ADDENDUM ELECTRICITY SUPPLY APPLICATION HANDBOOK

3.0 METERING GUIDELINES

CONTENT

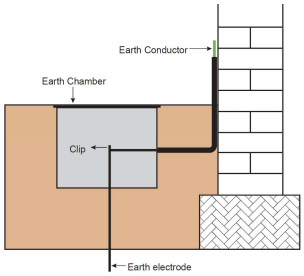
ABBREVIATIONS:

TNB	Tenaga Nasional Berhad
ELV	Extra Low Voltage
LV	Low Voltage
MV	Medium Voltage
HV	High Voltage
EHV	Extra High Voltage
CT	Current Transformer
PT / VT	Potential Transformer / Voltage Transformer
RE	Renewable Energy

3.1.0 GENERAL REQUIREMENTS

3.1.1 All the necessary meters for measuring the import or export of electricity shall be provided and maintained by TNB. The customer shall ensure the point at which every supply line shall terminate in any premise shall be accessible to TNB's personnel.

3.1.2 At any point in the premises at which supply line or lines terminate, the developer/consumer shall provide the meter board or metering panel according to TNB's specifications for the installation of meter and their accessories. All metering panel wholly made off conductive material shall be earthed to arrest any floating potential to prevent electrocution shock to public and to meet the requirements of electrical acts and regulations. The earthing of the meter panel should be bond to earth (complete with earthing rod/electrode and earth chamber). TNB may change any meter and its accessories or their positions in any premise as deemed necessary at any time for purposes of maintenance and meter reading.



3.1.3 Earthing braids strip from incoming utility LV cable termination must not be connected or bonded to any point of customer earthing system.

3.1.4 The Consumer shall ensure that the cellular or any other mode of communication that is approved by TNB in the metering room or meter location is adequate or sufficient for effective communication of remote meter reading. The Customer shall consult TNB on the minimum signal strength and additional facility to support communication of remote meter reading if required.

3.1.5 For low voltage supply without metering CT, the metering scheme is divided into 3 categories:

i. Single Phase Whole Current Supply

This metering scheme applies to individual domestic and non-domestic consumers including housing area.

ii. Three Phase Whole Current Supply

This metering scheme applies to individual domestic and non-domestic consumers including housing area.

iii. Group Metering for Single Phase and Three Phase Whole Current Supply

This metering scheme applies to high, medium and low-rise apartment, commercial premises, hawkers' centre/food court/food stalls and shop lots.

3.1.6 For low voltage supply that requires metering CT, TNB shall provide low voltage CTs for the meter installation and ground mounted metering kiosk (GMMK). The GMMK cost shall be borne by the consumer. However, for a situation whereby GMMK will not be provided by TNB (as per clause 3.5.3), ground mounted metering kiosk shall be provided and installed by consumer.

3.1.7 For medium voltage consumers, CTs and VTs will be provided and installed by TNB at TNB's outgoing switchgear. However, for situation whereby CTs and VTs could not be provided by TNB, CTs and VTs shall be provided and installed by consumer which should fulfil the requirements below:

i. The metering CTs shall be subjected to testing by TNB

ii. The passed test certificates for the metering VTs from an accredited laboratory shall be submitted

iii. Pre-commissioning test must be carried out for VTs and CTs by consumer and witnessed by TNB representative

3.1.8 For high voltage consumers, where the CTs are incorporated in switchgear panels, the consumer shall provide the metering CTs and VTs according to TNB's specifications and fulfil the requirement below:

i. Factory Acceptance Test (FAT) for CTs and VTs must be conducted and witnessed by TNB representative.

ii. The passed test certificates for the metering CTs and VTs from an accredited laboratory shall be submitted.

iii. Pre-commissioning test must be carried out for VTs and CTs by consumer and witnessed by TNB representative.

3.1.9 The Electrical Consultant/Registered Electrical Contractor shall ensure clear understanding of TNB metering requirements as detailed below. Should there be any doubt, he should consult the TNB Distribution Network Division Local Office.

3.1.10 The metering guidelines are subjected to change from time to time.

3.2.0 SINGLE PHASE WHOLE CURRENT SUPPLY

3.2.1 Voltage And Current Rating

The voltage supply shall be 230 V. The normal current rating of the electronic meter shall be 10 A - 100 A. The consumer / developer is advised to consult TNB Distribution Network Division Local Office for any enquiries.

3.2.2 Location of Meter Position

i. The meter board which accommodates TNB's service cut-out, meters and other auxiliary equipment shall, as far as is practical, be located near the termination of the service line and facing the main entrance of the premises and has ease of accessibility to TNB's personnel.

ii. For meter located at the premises, the consumers / developer shall provide meter board as shown in **Appendix 9.**

iii. For housing area with individual gate post, the meter shall be placed at the gate post. Access to meters placed at gate posts shall be from the front only. The design and specification for the meter panel, meter and accessory arrangement at the gate post is shown in **Appendix 26.**

iv. Where it is necessary to terminate the service line in a position outside the premise and exposed to the weather, a suitable weatherproof, well - ventilated box with clear glass cover approved by TNB shall be provided by the consumer at his own expense to house the cable termination and meter board, as per TNB's specifications **Appendix 15 to Appendix 22.**

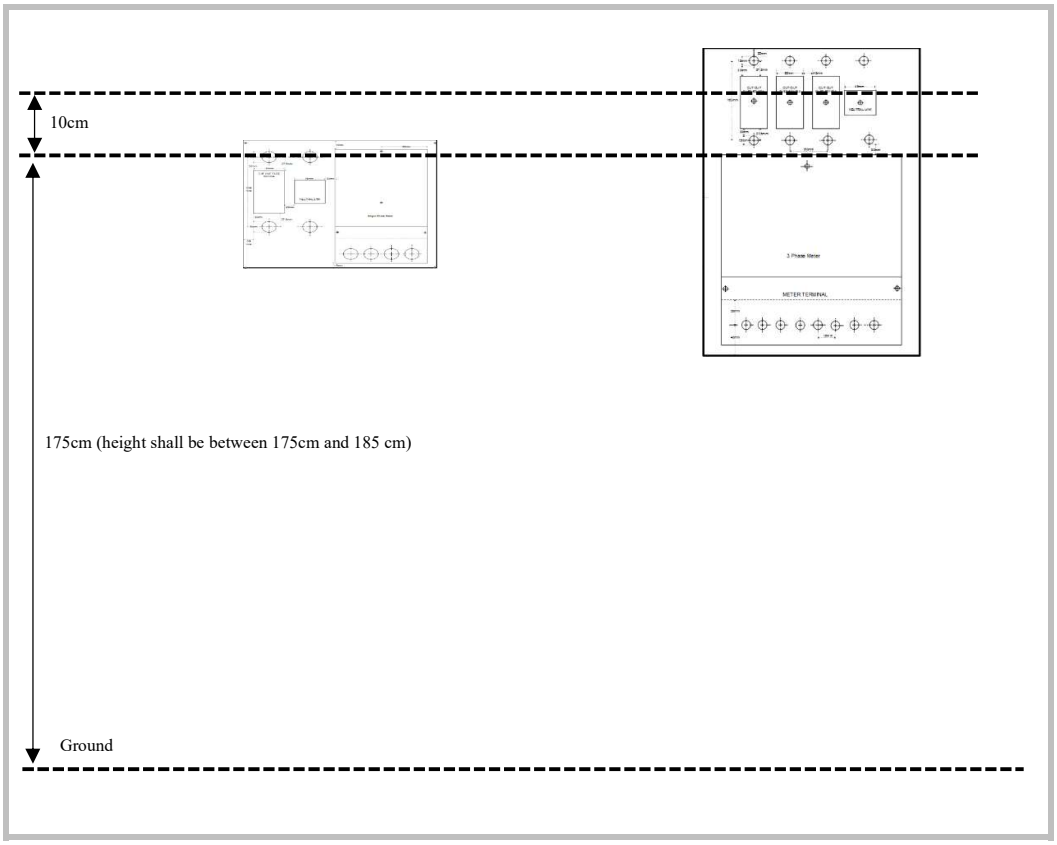
v. Consumers whose nature of business involve very dusty or dirty environment shall be required to provide outdoor meter panel to protect the meter installation.

vi. Group metering for multi tenanted consumers or open commercial outlets shall be addressed Section 3.4.0.

vii. Meter and their accessories shall be installed only in clean and dry location not exposed to the weather or mechanical injury, free from vibration and not exposed to direct sunlight and rain.

3.2.3 Height Of Meter Position

i. The height of the meter board in the consumer's premise at the wall facing the main entrance shall be between 1.75m (top of the meter) to 1.85m above ground level as illustrated in the pictures below :



ii. The top of the meter board at the gate post shall be 1.5 m above ground level.

3.2.4 Meter Board

i. The meter board shall be:

a) Any hard wood chemically treated against attack by termites (Plywood or chipboard or PVC or PE is NOT allowed).

b) Nonconductive fibre board / plate with minimum thickness of 5.0 mm. The diagram of the board is shown in **Appendix 9.**

ii. The arrangement for the meter, cut out, termination wires and the recommended size of the board is shown in **Appendix 10.**

iii. All board shall be rigidly fixed by a minimum of 5 fixing screws where one screw shall be at the center of the meter. The length of the screw at the center of the meter board must be long enough to penetrate the wall. The meter board should not be earthed using incoming utility earthing braids that come with LV cable termination.

iv. The consumer's main switches and accessories are not allowed to be installed on the same board.

v. In the case of outdoor meter installations, temporary supply or in mining areas, the recommended meter box is shown in **Appendix 15** to **Appendix 22**. The meter box shall have debossed or embossed metal plate so that the address of installation premises is written permanently and riveted to meter box. The recommended size of metal plate is shown below.

For example, the minimum requirement for address details is listed below:

a. For rural area: Lot number, and name of the village, district
b. For street with many meter panels: meter panel number and street name
c. Project that has not yet gazette the road: Lot No and Project Name
d. High rise: Level No and building name.

3.2.5 Wiring Arrangement

i. The size of meter cables shall be at minimum 10 mm sq. and shall not exceed 35 mm sq. according to the current rating of the meter which is 10 A – 100 A.

ii. Other than meter installation in risers, the wiring at the meter board shall be on the surface.

iii. For new installations, the applicant/user must provide wiring from cut-outs and neutral link to meter. For surface wiring, please refer to **Appendix 11.**

3.3.0 THREE PHASE WHOLE CURRENT SUPPLY

3.3.1 Voltage and Current Rating

The voltage supply shall be 400 V. The normal current rating of the meter shall be 10 A-100A. The consumer/developer is advised to consult the TNB Distribution Network Division Local Office.

3.3.2 Location of Meter Position

The requirements given in 3.2.2 (i) – (vii) applies for the locations of three phase meter position.

3.3.3 Height of Meter Position

The requirements given in 3.2.3 (i) – (ii) applies for the height of three phase meter.

3.3.4 Meter Board

i. The recommended size and arrangement of the three-phase meter, cut-outs and neutral link for the overhead and underground service is as shown in **Appendix 12 to Appendix 13**.

ii. The requirements given in 3.2.4 (i) – (v) apply for the three-phase meter board.

3.3.5 Wiring Arrangement

i. The requirement given in 3.2.5 (i) – (iii) also applies for the three-phase wiring arrangement.

ii. Other than meter installation in risers, the wiring at the meter board shall be on the surface. For surface wiring, please refer to **Appendix 14.**

3.4.0 GROUP METERING FOR SINGLE PHASE AND THREE PHASE WHOLE CURRENT SUPPLY

3.4.1 Location and Height of Meter Position

a) High, Medium & Low-Rise Apartment

i. In domestic multi-tenanted premises up to 5 storeys, all meters shall be grouped at ground floor in a dedicated metering room or steel netting meter cage.

ii. In domestic multi-tenanted premises above 5 storeys, all meters shall be grouped in dedicated metering room or steel netting meter cage at each floor of the tenants metering. There may be more than one group of metering location at each floor.

iii. The individual meter shall be properly and eligibly labelled with permanent metal plate and riveted to meter panel to indicate clearly the meter supplying to the respective consumer.

iv. The height from the top of the meter panel shall not exceed 2.1m and the bottom shall be above 0.3m from the ground. There shall be working space of 1 m in front the metering panel.

v. In the above requirements, all excess to the dedicated metering room or steel netting meter cage shall be equipped with hinge for locking facility by TNB.

b) Commercial Premises (excluding shop lots)

Multi tenanted commercial premises taking bulk supply shall have the meters installed following clause 3.5.0 or 3.6.0, whichever relevant. If the multitenant commercial premises are taking individual supply to landlord and tenants, the metering arrangement, locations and position shall be similar to clause 3.4.1 a)

c) Hawker Centre / Food Court / Food Stall

i. Location of Meter Position

- For Hawker Centre / Food Court / Food Stall centralized group metering, shall be located at the dedicated metering room or steel netting meter cage or end of each row, outside the premises, in a weatherproof and ventilated panel/area which is suitable for meter installation and meter reading as per TNB's specifications. The meter panel or box shall be rigidly and vertically mounted.

- The recommended size and arrangement of the meters, cut outs, and neutral link is as shown in **Appendix 23,** for single phase group metering and **Appendix 24,** for three phase group metering.

ii. Mounting of Meter

- The individual meter shall be properly and eligibly labelled with permanent metal plate and riveted to meter panel to indicate clearly the meter supplying to the respective consumer.

- The height from the top of the meter panel shall not exceed 2.1m and the bottom shall be above 0.3m from the ground. There shall be working space of 1 m in front the metering panel.

- In the above requirements, all excess to the dedicated metering room or steel netting meter cage shall be equipped with hinge for locking facility by TNB.

d) Shop Lots

i. Location and Height of Meter Position

- For shop-lots, all meters shall be grouped at ground floor, front wall of the shops in a dedicated metering compartment. The design and specification of shop lots meter panel is shown in **Appendix 25A & 25B.**

ii. Wiring Arrangement

- The requirement given in 3.2.5 (i) – (ii) also applies for the three-wiring arrangement.

- For surface wiring, please refer to **Appendix 11 & 14**

3.4.2 Metering Panel

i. The metering panel can be of mild steel or other TNB approved material and of thickness not less than 1.5 mm. All metering panel that is constructed from conductive material shall be earthed to arrest any floating potential to prevent electrocution shock to public and to meet the requirements of electrical acts and regulations. The earthing of the meter panel should be bond to earth (complete with earthing rod/electrode and earth chamber) that is separately from utility earthing.

ii. The recommended size and arrangement of the meters, cut-outs, and neutral link is as shown in **Appendix 23,** for single phase group metering and **Appendix 24,** for three phase group metering.

iii. The holes for the termination wire to the meters shall have appropriate bushings to prevent the wires from being damaged.

iv. In the case of meter box with a cover, the metal plate on which the meters are mounted as well as the cover shall have minimum two metal hinges to enable it to be swung open for at least 90^{O}.

v. The wiring arrangement shall follow:

- Single phase – Please refer to paragraph 3.2.5
- Three phase – Please refer to paragraph 3.3.5

3.5.0 LVCT METERING

LV consumers taking more than 100A per phase shall require current transformers for the metering scheme.

3.5.1 Location of Meter Position

i. Consumer shall provide an accessible space for the metering installation separate from the main switchboard nearest to the source of the TNB supply ie TNB Substation, feeder pillar and etc.

ii. The Consumer shall ensure that the cellular signal strength or any other mode of communication that is approved by TNB in the metering room or meter location is adequate or sufficient for effective communication of Remote Meter Reading. The Customer shall consult TNB on the minimum signal strength and additional facility to support communication of remote meter reading if required.

iii. All GMMK/metering kiosk shall be earthed to avoid any floating potential to prevent electrocution shock to public and to meet the requirements of electrical acts and regulations. The earthing of the GMMK/metering kiosk should be bonded to earth (complete with earthing rod/electrode and earth chamber) that is separately from utility earthing.

iv. The incoming and outgoing cable termination at the busbar shall be done by using suitable lug that fits firmly with the LV cable size and hinders any galvanized corrosion effect due to differences in conductor material (eg bimetal lug or mechanical lug). All connection points between cable and cable lugs, cable lugs and busbar shall be properly fixed to avoid any gap that will result loose contact and ohmic heating.

v. For multi-feeder metering, separate GMMK/metering kiosk are to be used for each feeder. The meter room size or space allocated for installation GMMK/metering kiosk shall consider all the required clearance and concrete plinth dimension.

3.5.2 Ground Mounted Metering Kiosk (GMMK) provided by TNB

i. TNB will provide the GMMK complete with busbar, meters and metering accessories. However, under the below conditions, customers need to provide the metering kiosk inclusive of busbar such as:

   a. On-site constraint. *
      *such example is existing installation that apply for upgrading / downgrading of maximum demand which having space constraint
   b. Internal reticulation of network after regulated meter.
   c. Temporary supply

ii. The location for the GMMK to be installed is between the TNB supply source and the MSB customer. For proper installation of GMMK, customers need to prepare the following:

a. For GMMK in the meter room – concrete trenching must be provided up to the GMMK by the customer.

b. For GMMK outside the building – GMMK must be installed on a concrete plinth. GMMK concrete plinth and sand back-fill shall be provided by the customer. Refer to Appendix 27 GMMK Concrete Plinth for GMMK on plinth design, dimension, and specification.

iii. The guidance principle for minimum clearance for the GMMK is as follows. Refer to Appendix 28 Clearance GMMK: -

a. 600mm from the rear and front side
b. 600mm from the left or right side

3.5.3 Metering Kiosk provided by customer.

Refer to **Appendix 29 & 30** for typical design of LVCT Metering Kiosk.

3.5.3.1 Metering Kiosk Shell

i. The metering kiosk shall consist of two (2) enclosed compartments to separate meter facilities as the upper compartment and busbar facilities as the lower compartment. The compartment shall each have a single leaf door.

ii. Metal housing is made of electro galvanized sheet steel and fitted with 3 sets of robust hinges on each door. The hinges must be concealed to provide better security. A two (2) point dedicated design locking arrangement employing cam lock system to be installed on top and bottom corners of each door leaf. Wire mesh glasses or equivalent shall be provided at the meter compartment door for meter display direct view.

iii. Brackets for padlocking of hole diameter bigger not less 12 mm with metal padlock cover of 3.0 mm thickness riveted to the door for extra safety to curb vandalism shall also be provided. When fully mounted, the metal cover shall resemble cubic form with opening provided only at the bottom with enough clearance to allow padlock to be inserted/taken out. The door shall be arranged to open through not less than 180^0 for maximum access.

iv. The shell shall be provided with watershed tops to prevent the accumulation of water. Ample ventilation shall be provided to permit natural circulation of air for both meter and busbar compartment. The ventilation apertures shall be suitably screened to prevent the entry of vermin and foreign objects. The degree of protection against persons, foreign objects and ingress of water shall be IP 33 in accordance with IEC 60529. The shell shall be fitted with lifting lugs, which are able to withstand the weight during loading and unloading of the metering kiosk.

iv. The enclosure shall accommodate frame earthing socket, incoming and outgoing with identification labels; and P1 and P2 terminals for current transformer identification labels. All relevant studs, bolts, nuts, washers, etc., shall be completely provided.

v. The enclosure shall be able to accommodate a single hole or equivalent for antenna/aerial of the metering modem to be installed outside of the meter

compartment and at the side of the kiosk for better signal. The hole shall be minimum 14 mm in diameter.

3.5.3.2 Busbars

i. The busbar system shall be consisting of one set of 3 phase tinned copper busbars with minimum size as below:

Rating of Metering Kiosk	Busbar Size
400 A	30 mm x 8 mm or equivalent cross-sectional area
800 A	38 mm x 10 mm or equivalent cross-sectional area
1600 A	80 mm x 10 mm or equivalent cross-sectional area

ii. The phases shall be identified with phase colour code.

iii. One tinned copper neutral bar having the same dimension and current rating as the associated phase busbars. Dedicated holes shall be made available to provide for neutral terminations which match the number of incoming and outgoing feeders.

iv. One tinned copper earth bar of minimum size 30 mm x 4 mm or equivalent cross-sectional area extending over the full length of the metering kiosk. The earth bar shall be connected to the neutral bar with copper braid/copper link. Dedicated holes for cable termination copper braid connection must be provided.

v. The neutral and earth bar shall be mounted using dead bolt, Loctite application or equivalent to ensure permanent and anti-vandalism.

vi. The thickness of the tin plating shall not less than 5 microns. The front side of the busbar shall be fixed as incoming, and the rear side of the busbar shall be fixed as outgoing and labelled to prevent CT reverse (P1 and P2).

3.5.3.3 Current Transformers

i. One set three (3) Nos. current transformer (R, Y, B) to be supplied and mounted at the busbars by TNB. Adequate electrical clearance shall be provided for the installed current transformers.
ii. Suitable and standard clamps shall be provided to secure the metering current transformers in position.

3.5.3.4 Metering Kiosk Compartment

i. Meter, terminal testing block (TTB) and meter fuses will be supplied and installed by TNB including wiring.

ii. The insulated fibre plate or equivalent of enough strength and sturdiness shall be used to mount the meters, meter fuses, TTB and wiring arrangement.The layout on the fibre plate shall ensure that meters shall meet the eye level requirement. The typical

dimensions of meters, meter fuses and TTB are as follows. However, these dimensions may differ according to suppliers.

iii. A transparent non-metallic cover shall be provided to protect and prevent personnel from touching exposed busbar.

Item	Dimensions
Meter	77 mm x 316 mm (maximum)
Fuse	40 mm long
TTB	80 mm x 180 mm

3.5.3.5 Cable Termination, Clamp Support, and CT wiring

i. The cable termination arrangements shall be located at the lowest point of the GMMK.

ii. Each incoming and outgoing cable shall be fitted with an appropriate set of cable clamps at the bottom of termination.

iii. Cable support shall be provided by suitable clamps at the bottom of the structure in such a manner that the cable entry to the metering kiosk is not obstructed by any metalwork.

iv. Provision shall be made to ensure enough clearance between mounted bimetal cable lugs with adjacent live and earthed parts after the termination of cables (Phase-to-phase clearance shall not be less than 25 mm and phase-to-earth clearance shall not be less than 19 mm).

v. The distance from the floor to the cable clamp shall be at least 200 mm and from the cable clamp to the neutral bar shall be at least 400 mm.

vi. A 6.0 mm taphole plus screw/washer shall be provided on each busbar to facilitate connection of the voltage supply to the meter voltage coils

vii. A 12 core 2.5 mm2 or 4 mm2 steel wire armoured cable shall be provided between the GMMK and current transformers and voltage source

viii. The LV CT shall be provided by TNB as below:

C.T Ratio	Internal Diameter	External Diameter
150/5	40 mm	90 mm
200/5	40 mm	90 mm
300/5	60 mm	100 mm
400/5	60 mm	100 mm
500/5	65 mm	125 mm
600/5	65 mm	125 mm
800/5	65 mm	125 mm

C.T Ratio	Internal Diameter	External Diameter
1000/5	85 mm	125 mm
1200/5	100 mm	140 mm
1600/5	100 mm	140 mm

ix. The Electrical consultant Engineer / Electrical Wiring Contractor shall ensure the above requirements are complied with. Should there be any deviation(s) from the requirements, he should consult the TNB Distribution Network Division Local Office.

3.6.0 MEDIUM VOLTAGE AND HIGH VOLTAGE METERING

3.6.1 General

For metering installations up to 33 kV, CTs and VTs shall be provided and installed by TNB at TNB's outgoing switchgear. However, for situation where CTs and VTs cannot be installed at TNB's control area, the CTs and VTs shall be provided and installed by consumer at consumer's own expense. The CTs and VTs provided shall follow TNB's specifications and the CTs shall be sent to TNB's laboratory for testing.

For metering installations of 132 kV and above, CTs and VTs shall be provided and installed by the consumer at consumer's incoming switchgear in accordance with TNB's specifications. TNB shall witness the commissioning test of both CTs and VTs.

A floor mounted metering cubicle complete with wiring as per **Appendix 31, 32, 33 & 34** shall be provided by the consumer in the specified metering room for the installation of TNB meters.

The schematic drawings together with the load data using the form as in **Appendix 8** are required to be sent to TNB Distribution Network Division Local Office offices for endorsement. All drawings must be signed by a Professional Engineer.

3.6.2 Specifications For Metering VTs And CTs

Metering VTs

VTs shall be from inductive type.

For consumer taking, 11 kV, and 33 kV:

Ratio	:	$\frac{Vs / \sqrt{3}V}{110 / \sqrt{3}V}$ * *where Vs is the supply voltage given to the consumer*
Class	:	0.5
Burden	:	50 VA minimum. Sharing can be allowed provided separate fusing is provided and the burden of the shared load shall not exceed 10 VA. If the burden of the shared load is more than 10 VA, then 100 VA VT shall be used.
Unit	:	3 Nos. for each feeder
Standards	:	IEC 61869-3

For consumer taking 132 kV and above:

Ratio	:	$\frac{Vs / \sqrt{3}V}{110 / \sqrt{3}V}$ * *where Vs is the supply voltage given to the consumer*
Class	:	0.2
Burden	:	50 VA minimum.

Sharing can be allowed provided separate fusing is provided and the burden of the shared load shall not exceed 10 VA. If the burden of the shared load is more than 10 VA, then 100 VA VT shall be used.

Unit : 3 Nos. for each feeder
Standards : IEC 61869-3

Metering CTs

For consumer taking, 11 kV, and 33 kV (indoor breaker):

Ratio : Is / 5A
** where Is is the primary ratio of the metering CT*
Class : 0.2
Burden : 15 VA
Unit : 3 Nos. for each feeder
Standards : IEC 61869-2

For consumer taking 33 kV (outdoor breaker), 132 kV and above:

Ratio : Is / 1A
** where Is is the primary ratio of the metering CT*
Class : 0.2
Burden : 30 VA
Unit : 3 Nos. for each feeder
Standards : IEC 61869-2

3.6.3 Test Certificate And Wiring Diagram

For CTs and VTs supplied by consumer, Test Certificate from an accredited laboratory shall be submitted to TNB. The schematic and wiring diagram of the particular consumer's switchgear signed by a Professional Engineer shall also be supplied to TNB to facilitate metering equipment installation.

3.6.4 Metering Panel

The maximum allowable distance between metering CTs and metering cubicle is shown in below table.

Table 3

CT Burden (VA)	Secondary Rated Current (Amps)	Cross Connection Of Conductor (mm2)	Maximum Allowable Distance (m)
15	5	2.5	30
15	5	4.0	47
30	5	2.5	65
30	5	4.0	100
30	1	2.5	1,647
30	1	4.0	2,545

Where meter burden for current circuit = 0.5 VA / ph

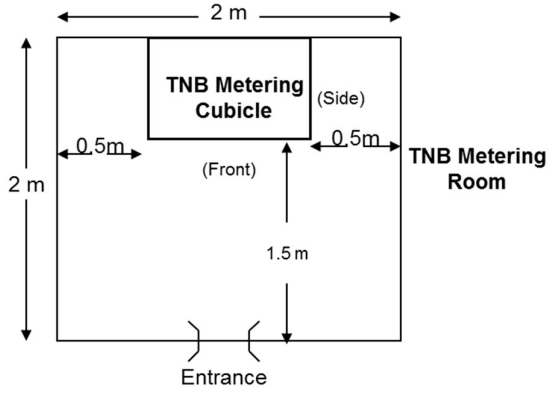
3.6.5 Location Of Metering Panel

A dedicated meter room close to TNB substation shall be provided and surrendered to TNB. The minimum size of the room shall be 2.0 m x 2.0 m x 2.5 m (height).

For installation that requires more than one metering panels to be installed (eg. Landlord / Tenant), suitable size of meter room shall be provided with the side and front clearance complying to the layout below:

For situation that requires the installation of CTs and VTs at consumer switchgear room, the location of dedicated meter room shall be provided close to the consumer's switchgear room.

Typical arrangement of the metering cubicle inside the metering room is as shown in the layout below:



3.6.6 Power Supply Point For Maintenance Purposes

A 13 Amps Switch Socket Outlet (S.S.O.) is to be provided and installed in the metering room.

3.6.7 Cable Requirement (For CTs And VTs Not Installed In TNB's Control Area)

a) Indoor Breakers

The consumer shall provide and connect a 12-core PVC/SWA/PVC, Cu, 2.5 mm^2 cable or better between the consumer's high voltage switchboard and the metering cubicle. There shall be no intermediary joint. The armoured cable shall not be buried or enclosed. It shall be preferably laid on cable tray.

b) Outdoor Breakers

A 'marshalling box' with independent sealing facility shall be provided by the consumer for the purpose of terminating the secondary circuit cabling of the current transformer and voltage transformer.The consumer shall provide and connect a PVC/SWA/PVC, Cu, 4 mm^2 cable or better between the'marshalling box' and the floor mounted metering cubicle.

3.6.8 Specification Of Mild Steel Cubicle For Medium Voltage And High Voltage Metering

a) General

This specification spells out the requirements for fabrication of steel floor mounted metering cubicle for the mounting of meters and accessories commonly installed for the purpose of medium voltage and high voltage metering.

Unless otherwise stated, all materials and accessories used in the fabrication of the cubicle shall be specified in **Appendix 31, 32, 33 & 34.**

The overall dimension shall be as specified in the drawings, but minor alteration to the positions and sizes of the cut - out panels, holes, etc. may be required to be made in the whole or part of the consignment.

b) Construction Details

i Physical Dimensions

The overall dimension of the cubicle shall be as specified in the drawings.
All dimensions are stated in Metric units.
The permissible tolerance shall be ± 4.0 mm.

ii Materials

The cubicle shall be constructed of either plain or electro - plated mild steel sheets of minimum thickness of 1.50 mm.

iii External Construction Details

Provision of a 2 - layer doors. The external door shall be made of mild steel with window opening made of Perspex 4 mm glass - look clear with high resistance to discolouration and weathering (10-year UV guarantee).

The internal door shall be made of mild steel with openings as shown in the diagram to hold a maximum number of six energy meters.

The external door shall be hinged such that they can be operated through an angle of 180°. The internal door shall be hinged inside the cubicle in which it can be opened approximately up to 100°. The doors shall be lockable for security reasons. Operation of the doors shall be through a handle provided with a lock.

In addition, hasp shall be provided for the purpose of locking both doors with padlocks.

Ventilation slits shall be provided as shown. These shall be rendered vermin - proof by fitting brass gauze screens in the interior of the cubicle. The cut - out panels and holes for the mounting of meters shall be provided on the internal door of the cubicle.

The edge of the cutting or drilling shall be rendered smooth.

iv Internal Construction Details

The cubicle shall be constructed for floor mounting. A base frame on which the cubicle sites shall be provided as shown in **Appendix 31** for a 1 or 2 feeder cubicle and **Appendix 32** for a 3 feeder cubicle. Holes in the frame shall be provided for the passage of four floor mounted studs to which the cubicle can be anchored.

Mild steel cross bars of at least 35 mm x 2 mm with 4 mm diameter holes spaced evenly apart shall be provided for anchoring bunched conductors. Alternatively, mild steel slotted angles shall be provided, and this is preferable. These cross bars shall form the framework of the cubicle.

v Painting And Finishing

The cubicle shall be treated to prevent corrosion by rust. This can be achieved either by using electro - plated mild steel sheets or by painting the mild steel metal surface with zinc - based anti-corrosive paint.

The interior surface shall be painted with matt white paint.

The base frame shall be black in colour.

vi Sealing facilities (For CT's And VT's Not Installed In TNB's Control Area)

Facility for sealing all metering wires connections & incoming cables at consumer's high voltage switchboard shall be provided by the consumer. Should there be any deviation from TNB's requirement, the Electrical Consultant Engineer should consult a TNB Metering Unit engineer for confirmation and approval.

5.0 APPENDICES

BORANG MAKLUMAT AWAL PERJANGKAAN BESAR

TENAGA NASIONAL BERHAD	Jenis Dokumen: Aras III **REKOD KUALITI**	Tajuk Prosidur: **BORANG MAKLUMAT AWAL PERJANGKAAN BESAR**	Nombor Dokumen: **MTER-750-21-QR-02**
	NAIB PRESIDEN **BAHAGIAN PEMBAHAGIAN** **PERKHIDMATAN PERJANGKAAN**	Mukasurat: 1 of 1 Edisi: 2 Tarikh: 1 Jun 2010	

Stesen		Tarikh	
Kod Cas Kerja		No. Akaun (Jika ada)	

Pengguna

Nama			
Alamat Tapak Bangunan			
Jenis Perusahaan		Tarif	

	Jurutera Perunding	Kontraktor Elektrik
Nama		
Alamat		
Telefon		
Faksimili		

Butir - butir Bekalan Masuk Pengguna Yang Dicadangkan

i. Kehendak Maksima		v. Nisbah Alatubah Arus	
ii. Jumlah Beban kVA		Kelas IEC / BS	
iii. Bilangan Pembekal		Tatah VA	
iv. Voltan Sesalur Masuk TNB		vi. Tarikh Beban Dijadualkan	
vii. Lain - lain Maklumat			

Makluman - makluman berikut hendaklah dikepilkan:

a. Gambarajah skematik (”single line schematic diagram”) untuk panduan perjangkaan menunjukkan sesalur TNB, suisgiar & busbar utama pengguna, alatubah - alatubah arus dan voltan perjangkaan dan seumpamanya (termasuk sistem bekalan tersedia sekiranya berkaitan)

b. Pelan “layout” menunjukkan ukuran - ukuran jarak, perkakas - perkakas elektrik, kios jangka, parit kabel dan seumpamanya

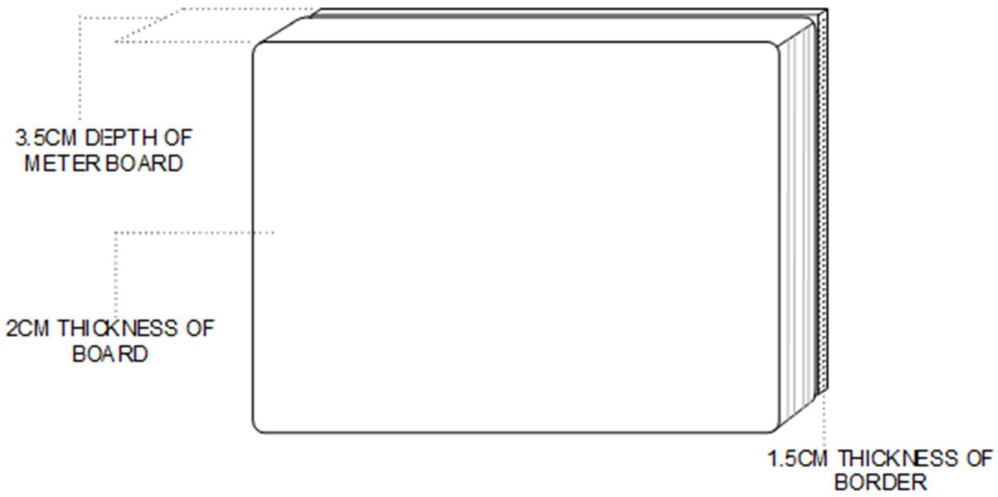
Disediakan Oleh:

(Wakil Pengguna)

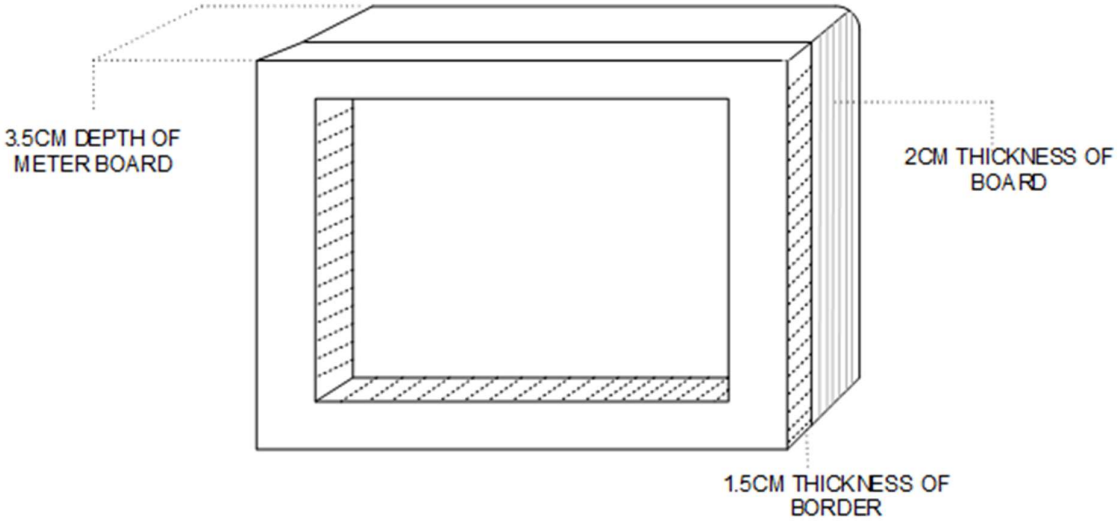
Diperakukan Oleh:

(Ketua Jurutera/Jurutera Asset Planning TNB)

SINGLE PHASE METER BOARD (HARDWOOD)



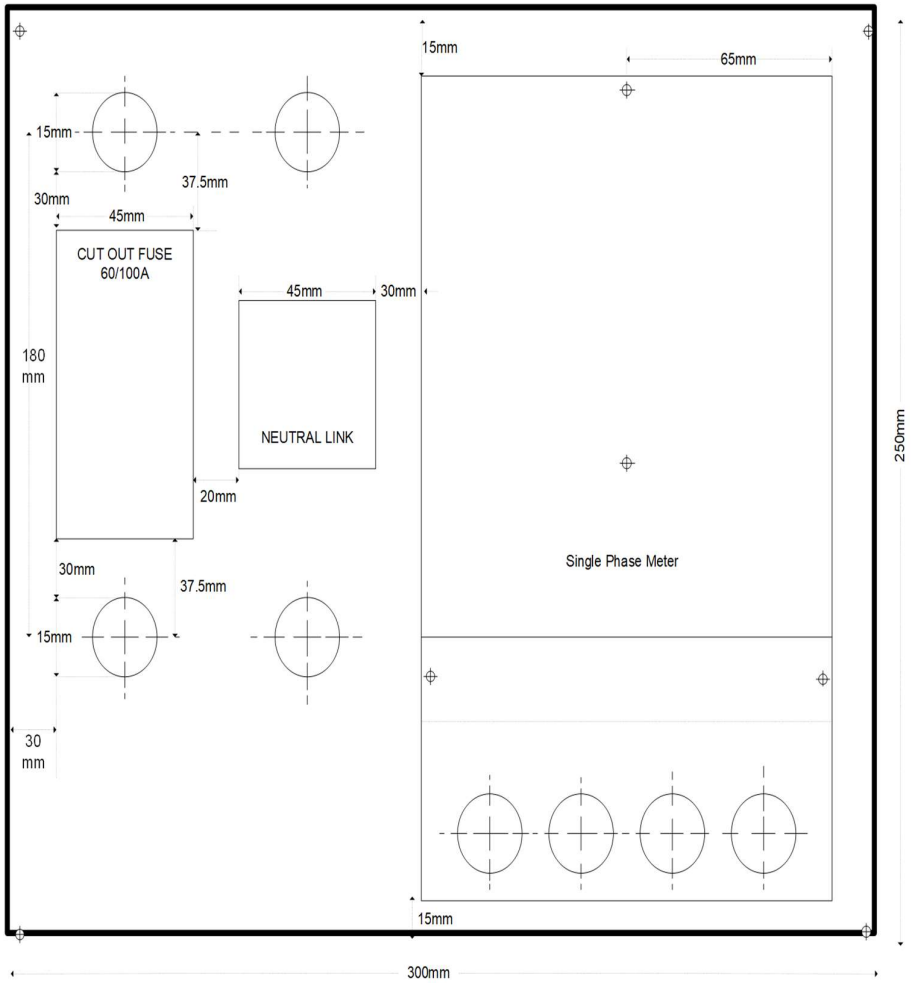
FRONT VIEW OF STANDARD METER BOARD (HARD WOOD)

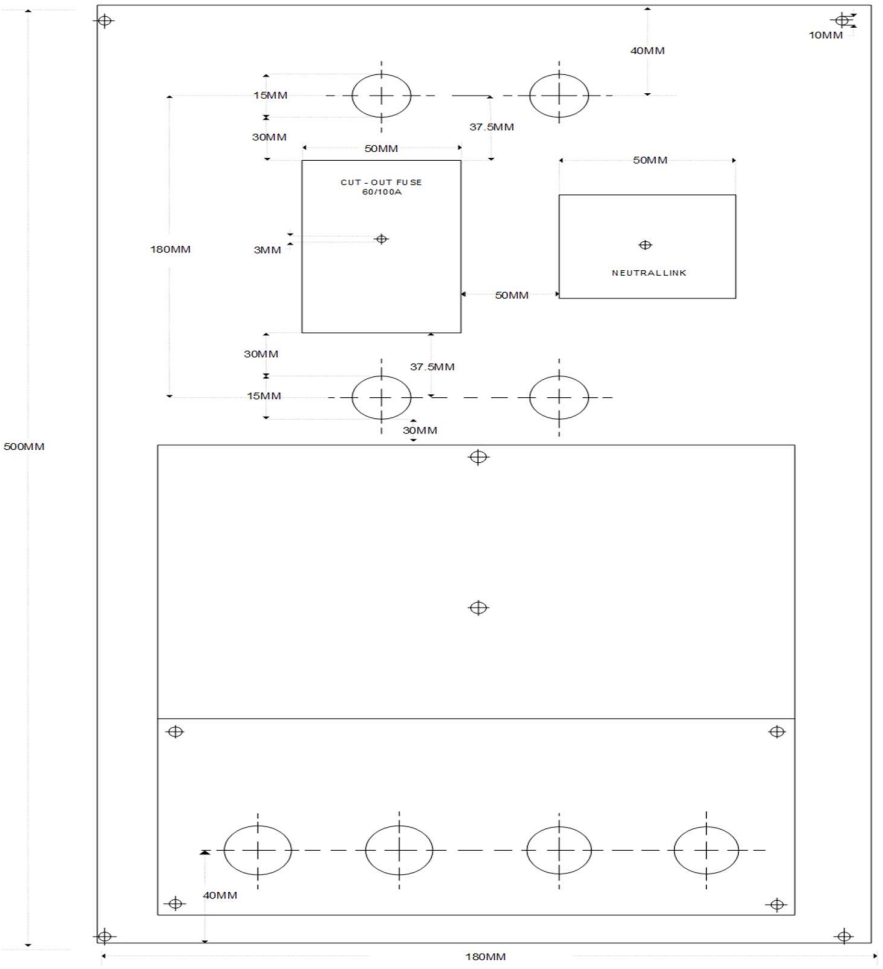


BACK VIEW OF STANDARD METER BOARD (HARD WOOD)

APPENDIX 10

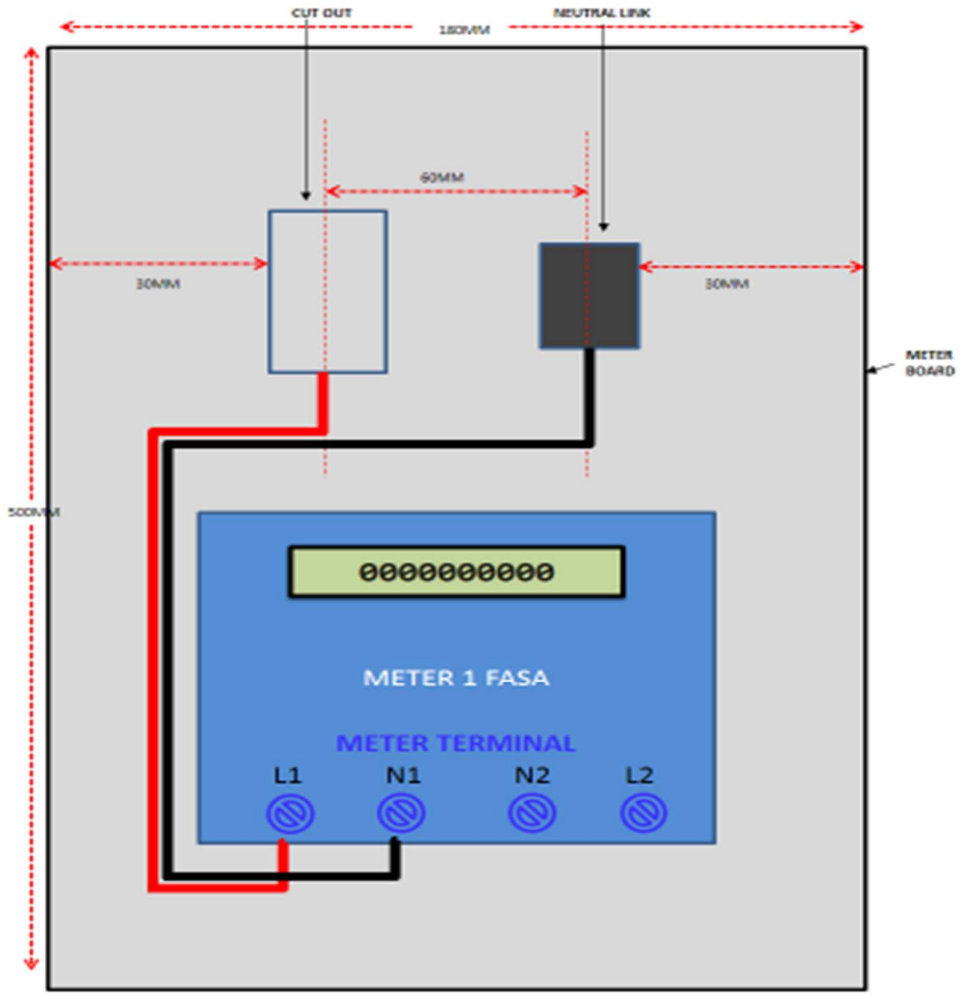
SINGLE PHASE METERING ARRANGEMENT





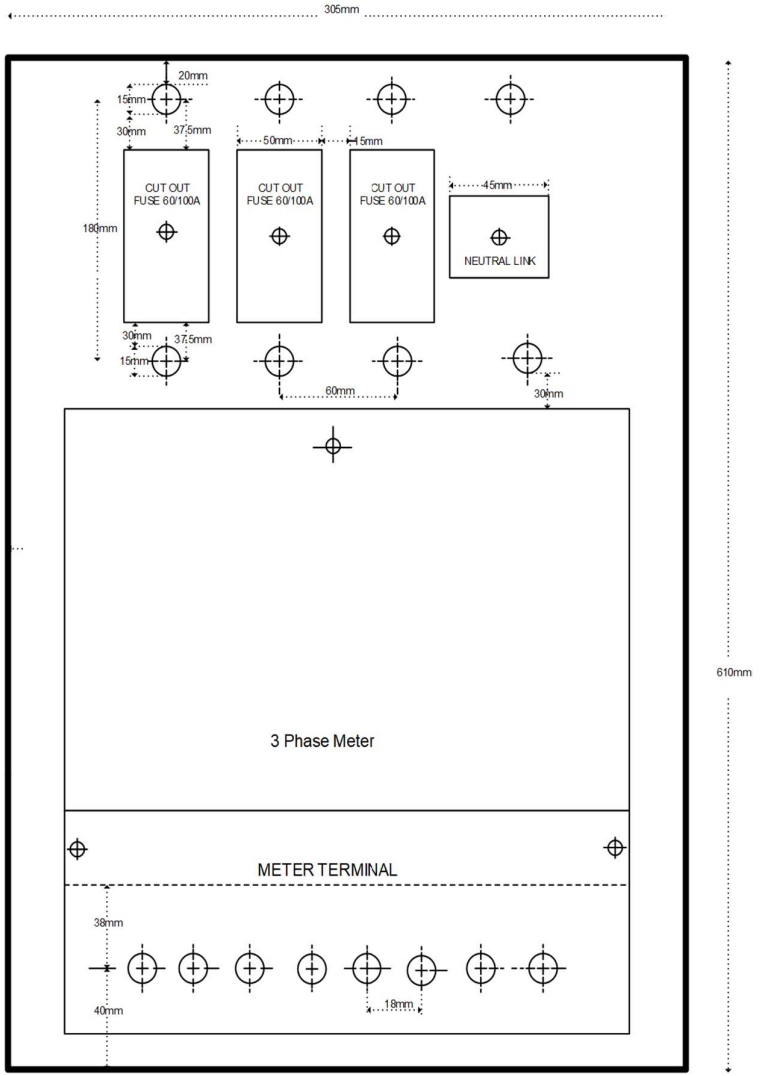
APPENDIX 11

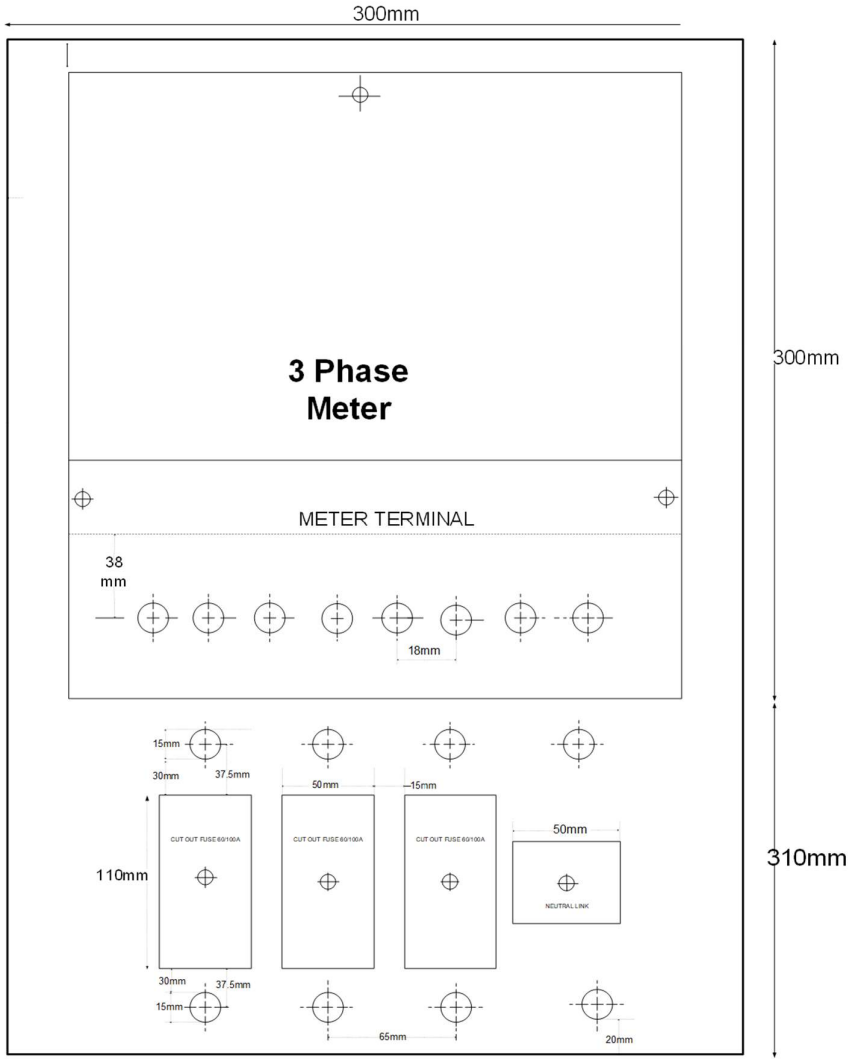
SINGLE PHASE SURFACE WIRING



APPENDIX 12

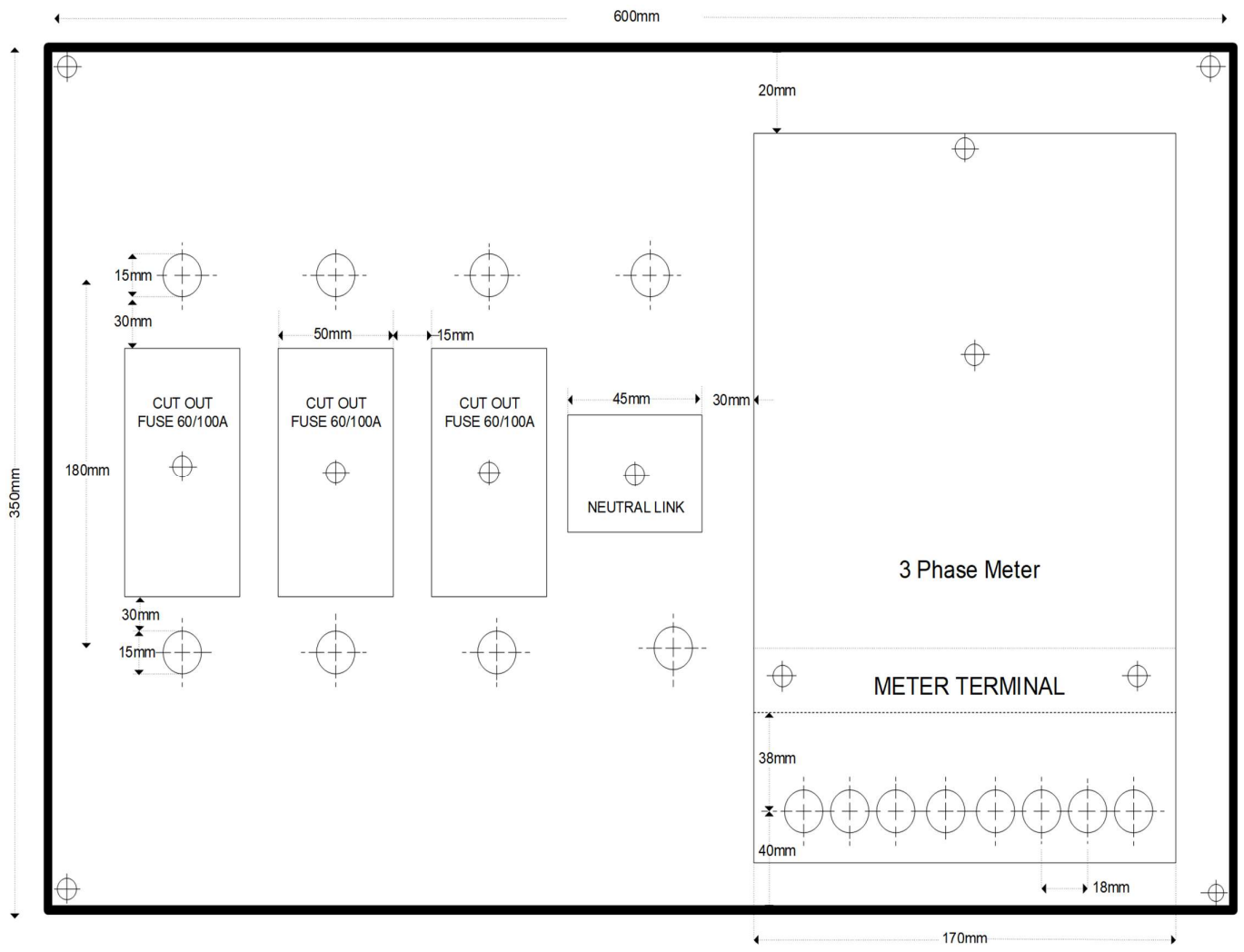
THREE PHASE METERING ARRANGEMENT





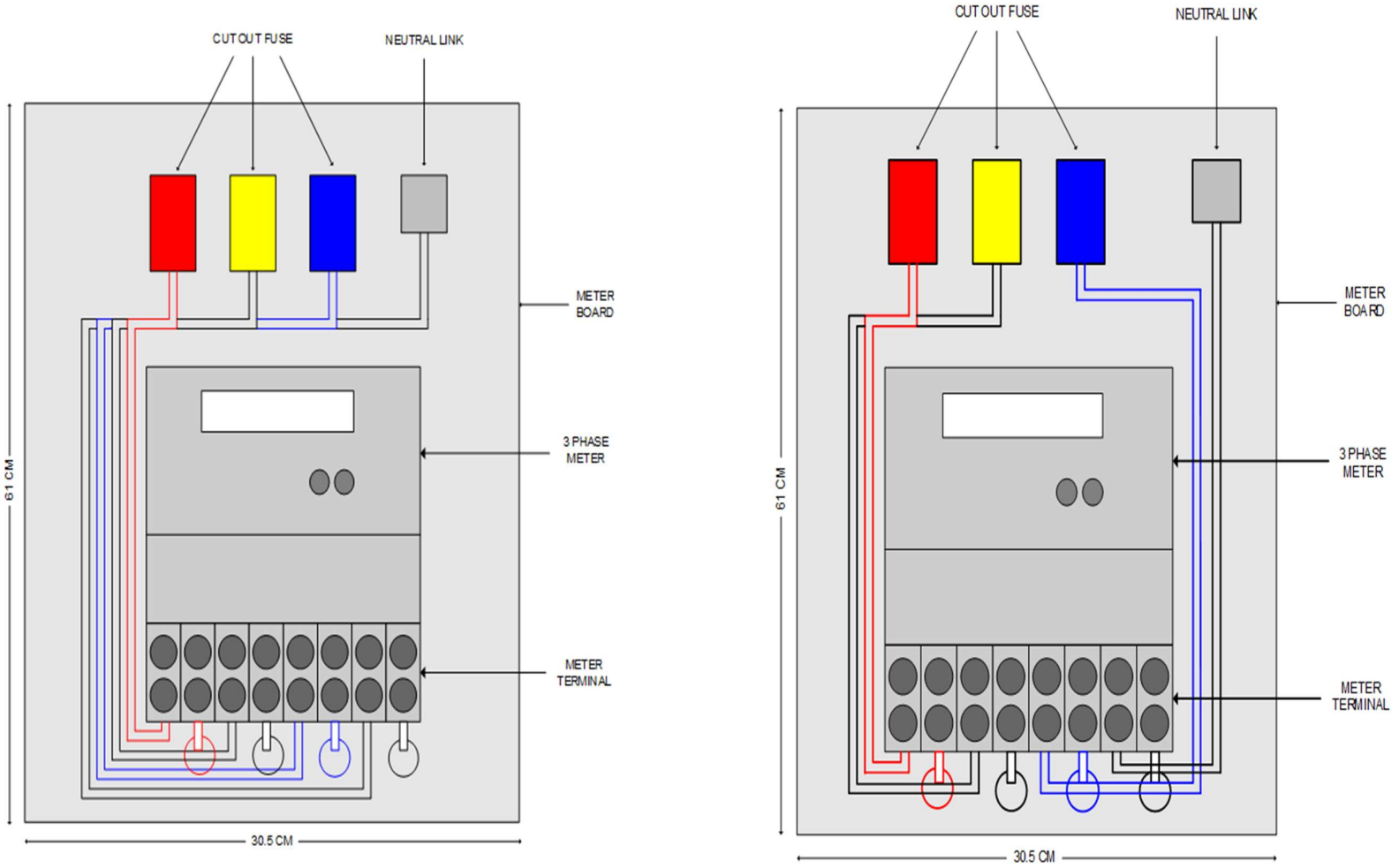
APPENDIX 13

THREE PHASE METERING ARRANGEMENT



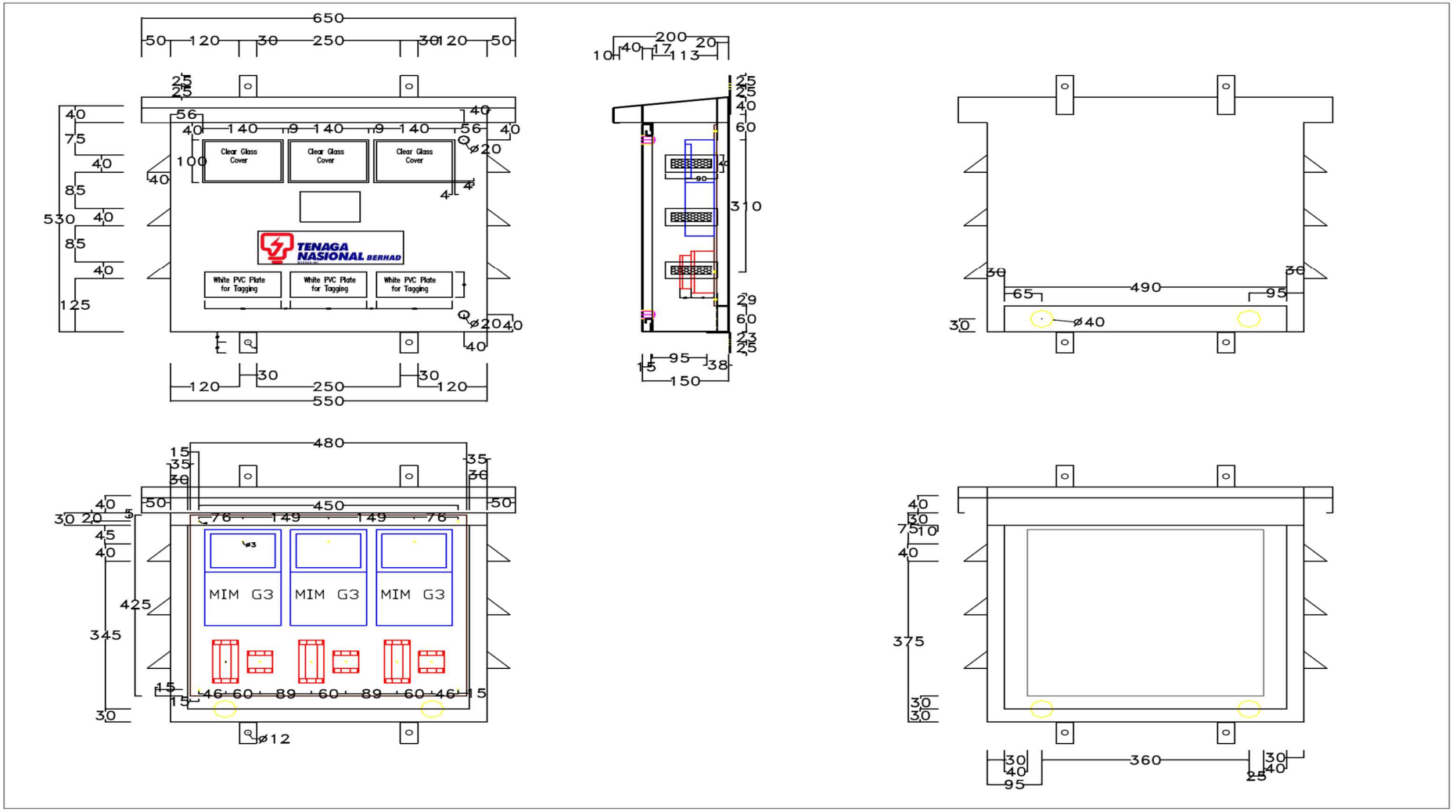
APPENDIX 14

THREE PHASE SURFACE WIRING

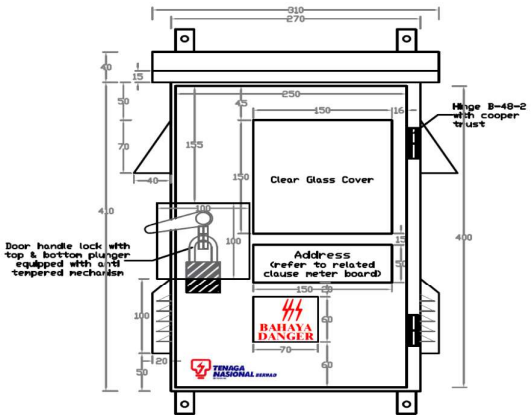


APPENDIX 15

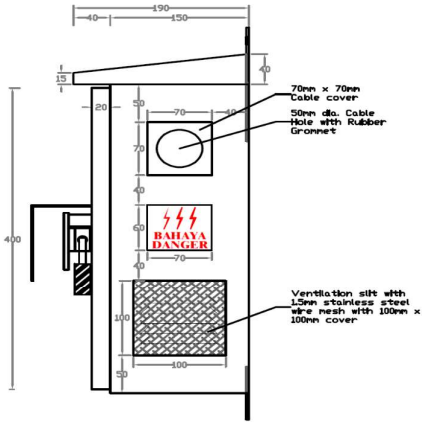
SINGLE PHASE METERING PANEL (MULTIPLE METER)



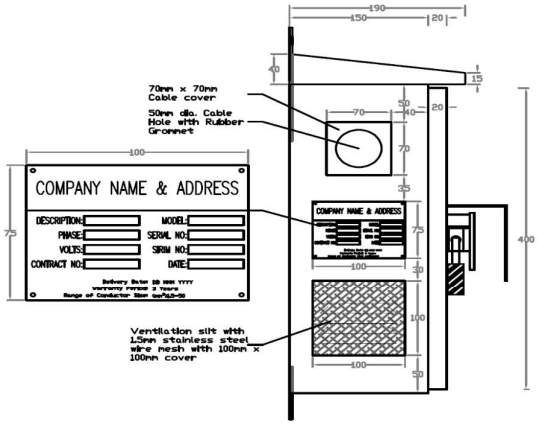
SINGLE PHASE METERING PANEL (POLE MOUNTED)



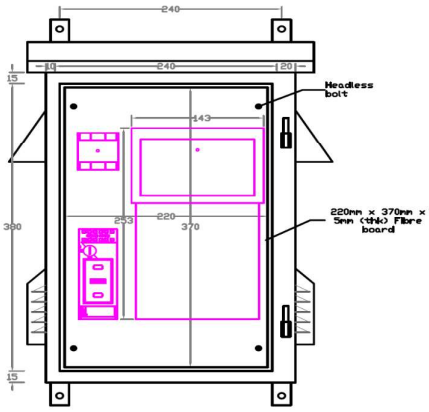
Front View



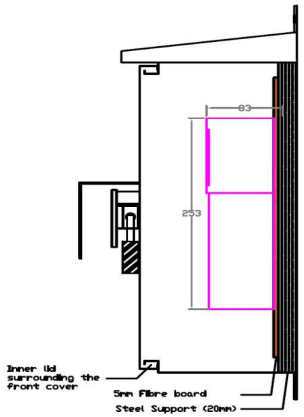
Right View



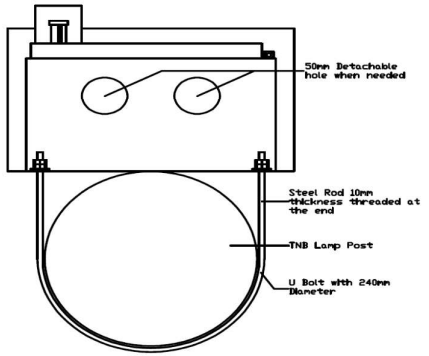
Left View



Inside View



X-Section



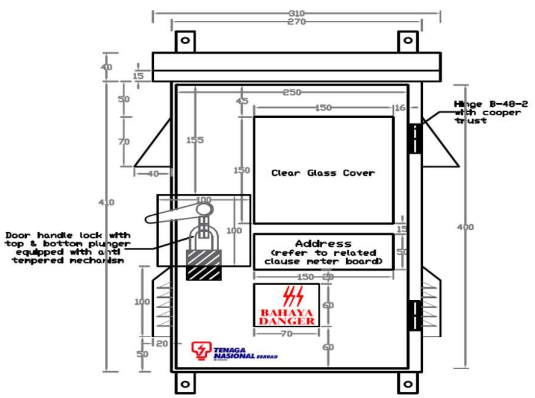
Bottom View

TENAGA NASIONAL BERHAD (200866-W)

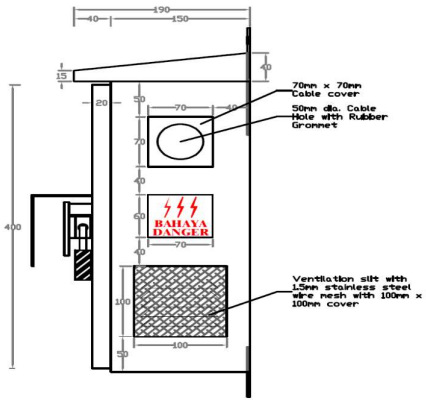
Drawn By:	IderisSh	01.05.2024
Check By:	Izhwan	01.05.2024
Approve By:	W.M.Balyan	01.05.2024
Title:	Whole Current Single Phase Outdoor Pole Mounted	
Drwg No:	SPN/ODPM-01/24	
Date:	01.05.2024	Rev: 1

APPENDIX 17

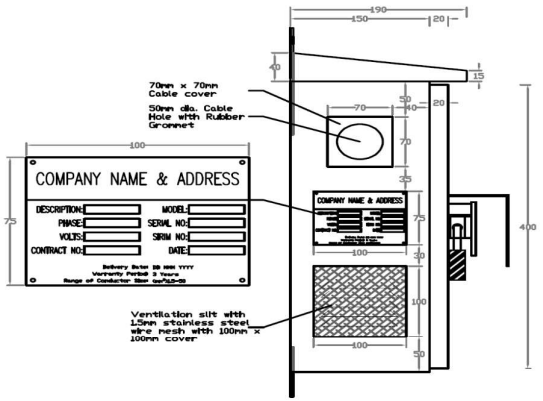
SINGLE PHASE METERING PANEL (WALL MOUNTED)



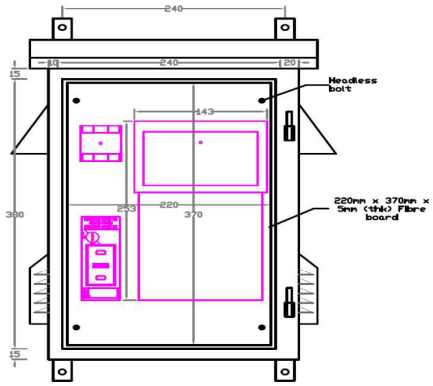
Front View



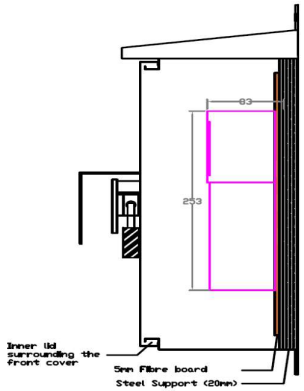
Right View



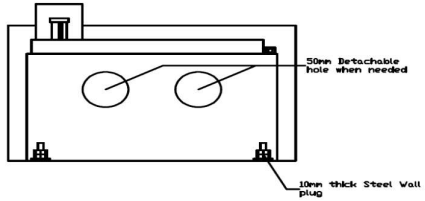
Left View



Inside View



X-Section



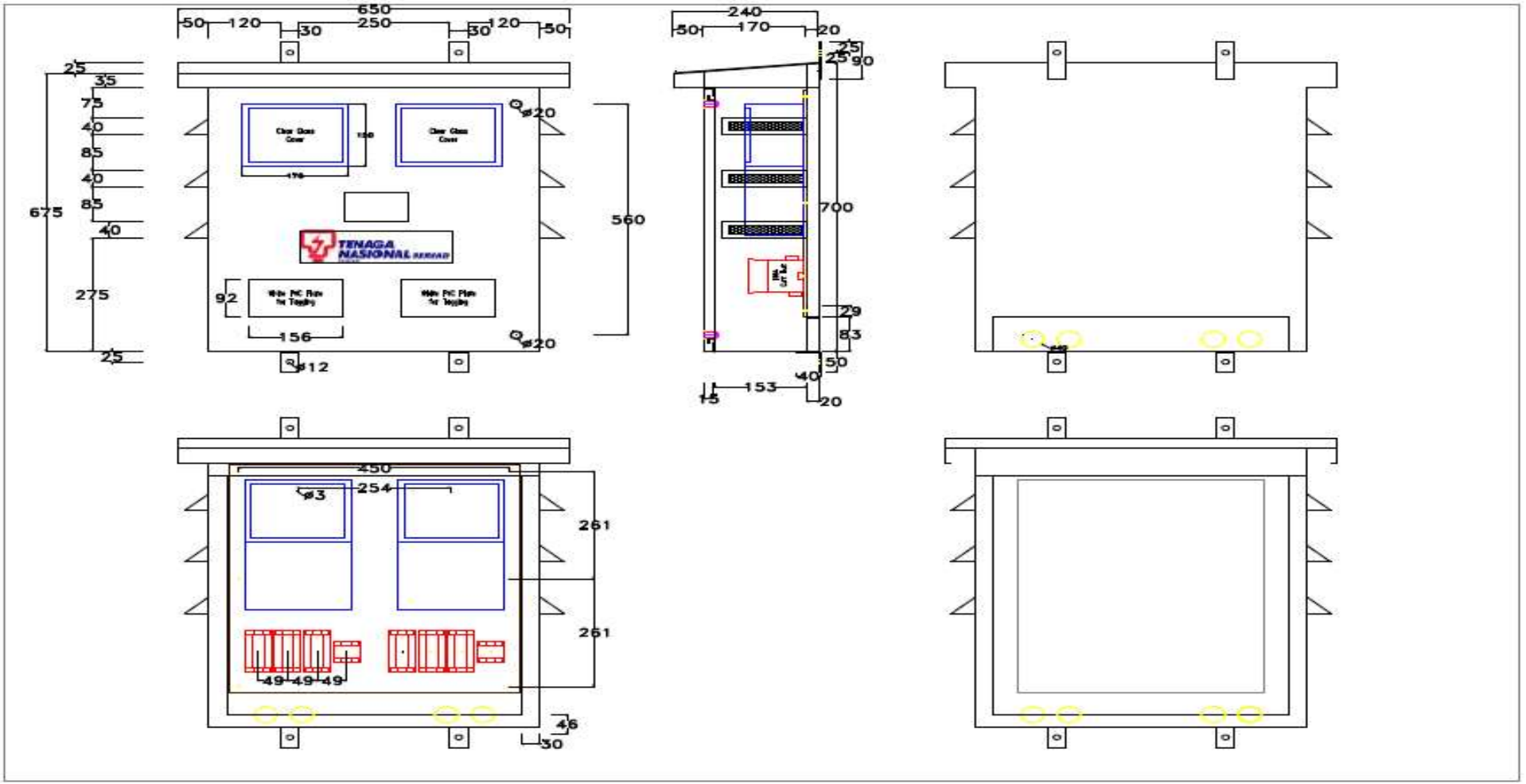
Bottom View

TENAGA NASIONAL BERHAD (200866-W)

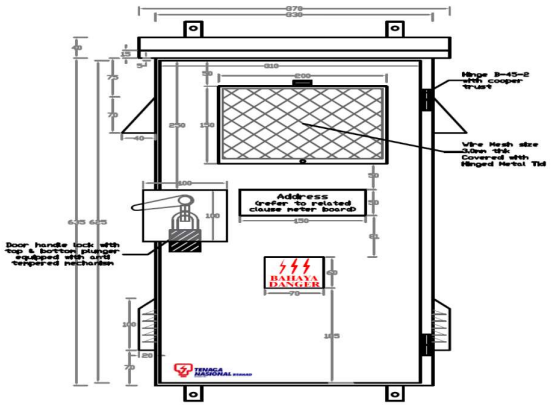
Drawn By:	IderisSh	01.05.2024
Check By:	Izhwan	01.05.2024
Approve By:	W.M.Balyan	01.05.2024
Title:	Whole Current Single Phase Outdoor Wall Mounted	
Drwg No:	SPN/ODWM-01/24	
Date:	01.05.2024	Rev: 1

APPENDIX 18

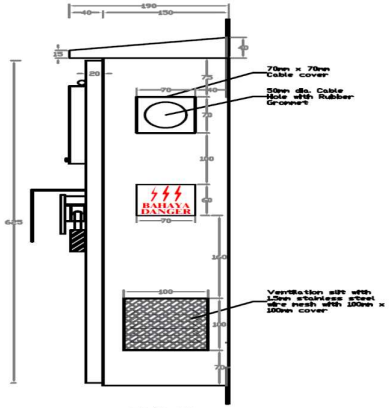
THREE PHASE METERING PANEL (MULTIPLE METER)



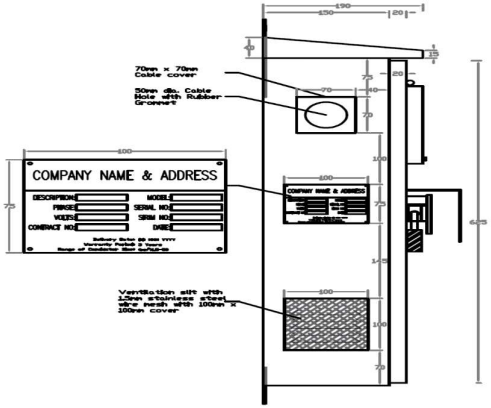
THREE PHASE METERING (POLE MOUNTED)



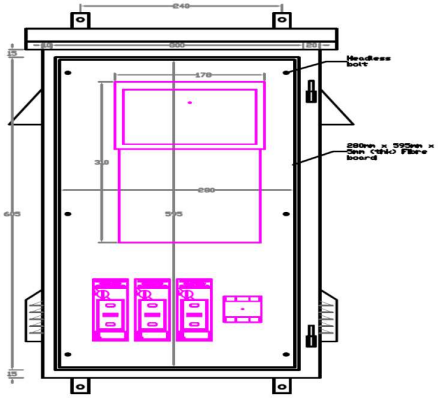
Front View



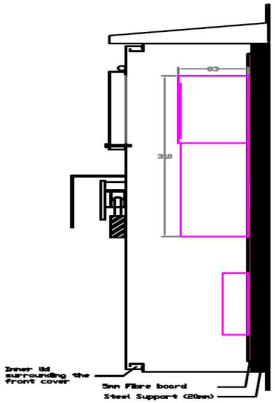
Right View



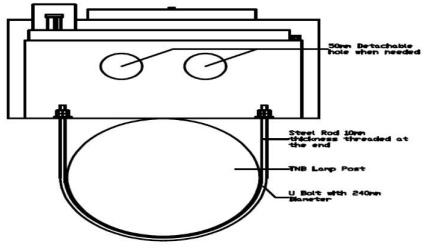
Left View



Inside View



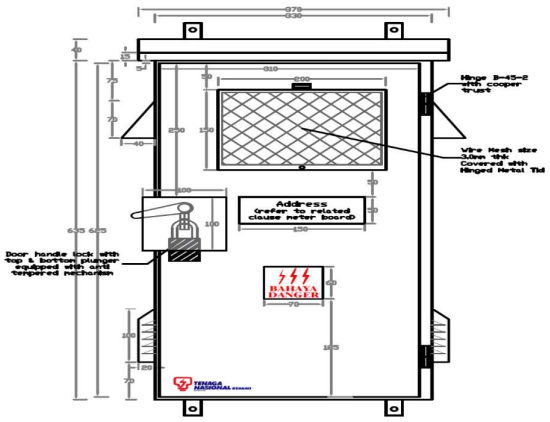
X-Section



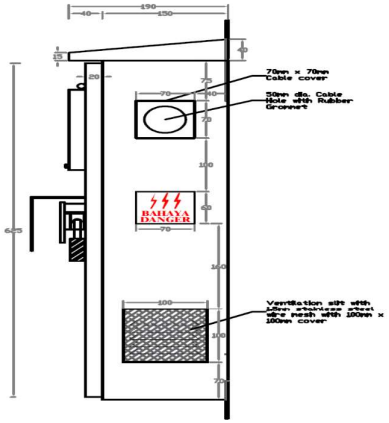
Bottom View

TENAGA NASIONAL BERHAD		
Drawn By:	IderisSh	01.05.2024
Check By:	Izhwan	01.05.2024
Approve By:	W.M.Balyan	01.05.2024
Title:	Whole Current Three Phase Outdoor Pole Mounted	
Drwg No:	TPN/ODPM-01/24	
Date:	01.05.2024	Rev: 1

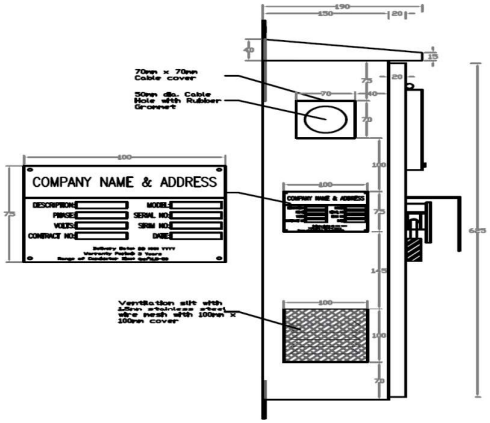
THREE PHASE METER PANEL (WALL MOUNTED)



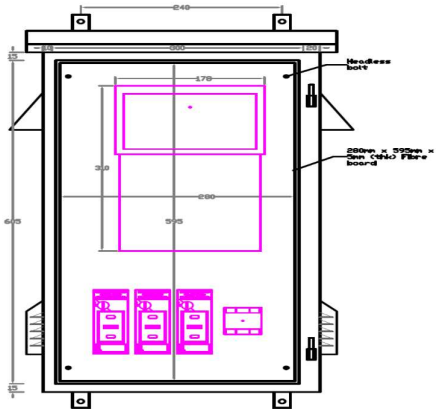
Front View



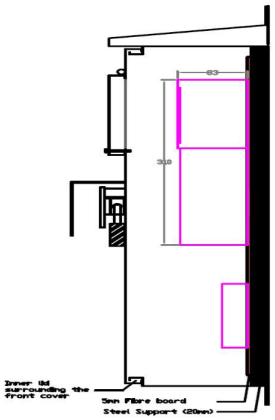
Right View



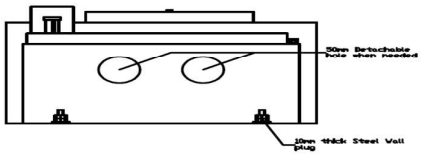
Left View



Inside View



X-Section

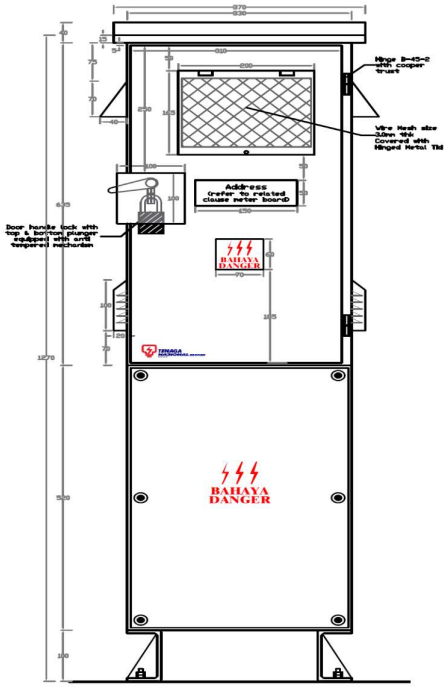


Bottom View

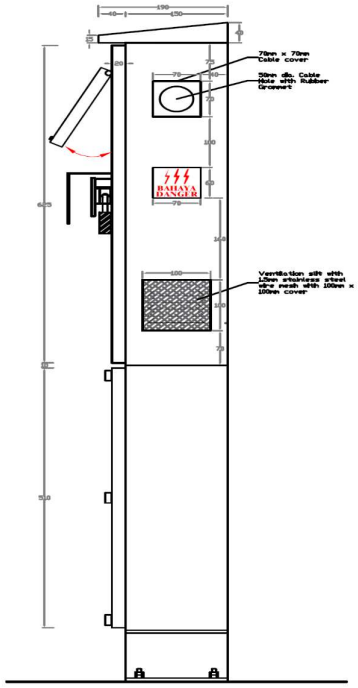
TENAGA NASIONAL BERHAD

Drawn By:	IderisSh	01.05.2024
Check By:	Izhwan	01.05.2024
Approve By:	W.M.Balyan	01.05.2024
Title:	Whole Current Three Phase Outdoor Wall Mounted	
Drwg No:	TPN/ODWM-01/24	
Date:	01.05.2024	Rev: 1

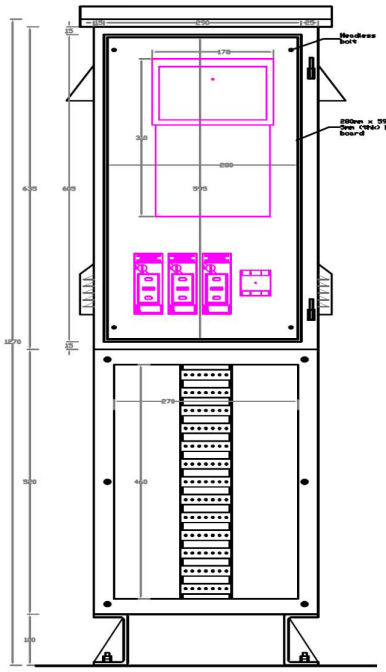
THREE PHASE METERING PANEL GROUND MOUNTED (WITHOUT BUSBAR)



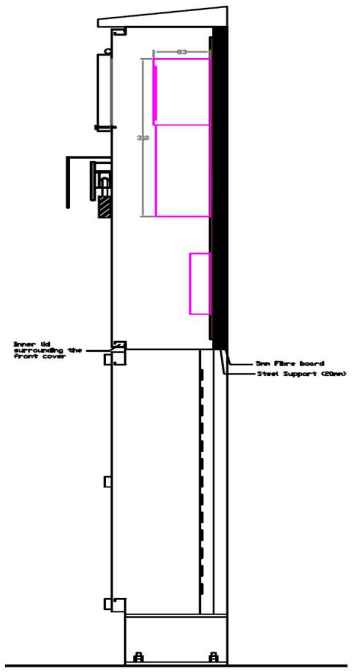
Front View



Right View



Inside View

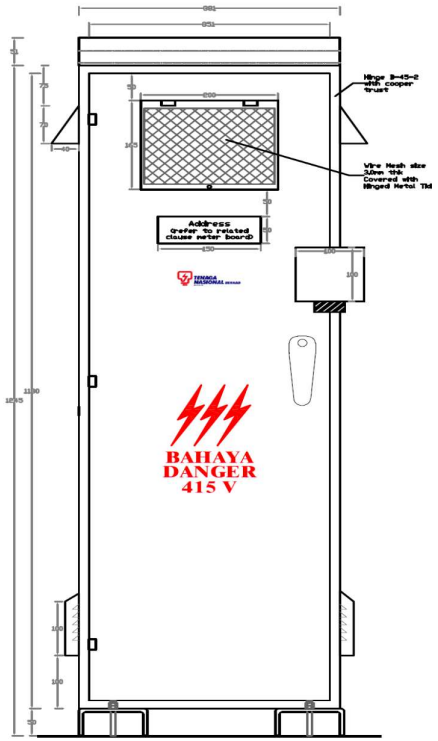


X-Section

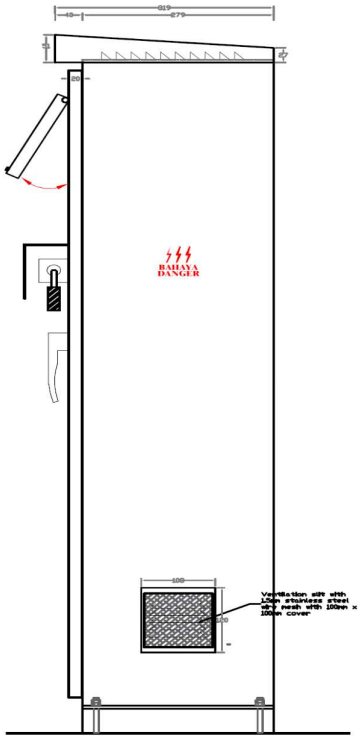
TENAGA NASIONAL BERHAD			
Drawn By:	IderisSh	01.05.2024	
Check By:	Izhwan	01.05.2024	
Approve By:	W.M.Balyan	01.05.2024	
Title:	Whole Current Three Phase Outdoor Ground Mounted		
Drwg No:	TPN/ODGM-01/24		
Date:	01.05.2024	Rev:	1

APPENDIX 22

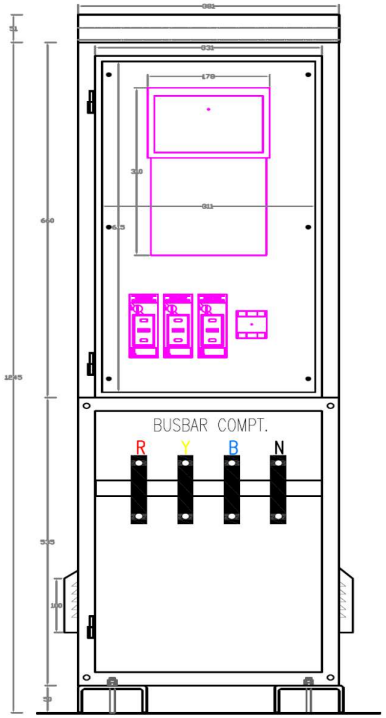
THREE PHASE METERING PANEL GROUND MOUNTED (WITH BUSBAR)



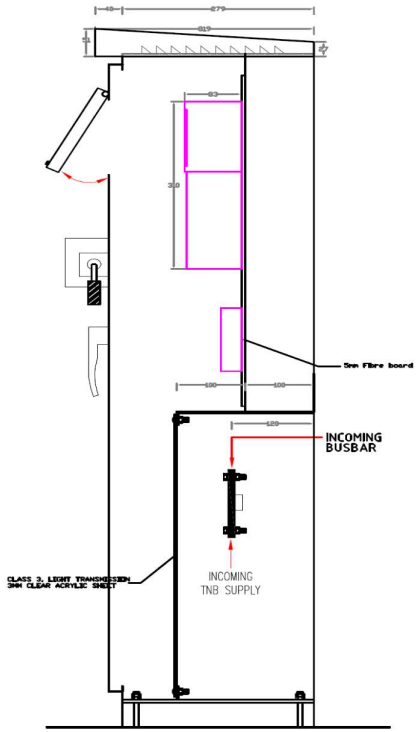
Front View



Right View



Inside View



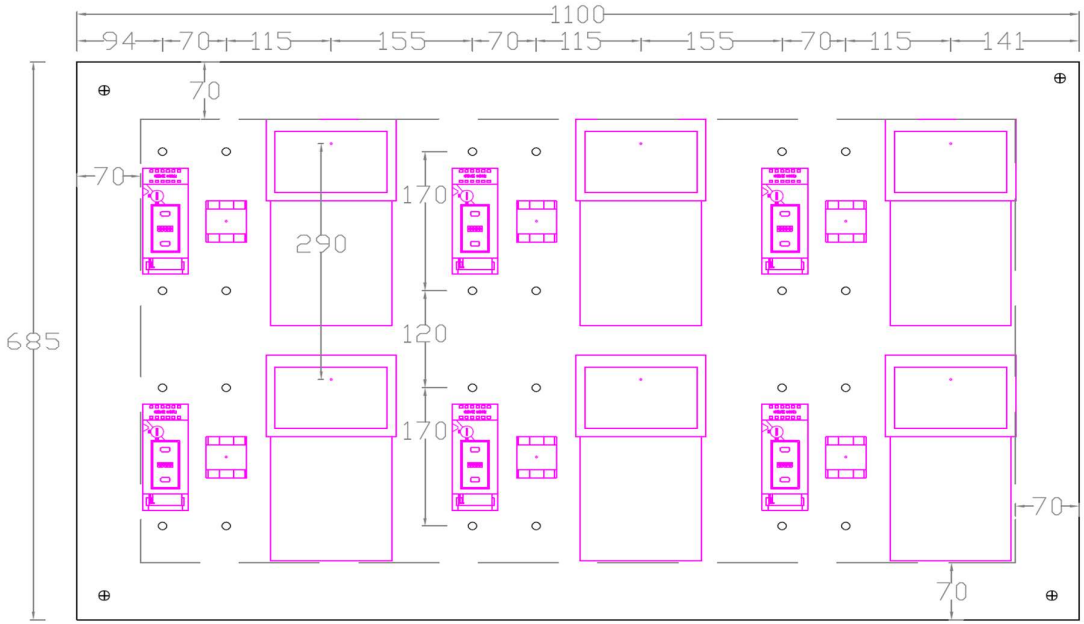
X-Section

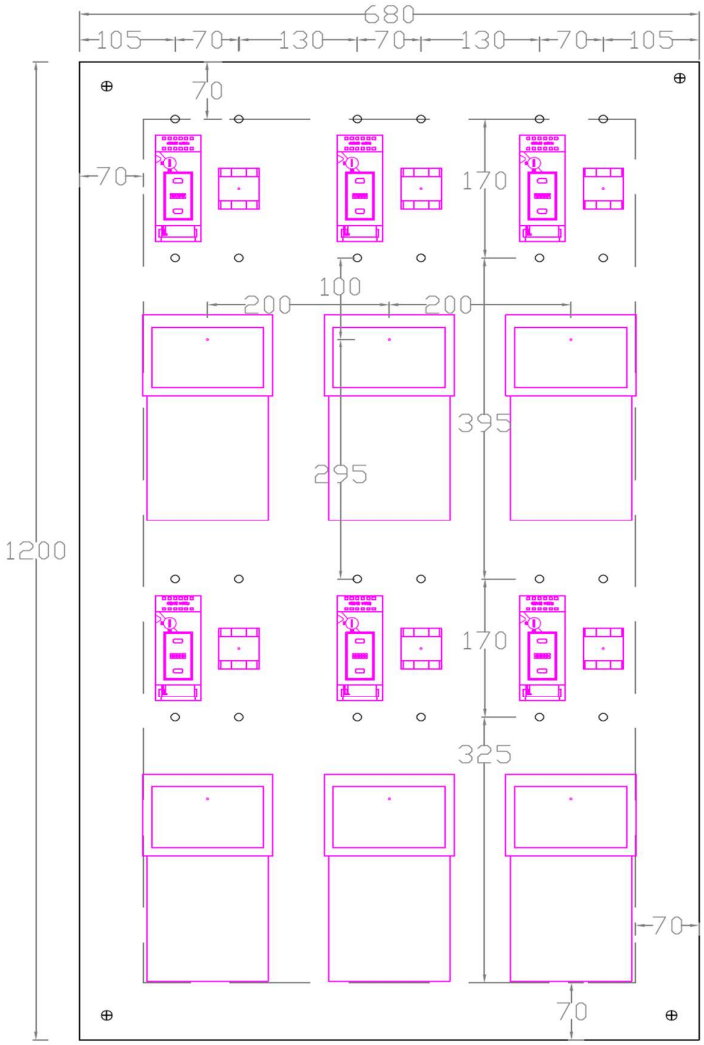
TENAGA NASIONAL BERHAD

Drawn By:	IderisSh	01.05.2024
Check By:	Izhwan	01.05.2024
Approve By:	W.M.Balyan	01.05.2024
Title:	Whole Current Three Phase Outdoor Ground Mounted c/w Busbar	
Drwg No:	TPN/ODGMB-01/24	
Date:	01.05.2024	Rev: 1

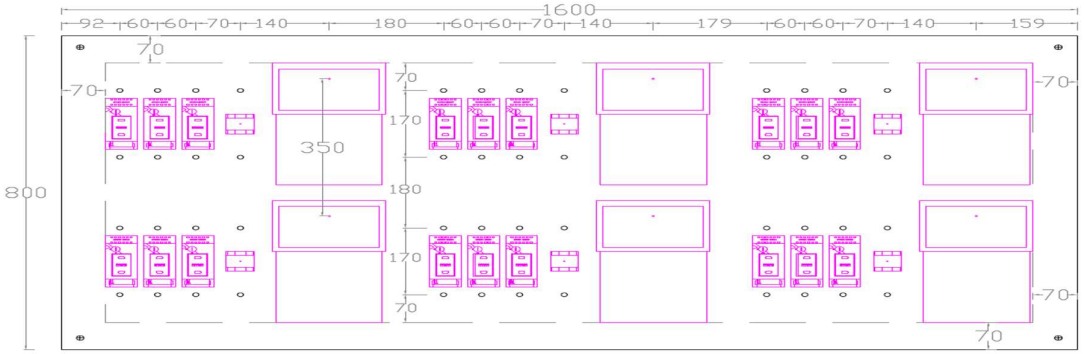
APPENDIX 23

SINGLE PHASE METERING GROUP METERING

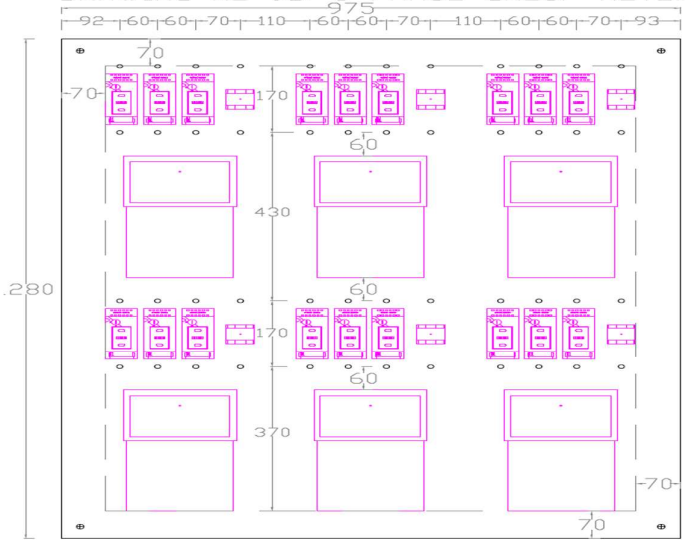


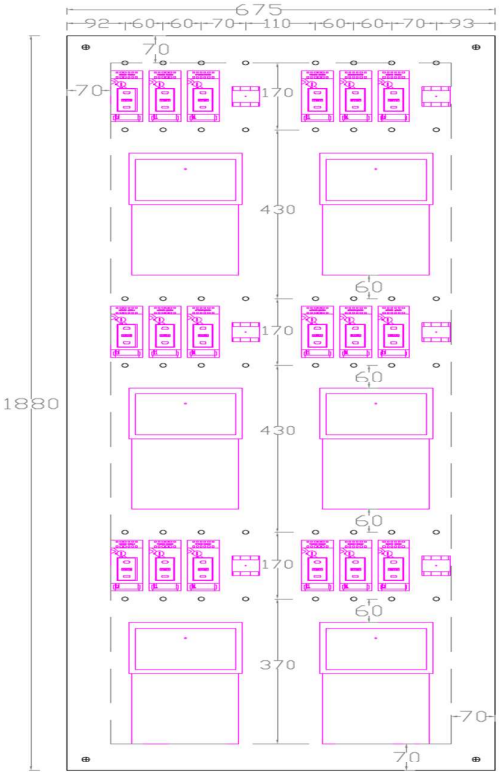


THREE PHASE GROUP METERING



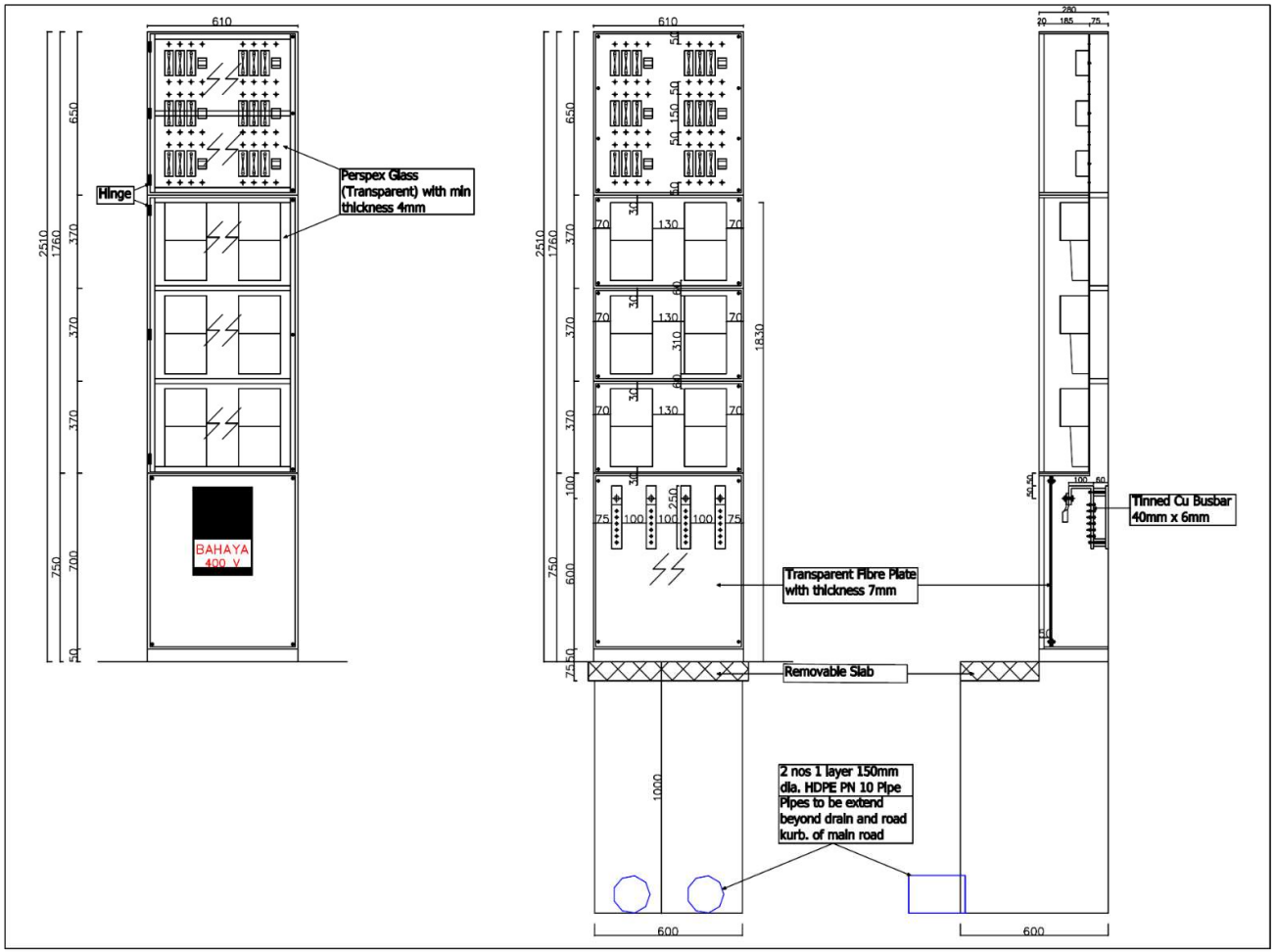
DRAWING NO 9D: 3 PHASE GROUP METERING





APPENDIX 25A

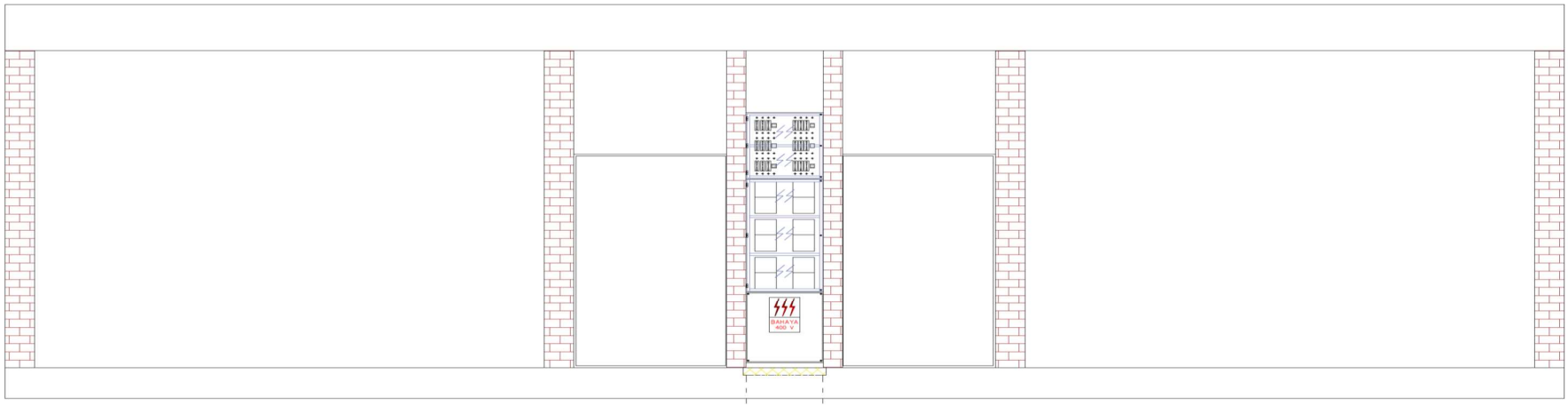
SHOP LOTS METER PANEL



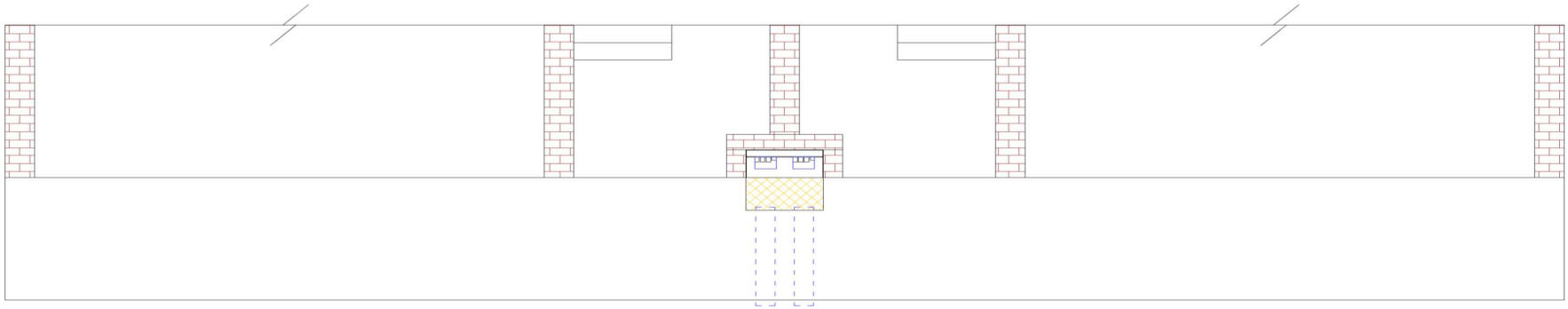
APPENDIX 25B

SHOP LOTS METER PANEL

ELEVATION FRON VIEW

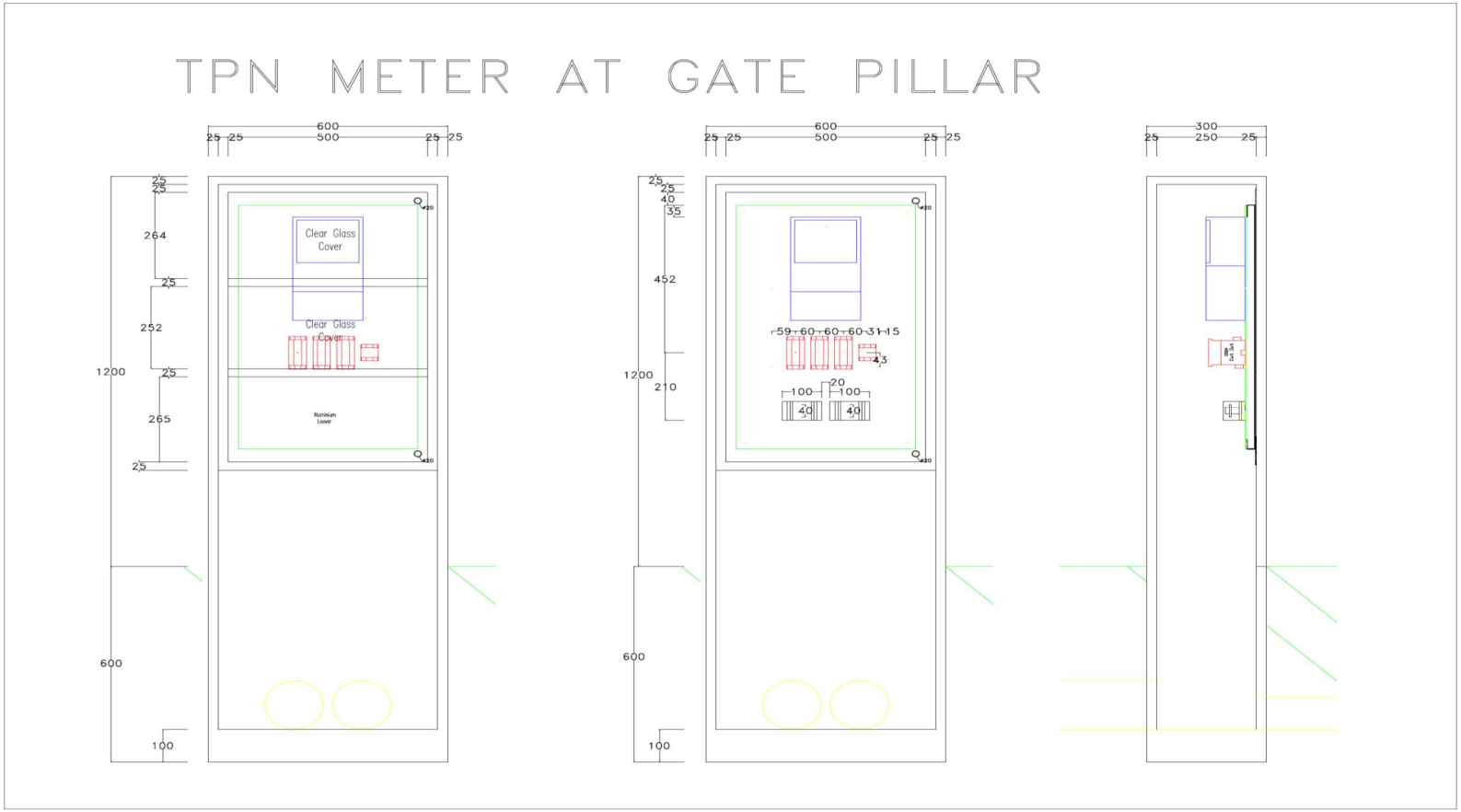


PLAN VIEW



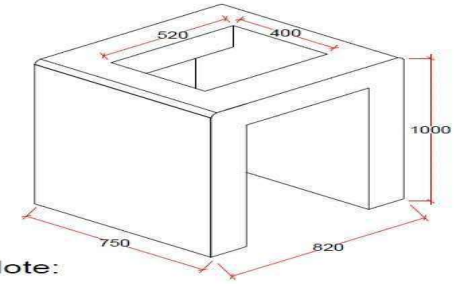
APPENDIX 26

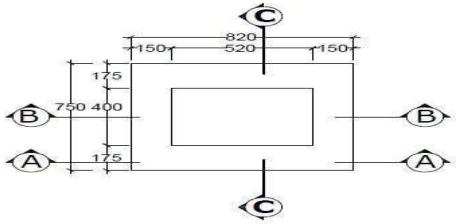
METER AT GATE PILLAR



APPENDIX 27

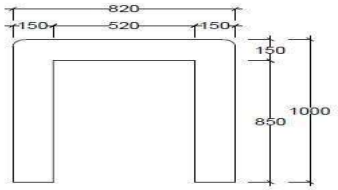
PLINTH GROUND MOUNTED METERING KIOSK LVCT



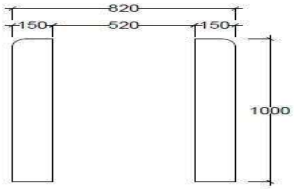


Note:

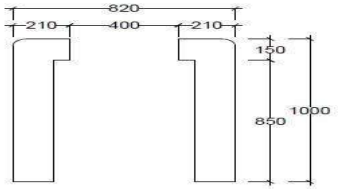
1. All Concrete mix shall be Grade 30
2. Piling as and where necessary
3. All plinth dimension to be constructed with actual equipment dimension on site
4. Sand filling to be done after installation of equipment (meter kiosk)



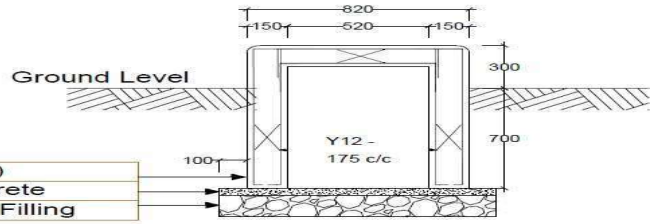
KERATAN A-A



KERATAN B-B



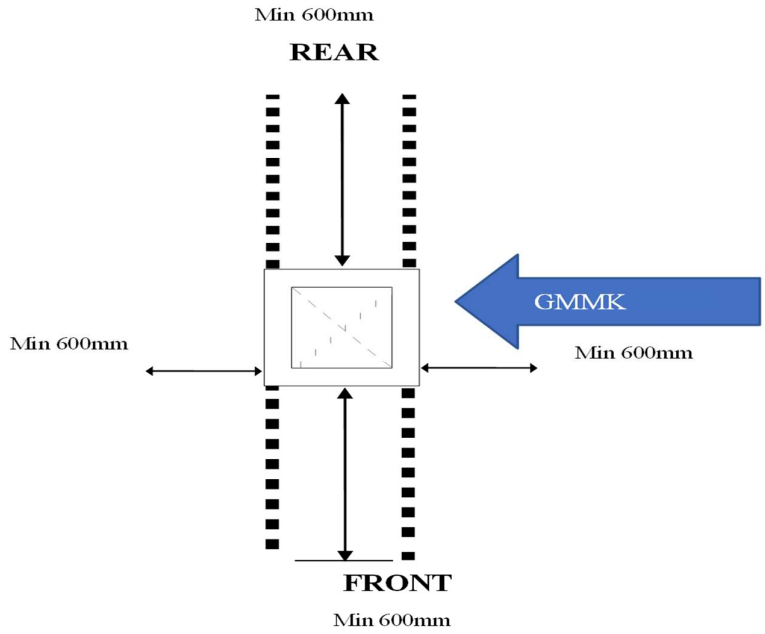
KERATAN C-C



New GMMK Design
Drwg. 24987, 10032022

APPENDIX 28

CLEARANCE GROUND MOUNTED METERING KIOSK LVCT

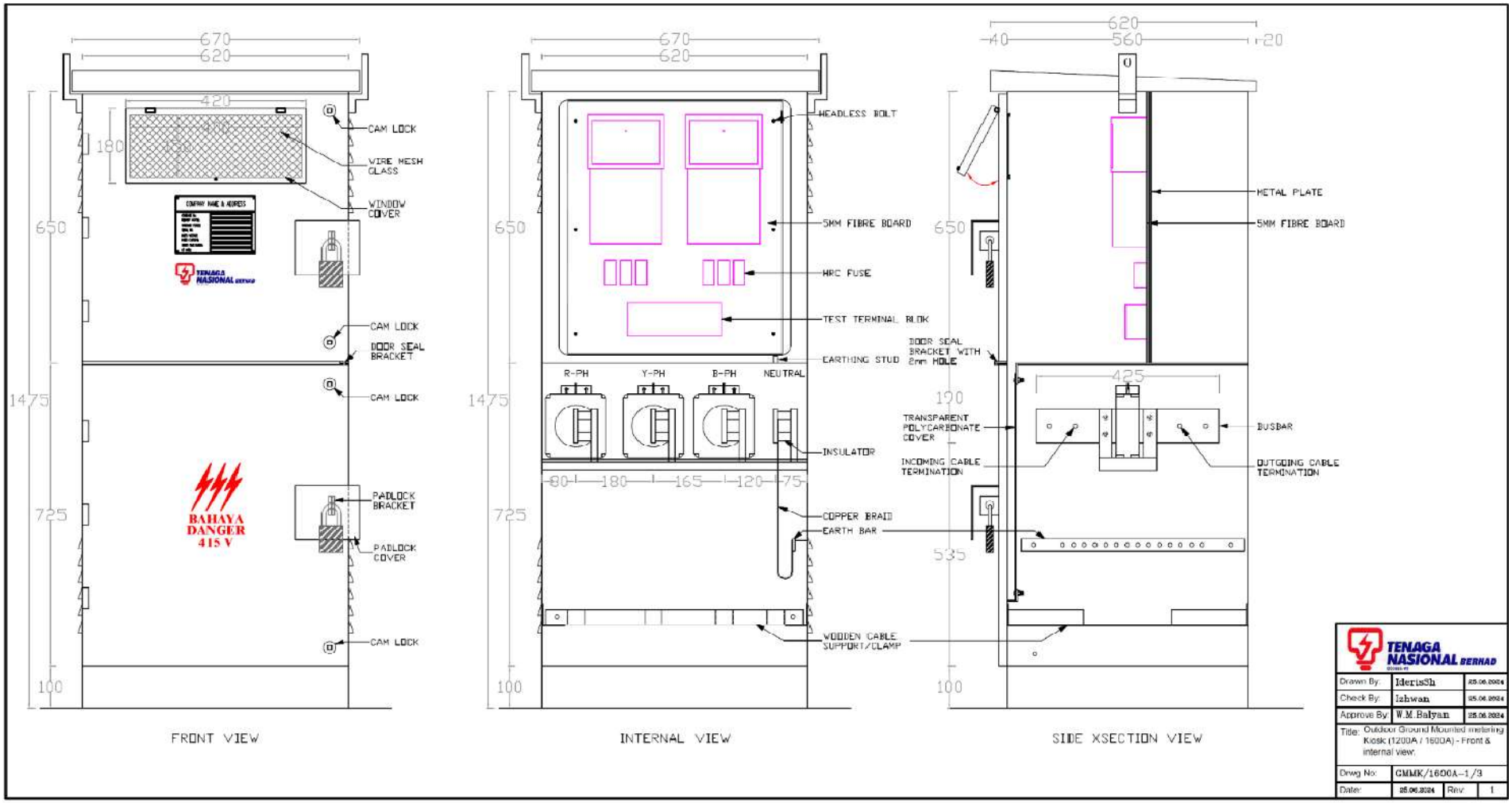


NOTE

- A minimum clearance of 600mm shall be maintained for the rear and front side.
- Minimum clearance 600mm for left or right

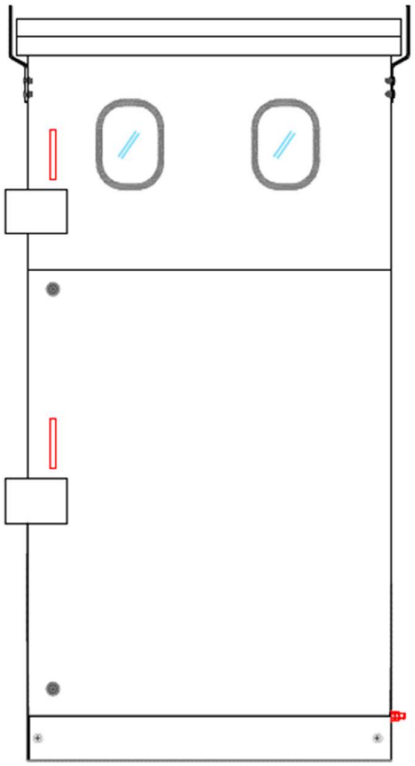
APPENDIX 29

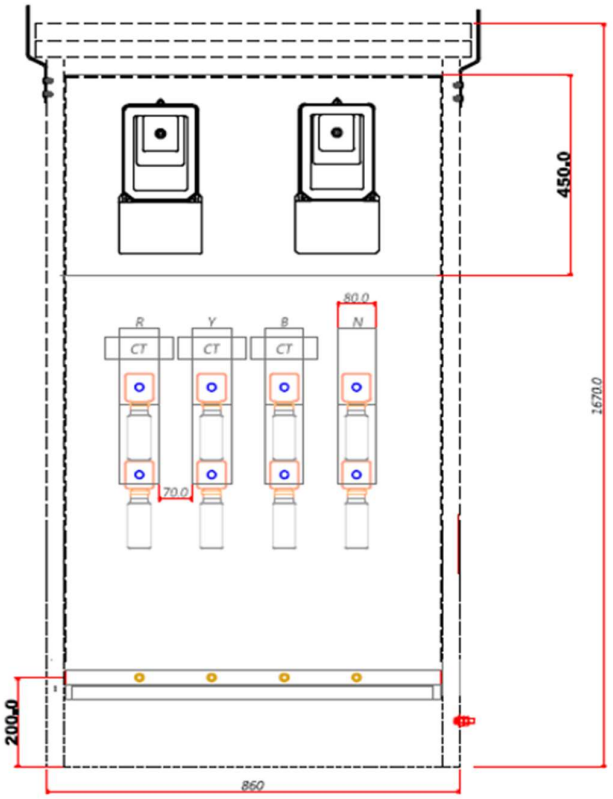
GROUND MOUNTED METERING KIOSK LVCT



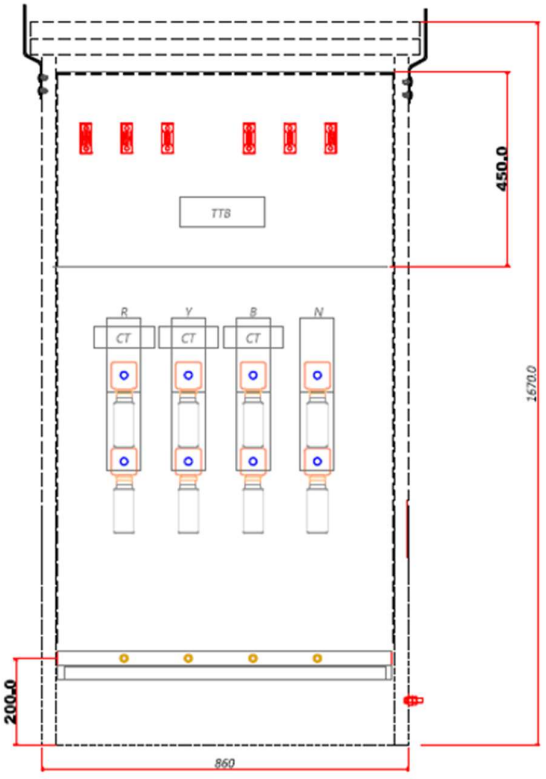
APPENDIX 30

GROUND MOUNTER METERING KIOSK LVCT

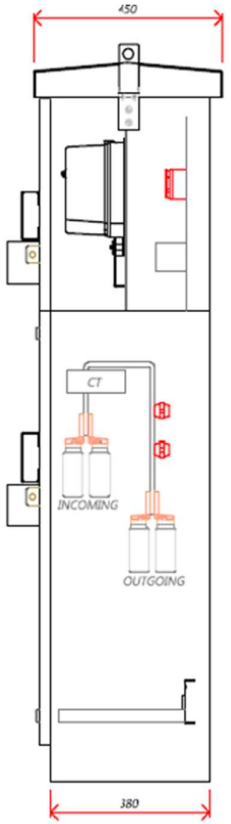




FRONT VIEW w/o DOOR (OPENED)



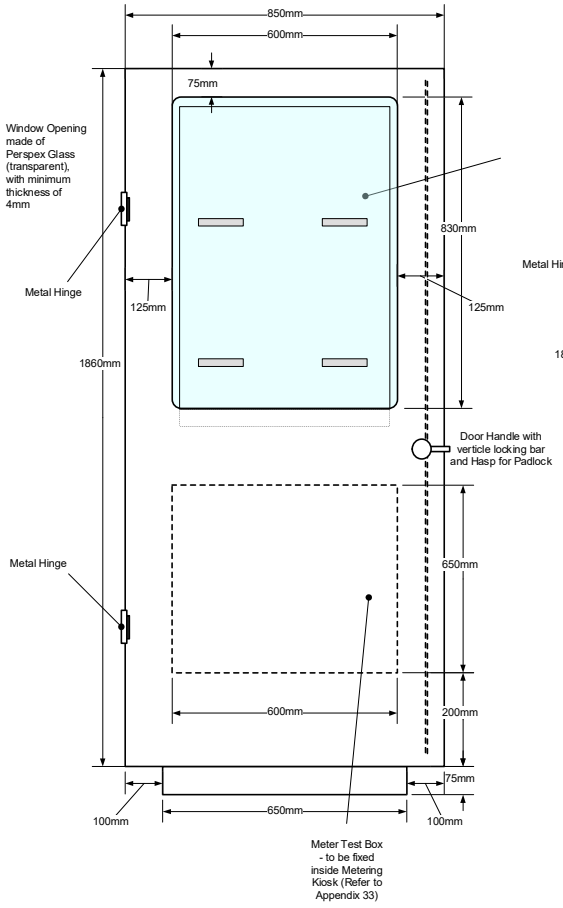
FRONT VIEW w/o DOOR (OPENED)



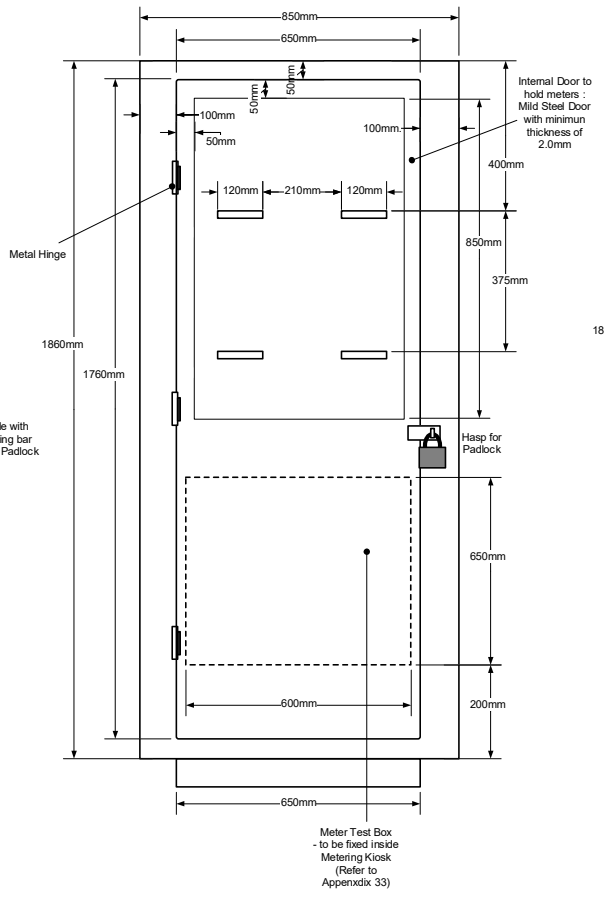
SECTION AA
(INTERNAL VIEW)

MV/HV, 2 FEEDER METERING KIOSK (FRONT VIEW AND SIDE VIEW)

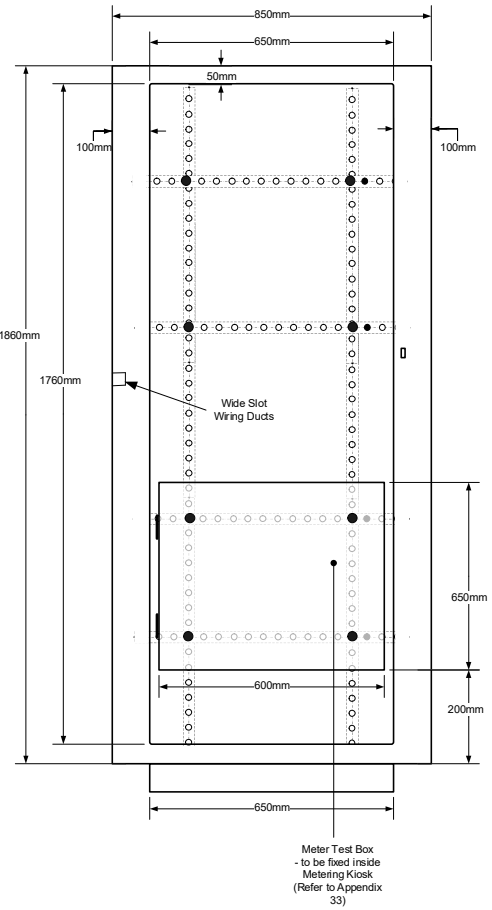
FRONT VIEW EXTERNAL



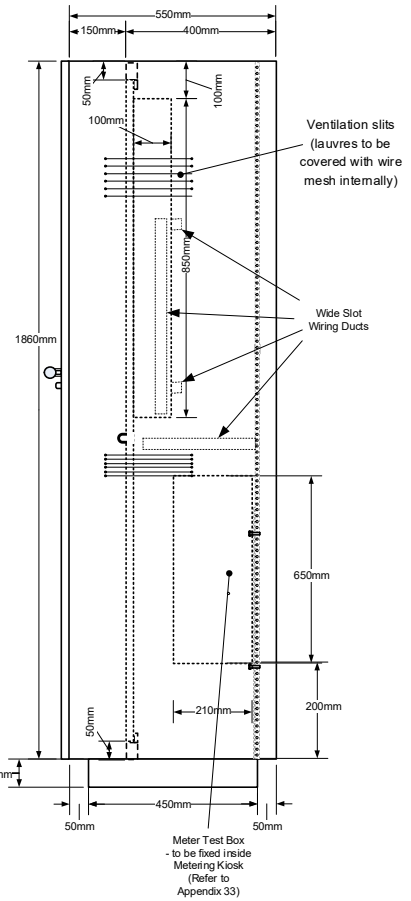
FRONT VIEW INTERNAL



FRONT VIEW KIOSK BASE

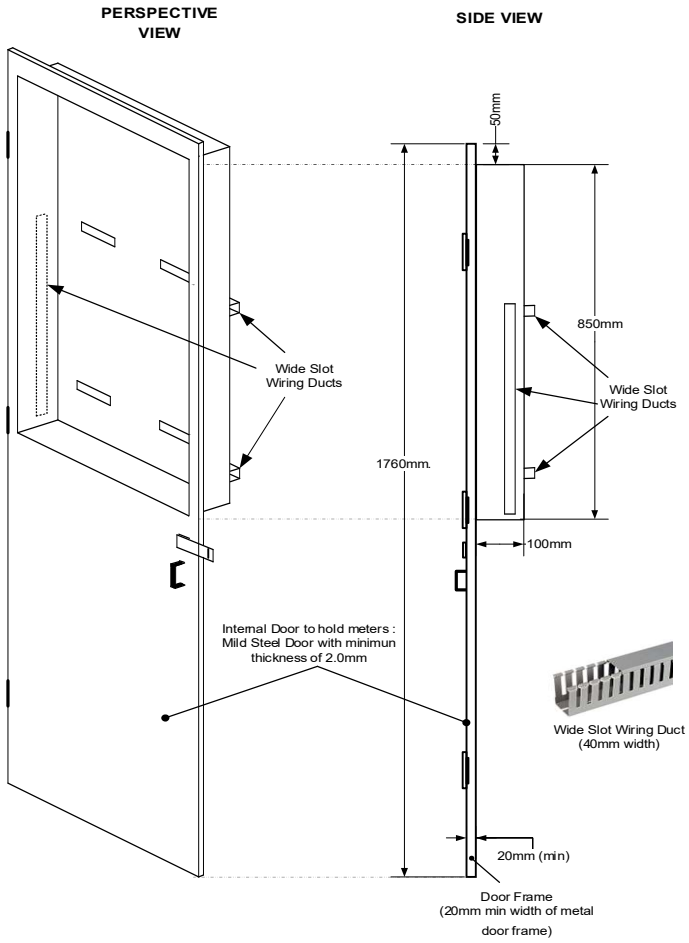


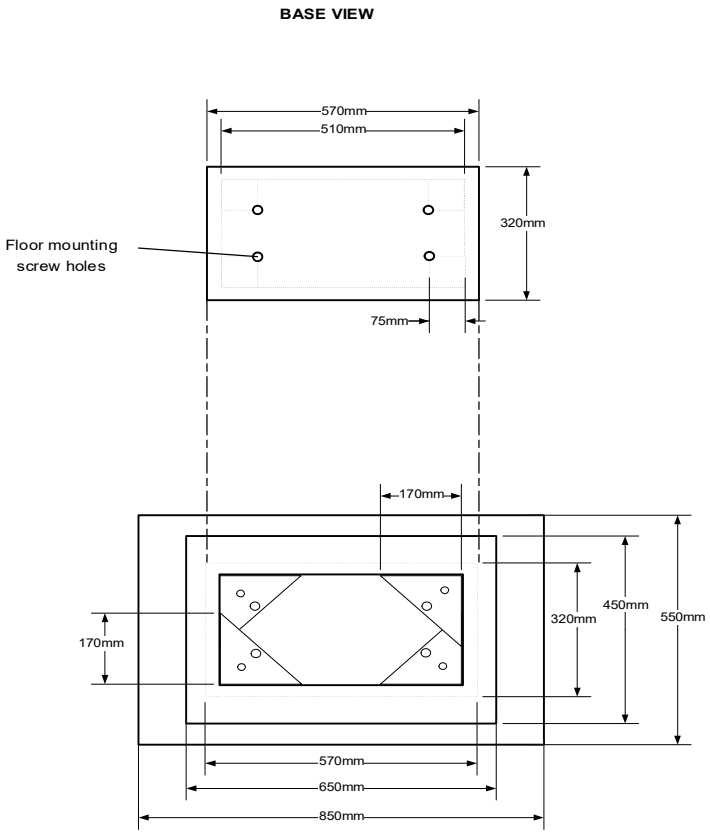
SIDE VIEW



APPENDIX 31

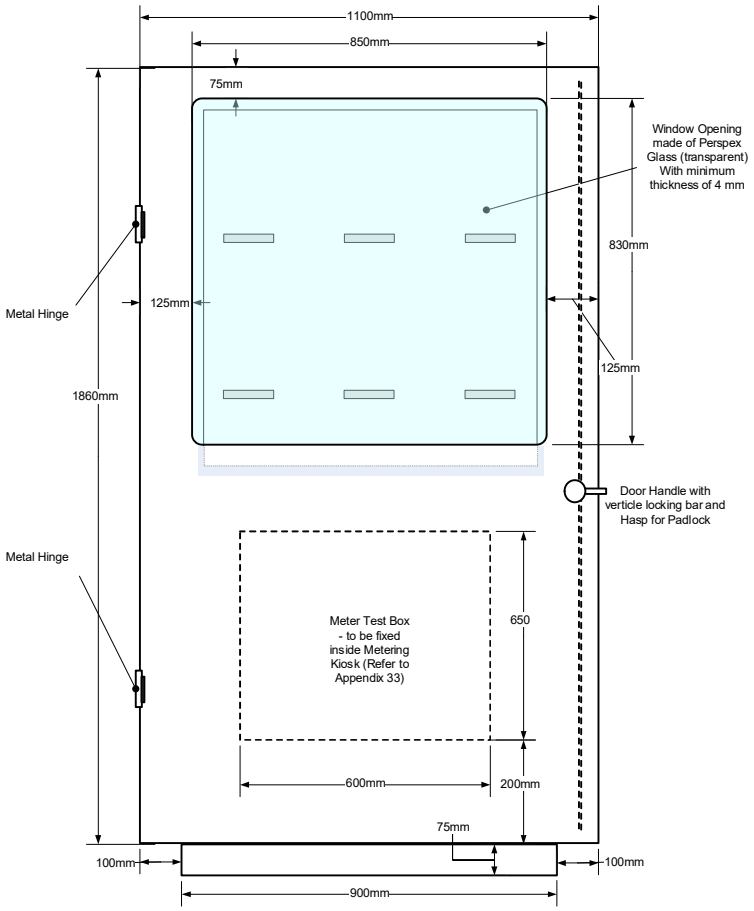
MV/HV, 2 FEEDER METERING KIOSK (PRESPECTIVE VIEW AND BASE VIEW)



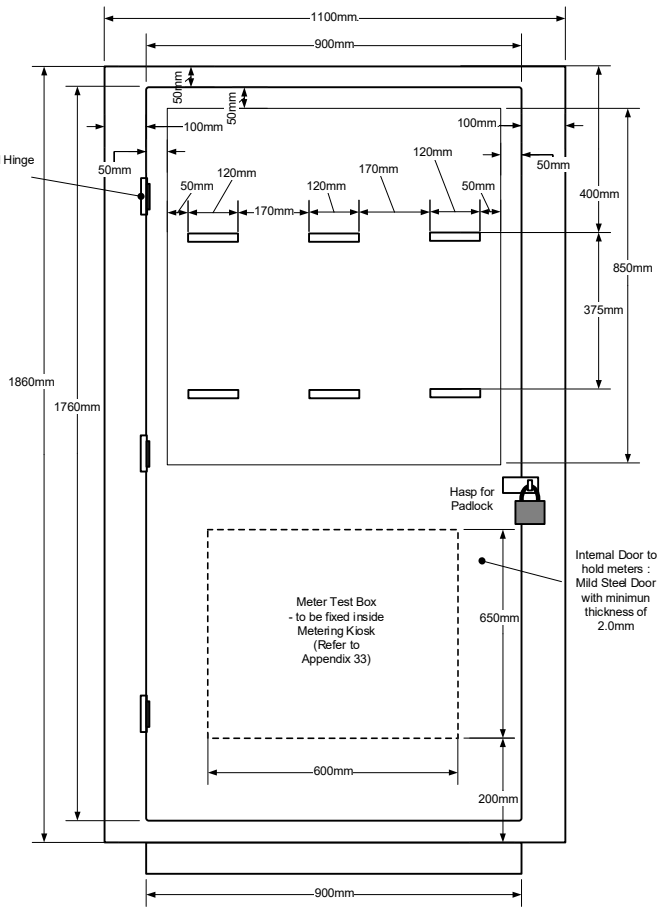


MV/HV, 3 FEEDER METERING KIOSK (FRONT VIEW EXTERNAL AND INTERNAL)

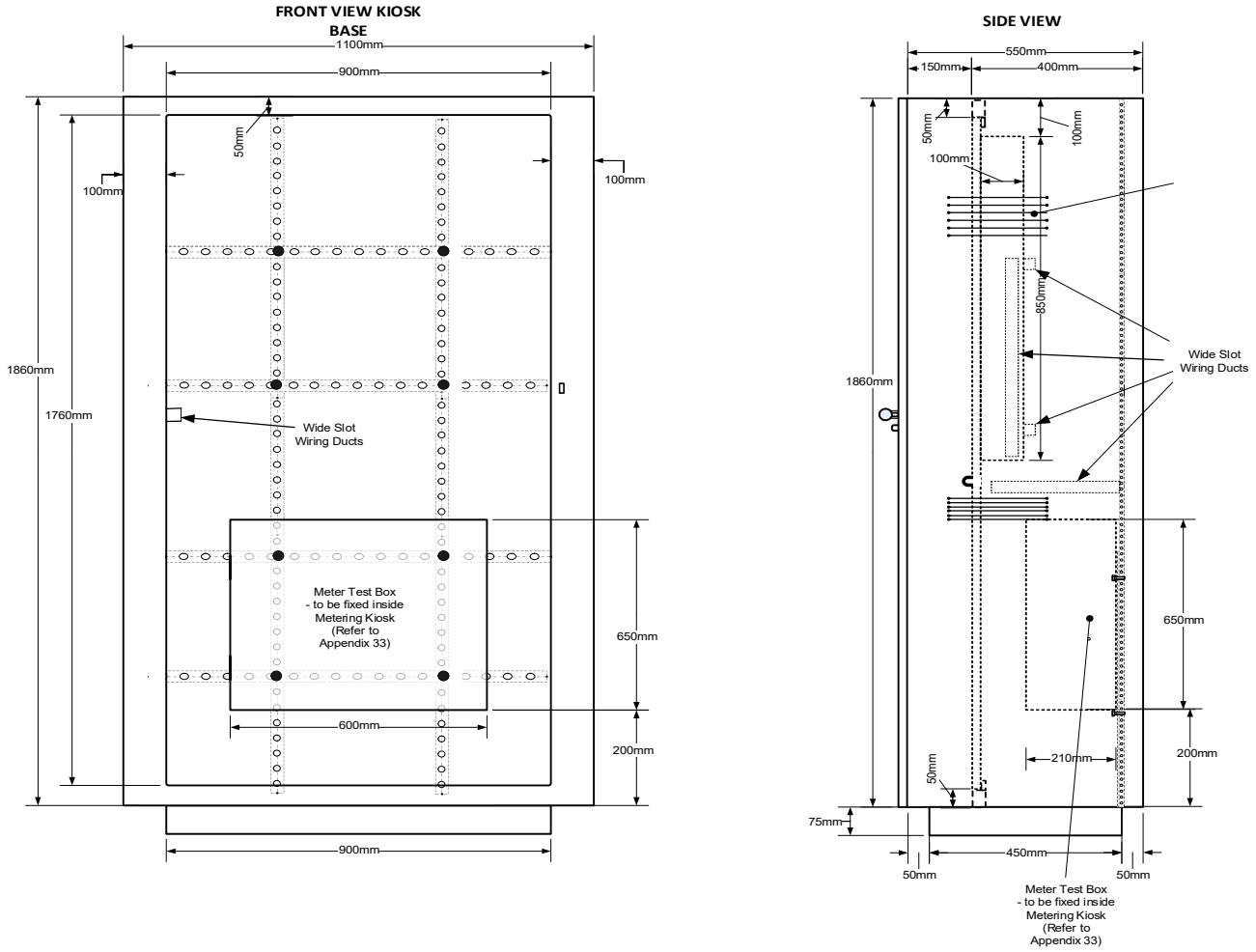
FRONT VIEW EXTERNAL



FRONT VIEW INTERNAL



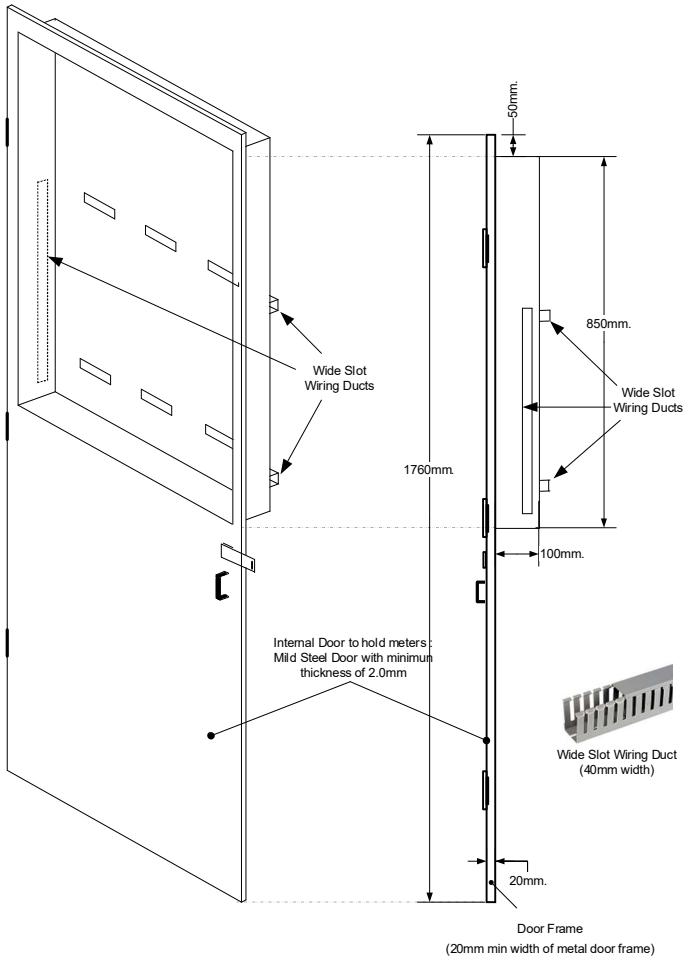
MV/HV, 3 FEEDER METERING KIOSK (FRONT BASE VIEW AND SIDE VIEW)



APPENDIX 32

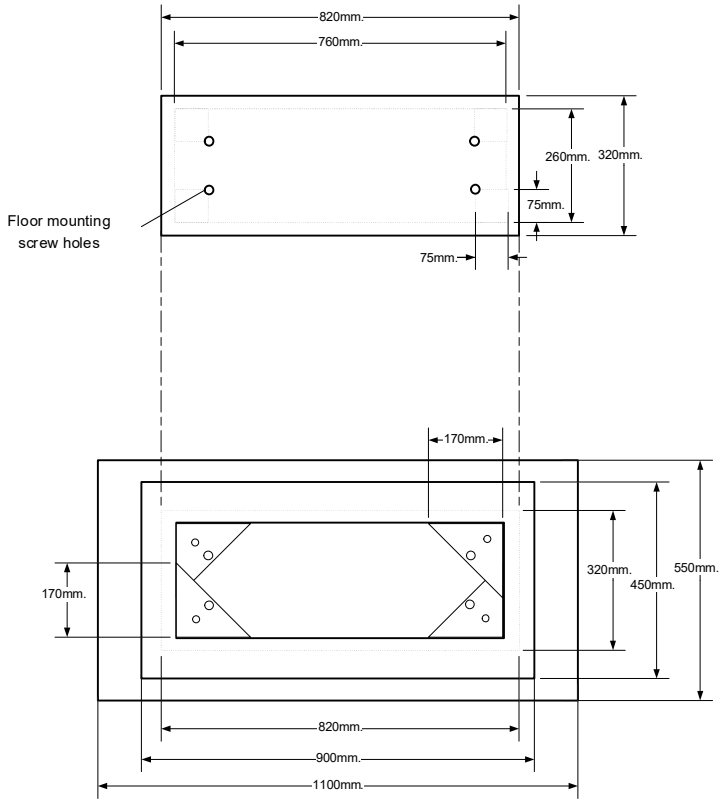
MV/HV, 3 FEEDER METERING KIOSK (PRESPECTIVE VIEW AND BASE VIEW)

PERSPECTIVE VIEW

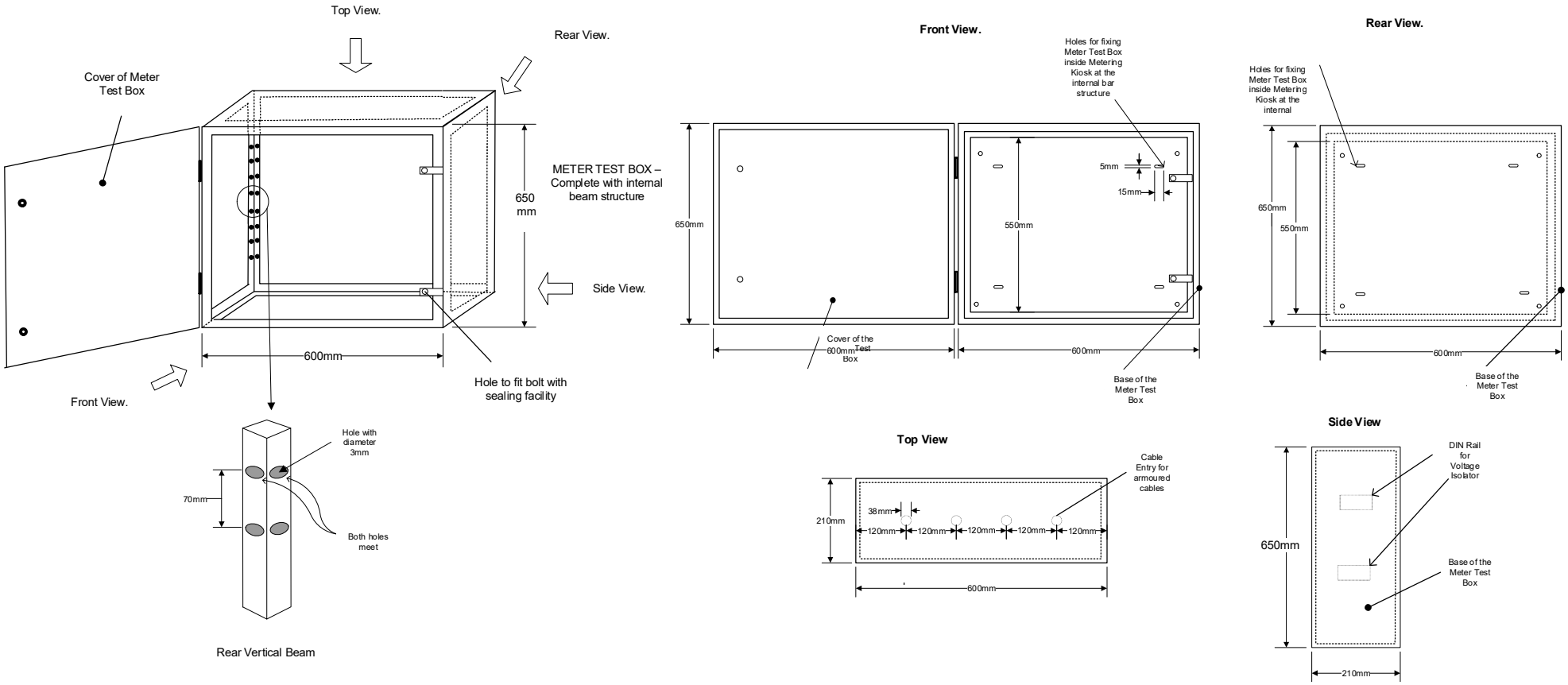


SIDE VIEW

BASE VIEW



MV/HV, 2 AND 3 FEEDER METERING KIOSK (METER TEST BOX VIEW)



APPENDIX 34

MV/HV METERING WIRING SCHEME