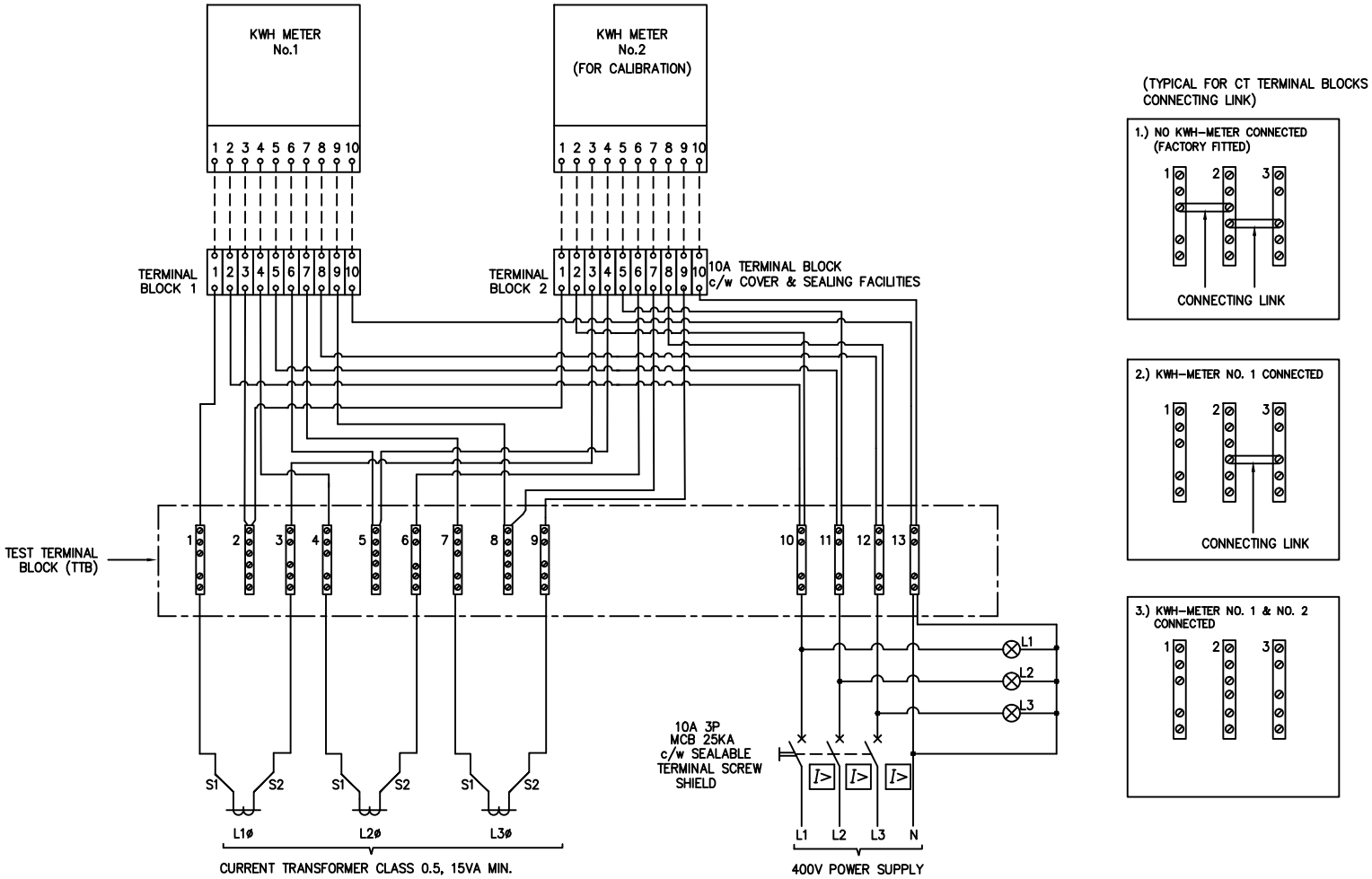
DRAWING No. EIR–S11 CADFILE NAME: APP24EIRS11

TITLE: STANDARD WALL MOUNTED INCOMER PANEL C/W KWH COMPARTMENT

SIZE: A3

SCALE: AS SHOWN

REV: 0



ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

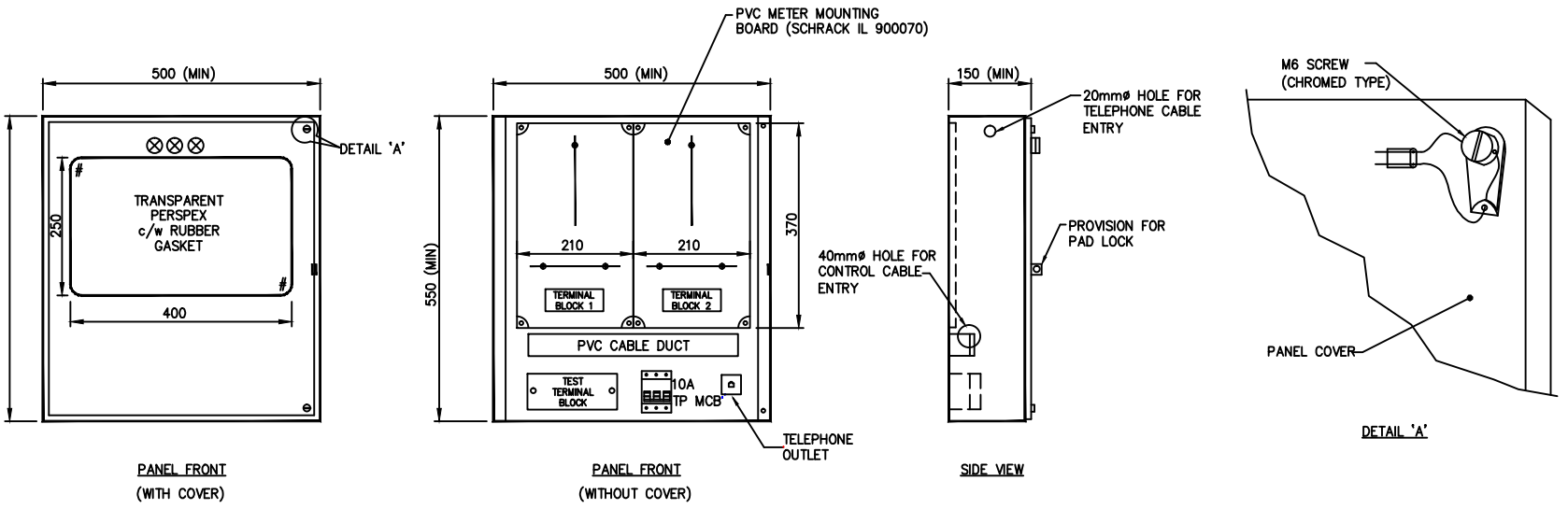
DRAWING No. EIR-S13 CADFILE NAME: APP25EIRS13

TITLE: CONTROL CIRCUIT FOR 2 NOS. KWH METER C/W TEST TERMINAL BLOCK

SIZE: A3

SCALE: AS SHOWN

REV: 0



NOTES:–

1) SUITABLE FOR ALL C.T. TYPE KWH METER.
2) MAX. CABLE SIZE TO KWH METER – 4 Sq.mm.
3) ONLY ONE CABLE IS ALLOWED TO BE CONNECTED TO EACH TERMINAL OF KWH METER.
4) CABLE ENTRY CAN BE EITHER SIDE.
5) PVC METER MOUNTING BOARD SHOULD SUIT ALL MAKES OF KWH METER (STANDARD FABRICATED MOUNTING)
6) DEGREE OF PROTECTION : IP 54
7) ENCLOSURE MATERIAL: 1.6mm ELECTROGALVANIZED SHEET
8) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032
9) REFER CONTROL CIRCUIT IN APPENDIX 25

RECOMMENDED APPLICATION:

1) INCORPORATED IN MAIN SWITCHBOARD

ALL DIMENSIONS ARE IN MILLIMETRES

GENERAL NOTES

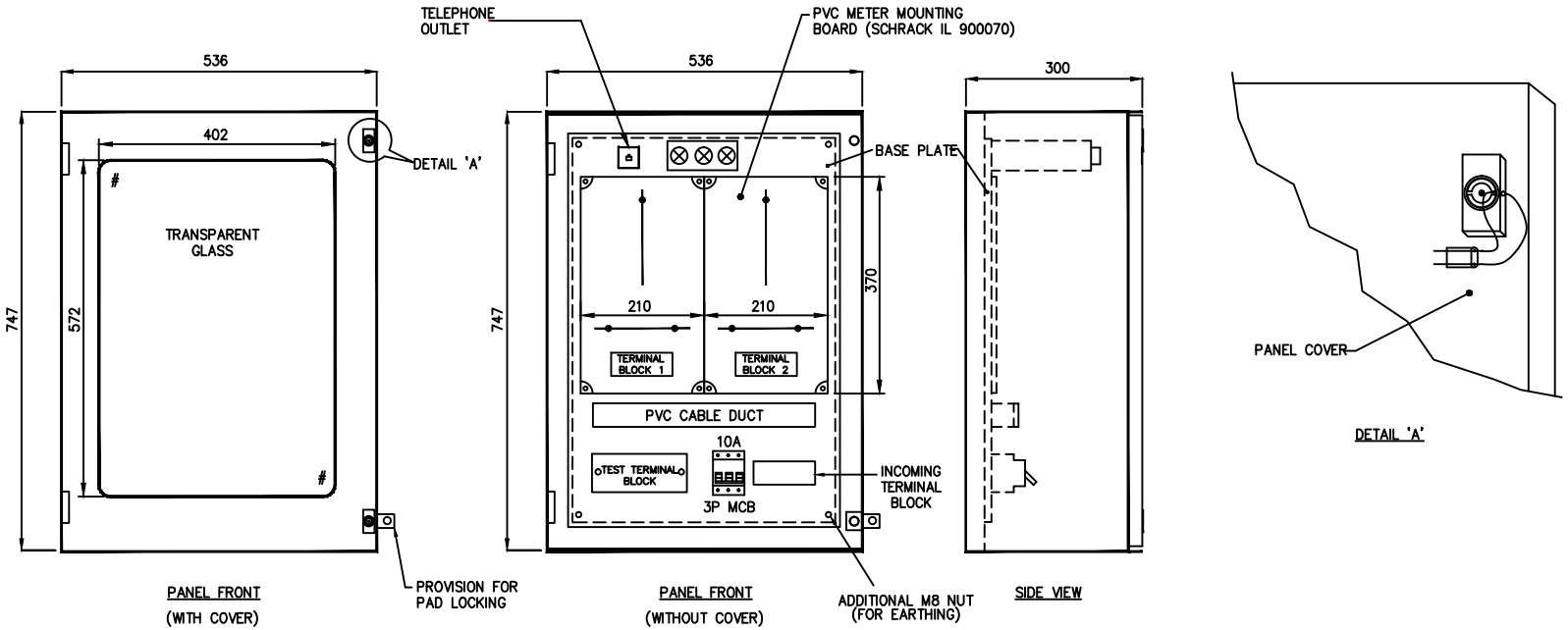
DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–S8 CADFILE NAME: APP26EIRS8

TITLE: STANDARD C.T OPERATED KWH METER PANEL TO BE INCORPORATED IN WALL MOUNTED & FLOOR STANDING MAIN SWITCHBOARD

SIZE: A3
SCALE: AS SHOWN
REV: 0



NOTES:–

1) SUITABLE FOR ALL C.T. TYPE KWH METER.
2) MAX. CABLE SIZE TO KWH METER – 4 Sq.mm.
3) ONLY ONE CABLE IS ALLOWED TO BE CONNECTED TO EACH TERMINAL OF KWH METER.
4) INCOMING CABLES MUST BE BOTTOM ENTRY.
5) PVC METER MOUNTING BOARD SHOULD SUIT ALL MAKES OF KWH METER (STANDARD FABRICATED MOUNTING)
6) DEGREE OF PROTECTION : IP 54
7) ENCLOSURE MATERIAL : POLYESTER
8) COLOUR – RAL 7032
9) REFER CONTROL CIRCUIT IN APPENDIX 25

RECOMMENDED APPLICATION:

1) OUTSIDE SUB-STATION

ALL DIMENSIONS ARE IN MILLIMETRES								
			0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA
GENERAL NOTES	DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR

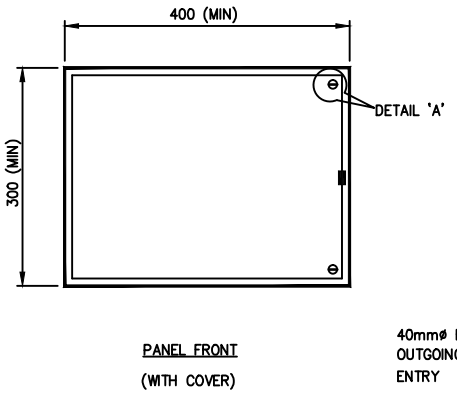
JABATAN PEMBANGUNAN ELEKTRIK
JABATAN PERDANA MENTERI

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

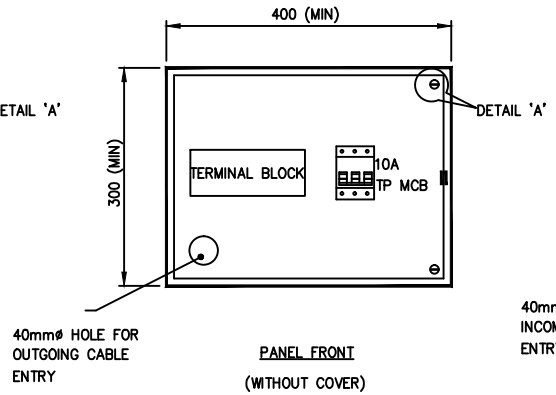
DRAWING No. EIR–S7 CADFILE NAME: APP27EIRS7

TITLE: STANDARD WALL MOUNTED CT OPERATE KWH METER PANEL

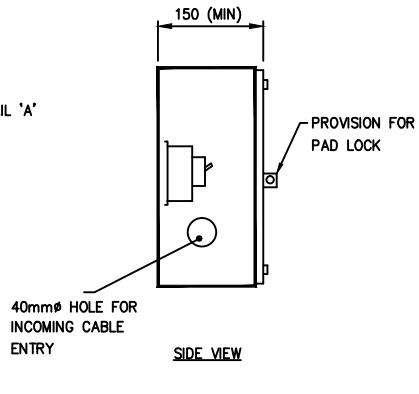
SIZE: A3
SCALE: AS SHOWN
REV: 0



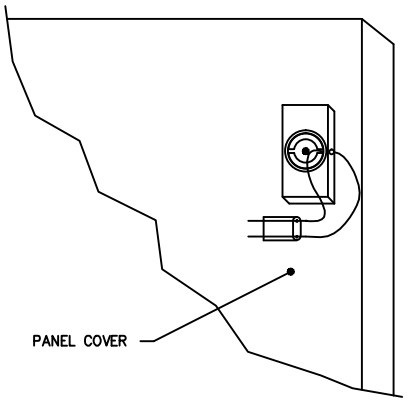
PANEL FRONT
(WITH COVER)



PANEL FRONT
(WITHOUT COVER)



SIDE VIEW



DETAIL 'A'

NOTES:–

1.) DEGREE OF PROTECTION : IP 54
2) ENCLOSURE MATERIAL: 1.6mm ELECTROGALVANIZED SHEET
3) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032
4) REFER TO APPENDICES 29A & 23 FOR INTERRELATED CONNECTION.

RECOMMENDED APPLICATION:

1.) INCORPORATED IN MAIN SWITCHBOARD WHERE KWH METER IS INSTALLED EXTERNALLY

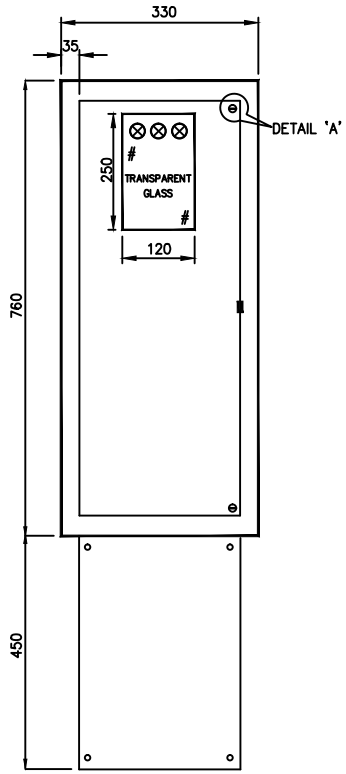
ALL DIMENSIONS ARE IN MILLIMETRES								
			0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA
GENERAL NOTES	DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

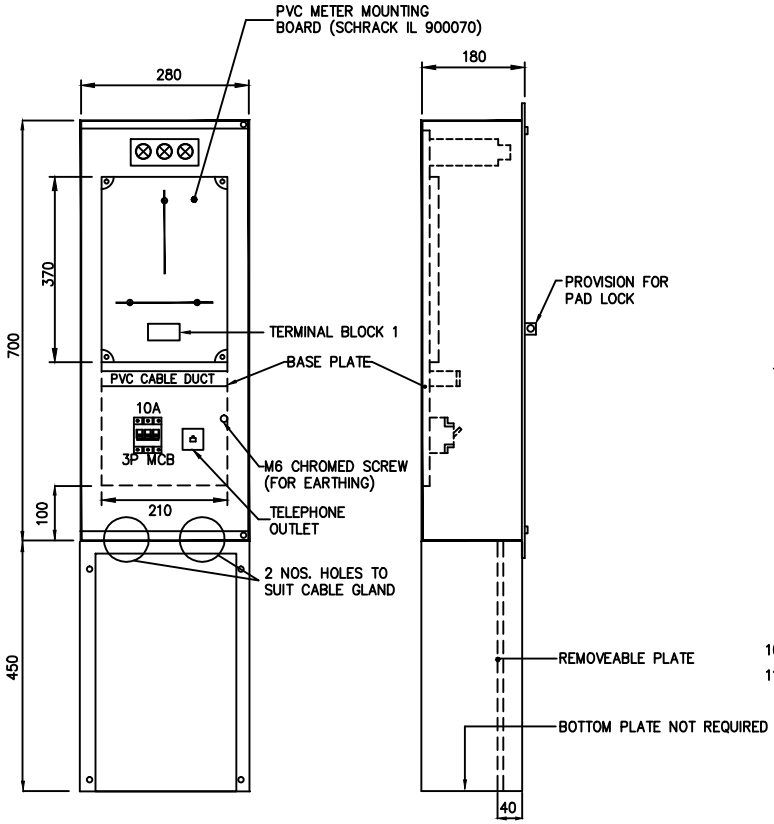
DRAWING No. EIR–S10 CADFILE NAME: APP28BEIRS10

TITLE: STANDARD KWH METER CT TERMINAL COMPARTMENT TO BE INCORPORATED IN WALL–MOUNTED IN WALL MOUNTED AND FLOOR STANDING MAIN SWITCHBOARD

SIZE: A3
SCALE: AS SHOWN
REV: 0

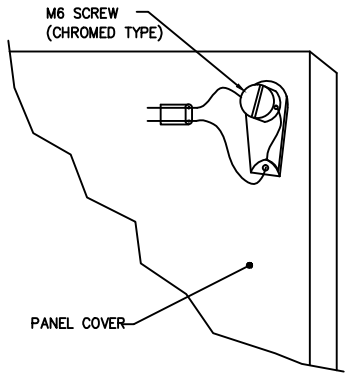


OUTER DOOR c/w FRAME
(DETACHABLE)



INNER BOX
(TO BE CONCEALED INTO CONCRETE PILLAR)

SIDE VIEW



DETAIL 'A'

NOTES:-

1) SUITABLE FOR ALL CT TYPE KWH METER.
2) MAX. CABLE SIZE TO KWH METER – 6 Sq.mm.
3) ONLY ONE CABLE IS ALLOWED TO BE CONNECTED TO EACH TERMINAL OF KWH METER.
4) INCOMING CABLES MUST BE BOTTOM ENTRY.
5) PVC METER MOUNTING BOARD SHOULD SUIT ALL MAKES OF KWH METER (STANDARD FABRICATED MOUNTING)
6) DEGREE OF PROTECTION : IP 54
7) ENCLOSURE MUST BE ABLE TO BE CONCEALED INTO CONCRETE GATE PILLAR
8) ENCLOSURE MATERIAL: 2mm ALUMIMIUM SHEET
9) COLOUR: ELECTROSTATIC POWDER COATING – RAL 7032
10) REFER CONTROL CIRCUIT IN APPENDIX 29C.
11) REFER TO APPENDICES 23 & 28 FOR INTERRELATED CONNECTION.

RECOMMENDED APPLICATION:

1) RESIDENTIAL HOUSES WITH GATE POST

ALL DIMENSIONS ARE IN MILLIMETRES

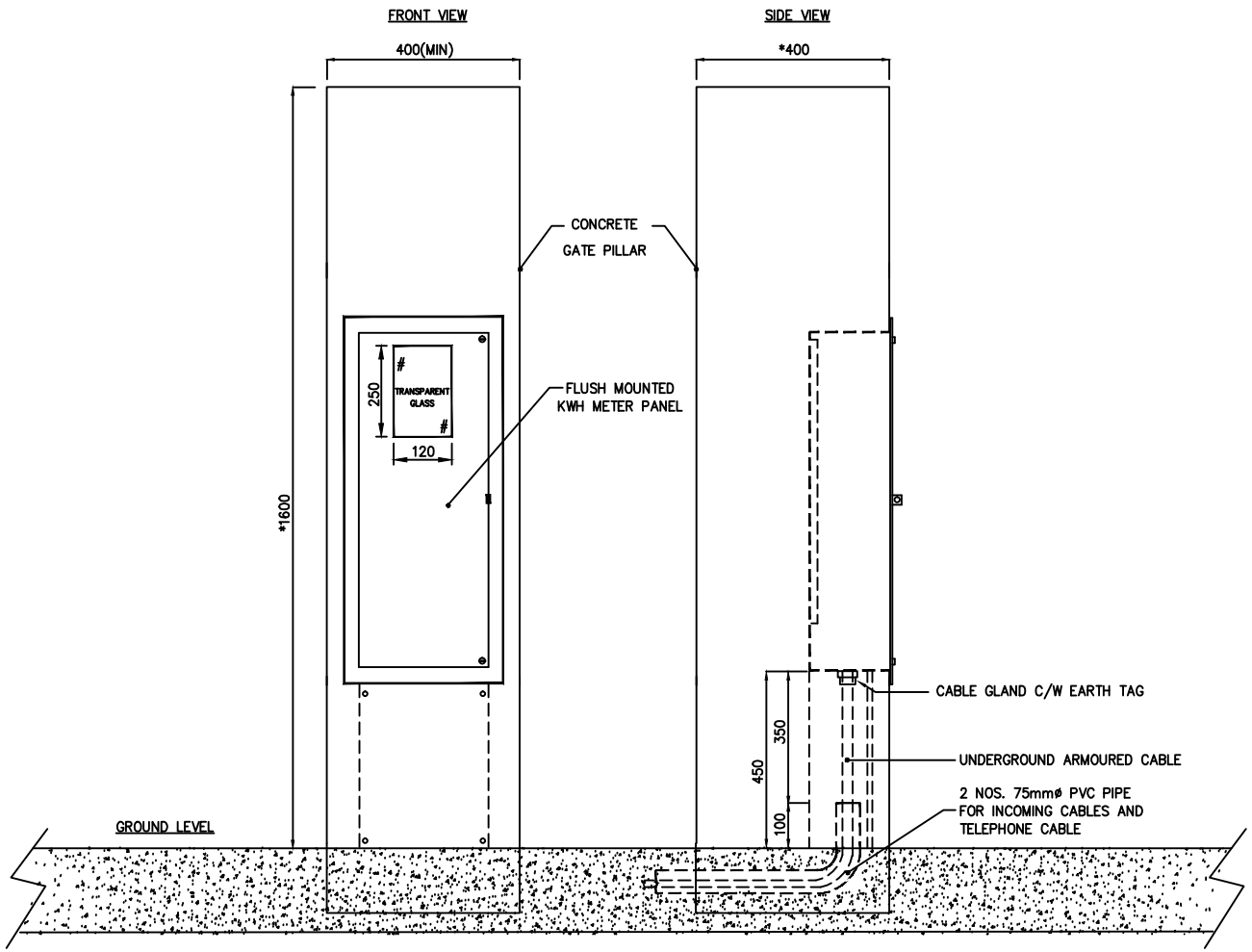
GENERAL NOTES

DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	TECO CSS	HNA

JABATAN PERKHIDMATAN ELEKTRIK
JABATAN PERDANA MENTERI

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR-S4B
CADFILE NAME: APP29AEIRS4B
TITLE: STANDARD FLUSH MOUNTED CT OPERATED KWH METER PANEL FOR GATE POST (IP43)
SIZE: A3
SCALE: AS SHOWN
REV: 0



ALL DIMENSIONS ARE IN MILLIMETRES

* – HEIGHT AND DEPTH VARIES
ACCORDING TO ARCHITECT'S REQUIREMENTS

GENERAL NOTES

DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
		0	STANDARD TEMPLATE	01.09.10	PT	TECO CSS	HNA

JABATAN PEMBEKALAN ELEKTRIK
JABATAN PERDANA MENTERI

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR–S4C

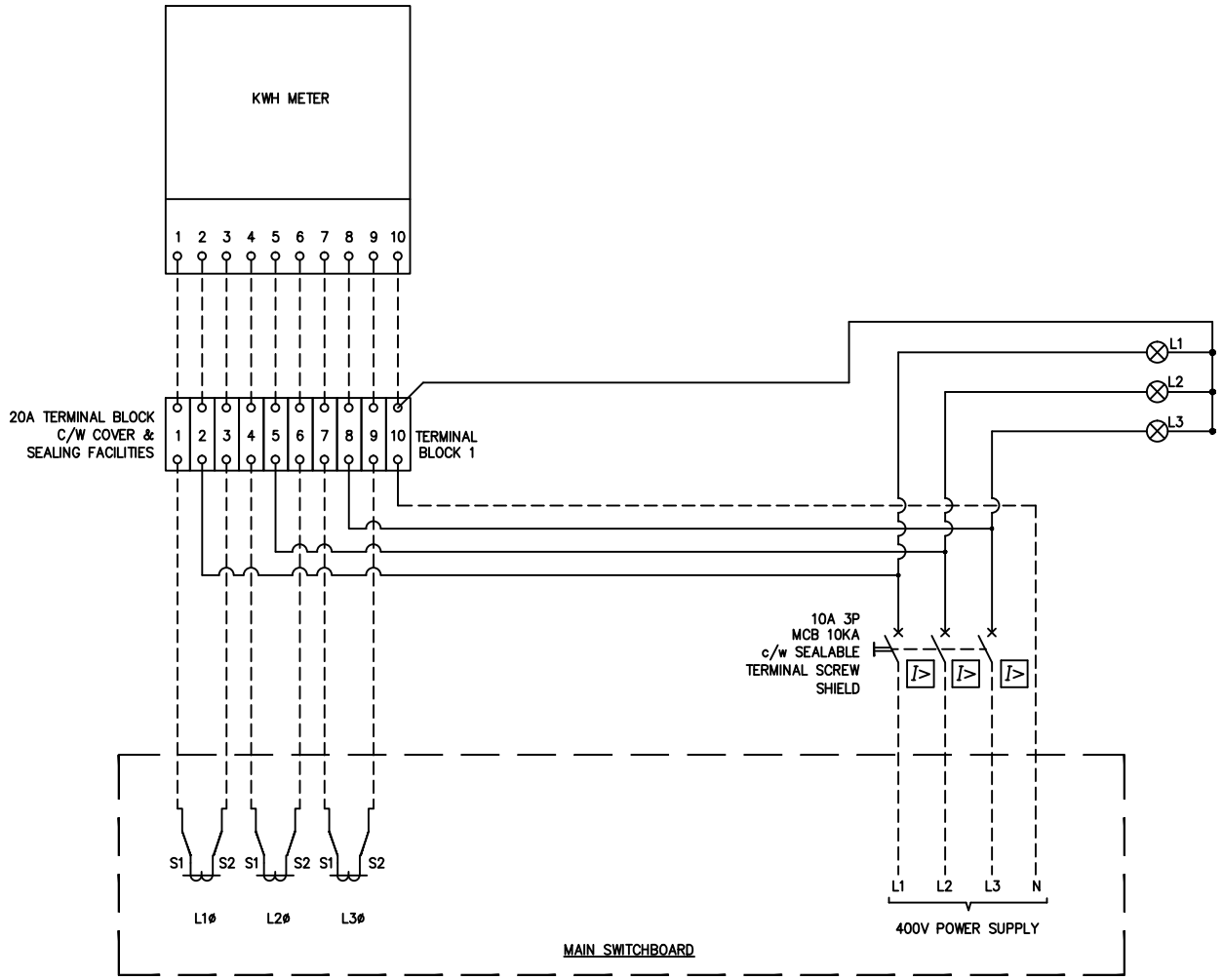
CADFILE NAME: APP29BEIRS4C

TITLE: TYPICAL MOUNTING FOR FLUSH MOUNTED CT OPERATED KWH METER PANEL

SIZE: A3

SCALE: AS SHOWN

REV: 0



GENERAL NOTES	DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DWN	CHK	APPR
			0	STANDARD TEMPLATE	01.09.10	PT	CSS	HNA

JABATAN PEMBEKALAN ELEKTRIK
JABATAN PERDANA MENTERI

ELECTRICAL INSTALLATION REQUIREMENTS (EIR)

DRAWING No. EIR-S4D
CADFILE NAME: APP29CEIRS4D
TITLE: CONTROL CIRCUIT FOR 1 NO. KWH METER
SIZE: A3
SCALE: AS SHOWN
REV: 0