ELECTRICITY SUPPLY APPLICATION HANDBOOK

VERSION 3.1

1949-2019
BRIGHTENING LIVES FOR A BETTER MALAYSIA
WORLD BRANDING AWARDS
BRAND OF THE YEAR
TENAGA NASIONAL
Better. Brighter.

Vision

To be among the leading corporations in energy and related businesses globally

Mission

We are committed to excellence in our products and services

Shared values

Our share values provide us with a principle that will shape our business ethics and operations

- **Customer first**
- **Business excellence**
- **Integrity**
- **Caring**

Acknowledgement

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In our endeavor to provide more effective and efficient service to our customers, your inputs have been of tremendous help to us to further improve and add more substance to the Third (3rd) Edition.

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ELECTRICITY SUPPLY APPLICATION HANDBOOK

CONTENT

1.0 SUPPLY APPLICATION

CONTENT

1.1.0 TENAGA NASIONAL BERHAD ELECTRICITY SYSTEM

1.1.1 Introduction

The Tenaga Nasional Berhad (TNB), a public listed company registered under Companies Act 1965, is charged with the following responsibilities:

- To generate, transmit, distribute and sell energy to consumer throughout Peninsular Malaysia.
- To plan, install, operate and maintain electricity installation for the generation, transmission and distribution of electricity.

To achieve the above objectives, the company owns and operate power plants and the National Grid and installed for this purpose are consumer service centres, call management centres, substations and administrative offices throughout Peninsular Malaysia. TNB's core activities are in generation, transmission and distribution of electricity which are being handled by four divisions :

- Generation Division
- Transmission Division
- Distribution Network Division
- Retail Division

1.1.2 Distribution Network Division and Retail Division

Distribution Network Division and Retail Division supply electricity in strict accordance with the provisions of the TNB Licence, Electricity Supply Act 1990, the Licensee Supply Regulations 1990 and the Electricity Regulations 1994 (and all amendments thereto).

Distribution Network Division is responsible for the upstream network operations which involves planning, designing, constructing, operating and maintaining the system that delivers electricity supply to the customers. Retail Division is responsible for the downstream retail operations conducted through a network of 14 states which involves marketing and selling electricity, connection of new supply, providing counter services through Retail Outlets (Kedai Tenaga), collecting revenues, operating Call Management Centres (TNB Careline 15454), handling customer enquiries or complaints and nurturing strong customer and government relationship.

Kedai Tenaga provides functions pertaining to Application for Electricity Supply, Billing & Collection, Upgrading of Services and other consumer related activities. Besides Kedai Tenaga, consumer can also opt for online services through myTNB Portal.

1.1.3 Kedai Tenaga

Kedai Tenaga is TNB's Service and Advisory Centre which are located throughout Peninsular Malaysia. Complete information on Kedai Tenaga throughout Peninsular Malaysia can be obtained via TNB website (www.tnb.com.my). This list is subject to changes and may be reviewed from time to time.

Services provided at Kedai Tenaga include:

a) One stop payment counter for all electricity bills.

- Payment can be made by cash, cheque, credit card or debit card.
- You can also make arrangements to have your electricity bills paid through banks or ATM cards.
- TNB, being a caring company, shall facilitate and make special arrangement on case to case basis for the payment of bills for elderly and handicapped consumers.

b) Electricity supply application

- At Kedai Tenaga, we offer you advice on all matters pertaining to your electricity supply application.
- For wiring purposes in your premise, you may choose from a varied selection of contractors from our directory of registered electrical contractors.

c) Inquiries pertaining to billing and other related services.

- Kedai Tenaga shall provide clarification on any billing inquiries and its related services to consumers.
- Appointments can be made to have the meter read in case the premises are locked during working hours.
- Testing of meters can be carried out if consumers suspect that the meter is faulty. A fee will be charge for such testing.

1.1.4 Electrical System

1.1.4.1 Voltages

The transmission voltage networks are 500kV, 275kV and 132kV, whilst the distribution voltages are 33kV, 11kV and 400/230 Volts. However, in the case of certain parts of Johor & Perak the distribution voltages may include 22kV and 6.6kV.

1.1.4.2 Supply Frequency

The supply frequency is 50Hz ± 1%.

1.1.4.3 Power Factor

Consumers are required to maintain their load power factor to a minimum of 0.85 for voltage level less than 132kV and 0.90 for voltage level 132kV and above.

1.1.4.4 Earthing System

High Voltage and Extra High Voltage

- 3 phase configuration
- Solidly earthed
- Overhead lines and underground cable are used extensively for high and extra high voltage distribution

Medium Voltage

- 3 phase configuration
- Impedance-earth (NER)
- Overhead lines and underground cable are used extensively for medium voltage distribution

Low Voltage 400/230V

- 3 phase 4 wire system
- Neutral point solidly earthed mixture of overhead lines, underground cables and aerial insulated cables
- Mixture of overhead lines, underground cables and aerial insulated cables

1.1.4.5 Short Circuit Ratings

All equipment proposed to be installed and connected to TNB supply must comply with the following short circuit ratings:

	System	Short circuit rating
i.	500kV	50 kA, 1s
ii.	275kV	40 kA, 3s for bulk station (50kA , 1s for Power Substation and 275kV within 500kV substation)
iii.	132kV	31.5 kA, 3s (40kA, 3s for substation adjacent to Power Station, or within 500/275kV substation)
iv.	33kV	25 kA, 3s
v.	22kV	20 kA, 3s
vi.	11kV	20 kA, 3s
vii.	6.6kV	20 kA, 3s
viii.	400/230 V	31.5 kA, 3s

1.1.4.6 Act, Regulation and Customer Charter

The electricity supply and installation practice in Peninsular Malaysia are governed by the following:-

1	Electricity Supply Act 1990 – Act 447
2	Licensee Supply Regulations 1990
3	Electricity Regulations 1994
4	Customer Charter – refer to TNB website (www.tnb.com.my)

1.1.4.7 Supply Voltage Options

Supply may be provided at any of the declared voltages :-

275 kV, 132kV, 33kV, 22 kV*, 11kV, 6.6 kV* and 400/230V. Generally, supplies to domestic premises are given at single phase 2-wire or three phase 4-wire while for non domestic premises the supply are at three phase 3-wire or three phase 4-wire. However, the

actual supply voltage provided depends on the individual applicant's load requirements (refer to Connection Guideline clause 3.1 – Maximum Demand levels and supply scheme):-

It should be noted that voltages other than the above classifications is not provided by TNB. However, consumers can make their own transformation arrangements where necessary.

* System for certain parts of Johor and Perak only.

1.1.5 Types of Supply

1.1.5.1 Supply Application Based on Load

All new applications and upgrade of supply requirement can be classified into two (2) types of supply applications.

a) Supply Application For Load Up To 100 A

- Supply from existing supply mains or
- Establishment of new supply mains or
- Establishment of new substation/substations
- Submission of applications to TNB by Electrical Contractor registered with the Energy Commission

b) Supply Application For Load Exceeding 100 A

- Supply from existing supply mains or
- Establishment of new supply mains or
- Establishment of new substation/substations
- Submission of applications to TNB by Electrical Consultant Engineer registered with the Board of Engineers Malaysia

Note: Establishment of new supply system may require the construction of a new substation/substations and its related ancillaries.

1.1.5.2 Consumers Standby Supply

Standby generator(s) may be used by the applicant at their premises, subject to compliance with the relevant laws. The generators shall remain a separate system from TNB distribution system and the applicant shall declare to TNB on the safe installation of the generator(s).

This may be used in place of TNB's supply source through a suitable, approved changeover facility. The Energy Commission and other relevant authorities govern the usage of generators and standby supply.

1.1.5.3 Alternative Source of Supply

A large consumer may require an alternative source of supply. TNB will provide such alternative supply at an additional cost fully borne by the consumer.

1.1.5.4 Provision Of Temporary Supply

Application for a Temporary Supply means the electricity supply required is for a non-permanent installation intended for a limited time. When a consumer is requesting for a permanent supply, but a planned supply source is not available at that point of time and temporary connection from another source of supply is constructed, the case is not considered as a Temporary Supply.

Examples of Temporary Supply are, but not limited to, festivals or exhibition sites, circuses and construction sites (inclusive of the worker's quarters).

Tariff for Temporary Supply shall be determined based on the usage of the Temporary Supply premise. For example, Tariff A is for the worker's quarters on construction site, Tariff B, C1 or C2 for construction site, festivals, exhibitions or circuses. A surcharge of 33% of the total bill, shall be charged monthly through out the Temporary Supply term.

The consumer is responsible to construct the respective infrastructure and TNB shall charge the cost of connection and termination of cables. However in isolated cases where the consumer does not have the ability and resources to construct the infrastructure, TNB may provide such service and hence the Connection Charge shall be revised accordingly to include the overall cost of constructing and dismantling. The Connection Charge monies however shall be refunded based on the net book value amount of the returned installations after the Temporary Supply has been dismantled.

1.1.5.5 Single Tenant Premises

If the supply is for a single tenant only then the entire supply will be metered at the applicant's incoming switchboard. The consumption will be charged at the appropriate tariff rates.

1.1.5.6 Multi Tenanted Premises

For multi-tenanted domestic and commercial premises, the owner / developer shall have the option of taking supply via bulk supply or individual supply to landlord and tenants respectively.

(a) If taking bulk supply, the owner / developer of the multi tenanted premises must obtain public distribution license (PDL) from Energy Commission. Copy of provisional public distribution licence (PDL) must be appended during submission for TNB's technical comment on development plan and supply application. Copy of official public distribution license (PDL) must be submitted to TNB during Special Electricity Supply Agreement signatory stage before commencement of electrical infrastructure work.

(b) In the event of premature termination or expiration of PDL where TNB is required to take over the corresponding PDL supply area by Energy Commission, PDL holder is responsible to ensure connection schemes and meter locations of landlord / tenants are complying to TNB requirement, as described in the Connection Schemes of Multi Tenanted Premises with individual supply to landlord / tenants in Appendix 1. All cost incurred to be fully borne by PDL holder.

(c) If taking individual supply, the owner / developer is responsible to ensure connection schemes and meter locations of landlord / tenants are complying to TNB requirement, as described in the Connection Schemes of Multi Tenanted Premises with individual supply to landlord/tenants in Appendix 1.

The design, installation and operating of such electrical system shall comply with requirements of all the relevant authorities including the Energy Commission's and TNB's.

1.1.5.7 Turnkey Projects

In certain cases, the applicant may apply to undertake the planning and installation of the electrical systems (including overhead lines, switchgears, cables, according to TNB's specifications and requirements) with the assistance of Electrical Consultant Engineer(s) and Electrical Contractor(s). Under the 'turnkey' concept the applicant will then hand over the entire electrical system to TNB. TNB shall have the absolute discretion in deciding whether the turnkey project to be carried out by the applicant.

1.1.6 Charges

1.1.6.1 Connection Charges

Please refer to the Statement of Connection Charges booklet available at TNB's website (www.tnb.com.my). The booklet is subjected to change as may be published from time to time.

1.1.6.2 Tariff

Please refer to the Tariff booklet available at TNB's website (www.tnb.com.my). Tariffs are subjected to change as may be published from time to time and approved by the Ministry of Energy, Science, Technology, Environment and Climate Change.

1.1.6.3 Request For Additional Requirement Or Special Features

The applicant shall bear the full cost for any request of additional requirements or special features made by the applicant and/or impose by Local Authority. Please refer to the Statement of Connection Charges booklet available at TNB's website (www.tnb.com.my). The booklet is subject to change as may be published from time to time.

1.1.7 SERVICE LEVEL AGREEMENT (SLA)

1.1.7.1 SLA with Housing Developers

Offer is open to all housing developers to enter into a Service Level Agreement (SLA) with TNB when applying for electricity supply for housing development (as prescribed under the Housing Development (Control and Licensing) Act 1966). The scope of the SLA includes the time frame process for connection of supply and the duties and obligation by TNB and housing developers in ensuring the electricity supply is connected to the housing projects within the stipulated time to avoid delays in handing over houses to the purchaser.

1.2.0 ELECTRICITY SUPPLY APPLICATION FOR LOAD UP TO 100A

1.2.1 Purpose

The application for the supply of electricity with load up to 100A which is for a single (1) phase and three (3) phase low voltage system is outlined here.

1.2.2 What Is The Steps Involved To Get Your Electricity

The following steps are required to get the supply of electricity up to 100A for a single (1) phase and three (3) phase low voltage system.

Steps	Action	Reference
1	**Appointment of an Electrical Contractor** Appoint an Electrical Contractor who will act on behalf and submit the electricity supply application through myTNB portal. For Move-In into existing premise (with no change in electricity load) or Change of Tenancy, the applicant shall skip Step 1.	Visit our online application page at **https://www.mytnb.com.my/**
2	**Complete All Required Documents** The Applicant or the appointed contractor complete the electricity application form and attach together the required documents. The applicant shall sign the application form with TNB. For online application, this step shall be done accordingly as explained by the guidelines available at the website.	Visit TNB's online application page at **https://www.mytnb.com.my/** **Appendix 2** – Required Documents Checklist
3	**Pay Essential Charges** Required initial payments (i.e. Connection Charge, Security Deposit and Stamp Duty) related to the application can be paid at Kedai Tenaga or online through myTNB portal.	
4	**Get Electricity Supply** TNB installs meter and connects the electricity supply once all the required payment is received.	

1.2.3 TNB Supply Lead Time

TNB supply lead-time will be based on TNB's Customer Charter as mention in TNB's website (www.tnb.com.my).

1.2.4 Dispute Between Applicant And The Electrical Contractor

In the event of a dispute between the applicant and the Electrical Contractor and the applicant wishes to terminate the services of the Electrical Contractor, the applicant shall duly notify the Electrical Contractor concerned in writing with the copy extended to TNB. TNB shall not be a party to any dispute or litigation arising thereof.

1.3.0 ELECTRICITY SUPPLY APPLICATION FOR LOAD EXCEEDING 100A

1.3.1 Purpose

The application for the supply of electricity for load exceeding 100A is outlined here.

1.3.2 Application Process

The application process incorporates not only TNB requirements but taking into account the Government Development Plan Approval Process in Peninsular Malaysia issued by the Bahagian Perancangan Dasar & Pembangunan Kementerian Perumahan dan Kerajaan Tempatan.

The inclusion of the said Government procedure shall ensure :

- Infrastructure planning and approval process of the TNB complements the National Policy
- TNB as a member Agency of the Government Development Plan Committee has to ensure complete transparency of its process through timely responses to Development Plan Approval Process
- TNB Supply Application Process ensures complete agreement of Distribution Division's plans and the Consultant Engineers submissions especially on the location and size of substations needed for the supply of electricity to the development area, and is valid for 2 years after the approval from the relevant Local Authority.

1.3.3 Application Parts

There are two parts to the application:

Part	Function
A	Authorities Approval Process
B	TNB Application Process (Technical & Financial Approval (After completion of Part A)

PART A: Authorities Approval Process

The part A process approval that involves TNB's technical comments is as shown in Development Plan Approval Process Flowchart in **Appendix 3**. At each application process, TNB requires a processing time of up to 14 days to complete the comments for the relevant Local Authority. The main process can be summarised as follows:

Stage	Description
1	**Submission Development Plan** The Developer / Owner / Consultant Engineer submit development plan application for the proposed development to Local Authority / One Stop Centre (OSC). All plans must be prepared by the party authorised by Local Authority. Applicant must adhere to the requirements stipulated in the Development Plan Checklist (checklist available in https://jkt.kpkt.gov.my) during the submission of Development Plan to Local Authority / One Stop Centre (OSC). The comments from all relevant technical agencies including TNB are required prior to approval by Local Authority / One Stop Centre.
2	**TNB Register Application** The local authority / One Stop Centre submits application to TNB complete with required details as in Development Plan Checklist TNB will: • Acknowledge receipt and register development order plan in Development Order Comment Book. Study the proposal. Match the existing system network and determine method of electricity supply.
3	**Mutual Understanding Of Plan** Both TNB and Consultant Engineer will conduct discussion to agree to technical requirement such as substation number, size, location, site and consumers main switch room, etc. In case of a dispute on TNB proposal, the Consultant Engineer shall refer to the relevant State General Managers. A discussion shall be arranged by the relevant State General Managers to arrive at an agreement.
4	**TNB Submit Comments to Local Authority / One Stop Centre** TNB submit to Local Authority / One Stop Centre the proposed development plans including all technical comments using TNB official stamp as required by Local Authority. Local Authority approves the proposed development plan. The validity is subjected to: - confirmation of layout details and pre-computation plans - no changes in development - 2 years extension or subject to respective Local Authority Development Order Plan validity requirement
5	TNB Application for Electricity Supply above 100A process starts (Part B)

PART B: TNB Application Process (Technical & Financial Approval)

Part B process is the TNB Application Process for Electricity Supply above 100 A as outlined in **the table below**. The process starts after the completion of Part A (Authorities Approval Process). The Process in Part B can be summarised as follows:

Stage	Description
1	**Submit Application** The Electrical Consultant Engineer (registered with Board of Engineers Malaysia) on behalf of the developer/consumer submits application for the Electricity Supply Application through myTNB portal and TNB Distribution Network Division Local Office. Complete details as in **Appendix 4** must be submitted with the application. TNB will issue an acknowledgement letter to the Electrical Consultant Engineer.
2	**Documentation Check And System Study** TNB will check on the documentation and carry out system studies and shall advise on the necessary amendments (if any) to the consultant by letter. The Electrical Consultant Engineer is to ensure that all the amendments are done and resubmitted to TNB.
3	**Joint Meeting** TNB will restudy the amendments and arrange for a joint meeting with the Electrical Consultant Engineer and Applicant for final acceptance of the technical requirements including substation details, cable/overhead line route, metering system requirements and meter location. Activities of both parties will be recorded in the Joint Meeting Action Log. TNB shall forward in writing the final proposal on the above agreed technical requirements to the Electrical Consultant/Applicant. Electrical Consultant on behalf of the Applicant shall in writing confirm acceptance of the final proposal to TNB.
4	**Connection Charges** TNB will issue a Notice of Connection Charges to the Electrical Consultant Engineer based on the accepted final proposal. The Electrical Consultant / Applicant shall make the payments for the Connection Charge.
5	**Electricity Infrastructure Agreement (Optional)** The applicant / TNB **may** decide to enter into an Electricity Infrastructure Agreement (mainly for large development) with regard to scope of work, charges, timely connection and their respective obligations.
6	**Discussion And Preparation Of Site Work** After payment of Connection Charges, the Electrical Consultant Engineer will arrange for pre start work discussion.

Stage	Description
7	**Construction Completion And Substation Energising** The substation site and the construction of the substation building shall be completed (in accordance to TNB specification and requirement) and hand over to TNB. TNB will install the electrical equipment including its ancillaries and shall be responsible for the commissioning of substation.
8	**Meter Application By The Electrical Contractor** The Electrical Consultant Engineer shall advise the Electrical Contractor (Appointed by the Applicant) to submit meter application.
9	**Get Electricity Supply** The energising of supply by TNB will normally be done at the same time as the installation of the meters. For HV / MV supply, the supply shall be energised in the presence of the Electrical Testing Engineer and for LV consumers in the presence of the Electrical Contractor.

1.3.4 What The Applicant Should Do

The Applicant should take the following action in applying for electricity supply application for load exceeding 100A.

Steps	Action	Reference
1	• Appoint one (1) Electrical Consultant Engineer for each electricity supply application • Submit an appointment letter of the Electrical Consultant Engineer allowing him to act on behalf of the applicant.	**Appendix 5** – Sample of Appointment Letter of Electrical Consultant
2	After approval from Local Authority / One Stop Centre and TNB completion of work plan, the applicant settles Connection Charges to TNB at any Kedai Tenaga or through myTNB portal The Applicant may decide to enter into an Electricity Infrastructure Agreement with TNB with regard to scope of work, charges, timely connection and their respective obligations.	
3	• Provide the substation(s) land and building(s) to TNB by: - Transfer the substation land at a nominal value of RM10.00 to TNB or; - Leasing the substation land at a nominal value of RM10.00 to TNB.	

Steps	Action	Reference
	• The Certificate of Completion and Compliance (CCC) of the substation building/compartment shall be handed to TNB. The transfer of the land title should be finalised prior to the handing over of site. In the absence of the land title, the applicant is to prepare a Bank Guarantee for TNB for the period of twelve (12) months and shall be renewed until the land title is transferred to TNB or registration of lease to TNB. Delay in title transfer may affect project implementation. TNB have the right to use the substation to supply electricity to other consumers.	
4	**Get Electricity Supply** TNB installs meter and connects the electricity supply once all the required payment is received.	

1.3.5 Supply Project Lead Time

The lead-time for supply connection depends on a number of factors including the type of premises, the electrical load required and the location of the premises and approval from the Local Authorities.

Applicants should submit their applications for supply as early as possible giving the necessary information of their requirements to the nearest Kedai Tenaga. They must also inform TNB of the progress of their project(s). The above measures are necessary to ensure that TNB's supply projects are coordinated with the construction and wiring installation at the applicants' premises, and thus avoid any delay in connection of supply. The typical supply project lead time required by TNB is as follows:

Voltage Level	Supply Project Typical Lead Time *
132 kV and above	3 years – 5 years
33 kV	18 months - 2 years
11 kV	6 months – 12 months
400 V and below (with substation)	3 months – 12 months
400 V and below (without substation)	Less than 3 months

* Provided there is no delay in the approval given by Local Authorities

However 132kV supply projects can be given within 24 months on a Fast Track basis on the following categories:

Fast Track 132kV Project

Category	Supply Project Lead Time	Terms & Conditions
1	12 months	a) PMU Site or Lines/Cables Right Of Way (ROW), Route Survey and Profile Plan To Be Made Available By The Customer & Notice To Enter (NTE) Issued By TNB Without Any Encumbrances. b) Length of Underground Cable: max. 5km c) Length of Transmission Line: max. 5km d) All Major Equipments Must Be Readily Available.
2	18 months	a) Site or Lines/Cables ROW, Route Survey and Profile Plan To Be Made Available By The Customer & Notice To Enter (NTE) Issued By TNB Without Any Encumbrances. b) Length of Underground Cable: max. 5km c) Length of Transmission Line: max. 10km d) Equipments To Be Procured Based on Equipments that Have Been Installed in TNB System.
3	24 months	a) Site or Lines/Cables ROW, Route Survey and Profile Plan To Be Made Available By The Customer & Notice To Enter (NTE) Issued By TNB Without Any Encumbrances. b) Length of Underground Cable: max. 5km c) Length of Transmission Line: max. 20km d) Equipments To Be Procured Based on Equipments that Have Been Installed in TNB System.

1.3.6 What The Electrical Consultant Engineer Should Do

The Electrical Consultant Engineer plays a major role to represent the Applicant and ensure compliance with other relevant government departments and TNB. The Electrical Consultant Engineer is advised to observe the steps as outlined below:

Steps	Action
1	• Submits application for the proposed development to Local Authorities / One Stop Centre and TNB • All plans must be prepared by a Licensed Surveyor. Liaise with TNB to come up with a mutual understanding of plan and to get approval by Local Authorities/ One Stop Centre.

Steps	Action
2	Upon approval of the Development Order Plan, Electrical Consultant submits application for the electricity supply to Kedai Tenaga. Complete details as outlined in **Appendix 4** and **Appendix 6** (Summary of Load for Demand Exceeding 100kVA (~ 140A)) must be submitted with the application. The application must be accompanied by 3 copies of the following :- (i) Latest Development Order Plan approved by Local Authority (ii) Site plan showing the lot number (s) and proposed substation sites (iii) Layout plan of substation building (iv) Single line diagram / schematic of installation (v) Layout plan of proposed consumer switchroom (where applicable) (vi) The approval of the building plans by the relevant Authorities • Clearly state details of the applicants supply requirements. Provide a comprehensive description of the proposed development and a list including details of the connected loads, motors/appliances, the associated ratings, type of motor starter and their arrangements (where applicable). • Submit Power Quality Compliance Declaration Form (**Appendix 7**) Submit the metering requirements for CT Meters as in **Appendix 8**
3	Ensure that all the amendments/additional requirements if required by TNB are complied with and resubmitted to TNB.
4	• Ensure that the Applicants main switchroom shall be located in accordance to TNB's requirements. • Provide appropriate cable trenching from the TNB's substation to the main switchroom and a panel/cubicle for metering or a free standing meter cubicle in the case of high voltage installation in the consumer's switchroom or substation.
5	• Ensure appointed Electrical Contractor (by Applicant) is registered with Energy Commission for the purpose of wiring up the premises • Provide installation test results and protection settings for all CT metered Applicants.
6	Ensure that the wiring and the installation work of Applicant's equipment shall be supervised by competent person(s).
7	Advise Applicant to submit application form through registered Electrical Contractor. The process is similar as outlined in Section 2.
8	Advise Applicant to deposit a sum of money equivalent to 2 months bill (as reviewed from time to time) upon receiving the notice of deposit. For deposit of more than RM2,000 the applicant are encourage to settle via Bank Guarantee.

1.3.7 Dispute Between Applicant And Electrical Consultant Engineer

In the event of a dispute between the Applicant and the Electrical Consultant Engineer and the Applicant wishes to terminate the services of the Electrical Consultant Engineer, the Applicant shall duly notify the Electrical Consultant Engineer concerned in writing with the copy extended to TNB. TNB shall not be a party to any dispute or litigation arising thereof.

1.4.0 APPLICATION PROCESS FOR STREETLIGHT

1.4.1 Purpose

This procedure outlines the process for the application for streetlight.

1.4.2 Types of Applications

The three (3) types of application for streetlights are:

- Application made by the Local Authority/Government Authority
- Application by Developer
- Application by Individual

1.4.3 Application by Developer

The Developer should take the following steps to apply for streetlight.

Steps	Action
1	Appoint a Consultant Engineer (Registered with the Board Of Engineers Malaysia) and an Electrical Contractor (registered with the Energy Commission).
2	The application is made together with the supply application for a new development with all the load details of the proposed public lighting that is approved by the Local Authority.
3	Electricity Contract Forms to be signed by Local Authority before TNB commissions the street light.

1.4.4 Application By Individuals/Local Authority/Government Authority

The application process is similar for both Individuals and Local Authority or Government Authority. Individuals must already have an account with TNB. The installation of streetlight depends on:

- Installation of streetlight on existing TNB pole
- Installation involving additional poles

IF	THEN
Installation of streetlight on existing TNB pole	Consumer submits application to the Kedai Tenaga.
Installation involving additional poles	The applicant settles the full cost of additional new pole/poles installed.

2.0 CONNECTION GUIDELINES

CONTENT

2.1.0 PLANNING AND DESIGN CRITERIA

TNB refers to *Grid Code for Peninsula Malaysia* and *Distribution Code for Peninsula Malaysia, Sabah & F.T. Labuan* in developing the connection system or supply infrastructure needs which are included in this section. Both documents are publicly available at the Energy Commission's website.

2.1.1 STEADY-STATE SUPPLY VOLTAGE PERFORMANCE

(a) Steady-State Voltage Fluctuation under Normal Condition

Under normal condition, when all circuit elements are in service, the distribution network including the points before the Users Connection Point shall be planned to be maintained as is **Table 1-1** below:-

Table 1-1: Steady -state voltage level regulation limits under normal conditions

Voltage Level	% Variation
400V and 230V	-6% & +10%
6.6kV, 11kV, 22kV, 33kV	+/- 5%
132kV dan 275kV	+/-5%
500kV	+/-5%

(b) Steady-State Voltage Fluctuation under Contingency Condition

Under contingency condition, when one or more circuit elements are on outage, the power frequency steady-state voltage at all points in the distributor's distribution system including the points before the consumer metering must be planned to be maintained as follows:

Table 1-2: Steady-State Voltage Regulation Limits under Contingency Condition

Voltage level	% variation
400V and 230V	+/- 10%
6.6kV, 11kV, 22kV,33kV	+/-10%
132kV & 275kV	+/- 10%
500kV	+/-10%

2.1.2 SUPPLY SECURITY LEVEL

Supply security of a distribution system network defines the availability of supply to consumers following the occurrence of supply interruption. Systems and necessary network management infrastructure may be designed to meet any of the standardized security level definitions currently adopted by TNB as indicated in **Table 1-3**.

2.1.2.1 Adopted Security Level Definitions For TNB Distribution System

Table 1-3: Security Levels for Distribution Network

Security Level	Average Restoration Period
Level 1	Less than 5 seconds
Level 2	Less than 15 minutes
Level 3	Less than 4 hours
Level 4	Less than 24 hours

2.1.2.2 Supply Security Level to Consumers

In accordance to Guaranteed Service Level (GSL), supplies to consumers at voltage levels of 11kV, 22kV and 33kV normally be provided with alternative circuits and/or other facilities such that supplies shall be restored within a period of up to 4 hours (Security Level 3), except due to natural disaster or weather. In exceptional instances where alternative feedback source is not available consumers at voltage levels of 11kV, 22kV and 33kV may have supply restoration time extended beyond 4 hours.

For supplies at 230V and 400V, the restoration period may vary beyond 3 hours depending on the type of network fault.

Time to restore electricity supply following major incident on grid or transmission system except due to natural disaster, and causing partial blackout, restoration time shall be within 8 hours and for total blackout situation it shall be within 18 hours.

2.1.2.3 Request for Higher Supply Security Level

However, TNB can design the supply scheme to meet higher security level requirement of individual consumer or group of consumers. All additional costs involved in providing the higher security level shall be borne fully by the consumer.

2.1.3 POWER QUALITY

2.1.3.1 Power Quality Requirement

2.1.3.1.1 TNB supplies electricity by the alternating current (ac) system with system frequency of 50 Hz with specified regulated voltage levels. The ranges of voltage regulations available are explained in section 2.1.1 of this guideline.

2.1.3.1.2 TNB shall supply electricity to the main incoming terminals or point of common couplings (PCC) between the consumers and TNB with general electromagnetic environment statistics as indicated in standards **IEC 61000-2-4** and **IEC/TR 61000-2-8.**

2.1.3.1.3 TNB does not guarantee that the electricity supply will not be interrupted or its frequency and voltage will not fluctuate outside the ranges stated in section 2.1.1. TNB will take the necessary steps to enhance the system reliability and security to all customers. The reliability of the supply system is evaluated and monitored by the Supply Average Interruption Duration Index (SAIDI). And the duration of supply restoration will be dependent upon the determined security levels as stated in section 2.1.2.1.

2.1.3.1.4 The supply voltage and frequency may fluctuate for short duration outside the voltage ranges stated in section 2.1.1 due to the following:-

a) When TNB takes the necessary action for safety reasons,
b) When TNB carries out critical maintenance and repairs on the network components,
c) When matters outside the control of TNB i.e. external influences, are the causes of the supply problem; and
d) Other circumstances that cause supply to be interrupted or cause voltage and frequency to fluctuate.

2.1.3.1.5 The consumer shall ensure that all equipment to be connected to TNB supply system is electromagnetically compatible with the electromagnetic environment declared by TNB.

2.1.3.2 Requirements of Consumer's Equipment

2.1.3.2.1 TNB specifies requirement that the consumer's must comply in order to minimize the impact of the electromagnetic disturbances that may exist in the power system for example voltage sags, transients/surges etc.

2.1.3.2.2 The requirements are:-

Table 1-4: TNB Power Quality Requirements

Type Of Disturbance	Indices	Acceptable permissible values at point of common coupling (PCC)	Reference Document
Voltage Step Change	ΔV %	1% - Frequent starting/switching and/or disconnection of load.	**UK's Engineering Recommendation P28**
		3 % - Infrequent single starting/ switching or disconnection of Load – once in two hours or more hours.	
		6 % - Starting/switching once or twice a year.	
Voltage Fluctuation and Flicker	Absolute Short Term Flicker Severity (P_{st})	1.0 (at 132kV and below)	**UK's Engineering Recommendation P28**
		0.8 (Above 132kV)	
	Absolute Long Term Flicker Severity (P_{lt})	0.8 (at 132kV and below)	
		0.6 (Above 132kV)	
Harmonic Distortion[2]	Total Harmonic Distortion Voltage (THDV) %	5 % at ≤ 400 Volt	**Engineering Recommendation ER G5/4**
		4 % at 11kV to 22kV	
		3% at 33kV	
		3% at 132kV	
Voltage Unbalance	Negative Phase Sequence Voltage %	2% for 1 minute	**UK's Engineering Recommendation P29**
Voltage sag	Immunity requirement	All critical equipment & processes must be immune to voltage sag.	**IEC 61000-4-11 & IEC 61000-4-34**

2.1.3.2.3 It is the responsibility of the consumer to ensure that his voltage sensitive equipment is able to function continuously through unanticipated voltage sags and transients/surges, caused when the system is subject to external interference such as lightning, 3rd party cable damage, other consumer's equipment fault, TNB equipment fault etc.

2.1.3.2.4 The consumer must select equipment that are immune to both voltage sags, transients/surges etc. Consumers should request from equipment manufacturers, equipment that can comply with the electromagnetic compatibility (EMC) requirement of IEC 61000 and ENGR.

2.1.3.2.5 The recommended standards to refer for evaluating equipment's sensitivities and identifying immunity solutions to voltage sags and transient/surge are **IEC 61000-4-11/34** and **IEC 61000-4-5.**

2.1.3.2.6 Overall the customer's plant and apparatus shall be compatible with the basic insulation levels (BIL) define in this handbook.

2.1.3.2.7 Guidelines on some immunity measures against voltage sags can be referred to TNB Power Quality Guidebook at http://www.tnb.com.my/tnb/con_quality.htm

2.1.3.3 Declaration to Power Quality Requirement

2.1.3.3.1 The consumer is required to declare his equipment compatibility and compliance with regards to the required power quality standard using the **Power Quality Compliance Declaration Form** in **Appendix 7**.

2.1.4 SHORT-CIRCUIT LEVELS

TNB network are design and operated in order to remain within the limits of short-circuit levels as in **Item 1.4.5 of Supply Application Section.** TNB equipment design is specified to the same Short Circuit rating. Consumer's equipment at the point of interface or part of the interconnection design shall also comply with the minimum Short Circuit rating. TNB may provide indicative or prospective fault level in terms of X/R at the interface point with consumer, if so required for detailed installation design.

2.1.5 PROTECTION REQUIREMENTS

2.1.5.1 Basic Requirements

In all cases, the basic requirement is that the consumer's arrangements for protection at the connection point, including types of equipment and protection settings, shall comply with TNB practices, and be as TNB specifies during the application for supply process. This is especially critical for MV and HV consumers.

2.1.5.2 Specific Requirements

Consumers shall take into consideration the following specific protection practices of TNB in designing their installation:

(a) Maximum clearance times (from fault current inception to fault clearing) shall be within the limits established by TNB in their short circuit rating policy.

(b) Auto-reclosing or sequential switching features may be used on TNB's distribution system. TNB will provide details on the operating sequence utilised for the supplies on the proposed installation so the consumer can plan for this in the design and protection of his facility.

(c) On some of TNB's distribution systems, e.g. lateral feeders or tee-offs, certain types of faults may cause disconnection of one phase only of a three-phase supply.

(d) The following additional protection features are recommended to consumers with special requirements:

i. For voltage sensitive consumer, it is advisable to install over/under voltage protection scheme with a suitable time delay scheme.

ii. A suitable time delay scheme must be installed for the under voltage relay that governs the changeover system for the generator and other voltage sensitive equipment.

iii. And it is not recommended to install an over/ under voltage protection scheme at the incomer VCB to factory.

iv. Consumer intending to have more than 1 incoming feeder shall take into consideration supply option with Automatic Transfer Scheme (ATS). However, all technical requirements shall be discussed and agreed by both TNB and consumer.

All costs and installation work are to be borne by consumer.

2.1.5.3 Protection System Evaluation Process

Consumer's installation to be supplied at 11kV and above shall provide the appropriate and matching protection scheme to support the desired operation of the designed supply scheme. The reliability of the equipment, protective devices and protection systems being deployed at the consumer connection or interface points may affect the reliability of TNB's supply system.

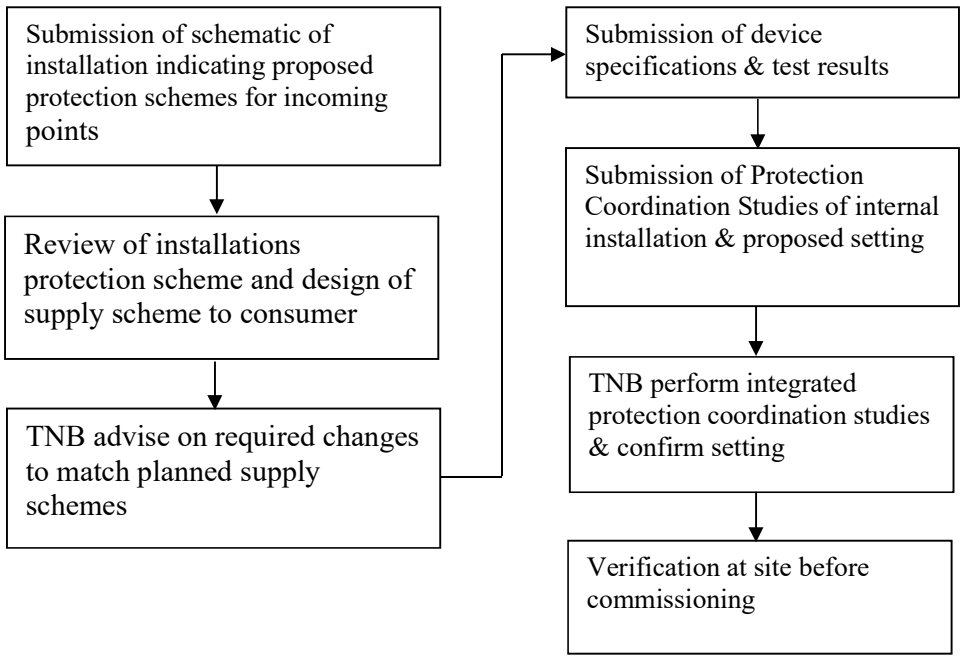


Figure 1-1 above illustrates the steps involved in the evaluation of protection schemes.

2.2.0 DEMAND ESTIMATION

Supply schemes and networks are to be adequately designed or dimensioned to meet initial and growth of consumer individual and group maximum demand.

The demand estimates are based upon load declared by consumer and TNB's own information on load profile characteristics for various consumer classes. Range of values are given as demand profile are known to varies according to geographical location of consumers around the TNB service areas in Peninsular Malaysia.

Fairly accurate assessment of individual and group demand of consumers are critical for correct dimensioning of network or facilities in meeting the initial and future demand of consumers as imposed on the network.

2.2.1 Demand Estimates For Consumer Sub-Classes Or Premises

Table 2-1 and **Table 2-2** indicates the typical ranges of maximum demand for domestic and shop-lots or shop-houses respectively. These values shall be subjected to revisions based upon of latest results load profiling studies.

Table 2-1: Range of maximum demand (M.D) for domestic consumer sub-classes or premises

No.	Type Of Premises	Rural (kW)	Suburban (kW)	Urban (kW)
1	Low cost flats, single storey terrace, studio apartment (< 600 sq ft)	1.5	2.0	3.0
2	Double storey terrace or apartment	3.0	4.0	5.0
3	Single storey, semi-detached	3.0	5.0	7.0
4	Double storey, semi-detached	5	7.0	10
5	Single storey bungalow & three-room condominium	5	7.0	10
6	Double storey bungalow & luxury condominium	8.0	12	15

Table 2-2: Range of maximum demand (M.D) for types of shop-houses

No:	Type Of Premises	Rural (kW)	Suburban (kW)	Urban (kW)
1	Single storey shop house	5	10	15
3	Double storey shop house	15	20	25
3	Three storey shop house	20	30	35
4	Four storey shop house	25	35	45
5	Five storey shop house	30	40	55

* The above MD range is meant for reference as the minimum value. MD declared by consultants must be accompanied with the connected load and design calculations of the development.

*For commercial more than 3 storey supply must be underground

For underground system, every lot of shop house is required to have individual service cable termination into the shop lots meter panel.

2.2.2 Demand Estimates Of Mixed Development Area.

Accurate determination of the maximum possible demand for a newly proposed development is critical in the effective long-term planning of supply network within the specific area. Adequate land areas for transmission main intakes (PMU 275kV, 132/33kV, 132/22kV, 132/11kV), major distribution stations (PPU 33/11kV, 22/11kV), sub-stations (PE 11/.4kV, 22/.4kV), feeder pillars, underground cable and overhead line routes will have to be allocated at the layout approval stage by the relevant authorities.

The total demand will indicate the supply voltage and target network configuration for the whole development area. Network facilities will be developed in phases in tandem with physical development.

Site selections for PMU, PPU, sub-stations and feeder routes are determined at development plan stage to achieve optimal technical performance of network and costs based on the planned target network.

2.2.3 Group Coincident Factor

Group coincident factor is applied in the computation of unit demand and group demand. The typical values for coincident factors for different groups of consumers are as tabulated in the table below:

Consumer Groups	Coincident Factors
Residential	**0.90**
Commercial	**0.87**

Consumer Groups	Coincident Factors
Industrial	0.79
Residential + Commercial	0.79
Residential + Industrial	0.87
Commercial + Industrial	0.79
Mixed Group	0.75

2.3.0 SUPPLY SCHEMES

Based upon consumer's declared demand level and required security level, supply schemes to consumers are appropriately designed to meet these requirements as discussed in section 1.

2.3.1 Maximum Demand Levels And Supply Schemes

The table below indicates the minimum supply schemes for various demand levels of individual consumers.

Consumers with the following M.D shall adhere to the minimum supply scheme.

Table 3-1: Minimum supply schemes for various M.D levels

M.D ranges of individual consumer	Supply voltage	Minimum supply scheme
Up to 12 kVA	230V	Single phase overhead or underground services from existing LV network
>12kVA to 100kVA (Non-Domestic)	400V	Three phase overhead or underground cable service from existing LV network subject to system capability study by TNB
Up to 100 kVA (Domestic)	400V	Three phase overhead or underground cable service from existing LV network subject to system capability study by TNB
>100kVA to 350kVA	400V	Underground cable service from feeder pillar or a new/existing substation, subject to system capability study by TNB
>350 kVA to 1000kVA	400V	Direct underground cable service from new substation
1000kVA up to <5000kVA	11kV	Directly fed through TNB 11kV switching station. An additional PPU land may need to be allocated subject to system capability study by TNB.
1000kVA up to 10000kVA	22kV	Directly fed through TNB 22kV switching station An additional PPU land may need to be allocated subject to system capability study by TNB'
5000kVA to 25000kVA	33kV	Directly fed through TNB 33kV switching station An additional PMU land may need to be allocated subject to system capability study by TNB'
25,000kVA to <100,000kVA	132kV , 275 kV	Directly fed through TNB 132kV or 275kV substation respectively. TNB shall reserve the absolute right to provide alternative arrangements after taking into consideration the location, economic and system security factor

M.D ranges of individual consumer	Supply voltage	Minimum supply scheme
100,000kVA and above	275 kV	Directly fed through TNB 275kV substation. TNB shall reserve the absolute right to provide alternative arrangements after taking into consideration the location, economic and system security factor

The above minimum supply scheme for the consumer is the **minimum** level of supply scheme shall be adhered by the consumer. If upon system analysis & study conducted by TNB, a higher supply scheme is required to give quality supply to the consumers, the later prevails.

The table below indicates the requirement of substations for various demand levels of single development.(more than 1 consumer), total maximum demand including all phases / parcels in the development.

Table 3-2: Requirement of substations for single development

M.D ranges of single development	Substations requirement
Up to 350kVA	A new 11/0.4kV substation may be required, subject to system capability study by TNB
>350 kVA to < 1000kVA	A new 11/0.4kV substation is required
1000kVA up to <5000kVA	11/0.4kV and/or 11kV substations is required. A new PPU may be required, subject to system capability study by TNB
1000kVA up to 10000kVA	22/0.4kV and/or 22kV substations is required. A new PPU may be required, subject to system capability study by TNB
5000kVA to 25000kVA	11/0.4kV and/or 11kV and/or 33kV substations and/or PPU is required. A new PMU may be required subject to system capability study by TNB
Above 25000kVA	11/0.4kV and/or 11kV and/or 33kV substations and/or PPUs and PMUs 132kV is required. A new PMU 275kV may be required subject to system capability study by TNB

2.3.2 Substation Categories, Type & Design

2.3.2.1 Sub-Station Categories

a. Transmission Main Intake (Pencawang Masuk Utama-PMU)

Transmission Main Intake is the interconnection point of 132kV or 275kV to the distribution network. The standard voltage transformations provided at the PMU are as follows:-

- 275/132kV
- 132/33kV
- 132/11kV

b. Main Distribution Sub-Station (Pencawang Pembahagian Utama- PPU)

Main Distribution Sub-station is normally applicable to 33kV for interconnecting 33kV networks with 11kV networks. It provides capacity injection into 11kV network through a standardized transformation of 33/11kV.

c. Main Switching Station (Stesyen Suis Utama- SSU)

SSU at 33kV, 22kV and 11kV are established to serve the following function:-

1. To supply a dedicated bulk consumer (33kV, 22kV, 11kV)

2. To provide bulk capacity injection or transfer from a PMU/PPU to a load center for further localized distribution.

d. Distribution Substation (Pencawang Elektrik – P/E)

Distribution substations are capacity injection points from 11kV, 22kV and sometimes 33kV systems to the low voltage network (400V, 230V). Typical capacity ratings are 1000kVA, 750kVA, 500kVA and 300kVA.

Note: Service cable from the TNB 33 kV and 11 kV substation (whereby the metering room is within TNB's control area) to the consumer substation shall be laid and maintain by TNB if the service cable is within 30 metres. For service cable above 30 meters shall be bourne by the consumer.

Conventional Substation

Conventional substation designs are of indoor type (equipment housed in a permanent building) and out-door type (ground-mounted or pole-mounted). Standard layout c/w M & E design of SSU 11kV and 11/0. 4kV sub-station is available at TNB offices, and publicly available in TNB website: *Substation Design Booklet*.

Compact Substation

Compact substation 11/0.4kV is being considered as standard substation for installation at new development with following guideline:

- Maximum size of compact substation 11/.4kV for new housing development (domestic consumers) is 500kVA.

- Maximum size of compact substation 11/.4kV for new commercial and industrial development is 1000kVA, subject to availability of matching size metering kiosk for single-customer connection.
- Compact substation to be placed close to the load center.
- Compact substation not to be placed at the corners of one development, and to be away from the sewarage plant.
- Compact substation cannot be placed close to each other to ensure efficient load distribution to the consumers.

The selection of compact substation placement is subject to TNB system planning and operational requirement. Compact substation is not suitable in circumstances as follow that requires indoor type substation:

- Places identified for circuit breaker installation including places of important and sensitive.
- Places with more than two 11kV feeder connections.
- MSC status area
- Within the attached type substation building

Main Distribution Substation / Main Switching Substation
Appropriate distribution network design to ensure security of supply & restoration time to consumers:

- If the development is more than 5MVA, Main Distribution Substation (PPU) and / or Main Switching Station (SSU) shall be provided by the developer within the housing development to support 11kV network connection to respective distribution substation.
- For development that is less than 5MVA, requirement of Main Distribution Substation (PPU) and / or Main Switching Station (SSU) depends on the existing network configuration & constraints.

2.3.2.2 Land Or Building Size Requirements For Substations

Table 3-3: Land and building size requirements for substations

Substation Category	Type	Land Size (Average Dimensions – NOT inclusive of Land Set-back Requirements)	Building Size (Average Dimensions)
Transmission Main Intake/Pencawang Masuk Utama (PMU): (a) 132/33/11kV (b) 132/33/11kV (with capacitor bank)	Gas Insulated Switchgear (GIS) Without outdoor switchyard	(a) 60.0m x 80.0m (b) 140 m x 75m	Customized design to match land size building bylaws

Substation Category	Type	Land Size (Average Dimensions – NOT inclusive of Land Set-back Requirements)	Building Size (Average Dimensions)
Transmission Main Intake/Pencawang Masuk Utama (PMU): (a) 132/33/11kV (b) 132/33/11kV (with capacitor bank)	Air Insulated Switchgear (AIS) With outdoor switchyard	(a)130.m x 130.0m (b) 160 m x 150 m	Customized design to match land size building bylaws
Main Distribution Substation (PPU) (a) 33/11kV (b) 22/11kV	Indoor type	46.0m x 46.0m	Customized design to match land size building by laws (refer to *Substation Design Booklet*)
Main Switching Substation (SSU) (a) 33kV (b) 22kV(phasing out to 33kV)	Indoor	30.0m x 30.0m	Customized design to match land size building by laws (refer to *Substation Design Booklet*)
Main Switching Station (SSU) 11kV (for LPC)	Conventional – Stand alone	Land size to take into consideration of Uniform Building By-Law's set-back requirement Refer to *Substation Design Booklet* for building layout details Substation building colour shall be blended with the surrounding development	7.6 m x 5.7 m
Main Switching Station (SSU) 11kV (to support 11kV network connection to respective distribution substation (PE).)	Conventional – Stand alone		7.0 m x 6.0 m
Distribution Substation (P/E) (a) 11/.415kV (b) 22/.415kV	Conventional – Stand alone (a)Single chamber		7.6 m x 5.7 m
	(b) Double chamber		10.6 m x 5.7 m
	(c) Compact substation	7.0m x 4.0m	NA

Note: Set-back requirement (subject to respective local authority's latest requirement) :

(a) JKR : On all Federal and State Routes: 20.1m (66ft) from center of road + 15.0m (50ft) for service road to substation site.

(b) Local Authority/City Council/Jabatan Perancang Bandar : 6.1m (20ft) for building line + other requirements as requisitioned by Local Authority/City Council/Jabatan Perancang Bandar.

(c) LLM (Malaysian Highway Authority): As requisitioned by LLM.

The establishment of transmission main intake also requires the allocation and acquisition of right of way or wayleaves for the transmission lines. Depending on the specific design of each PMU, the overall right of way or wayleaves requirements may be different.

Developers of large-scale development areas, depending on the estimated demand shall be required to allocate land for any or a combination of sub-stations categories, wayleaves or right of way for 132kV/275kV lines. These requirements will be specified by TNB upon submission of tentative layout plans and load estimates for the whole development area during pre-consultation stage.

2.3.2.3 Type of fire fighting System for the Substation

Consumer is required to install fire fighting system in substations of following types:

i. Attached type substation
ii. Transmission Main Intake (PMU) / Main Distribution Substation (PPU) / Main Switching Station (SSU)
iii. Standalone substation with generator room attached.

The fire fighting system for use in substation must be certified by TNB with valid "Certificate of Product Acceptance" (Sijil Guna Pakai – SGP) by TNB.

The fire fighting system must be designed to suit the substation and meets the following criteria:

i. Shall be a complete system consists of suppression system and alarm and detection system.
ii. Must be certified and tested by certified test agencies (UL, FM, LPCB or equivalent)
iii. Must be verified by Bomba as a total flooding system.
iv. Must be designed to suit and use in substation
v. Extinguishing Agent must be clean and residual-free and must not be corrosive on electrical and electronic equipment.
vi. Environmentally friendly as determined by Kyoto Protocol, Montreal Protocol and EPA SNAP List / EPEE
vii. Occupant safe
viii. Must be suitable for extinguishing all Classes of fire (Class A, B, C and E)
ix. Fire fighting system shall be given a warranty of 5 years from date of commissioning by installer that covers all of above and in the event of accidental discharge occurs, warrantee shall cover damages on TNB equipment.

Fire fighting system installed at TNB installation shall be approved according to standards given below :-

1. Suppression system
   a. MS ISO 14520 - Gases Fire Extinguishing System
   b. NFPA 2001 - Clean Agent Fire Extinguishing System
   c. NFPA 2010 - Aerosol System

2. Alarm and detection system
   a. ISO 7240 - Fire Detection and Alarm System
   b. NFPA 72 - Standards for Protective Signalling
   c. EN 54 - Standardization for All Component Parts of a Fire System

All maintenance work shall be conducted by the consumer or owner of building based on standard NFPA: 2001 and ISO14520.

Exhaust fan with thermostat control is required to be installed at all attached substations (SSU 11kV and P/E 11/0.4kV) as well.

2.3.3 Standard And Special Feature Design Schemes

Standard features of supply schemes are categorized as those typical design schemes for individual or consumer groups or classes. Typical cases are as follows:-

(i) Supply scheme supplying domestic premises is predominantly through overhead systems and conventional sub-station.

(ii) Bulk supply consumers at 11kV and above, are normally supplied via one or two service cables depending on the MD required. All system will be designed based on Security Level 3 or Security Level 4. If higher security level is required, or another dedicated cable is required by the consumer, then it shall be considered as special features.

(iii) Consumers with MSC status or applying for MSC status requiring higher security level, the installation to meet the higher security level shall be considered as special features.

(iv) For any special features, consumer is required to bear the cost of equipment, installation and any related scope of work.

2.4.0 CONNECTION GUIDELINE FOR EMBEDDED / DISTRIBUTED GENERATORS

The Connection Guideline for Embedded / Distributed Generators shall be in accordance to the Renewable Energy Act 2011 and its subsidiary legislation.

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. 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 The Consumer shall ensure that the 3G 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 ("RMR"). The Customer shall obtain the advice from TNB on the minimum signal strength of -77dBm and above.

3.1.4 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.

3.1.5 For low voltage supply requiring metering CT, TNB shall provide low voltage CTs for the meter installation. The CTs shall be of the single ratio and single purpose type.

3.1.6 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

3.1.7 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.

3.1.8 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.

3.1.9 Customers participating in New Enhanced Dispatch Agreement (NEDA) programme shall

i. Agree all data declared in the portals (such as TNBTWeb/Market Participants Interface etc.) are valid for settlement purposes.
ii. Install separate metering systems for the import and export energy if the export capacity is lower than 5% of the declared import demand.
iii. Install separate metering systems for the import and export energy if the export capacity is higher than 100% of the declared import demand.

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 10, Drawing No. 2A.**

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 9, Drawing No. 1A, 1A(i), 1A(ii).**

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 12, Drawing 4A and 5A.**

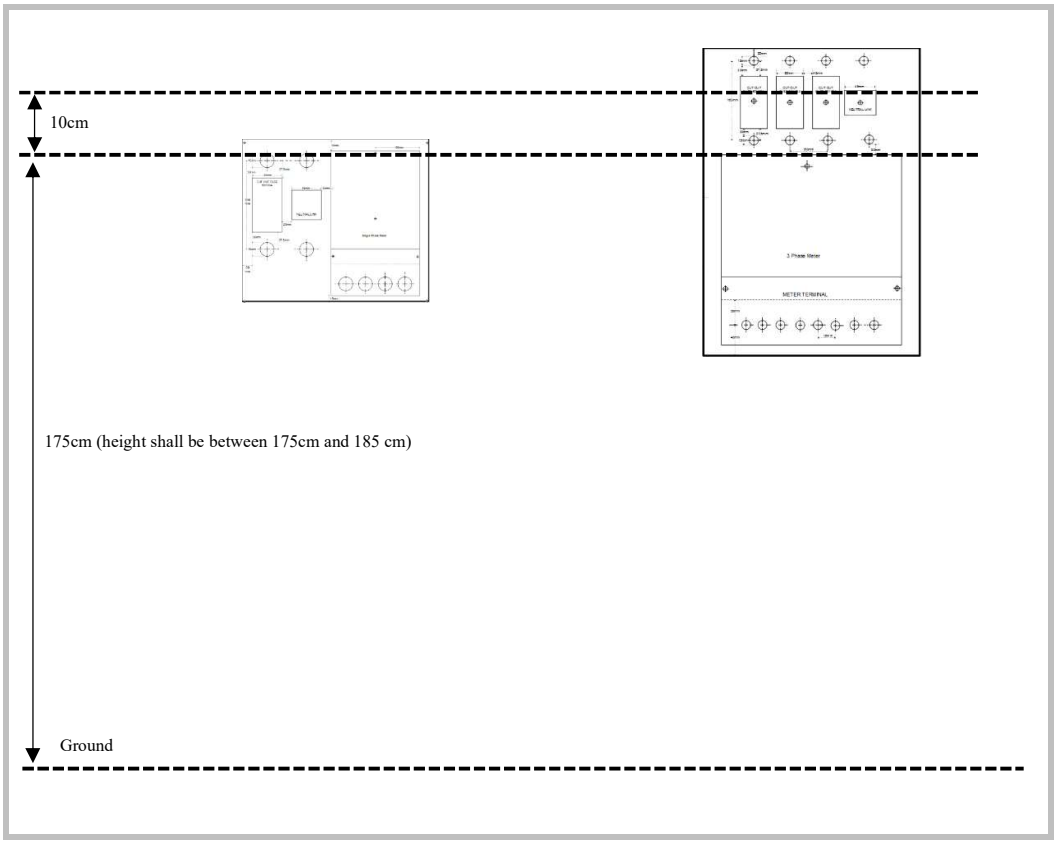
v. Consumers whose nature of business involve very dusty or dirty environment shall be required to provide outdoor meter panel to protect the meter installation.

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) Fibre board / plate with minimum thickness of 5.0 mm. The diagram of the board is shown in **Appendix 10, Drawing No 2A.**

ii. The arrangement for the meter, cut out, termination wires and the recommended size of the board is shown in **Appendix 11, Drawing No. 3A and 3B.**

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.

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 at poles for e.g. temporary supply or in mining areas, the recommended meter box is shown in **Appendix 13, Drawing No. 5A.**

3.2.5 Wiring Arrangement

i. The size of meter cables shall be at minimum 10 mm sq. and shall not exceed 25 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.

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 2.2 (i) – (viii) applies for the locations of three phase meter position.

3.3.3 Height of Meter Position

The requirements given in 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 14, Drawing No. 6A – 6C** respectively.

ii. The requirements given in 2.4 apply for the three phase meter board.

3.3.5 Wiring Arrangement

i. The requirement given in 2.5 (i) – (ii) 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 external wiring, please refer to **Appendix 15 Drawing No. 7A, 7B and 7C.**

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 5.0 or 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 4.1.

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 weather proof 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 16, Drawing No 8A – 8C** for single phase group metering and **Appendix 17, Drawing No 9B – 9D** 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 16 & 17.**

ii. Wiring Arrangement

- The requirement given in 2.5 (i) – (ii) also applies for the three wiring arrangement.
- For external wiring, please refer to **Appendix 15 Drawing No 7A, 7B and 7C.**

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.

ii. The recommended size and arrangement of the meters, cut-outs, and neutral link is as shown in **Appendix 16, Drawing No. 8A – 8C** for single phase group metering and **Appendix 17, Drawing No. 9B – 9D** 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 3G 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 ("RMR"). The Customer shall obtain the advice from TNB on the minimum signal strength of -77dBm and above.

iii. The maximum distance of the cable from the CTs to the meter panel allowable is shown in Table 1 below. Prior approval for location of the metering panel shall first be obtained from TNB.

Table 1

CT Burden VA	Secondary Rated Current A	Cross Connection of Conductor mm2	Maximum Distance Allowable m
7.5 7.5	5 5	2.5 4.0	12.0 20.0

Where meter burden for current circuit is: L.V. = 0.5 VA/ph

3.5.2 Meter Panel Requirement

i. All metering panels shall be provided by the consumer.

ii. For multi-feeder metering, separate meter panels are to be used for each feeder.

iii. The meter panels shall be ground mounted. Refer to Appendix 18 for meter panels design and specifications.

3.5.3 LVCT Metering Installation Requirements

i. A 12 core 2.5 mm^2 or 4 mm^2 steel wire armoured cable shall be provided between the meter panel and current transformers and voltage source. The armoured cable shall not be buried or enclosed

ii. A 6.0 mm tap-hole plus screw/washer shall be provided on each busbar to facilitate connection of the voltage supply to the meter voltage coils.

3.5.4 Mounting of Metering Low Voltage Current Transformers (LV CTs)

i. For RE installation where the incoming supply is controlled by a circuit breaker in meter panels, the metering CTs shall be installed before the circuit breaker and the meter voltage connections made.

ii. The LV CT shall be provided by TNB as below.

Table 2

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
1000/5	85 mm	125 mm
1200/5	100 mm	140 mm

iii. 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 19 Drawing No. 11A - 11P** 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 send 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 61869-2

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 61869-2

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 61869-3

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 61869-3

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

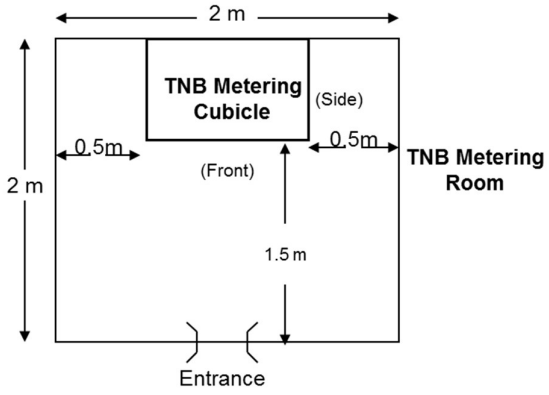
3.6.5 Location Of Metering Panel

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 mm2 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 mm2 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 bespecified in **Appendix 19 (Drawing No. 11A - 11P).**

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 19 Drawing 11 E** for a 1 or 2 feeder cubicle and **Appendix 19 Drawing 11 J** 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.

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.

4.0 GLOSSARY AND DEFINITIONS

In this guideline, the following words and expressions shall bear the following meanings:

Active Energy	The electrical *energy* produced, flowing, or supplied by an electric circuit during a time interval, being the integral with respect to time of the instantaneous power, measured in units of watt-hours (wh) and multiples thereof.
Active Power	The product of voltage and the in-phase component of alternating current measured in units of watts and multiples thereof.
Adequate / Adequacy	The ability of the *distribution system* to provide acceptable and continuous supply while remaining within component ratings during *contingencies*.
Apparent Power	The product of voltage and of alternating current measured in units of volt amperes. Is also the square root of the sum of the squares of the *active power* and the *reactive power*.
Automatic Voltage Regulator	A *System* for controlling *generating unit* or *transformer* voltage within set limits.
Capacitor Bank	Electrical equipment used to generate *reactive power* and support voltage levels on distribution and transmission lines in periods of high *load*.
Capacity	The net MW and MVAr *capacity* of a *generating unit*, or any other transmission/distribution *apparatus* at a particular time, to supply electrical *energy*.
Connection Point	The agreed point of supply established between a *distributor* and other *entity*.
Consumer	A person who engages in the activity of purchasing *energy* supplied through a *Transmission or distribution system*; and/or the final end *User* of *energy*.
Contingency	In respect of a transmission or *distribution network*, a sequence of related *Events* which result in *outage*s of one or more transmission or distribution elements.
Current Harmonic Distortion	It is the measure of the departure of the a.c. current waveform from sinusoidal shape, that is caused by the addition of one or more harmonics to the fundamental.

Current Transformer (CT)	A *transformer* for use with *meter*s and/or *protection* devices in which the current in the secondary winding is, within prescribed error limits, proportional to and in phase with the current in the primary winding.
Customer	Please refer to the term *consumer*.
Demand	The *demand* of MW and MVAr of electricity (i.e., both Active and *reactive power*), unless otherwise stated, at a particular time or during a time period.
Discrimination	The quality where a relay or protective *system* is enabled to pick out and cause to be *disconnected* only the faulty *apparatus*.
Distribution Network	A *system* comprising of electrically *connect*ed equipment or elements that produce, transport, transform, control, and consume electrical power at v*oltage* levels of 33kV, 22kV, 11kV, 6.6kV, 400V and 230V.
Distribution System	The *system* consisting (wholly or mainly) of electric lines which are owned and operated by *distributor* and used for the distribution of electricity from *grid supply point*s or *generating unit*s or other entry points to the point of delivery to *consumers* or *Other distributors*.
Disturbance	Any perturbation to the electric *system* caused by the sudden loss of *generation* or *interruption* of *load*.
Electrical Contractors	Are contractors having a license from PKK in the electrical category (Class I, II or III) and also registered with the Energy Commission and have own certified chargeman and wireman also registered with the Energy Commission.
Electrical Consultant Engineer	Professional Electrical Engineer registered with the Board of Engineers Malaysia (BEM) after having fulfill all requirements to be a professional engineer as specified by BEM.
Embedded Generating Unit	A generating unit connected within a distributrion network and not having direct access to transmission network. This includes an *embedded generator connected* to its own Network which Network is *Interconnected* with the *distributor*'s Network either directly or through a step up *transformer*.
Embedded Generation	The production of electrical power by converting another form of *energy* in a *generating unit* that is *connect*ed to the *distribution system*.

Embedded Generator	A *generator* or *consumer* who owns, operates, or controls an *embedded generating unit*.
Energy (Active and Reactive)	*Active energy* is the electrical *energy* produced, flowing or supplied during a time interval measured in units of watt-hours (Wh) or standard multiples thereof. *Reactive energy* is the *energy* produced, flowing or supplied during a time interval measured in units of volt-ampere-hours reactive, (varh) or standard multiples thereof.
Extra High Voltage or EHV	A voltage more than 230kV
Extra Low Voltage or ELV	A voltage less or equal to 50V
Frequency	The number of alternating current cycles per second (expressed in hertz) at which alternating current electricity is operating.
Generation	The production of electrical power by converting another form of *energy* in a *generating unit*.
Generating Plant	Please refer to the term *generating system*.
Generating System	A *system* comprising one or more *generating unit*s.
Generating Unit	Any *apparatus* which produces electricity.
Interface	Point of connection defining the boundary between entities.
Interruption	The loss of service to one or more *consumer*s or other facilities and is the result of one or more component *outage*s for a sustained duration of greater than 1 minute, depending on the *system* configuration.
High Voltage (HV)	A voltage more than 50kV but less or equal to 230kV
Load	To Active, Reactive, or *apparent power*, as the context requires, generated, transmitted, distributed or consumed.
Loading	The *apparent power* level at which each element of the network is operated.
Low Voltage or LV	A voltage more than 50 volt but less or equal to 1KV
Medium Voltage or MV	A voltage more than 1kV but less or equal to 50kV
Meter	A device complying with Standards which measures and records the production or consumption of electrical *energy*.

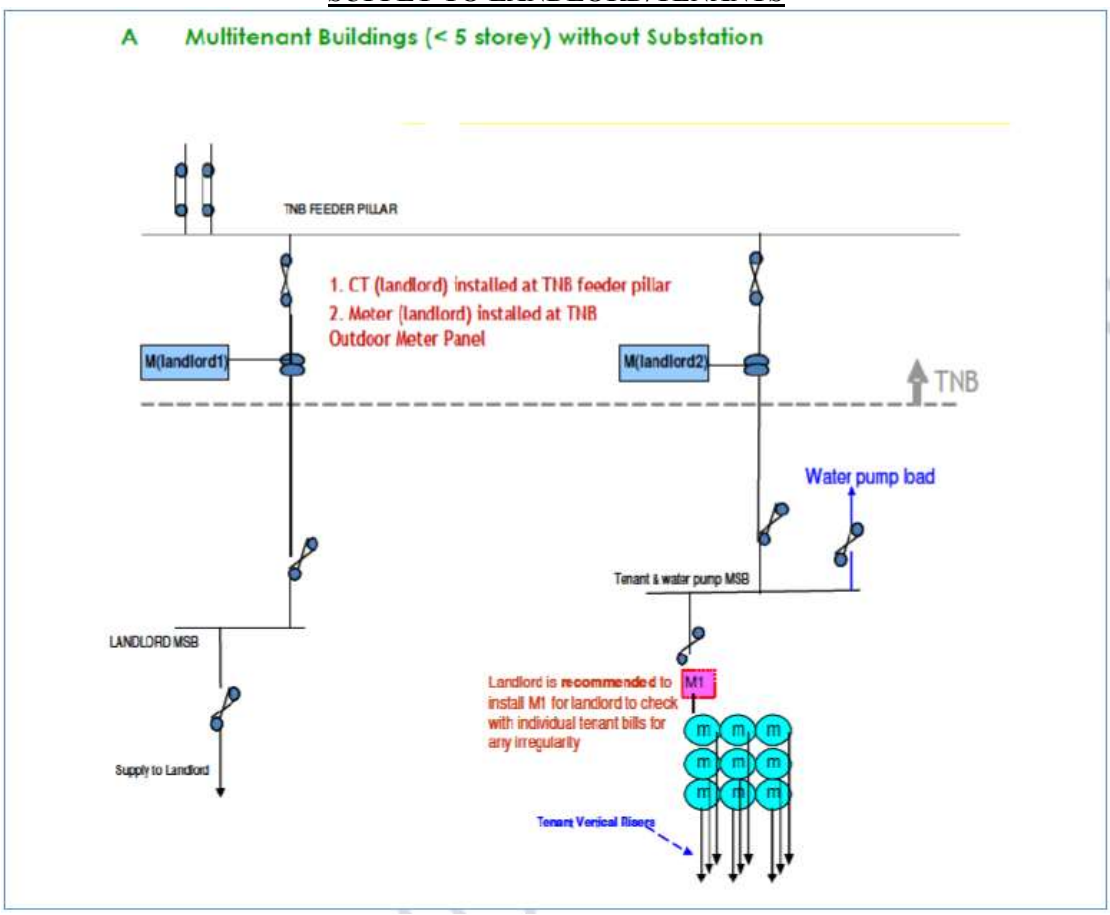
Metering	Recording the production or consumption of electrical *energy*.
Metering Data	The data obtained from a *metering* installation, the processed data or substituted data.
Metering Point	The point of physical *connection* of the device measuring the current in the power conductor.
Metering System	The collection of all components and arrangements installed or existing between each *metering point* and the *metering data*base.
MV Distribution Network	The various circuits and *apparatus* owned by the *distributor* operating at primary phase to phase voltages above 1 kV and less or equal to 50 kV.
Outage	Describes the state of the component when it is not available to perform the intended function due to some *Event* associated with that equipment. duration will count toward computation of *SAIDI*.
Planning Criteria	Please refer to the term *planning and design criteria*
Planning & design criteria	Refers to a set of measures for assessing the performance of the *distribution system* during the planning stage.
Point of Interface	A designated boundary of ownership between the *distributor* and the other *entities*.
Power Factor	The ratio of *active power* to *apparent power*.
Power Quality	It is the measure of the purity of supply voltage and current waveforms.
Power Quality Characteristics	In this Code the term refers to the measures used for determining the purity of the *a.c.* voltage or current waveforms.
Protection	The provisions for detecting abnormal conditions on a *system* and initiating fault clearance or actuating signals or indications.
Protection Apparatus	A group of one or more *protection* relays and/or logic elements designated to perform a specified *protection* function.
Protection System	A *system*, which includes equipment, used to protect facilities from damage due to an electrical or mechanical fault or due to certain conditions of the *power system*.

Prudent Utility Practices	With respect to the *distributor*, means the exercise of that degree of skills, diligence, prudence and foresight consistent with Electricity Supply Act 1990 and the Regulations, condition of *Licence*, standards, the Code and the *distributor* owned standards and practices.
Reactive Energy	A measure, in varhours (varh) of the alternating exchange of stored *energy* in inductors and capacitors, which is the time-integral of the product of voltage and the out-of-phase component of current flow across a *connection point*.
Reactive Power	The product of voltage and current and the sine of the phase angle between them measured in units of volt amperes reactive. The rate at which *reactive energy* is transferred.
Reliability	In the context of a *distribution system* is a measure of availability of *Adequate* and secure supply to the *consumer*s
Security	Means *Security Of Supply*.
Security of Supply	The ability of the *distribution system* restore supply to *consumer*s following momentary or *temporary interruptions*.
Single Contingency	In respect of a transmission or *distribution network*, a sequence of related *Events* which result in the removal from service of one transmission or *distribution line*, or *transformer*. The sequence of *Events* may include the application and clearance of a fault of defined severity.
Substation	A facility at which two or more lines are switched for operational purposes. May include one or more *transformer*s so that some *connected* lines operate at different nominal voltages to others.
Supply Security	Please refer to the term *Security Of Supply*.
Total Harmonic Distortion	The departure of a wave form from sinusoidal shape, that is caused by the addition of one or more harmonics to the fundamental, and is the square root of the sum of the squares of all harmonics expressed as a percentage of the magnitude of the fundamental *frequency*.
Transformer	A plant or device that reduces or increases the voltage of alternating current.

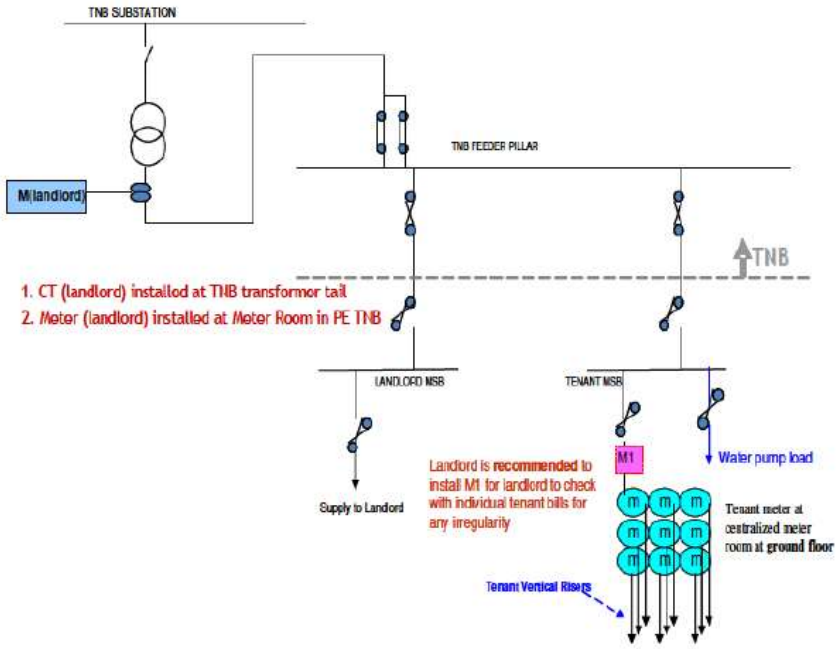
Distribution System	A *distribution system* that: (1) is used to convey, and control the conveyance of, electricity to *consumers* (whether wholesale or retail); and (2) is *connected* to another such *system*.
Voltage Dip	Transient reduction in voltage magnitude measured as the percentage or per unit reduction of the voltage magnitude to the nominal voltage magnitude.
Voltage Harmonic Distortion	It is the measure of the departure of the *a.c.* voltage waveform from sinusoidal shape, that is caused by the addition of one or more harmonics to the fundamental.
Voltage Sag	Transient reduction in voltage magnitude measured as the percentage or per unit remaining voltage magnitude to nominal voltage magnitude.
Voltage Sensitive *Load*	A *load* that will mal-operate on transient distortion of supply voltage sinusoidal waveform.
Voltage *Transformer* (VT)	A *transformer* for use with *meter*s and/or *protection* devices in which the voltage across the secondary terminals is proportional to and in phase with the voltage across the primary terminals.

5.0 APPENDICES

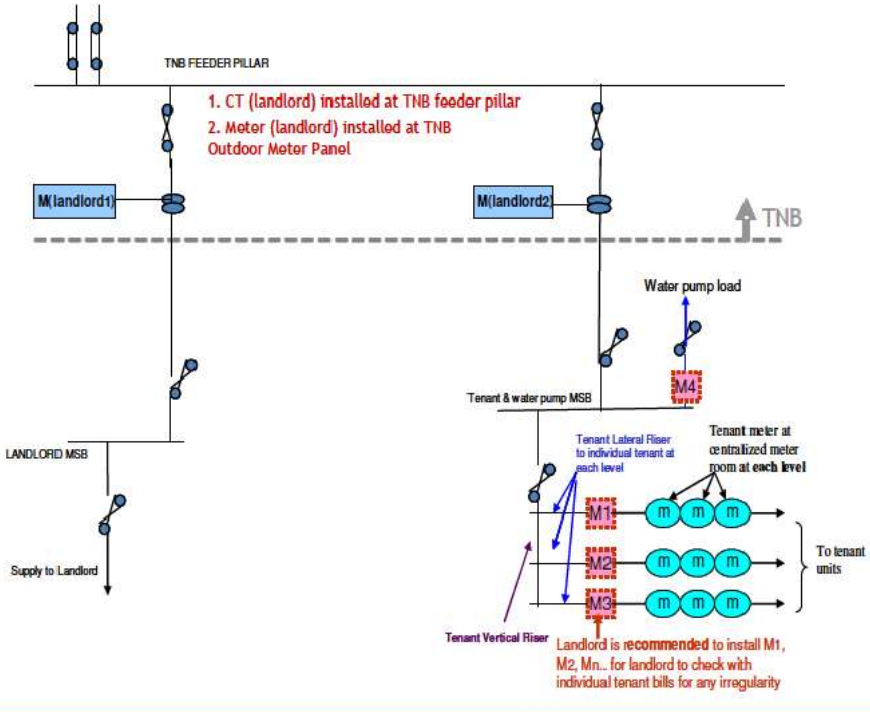
CONNECTION SCHEMES OF MULTI TENANTED PREMISES WITH INDIVIDUAL SUPPLY TO LANDLORD/TENANTS



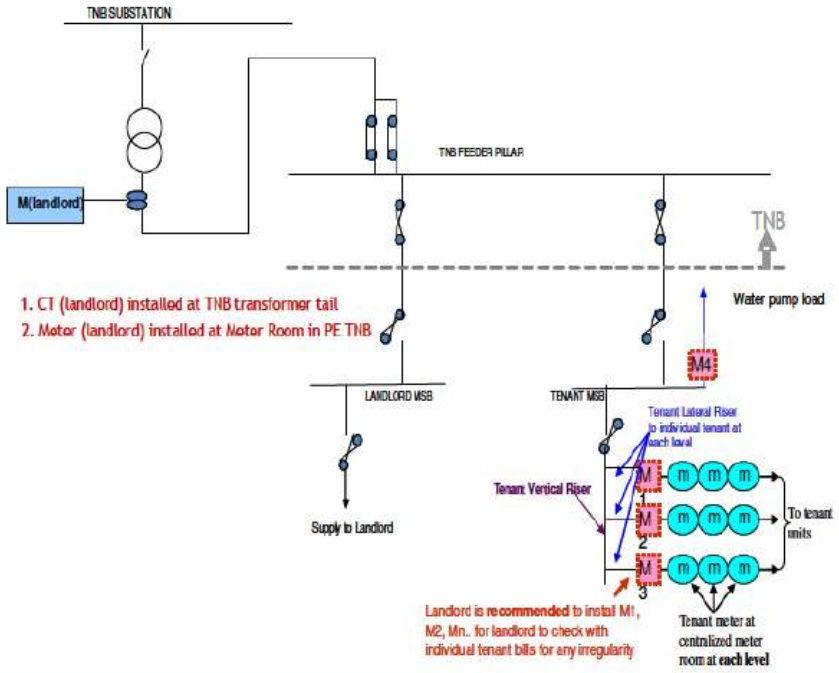
B Multitenant buildings (< 5 storey) with Substation



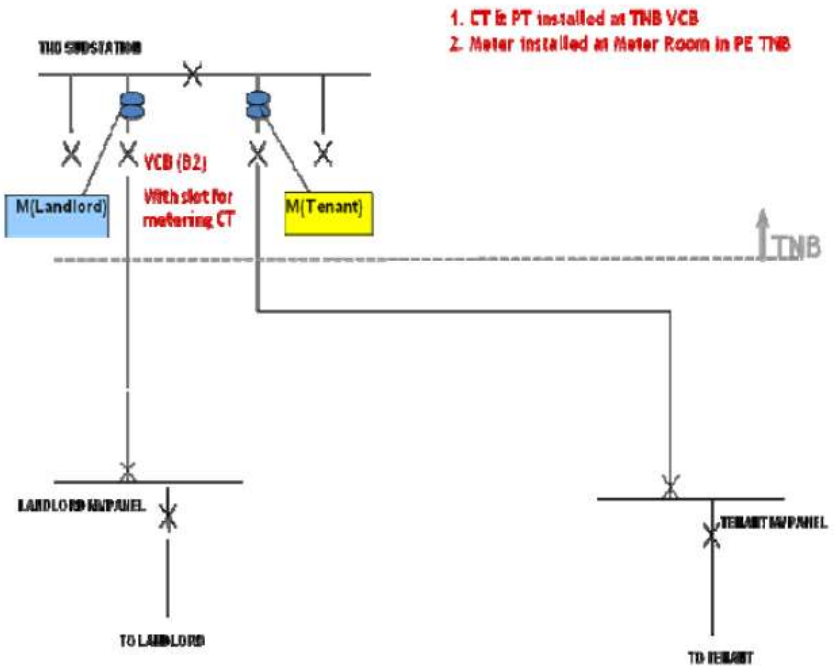
C Multitenant Buildings without Substation



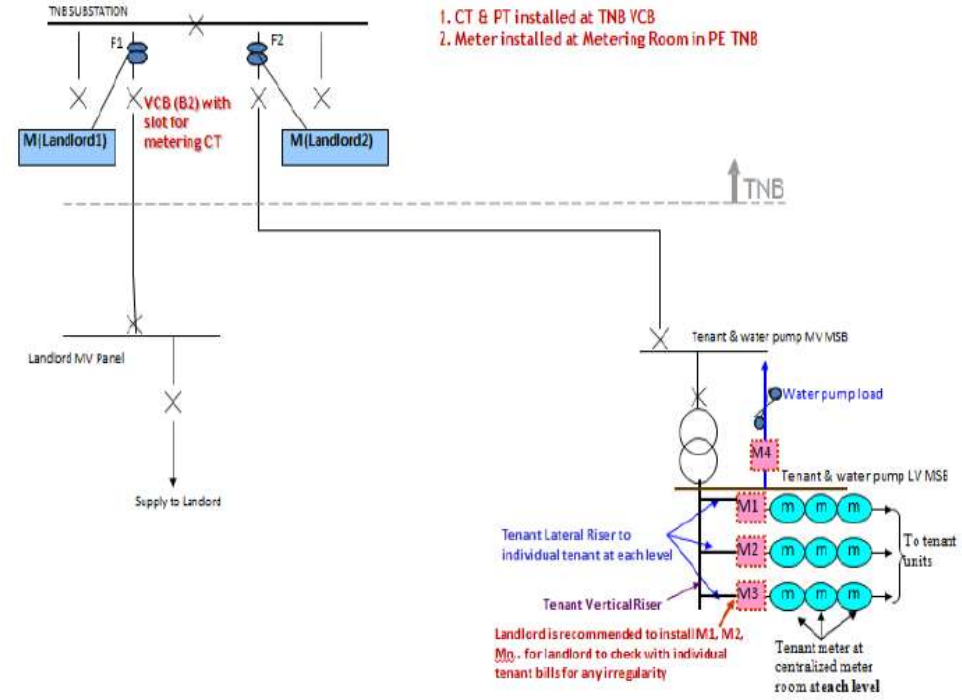
D Multitenant Buildings with Substation (Landlord & Tenant takes LV supply)



E Multitenant buildings with Substation (Landlord & Tenant takes MV supply)



F Multitenant buildings with Substation (Development takes MV supply with Landlord load >1600A)



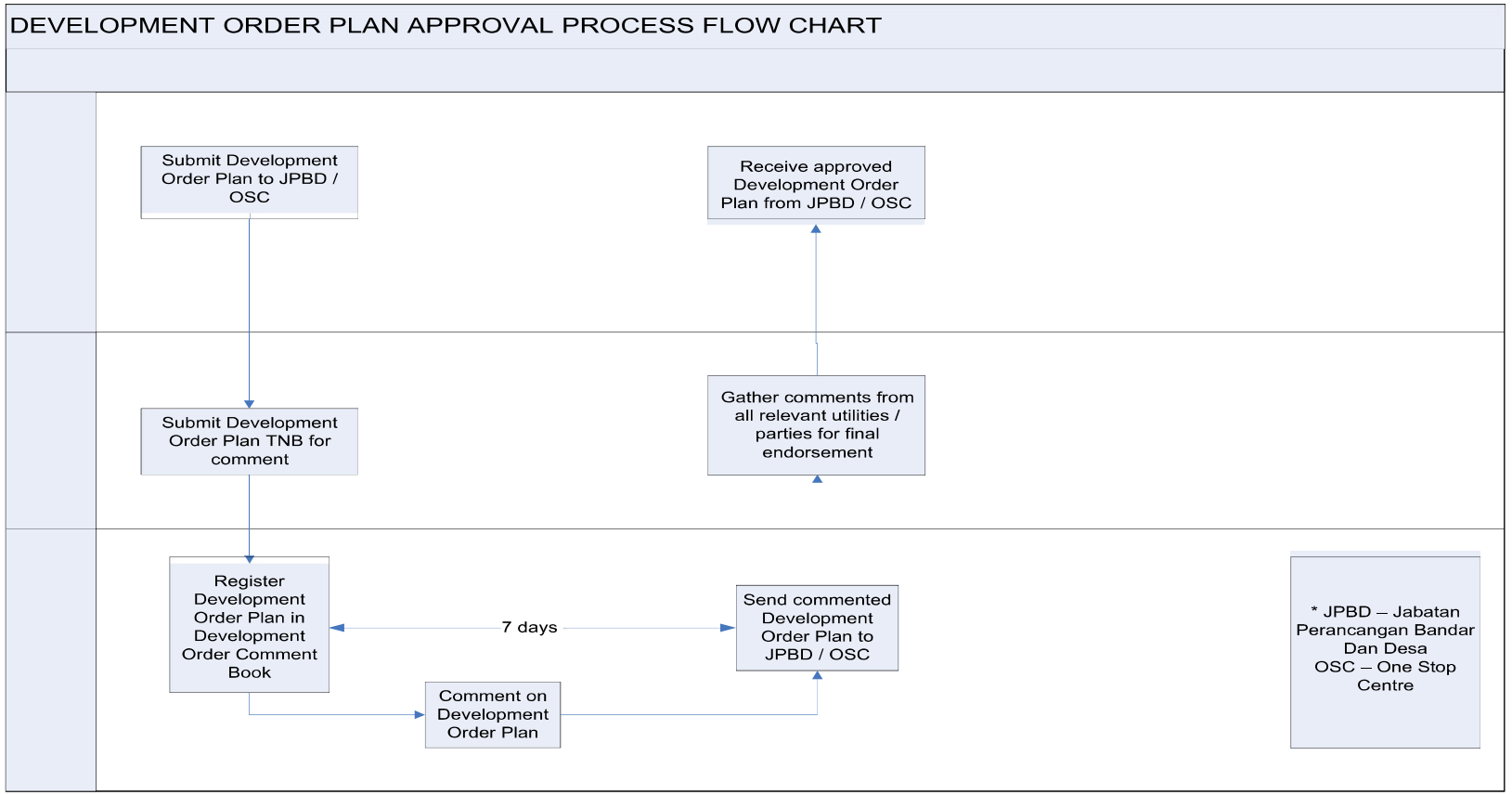
KEPERLUAN DOKUMEN PERMOHONAN BEKALAN ELEKTRIK KURANG DARIPADA 100A

Required Documents by Applicant	Under Personal Name	Company / Sole Proprietorship / Enterprise / Partnership / Society	Government Body / Agencies	Document Details
Completed & Signed Application Form	✓	✓	✓	
Copy of Applicant's Identification Document	✓	IC Copy of Authorized Person / Representative	IC Copy of Authorized Person / Representative (Optional)	e.g. NRIC or Passport
	-	Letter of Authorization with Company Letterhead	Letter of Authorization with Government/Agencies Letterhead	e.g. Letter indicating the company representative's name and NRIC
Copy of Registration Certificate	-	✓	-	e.g. Company (Form 9) or Business (Form D) or Joint Management Body Certificate or Management Corporate Certification or Association Registration Certificate or any other form of official registration document of the organization (for examples, Mosques and Private Islamic School are registered under The State Islamic Department, or Cooperatives are registered Cooperative Commission of Malaysia).
Documentary Proof of Premise Occupation	✓	✓	✓	e.g. S&P Agreement Applicant need to provide only the page containing: 1. First Page: Agreement with 2 parties (Premise Owner & Purchaser) 2. ii. Second Page: Full premise address with document stamped 3. Last Page: Signature of both Premise Owner & Purchaser or Tenancy Agreement: Applicant need to provide only the page containing

Required Documents by Applicant	Under Personal Name	Company / Sole Proprietorship / Enterprise / Partnership / Society	Government Body / Agencies	Document Details
				1. Applicant Name 2. Full premise Address 3. Date of Agreement or Court Order for Auction Property or Land Title or Strata Title. In the absence of the above documents, any relevant document that indicates the applicant's occupancy of the premise is also acceptable. For examples, other utility bills or invoices like Indah Water Konsortium (IWK), telephone bills or any official correspondences under the applicant's name. Additional supporting documents required under the new Amendments of ESA 1990 for Commercial and Industrial customers: 1. Proof of land ownership or consent from the land owner 2. Development Order from the local authority
Required Documents by the Appointed Electrical Contractor				
Form G - Supervision and completion certificate & Drawings Form H - Test Certificate & Drawings				✓
Location Map (e.g Google Map)				✓
Premise Picture (inclusive of premise, meter panel location and D hook if related)				✓
Picture of the nearest power supply with respect to premise				✓

APPENDIX 3

PART A: DEVELOPMENT ORDER PLAN APPROVAL PROCESS FLOW CHART



ELECTRICITY SUPPLY APPLICATION EXCEEDING 100A
CHECKLIST FOR CONSULTANT ENGINEER

NO	FORM/DOCUMENT	INFORMATION REQUIRED	STAGE 1	STAGE 2
A	1. Basic Information	Address of Installation	Y / N	
		Name & Address of Owner / Developer	Y / N	
		Name & Address of Consultant Engineer	Y / N	
		Type of Premise	Y / N	
		Voltage Level (275kV, 132 kV, 33 kV, 22 kV, 11 kV, 0.4kV)	Y / N	
		Supply Scheme (O/H or U/G; Bulk IPD)	Y / N	
		Total Load Required (kW)	Y / N	
		Date Supply Required	Y / N	
		Latest site photo	Y / N	
A	2. Plan & Drawings (refer to latest ESAH)	Latest Development Order Plan approved by local authority	Y / N	
		Site Plan & contour plan with Proposed Sub-Station Sites (Top view & Side-Section Plan)	Y / N	
		Location plan on meter panel / room or front elevation of building requiring supply (to determine meter location)	Y / N	
		Layout Plan of Sub-station Building	Y / N	
		Location & Layout Plan of Main Switch Room	Y / N	
		Single Line Diagram / Schematic of Installation	Y / N	
		Storage Device / CD for all the above plans (JUPEM standard map with Coordinates System – UTM WGS84)	Y / N	
B	Load Details		Y / N	
C	Metering Details		Y / N	
D	Load Profile & Consumption		Y / N	
E	Motor Loads		Y / N	
F	Capacitor Bank Installation		Y / N	
G	Power Quality Compliance Declaration Form		Y / N	
H	Fire Fighting Documentation for attached substation		Y / N	
	Substation Land	1 Copy Borang A (Perakuan Pajakan/Pindahmilik Tanah Pencawang)		Y / N
		Bank Guarantee		Y / N
		8 Copies Pre-Com Plan PE (Endorsed by certified surveyor)		Y / N
		1 Copy of Hakmilik / Geran		Y / N
	MV & HV Metering	Preliminary metering information sheet		Y / N

APPENDIX 5

SAMPLE OF APPOINTMENT LETTER OF CONSULTANT ENGINEER

Applicant's Letterhead (if available) consisting applicant's name and address

---

Rujukan :

Tarikh :

Kepada :
Pengurus Besar Negeri (Selangor)
Bahagian Pembahagian TNB
Persiaran Damai, Seksyen 11
40000 Shah Alam
Selangor.

SURAT PERLANTIKAN SYARIKAT JURUTERA PERUNDING……
SEBAGAI PERUNDING BAGI MENGURUSKAN PERMOHONAN BEKALAN ELEKTRIK KE……

Dengan ini kami mengesahkan pelantikan syarikat perunding di atas sebagai perunding rasmi yang akan menguruskan proses permohonan bekalan elektrik ke premis / tapak pembangunan di atas dengan pihak TNB.

Sekian, harap maklum.

Yang Benar,

…….
(Name of Applicant)

Office Stamp

s.k. Jurutera Perunding

SUMMARY OF LOAD FOR DEMAND EXCEEDING 100A

A. Basic Information		
1	Address of installation	
2	Site Location (Lot & Mk No.)	
3	Single-tenancy or multi-tenanted premise	
4	Type of Premise	
5	Total Gross Built-in Floor Area	
6	Total Land Area	
7	Name of Architect	
	Address	
	Telephone no.	
	Fax no	
	E-mail Address	
8	Name of Surveyor	
	Address	
	Telephone no.	
	Fax no	
	E-mail Address	
9	Name of Owner/Developer	
	Address	
	Telephone no.	
	Fax no	
	E-mail Address	
10	Name of Consultant Engineer	
	Address	
	Telephone no.	
	Fax no	
	E-mail Address	
11	Name of Electrical Contractor	
	Address	
	Telephone no.	
	Fax no	
	E-mail Address	
12	Requirements for temporary supply	MD (Kw) : Date supply required :
		Voltage (V)
13	Date supply required (ORIGINAL)	MD (Kw) : Date supply required :
14	Date supply required (FINAL)	MD (Kw) : Date supply required :
15	PLANS* CERTIFIED BY PROFESIONAL ENGINEER 3 SETS : (Please specify plan no & date below)	
15a	Master Develepment/Layout Plan	
	(Pelan Induk Lokasi & Lot Pembangunan Tanah)	
	approved by JPB&D	Plan No : Date :
15b	Site Plan/Proposed Sub-station Sites	
	(Pelan Lokasi & Cadangan Tapak Pencawang	
	Elektrik Fasa)	Plan No : Date :
15c	Layout Plan of Sub-station Building	
	(Stand-Alone/ Compartment)	
	Pelan SusunAtur(Layout)Bangunan Pencawang	Plan No : Date :
15d	Layout Plan of Main Switch Rooms	
	(Pelan Bilik Suis & Skematik Papan Suis Pengguna)	Plan No : Date :
15e	Single Line Diagram/Schematic of Installation	
	(Pelan Skematik Pepasangan)	Plan No : Date :
16	Front elevation of building requiring supply	

***NOTES:**

(i) The Master Develepment/Layout Plans (15a) are approved by Local Authority/Jabatan Perancang Bandar & Desa/Jabatan Tanah & Galian
These Plans should already contain TNB preliminary comments on sub-station and right of way/wayleave requirement,as the case may be

(ii) The Site Plans/Proposed Sub-stations Sites (15b) indicate the locations of sub-station sites for the overall development area

(iii) The Layout Plans of sub-station building (15c) must show the cable entry locations,trenching and ducting details according to TNB specifications

(iv) Layout Plan of Main Switch-room (15d) must indicate the location of MSB,trenching/ducting details for cable entry

(v) The Wiring Diagrams should indicate incoming switches,metering location and devices,protection schemes and devices, bus-bar and switchgear rating

(vi) All drawings and plans are to be submitted in three (3) complete sets. Soft copies in ACAD are also preferable.

MAP B FOR LANDLORD TENANT SCHEME

TENAGA NASIONAL

Map B: Load Details

PROJECT TITLE: Tajuk Projek:

** MSB Labelling must match with single line diagram MSB naming*
**Building and MSB Labelling for Landlord/Tenants only*

							Load Details (Total including special loads)				
No .	**Type of Development**	**Building**	**MSB Labelling**	**Type of Premise**	**No of Units**	**Tariff**	**Total Connected Load (kW)/Unit**	**Individual Coincident Factor**	**kWMD /Unit**	**GCF** Dom =0.79 Com = 0.87 Ind = 0.79 Single = 1.00	**Total kWMD**
1	Landlord /Tenant	Tower A		Landlord: Water pump load/common load					0.00		
									0.00		
									0.00		
									0.00		
									0.00		
									0.00		
				MSB Tenant (Bulk Meter) *Note: meter size for the 2nd feeder of Land-lord should be summation of Water pump load & all Tenants load within the same Tower block*							**0**
				Landlord / JMB [exclude water pump load/common load]					0.00		
2	Landlord /Tenant	Tower B		Landlord: Water pump load/common load					0.00		
									0.00		
									0.00		
									0.00		
									0.00		
									0.00		
									0.00		
				MSB Tenant (Bulk Meter) *Note: meter size for the 2nd feeder of Land-lord should be summation of Water pump load & all Tenants load within the same Tower block*							**0**
				Landlord / JMB [exclude water pump load/common load]					0.00		
Grand Total					**0**						**0**

TENAGA NASIONAL

Map B: Special Loads

PROJECT TITLE: Tajuk Projek:

** MSB Labelling must match with single line diagram MSB naming*
**Building and MSB Labelling for Landlord/Tenants only*

No .	Type of Development	Building	MSB Labelling	Type of Premise	No of Units	Tariff	Additional info: Special Loads (For Industrial applicant only) Type: Arc furnace /Arc welding / PQ sensitive / none	kWMD
1	Landlord /Tenant	Tower A		Landlord: Water pump load/common load				
				MSB Tenant (Bulk Meter) *Note: meter size for the 2nd feeder of Land-lord should be summation of Water pump load & all Tenants load within the same Tower block*				
				Landlord / JMB [exclude water pump load/common load]				
2	Landlord /Tenant	Tower B		Landlord: Water pump load/common load				
				MSB Tenant (Bulk Meter) *Note: meter size for the 2nd feeder of Land-lord should be summation of Water pump load & all Tenants load within the same Tower block*				
				Landlord / JMB [exclude water pump load/common load]				
Grand Total					**0**			

TENAGA NASIONAL

Map B: Meter Details

PROJECT TITLE: Tajuk Projek:

** MSB Labelling must match with single line diagram MSB naming*
**Building and MSB Labelling for Landlord/Tenants only*

							Meter Details				
No .	**Type of Development**	**Building**	**MSB Labelling**	**Type of Premise**	**No of Units**	**Tariff**	**Supply Connection Scheme (Underground / overhead)**	**Voltage Level**	**No of meters**	**Meter Type**	**CT Size (If applicable)**
1	Landlord /Tenant	Tower A		Landlord: Water pump load/common load							
				MSB Tenant (Bulk Meter) *Note: meter size for the 2nd feeder of Land-lord should be summation of Water pump load & all Tenants load within the same Tower block*						
				Landlord / JMB [exclude water pump load/common load]							
2	Landlord /Tenant	Tower B		Landlord: Water pump load/common load							
				MSB Tenant (Bulk Meter) *Note: meter size for the 2nd feeder of Land-lord should be summation of Water pump load & all Tenants load within the same Tower block*						
				Landlord / JMB [exclude water pump load/common load]							
Grand Total					**0**				**0**		

MAP B FOR NORMAL SCHEME

TENAGA NASIONAL

Map B: Load Details

Tajuk Projek:

					Load Details (Total including special loads)				
No .	**Type of Development**	**Type of Premise**	**No of Units**	**Tariff**	**Total Connected Load (kW)/Unit**	**Individual Coincident Factor**	**kWMD /Unit**	**GCF** Dom =0.79 Com = 0.87 Ind = 0.79 Single = 1.00	**Total kWMD**
1	Multi Premise						0.00		
							0.00		
							0.00		
							0.00		
							0.00		
							0.00		
							0.00		
							0.00		
							0.00		
							0.00		
							0.00		
							0.00		
							0.00		
Grand Total			**0**						**0**

TENAGA NASIONAL

Map B: Special Loads

Tajuk Projek:

No .	Type of Development	Type of Premise	No of Units	Tariff	Additional info: Special Loads (For Industrial applicant only)	
					Type: Arc furnace /Arc welding / PQ sensitive / none	kWMD
1	Multi Premise					
Grand Total			**0**			

TENAGA NASIONAL

Map B: Meter Details

Tajuk Projek:

					Meter Details				
No .	**Type of Development**	**Type of Premise**	**No of Units**	**Tariff**	**Supply Connection Scheme (Underground / overhead)**	**Voltage Level**	**No of meters**	**Meter Type**	**CT Size (if applicable)**
1	Multi Premise								
Grand Total			**0**				**0**		

D. Load profile and consumption data, if relevant :-			
Monthly Peak MD (kW)	Monthly Consumption (hours/month)	Load Factor	Estimated monthly consumption (kWh)

E. Details on Motor Loads						
Motor Size	Type of control equipment	Sub-transient Reactance / Loacked Rotor Reactance	Starting Current (Amps)	Starting Frequency (nos/hour)	Power Factor	Under voltage setting

F. Capacitor bank installation :-			
Type of connection			Star / Delta
No. of bank			
KVAr/bank			
Total KVAr			
Tupe of control equipement			

POWER QUALITY DECLARATION FORM

Declaration of Electromagnetic Compatibility (EMC) Compliance

1.0 Name of customer

2.0 Area / State:

3.0 Type of industry:

4.0 Declared Maximum Demand (MW):

<table>
<tr><th>Types Of PQ Disturbances</th><th>Reference Standards</th><th>Declaration / Results of PQ study/ Compliance</th><th>Compliance (Yes/No)</th></tr>
<tr><td>Voltage Step Change</td><td>Engineering Recommendation ERP28</td><td><table><tr><th>Type of equipment</th><th>Category</th><th>ΔV %</th></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table></td><td></td></tr>
<tr><td>Voltage Flicker</td><td>Engineering Recommendation ERP28</td><td><table><tr><th>Location</th><th>P_{ST}</th><th>P_{LT}</th></tr><tr><td>Point of common coupling</td><td></td><td></td></tr></table></td><td></td></tr>
<tr><td>Harmonic Distortion</td><td>Engineering Recommendation ER G5/4</td><td><table><tr><th>Location</th><th>THDV (%)</th></tr><tr><td>Point of common coupling</td><td></td></tr></table></td><td></td></tr>
<tr><td>Voltage Unbalance</td><td>Engineering Recommendation ERP29</td><td><table><tr><th>Location</th><th>%</th></tr><tr><td>Point of common coupling</td><td></td></tr></table></td><td></td></tr>
<tr><td>Voltage sags</td><td>IEC 61000-4-11 & IEC 61000-4-34

Test & immunity classification:
Class 1 to class 3</td><td>Declaration of compliance

<table><tr><th>Critical equipment</th><th>Compliance Class</th></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table></td><td></td></tr>
</table>

Prepared by

Signature:

Name:

Date:

Approved by

Signature:

Name:

Date:

APPENDIX 8

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: Edisi: Tarikh:	1 of 1 2 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)

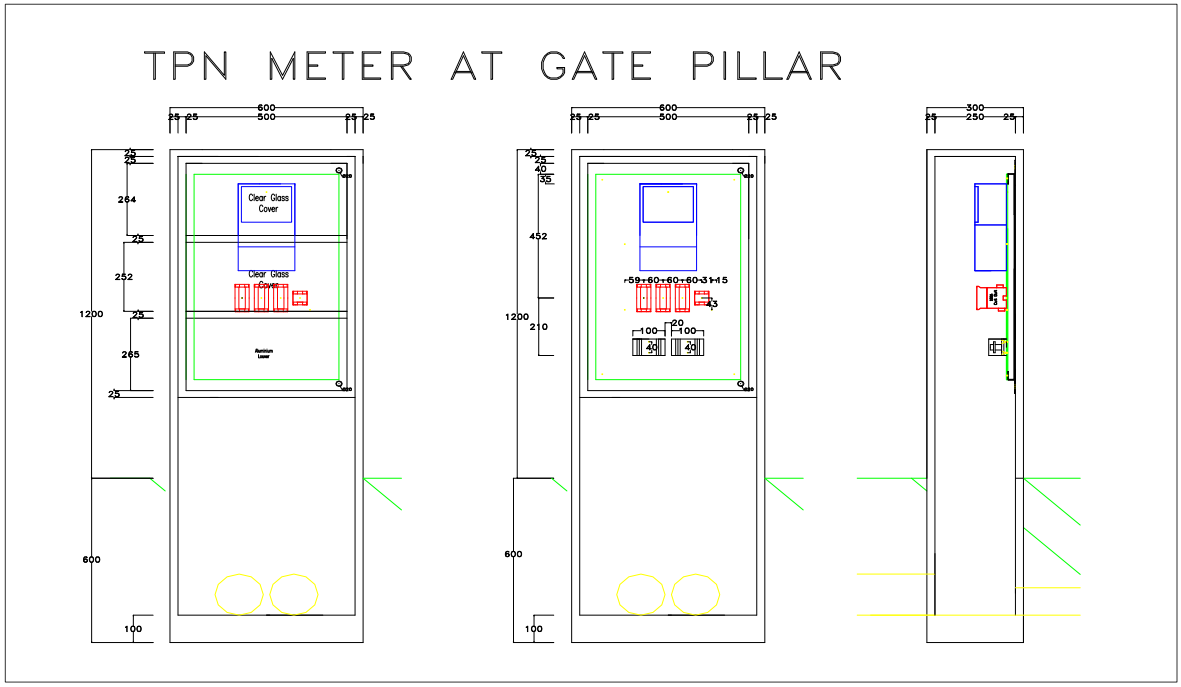
Diperakukan Oleh:

_____

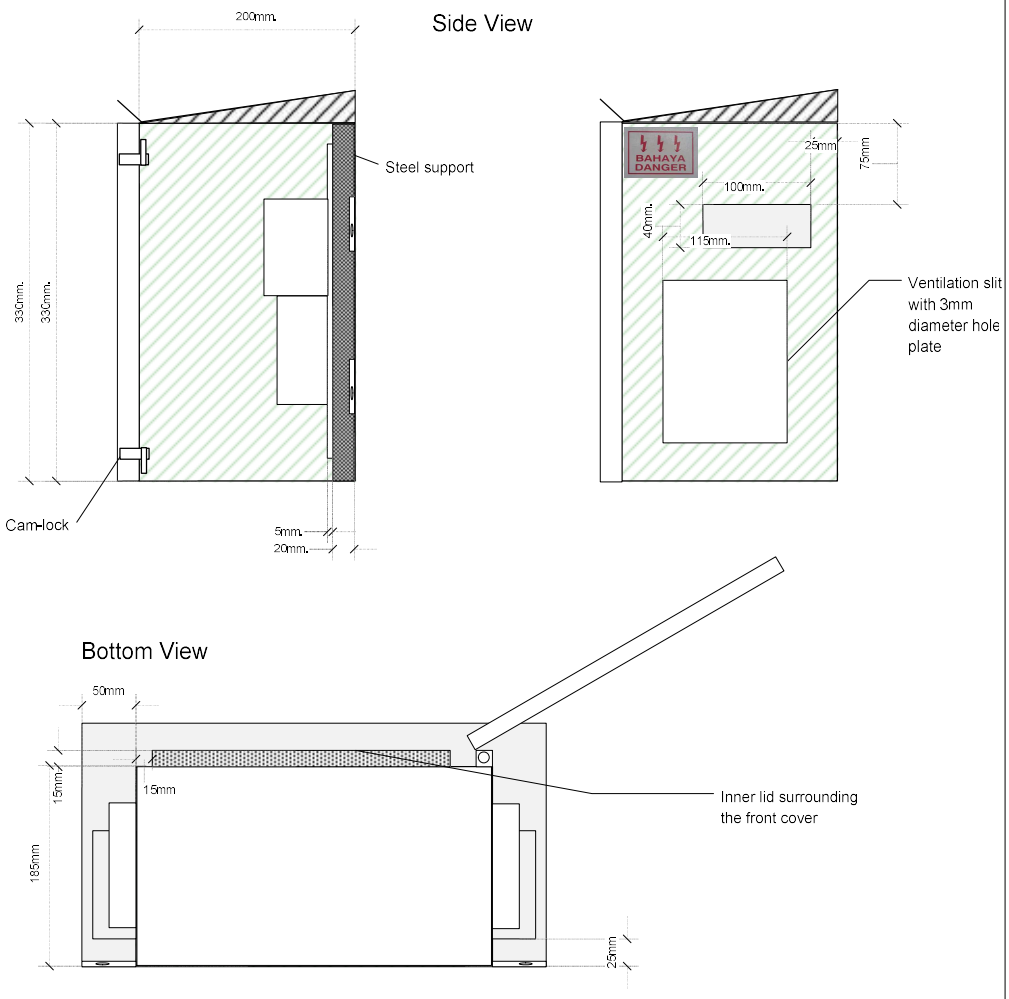
(Pengurus Kawasan / Cawangan)

APPENDIX 9

DRAWING NO 1A: METER AT GATE PILLAR



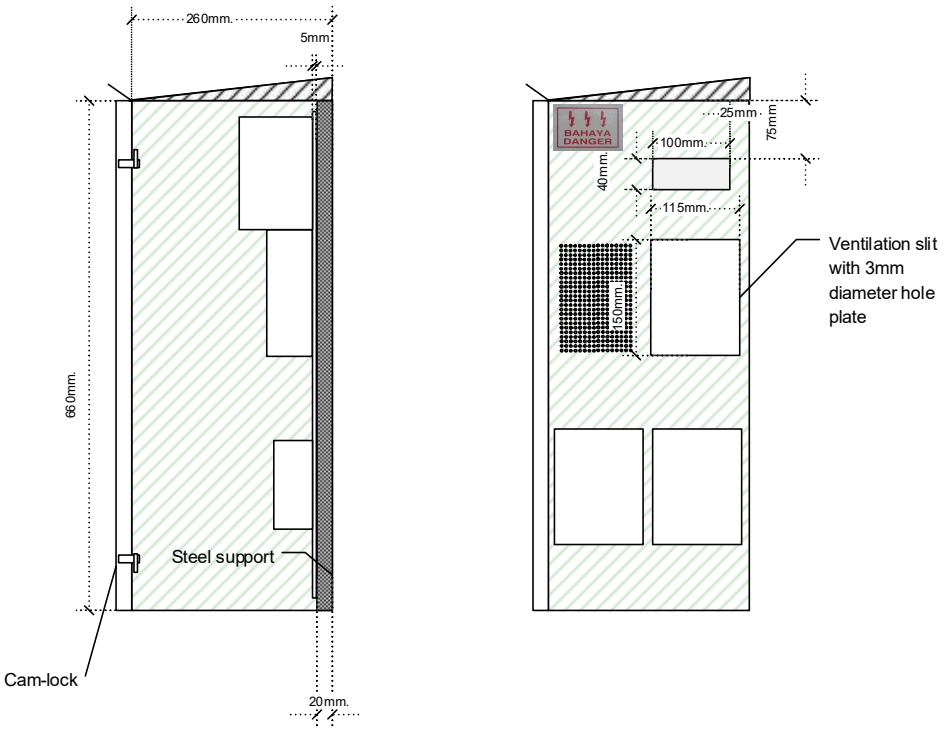
DRAWING NO. 1B: METER BOX DESIGN



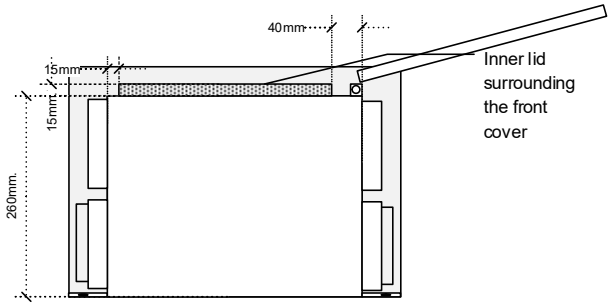
TENAGA NASIONAL BERHAD

	NAME	DATE
DRAWN BY	Ir Wan Mohd Nazdi Wan Abd Rahman	15/4/2009
APPROVED BY	Tn Haji Aminuddin Wahab	20/4/2009
TITLE	Whole Current Single Phase Outdoor Wall Mounted	
PAGE 2 OF 2		SCALE 1" = 125mm
DATE 20/4/2009		VERSION 1.0

Side View



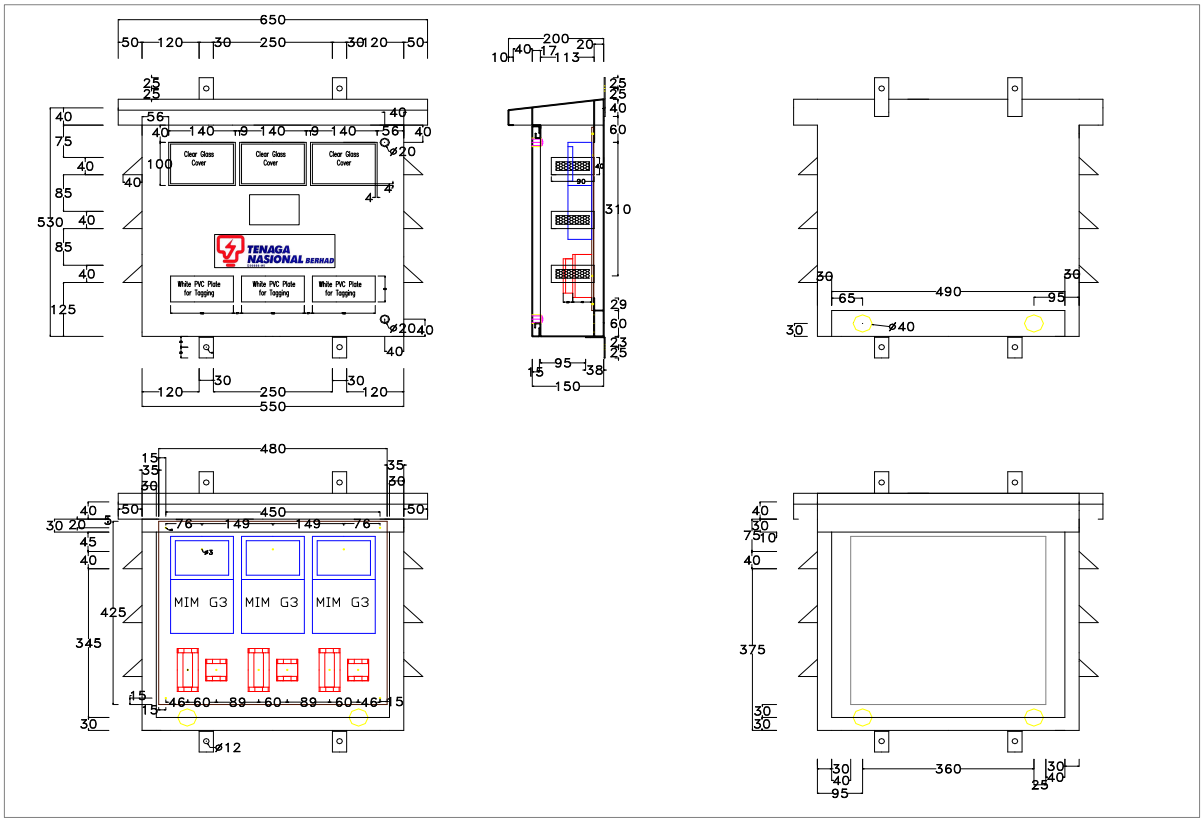
Bottom View



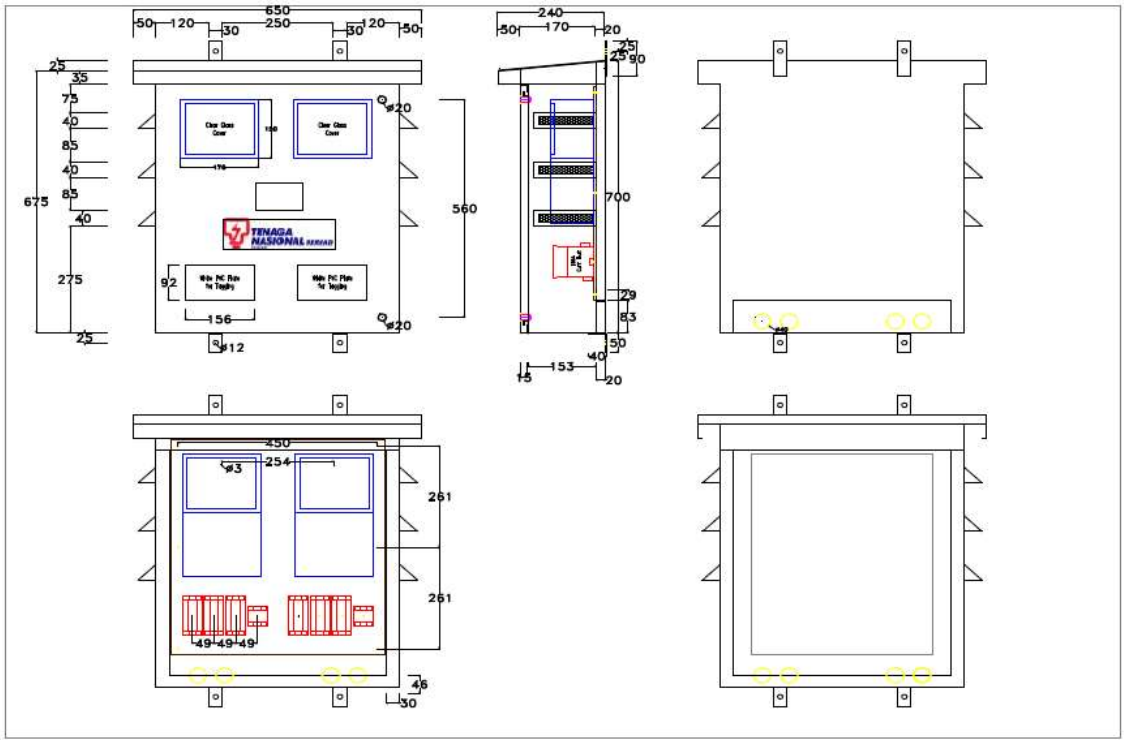
TENAGA NASIONAL BERHAD

	NAME	DATE
DRAWN BY	Ir Wan Mohd Nazdi Wan Abd Rahman	15/4/2009
APPROVED BY	Tn Haij Aminuddin Wahab	20/4/2009
TITLE	Whole Current Three Phase Outdoor Wall Mounted	
PAGE	2 OF 2	SCALE 1.5" = 305mm
DATE	20/4/2009	VERSION 1.0

DRAWING NO. 1C (I) - SINGLE PHASE METER PANEL (POLE)

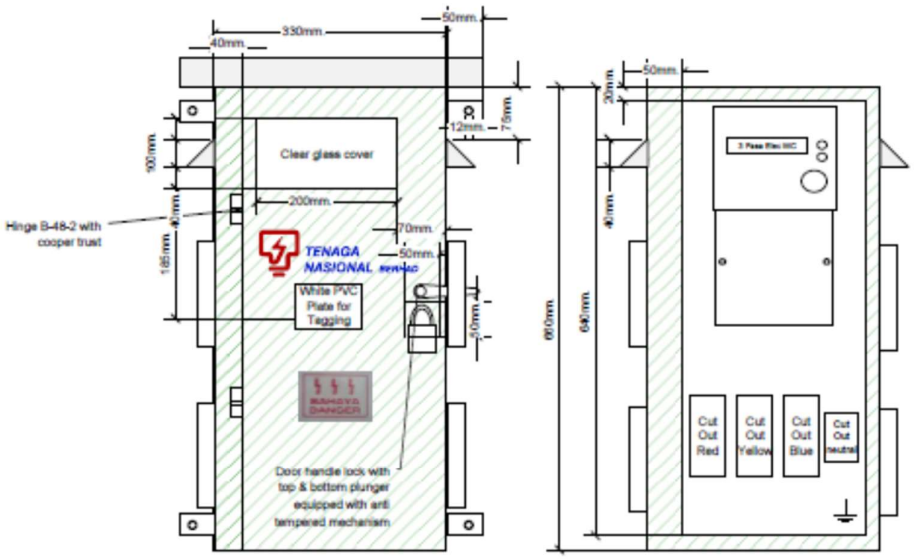


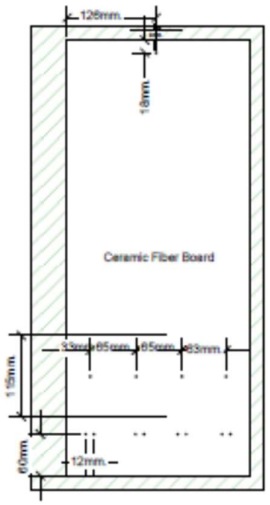
DRAWING NO. 1C (II) - THREE PHASE METER PANEL (POLE)



DRAWING NO. 1D (FRONT VIEW)

Appendix 10: Drawing No. 1D (Front View)

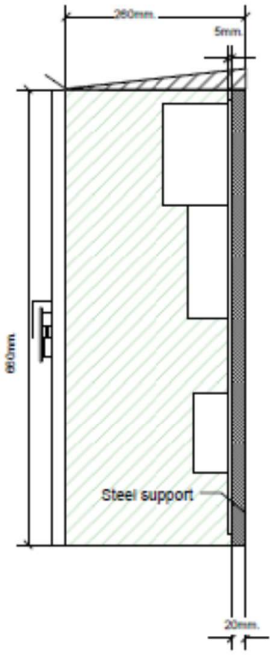


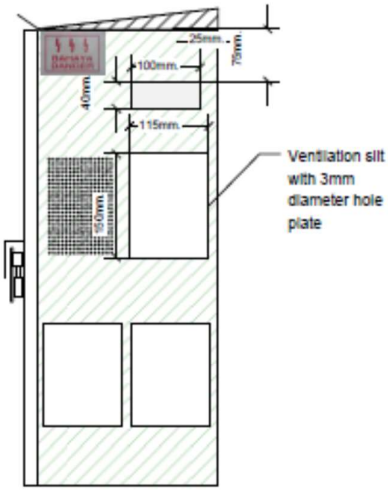


TENAGA NASIONAL BERHAD		
	NAME	DATE
DRAWN BY	Ir Wan Mohd Nazdi Wan Abd Rahman	15/4/2009
APPROVED BY	Tn Haji Aminuddin Wahab	20/4/2009
TITLE	Whole Current Three Phase Outdoor Wall Mounted	
PAGE	1 OF 2	SCALE 1.5" = 305mm
DATE	20/4/2009	VERSION 1.0

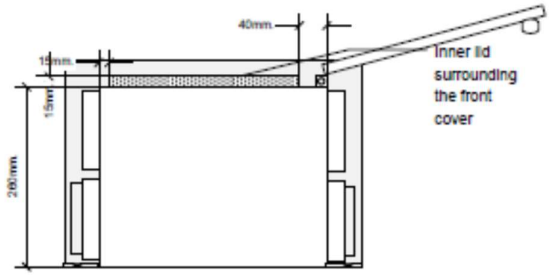
DRAWING NO. 1D (SIDE VIEW)

Appendix 10: Drawing No. 1D (Side View)





Bottom View

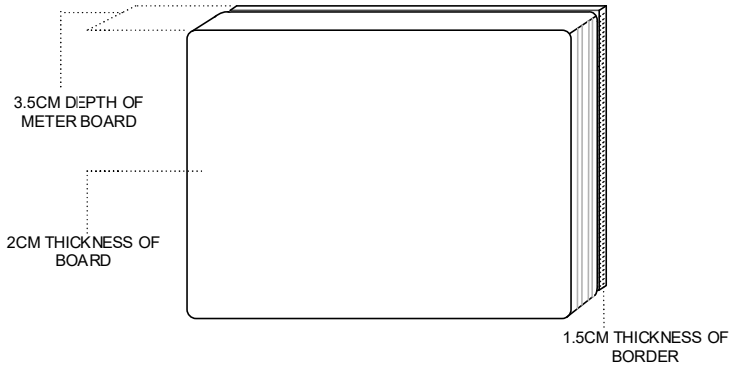


TENAGA NASIONAL BERHAD

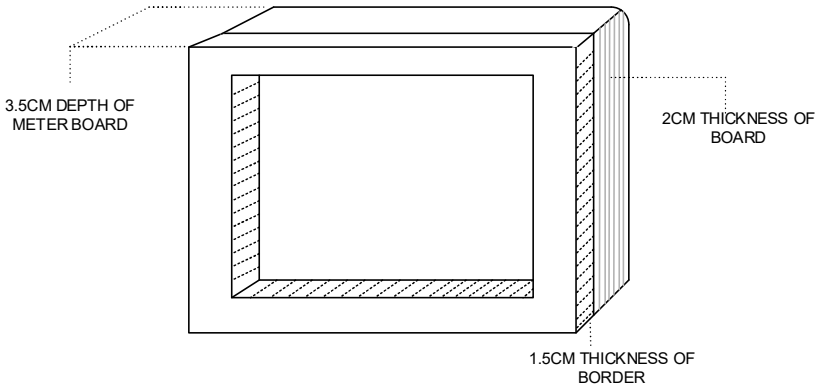
	NAME	DATE
DRAWN BY	Ir Wan Mohd Nazdi Wan Abd Rahman	15/4/2009
APPROVED BY	Tn Haji Aminuddin Wahab	20/4/2009
TITLE	Whole Current Three Phase Outdoor Wall Mounted	
PAGE	2 OF 2	SCALE 1.5" = 305mm
DATE	20/4/2009	VERSION 1.0

DRAWING NO. 2A: SINGLE PHASE METER BOARD (HARDWOOD)

DRAWING N0 2A : SINGLE PHASE METER BOARD (HARDWOOD)



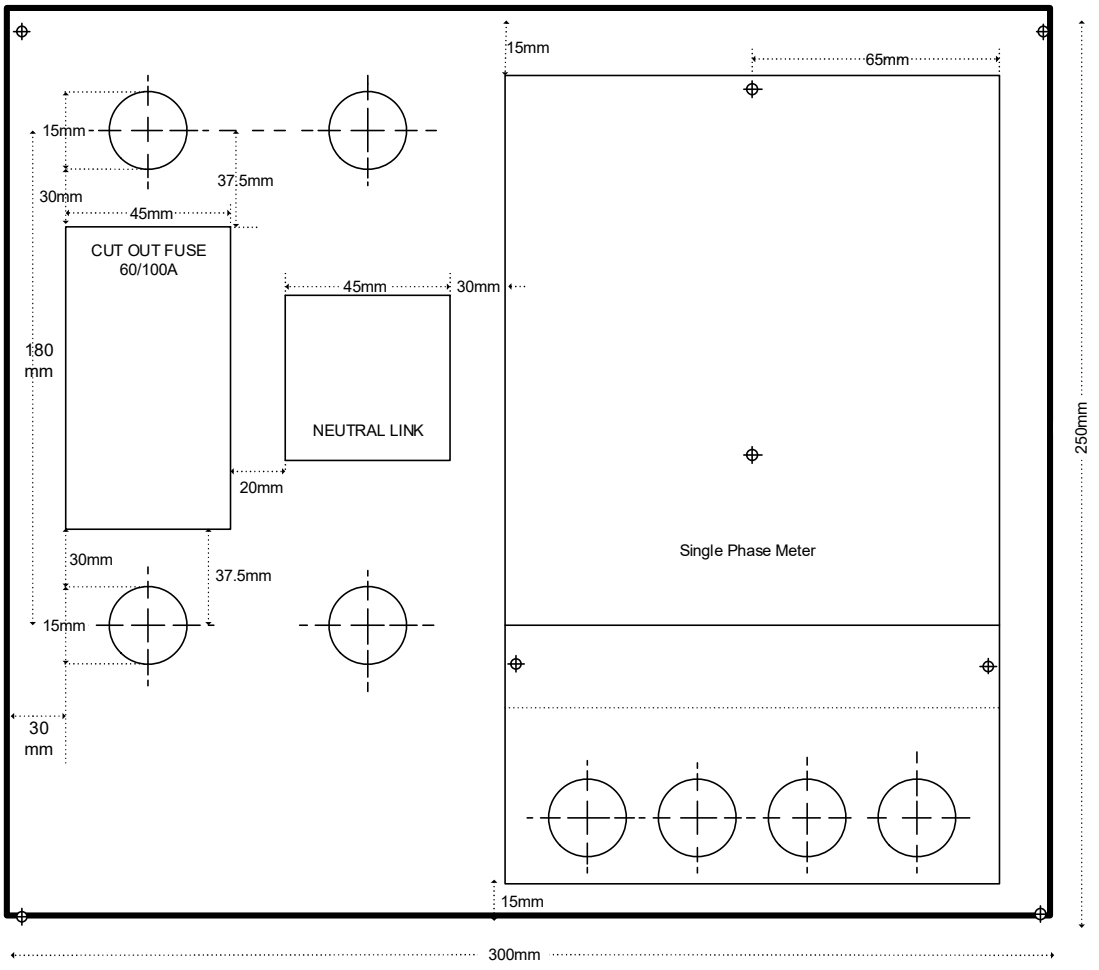
FRONT VIEW OF STANDARD METER BOARD (HARD WOOD)



BACK VIEW OF STANDARD METER BOARD (HARD WOOD)

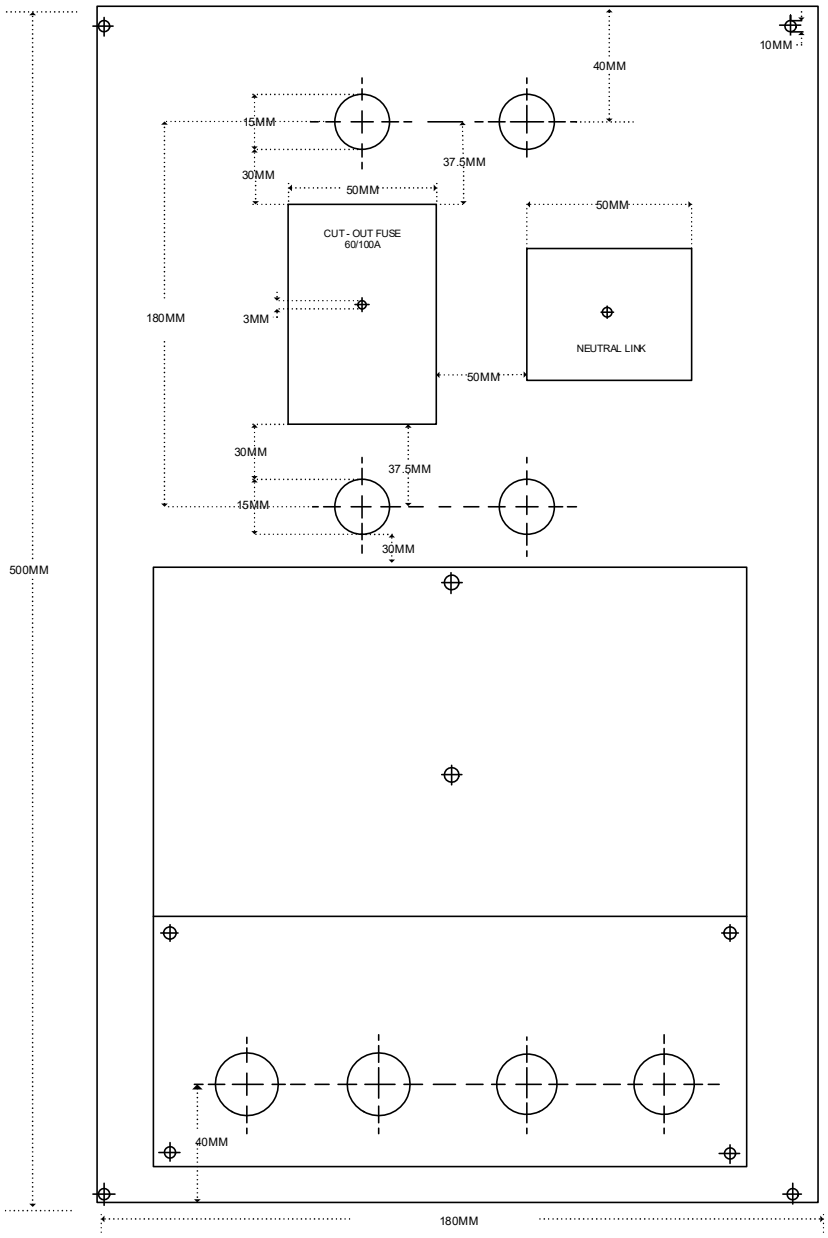
DRAWING NO. 3A: SINGLE PHASE METERING ARRANGEMENT

DRAWING NO 3A : SINGLE PHASE METERING ARRANGEMENT



DRAWING NO. 3B: SINGLE PHASE METERING ARRANGEMENT

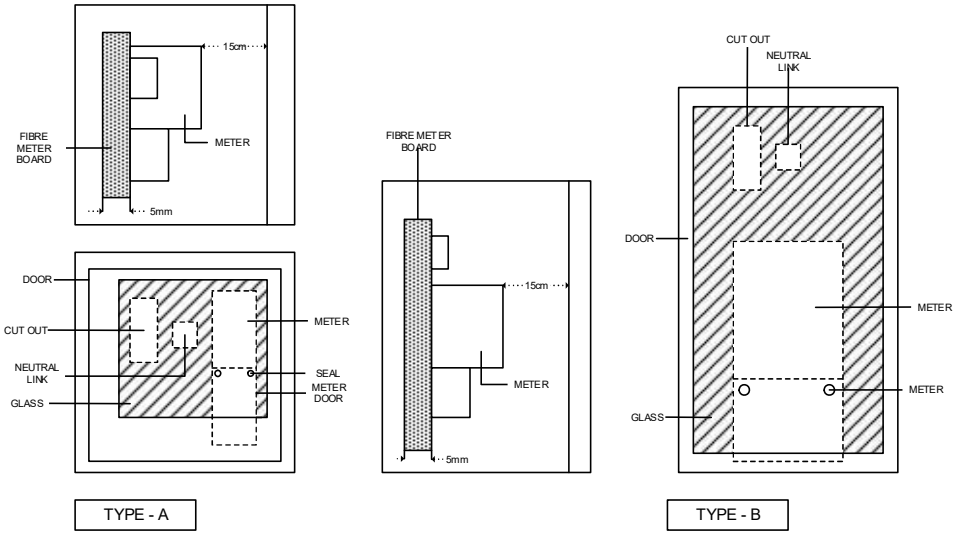
DRAWING NO 3B : SINGLE PHASE METERING ARRANGEMENT



DRAWING NO. 4A: OUTDOOR METERING PANEL

DRAWING NO 4A : OUTDOOR METERING PANEL

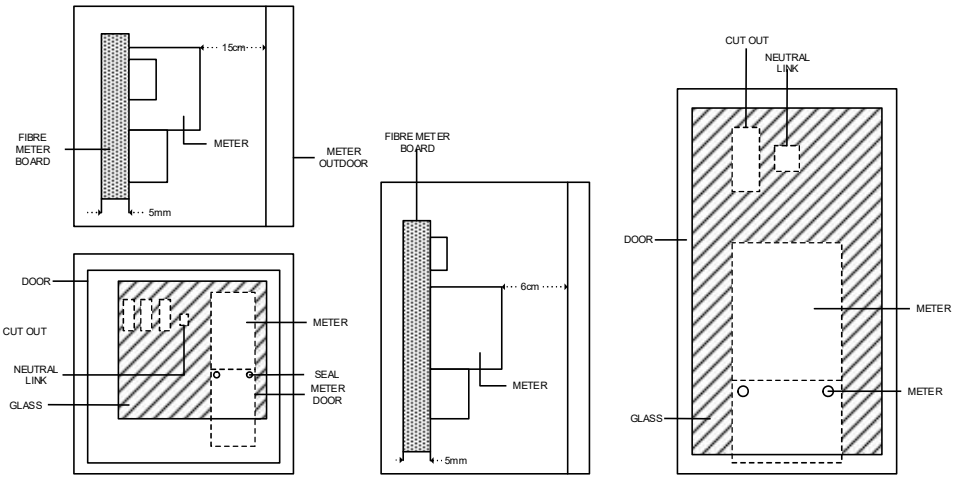
SINGLE PHASE METER



TYPE - A

TYPE - B

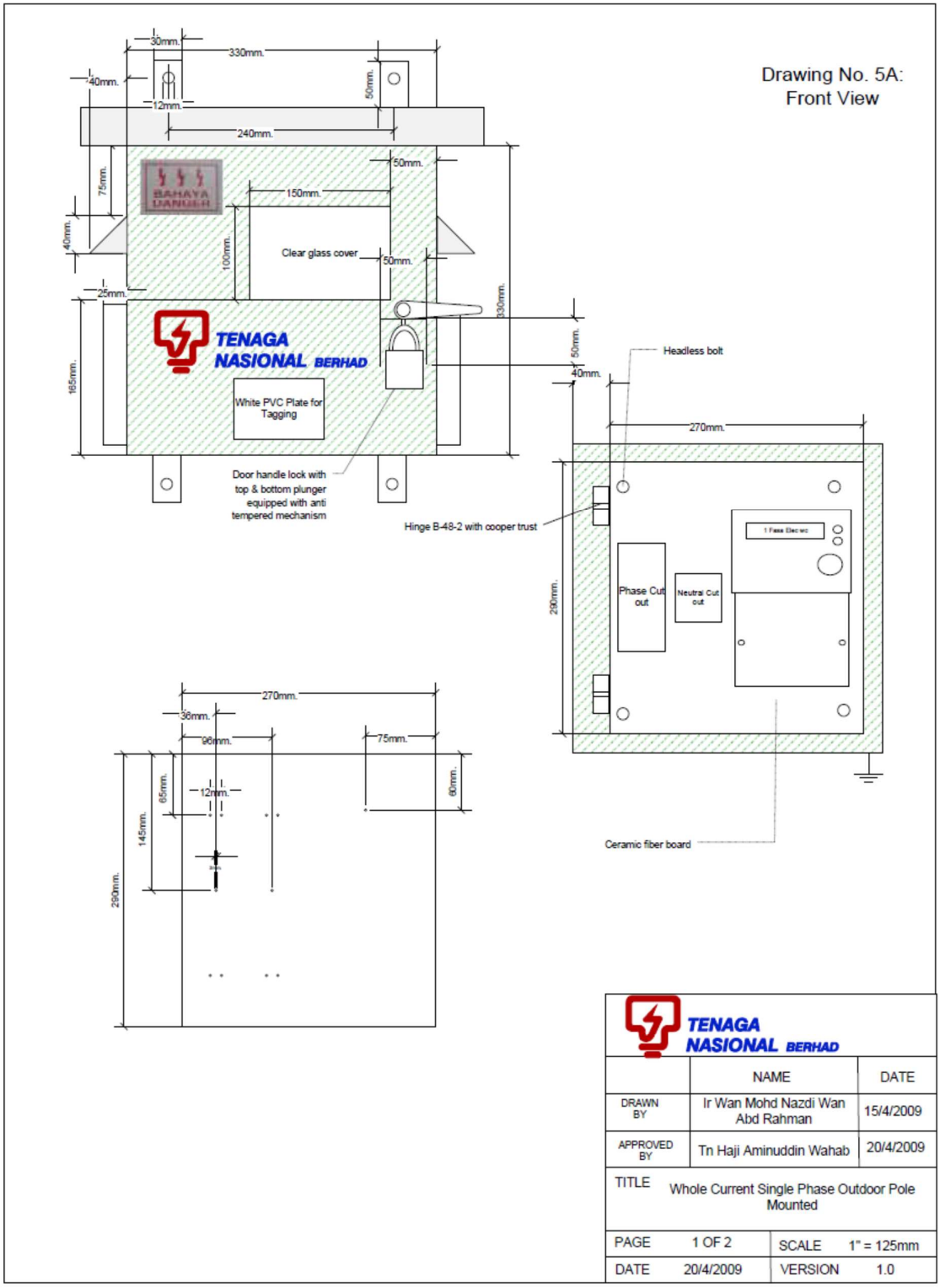
THREE PHASE METER



TYPE - A

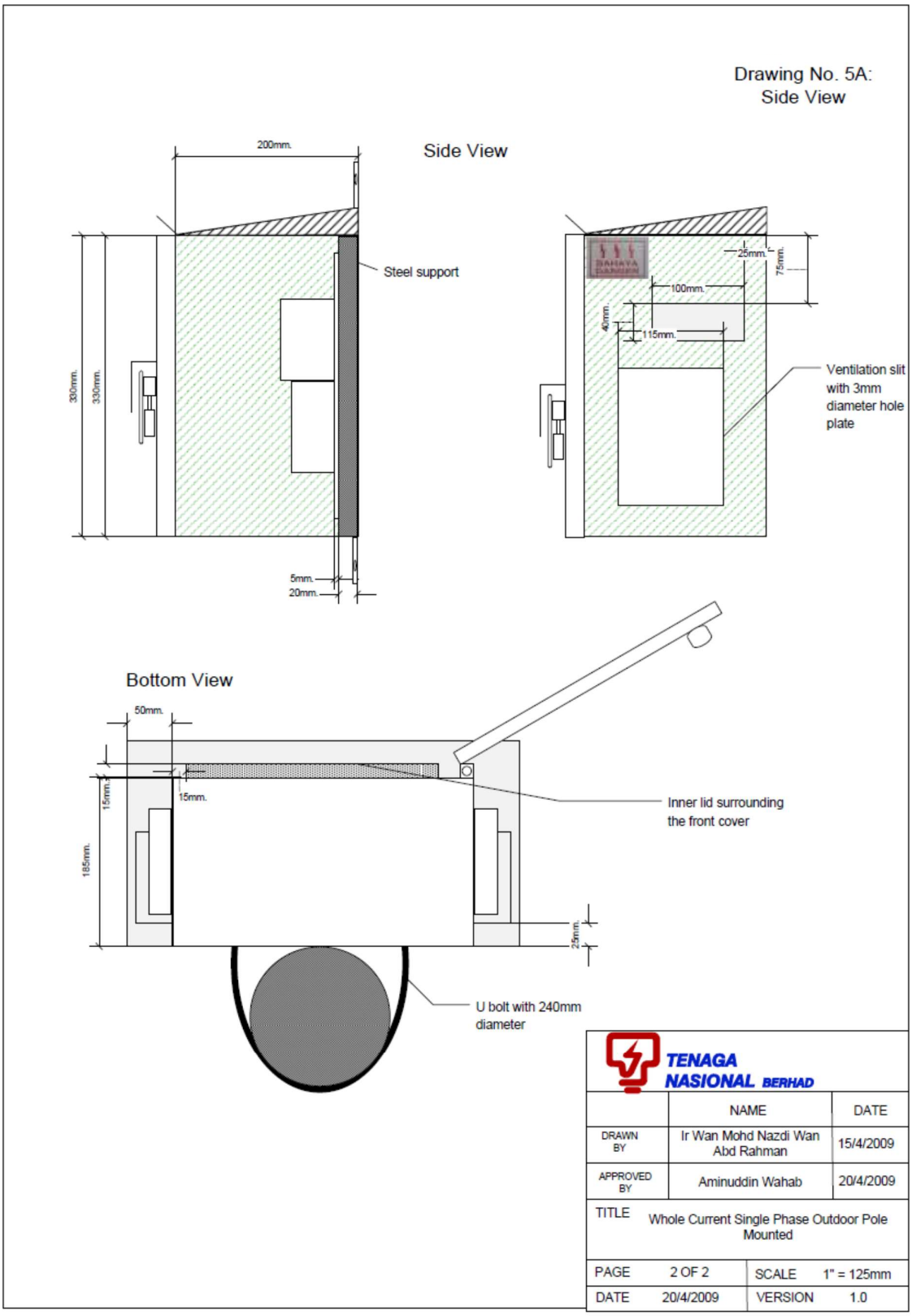
TYPE - B

DRAWING NO. 5A: FRONT VIEW - WHOLE CURRENT SINGLE PHASE OUTDOOR POLE MOUNTED



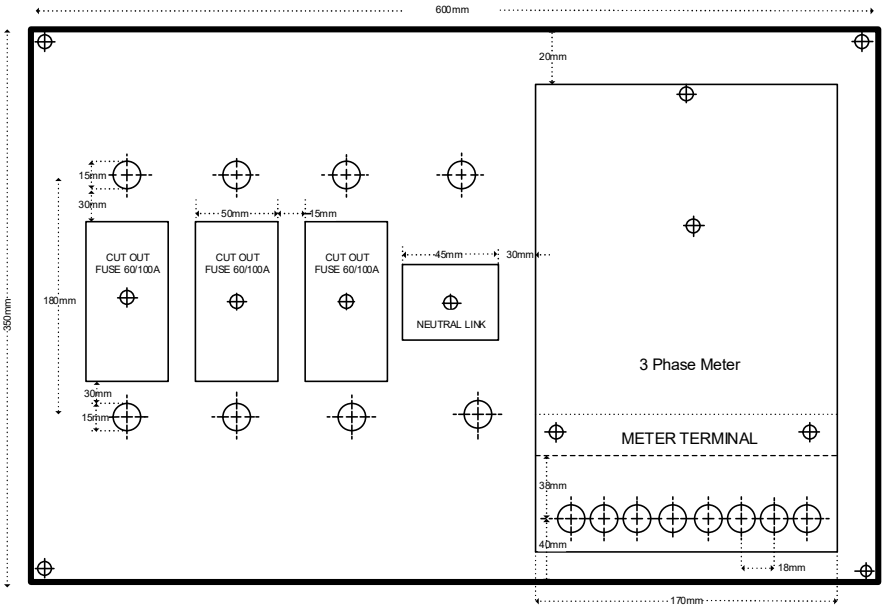
TENAGA NASIONAL BERHAD		
	NAME	DATE
DRAWN BY	Ir Wan Mohd Nazdi Wan Abd Rahman	15/4/2009
APPROVED BY	Tn Haji Aminuddin Wahab	20/4/2009
TITLE	Whole Current Single Phase Outdoor Pole Mounted	
PAGE	1 OF 2	SCALE 1" = 125mm
DATE	20/4/2009	VERSION 1.0

DRAWING NO. 5A: SIDE VIEW

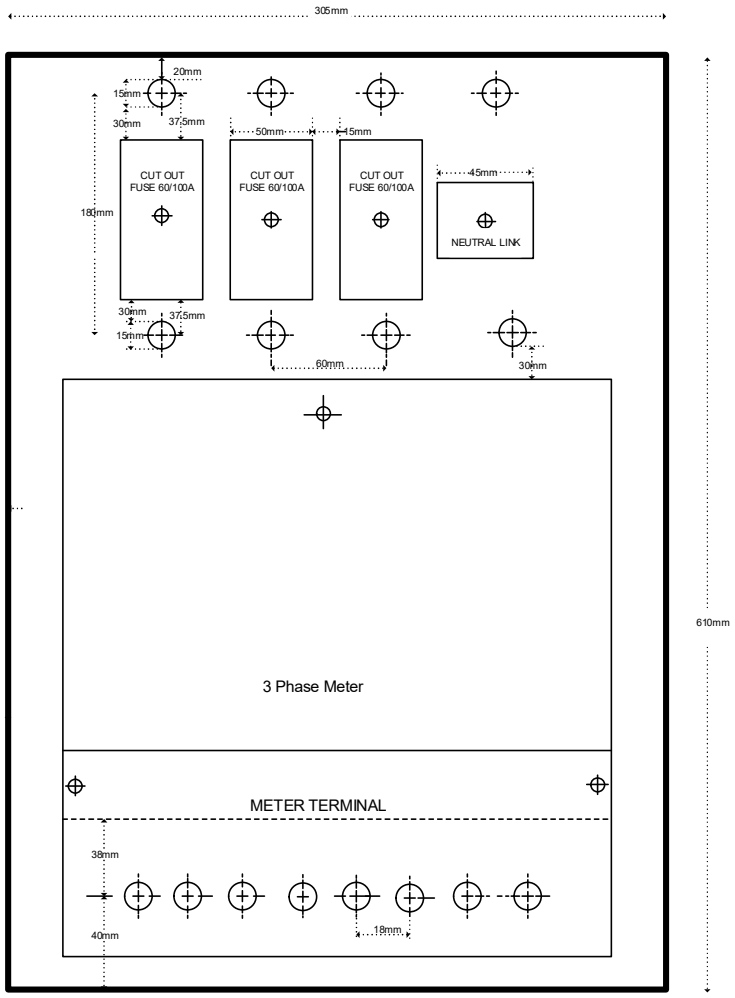


DRAWING NO. 6A – 3 PHASE OVERHEAD INCOMING

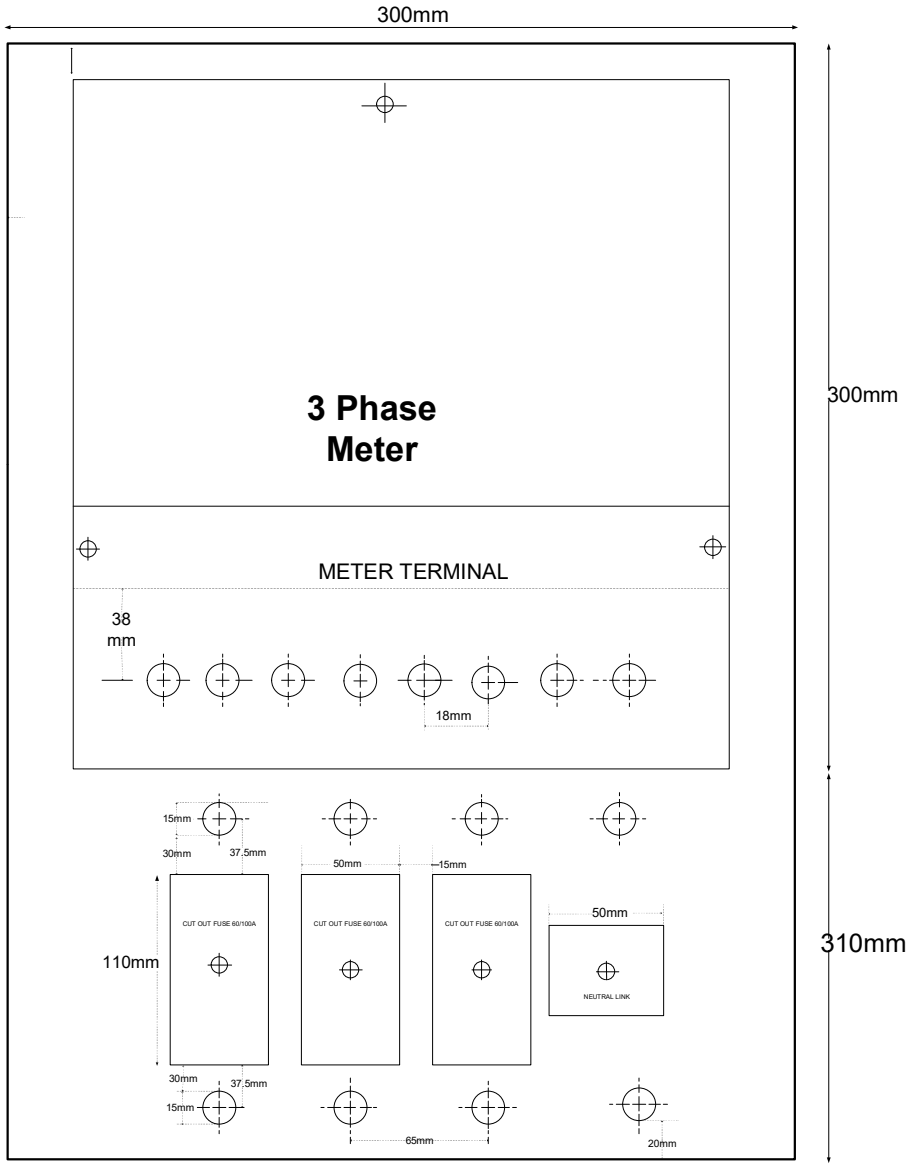
DRAWING NO 6A : 3 PHASE OVERHEAD INCOMING



DRAWING NO 6B : 3 PHASE OVERHEAD INCOMING

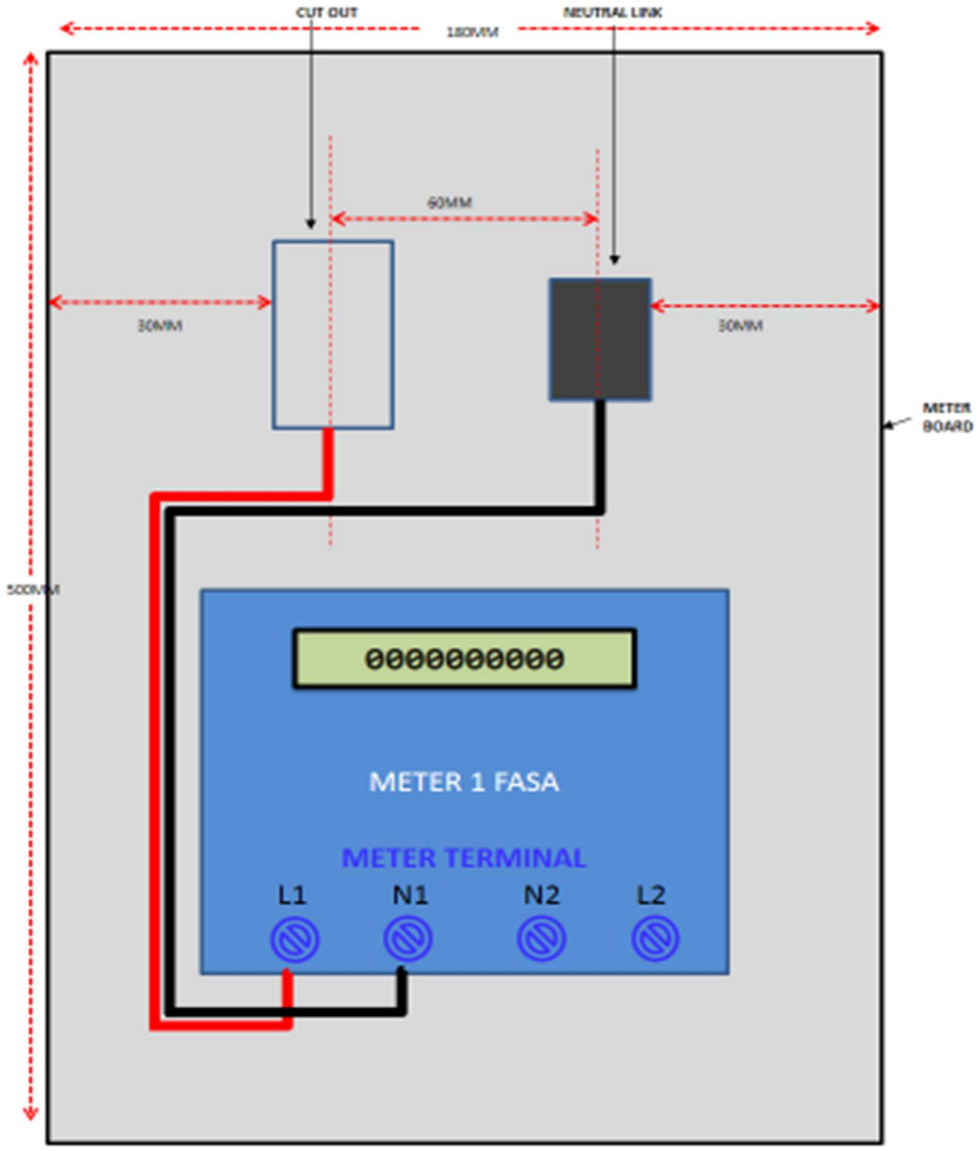


DRAWING NO 6C : 3 PHASE UNDERGROUND INCOMING

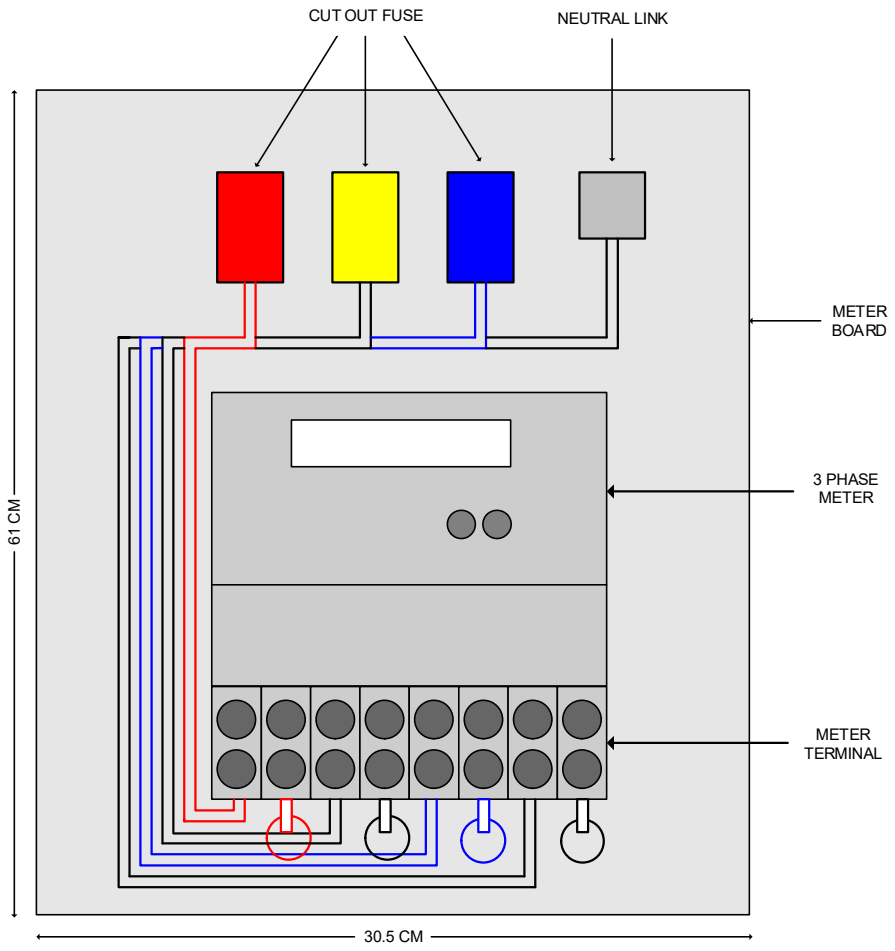


APPENDIX 15

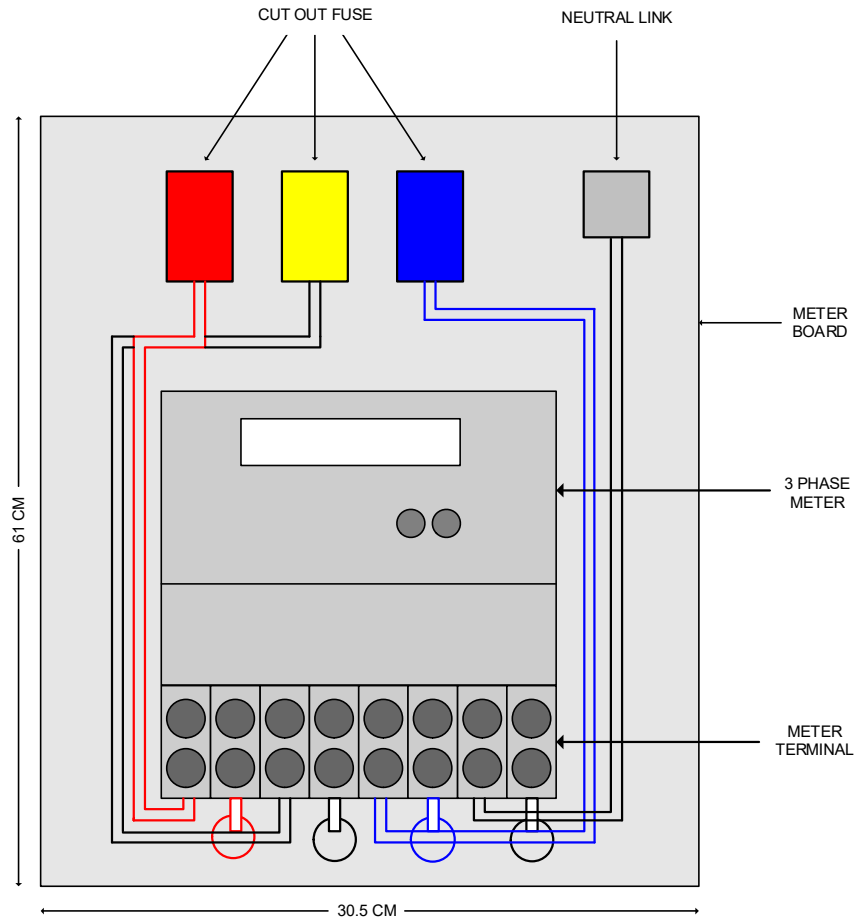
DRAWING NO. 7A: EXTERNAL SURFACE WIRING (SINGLE PHASE)



DRAWING NO. 7B: SURFACE WIRING EXAMPLE FOR 3 PHASE WHOLE CURRENT METER

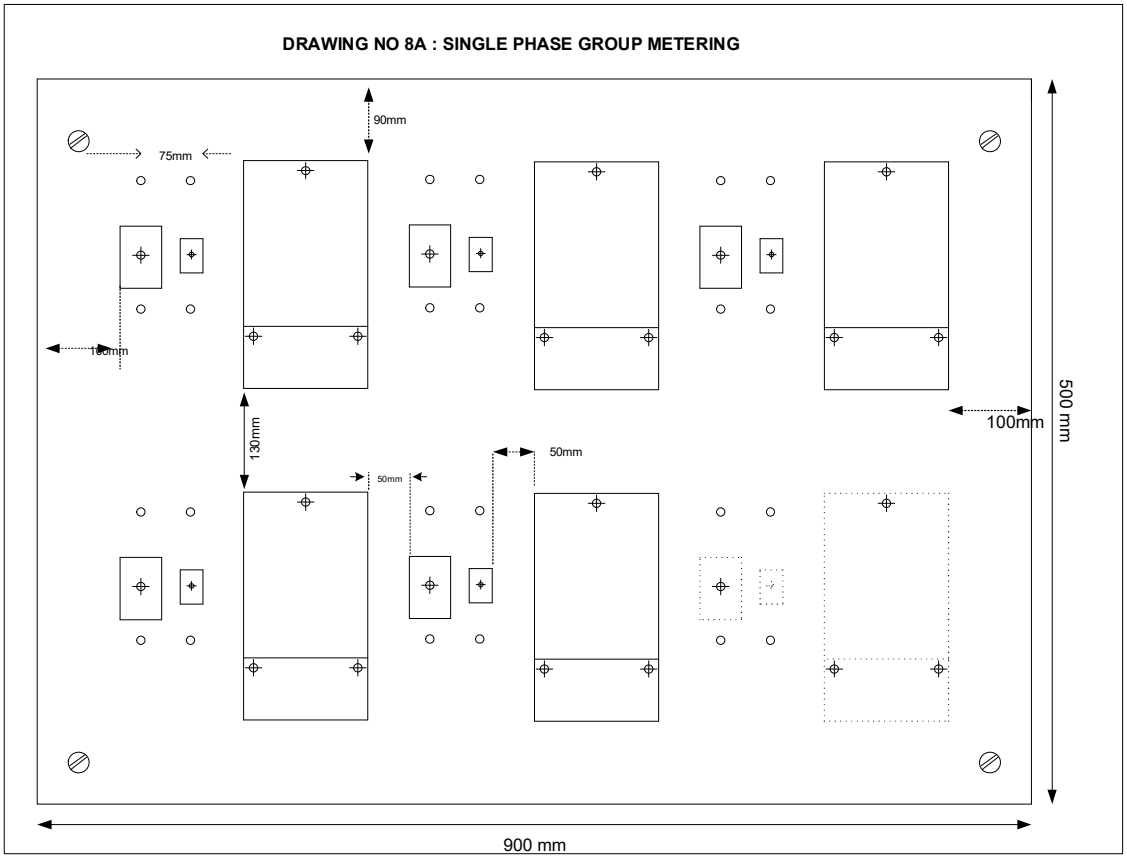


DRAWING NO. 7C: SURFACE WIRING EXAMPLE FOR 3 PHASE WHOLE CURRENT METER



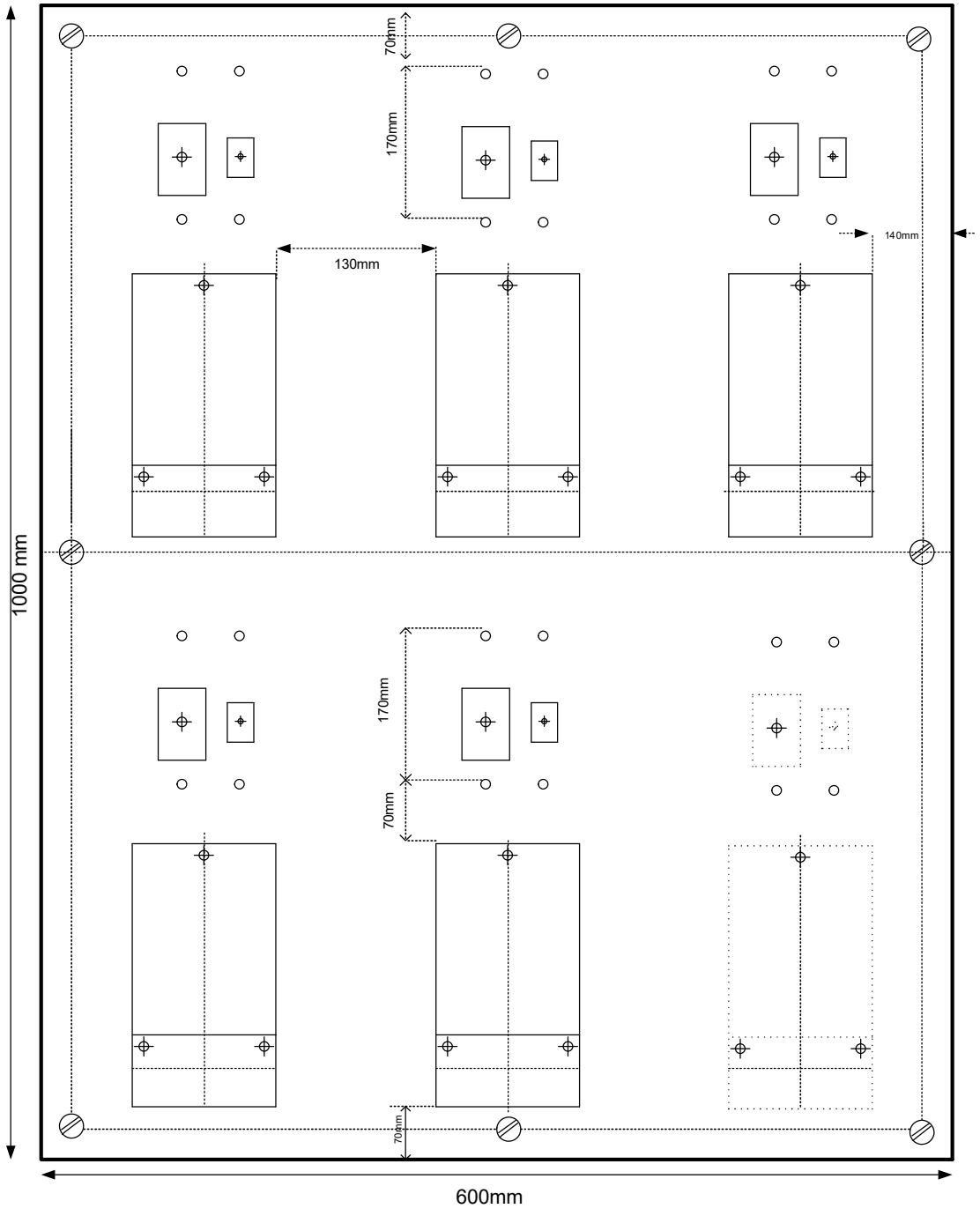
APPENDIX 16

DRAWING NO. 8A: SINGLE PHASE GROUP METERING



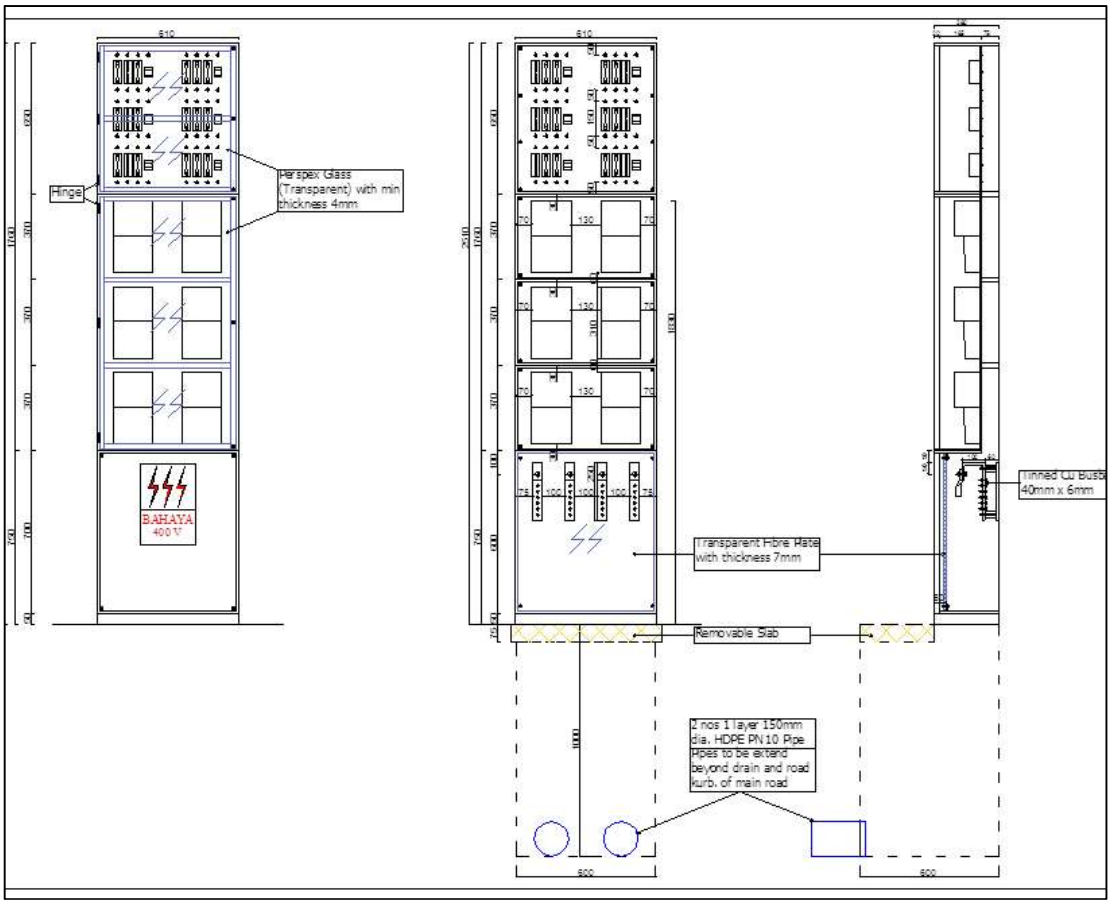
DRAWING NO. 8B - SINGLE PHASE GROUP METERING

DRAWING NO 8B : SINGLE PHASE GROUP METERING



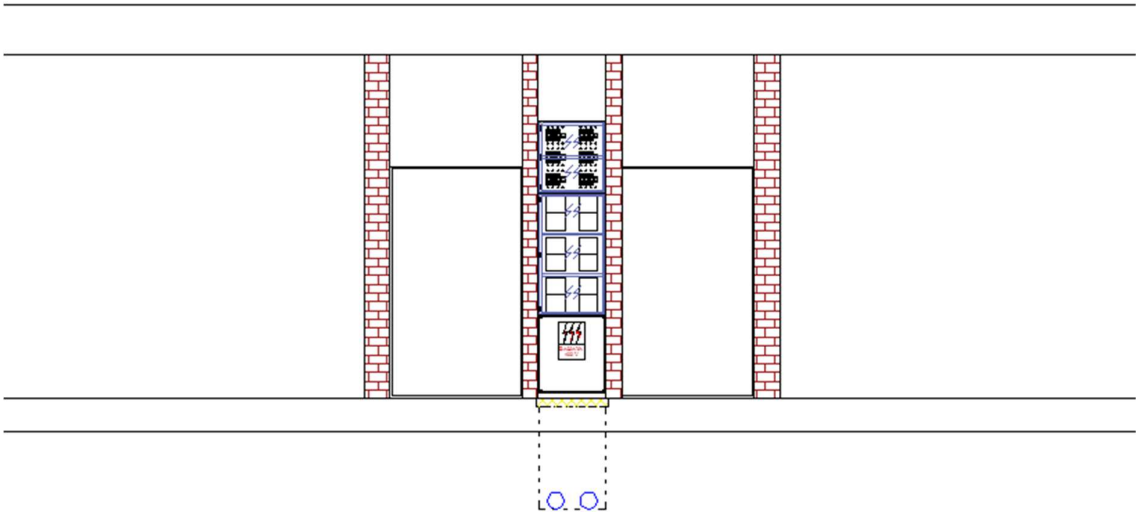
APPENDIX 17

DRAWING NO 9A (I): SHOP LOTS METER PANEL

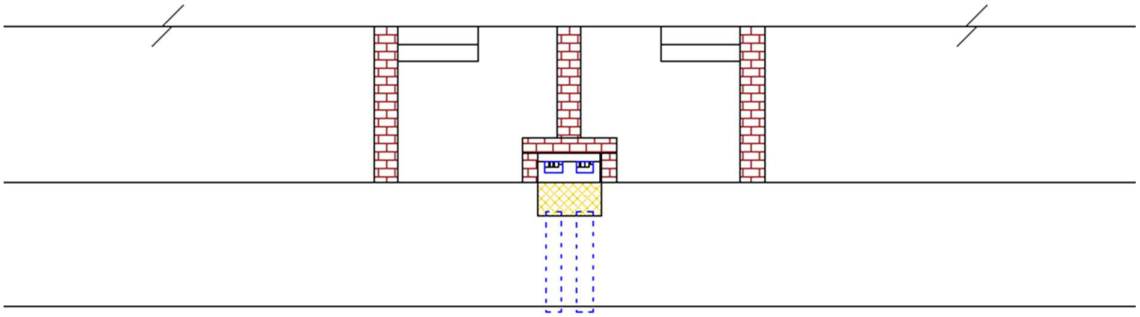


DRAWING NO 9A (II): SHOP LOTS METER PANEL

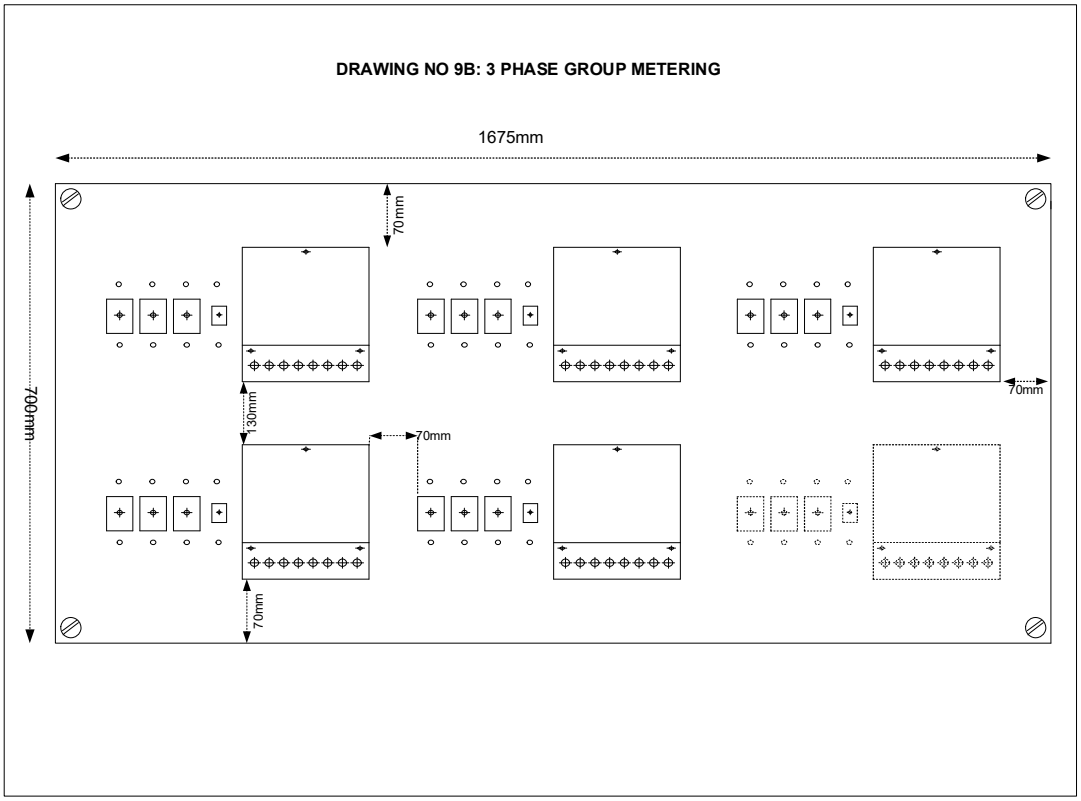
Elevation Front View



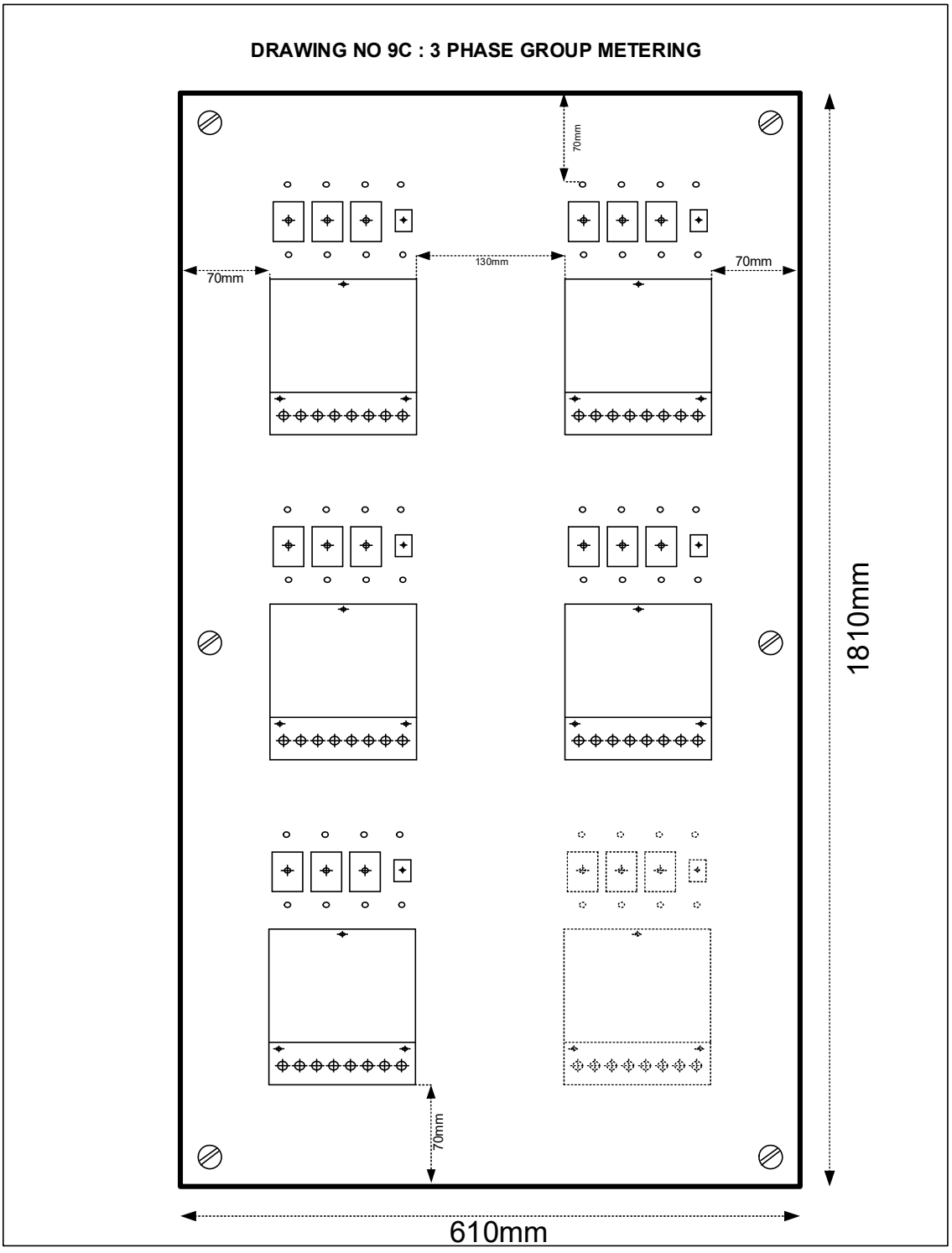
Plan View



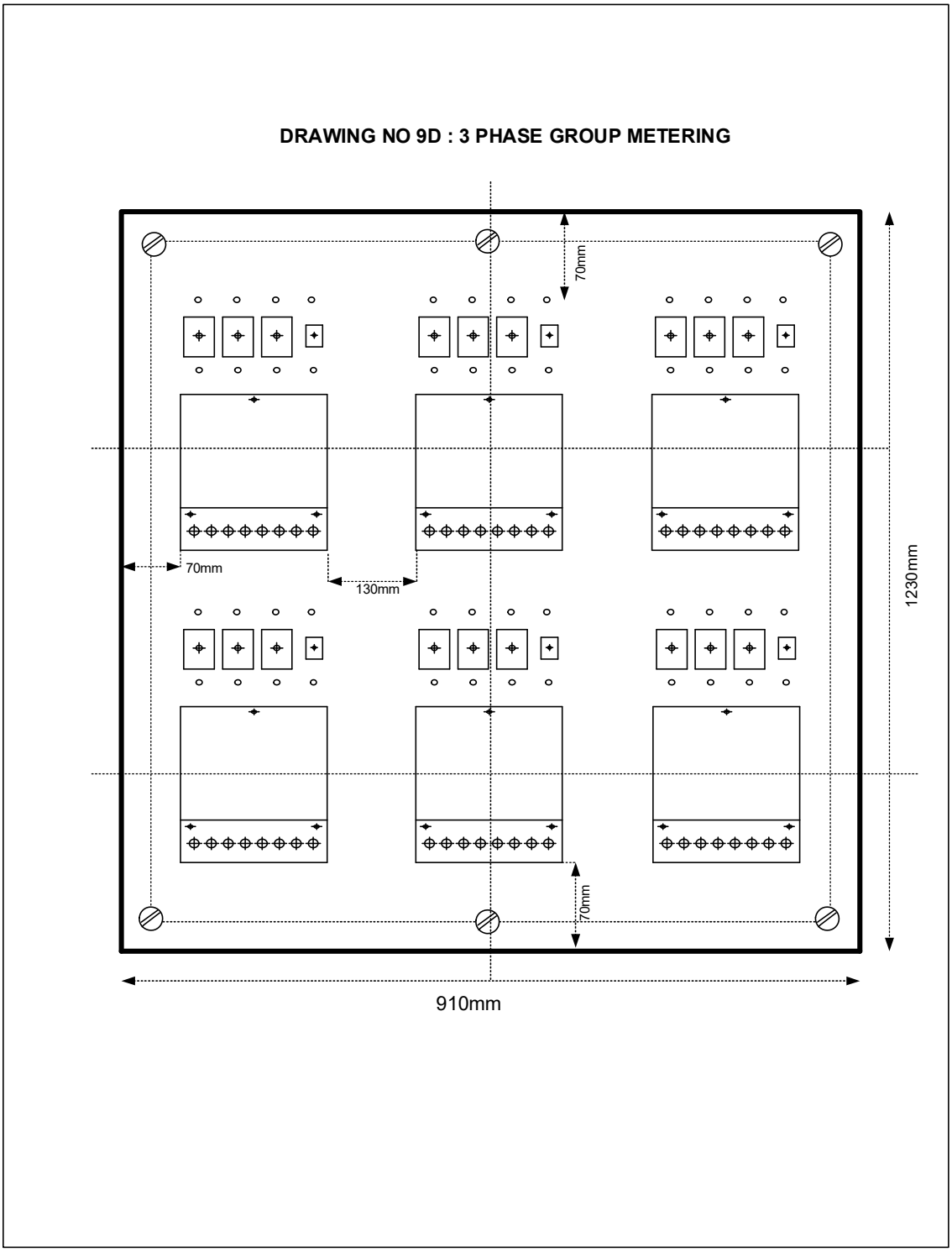
DRAWING NO 9B: 3 PHASE GROUP METERING



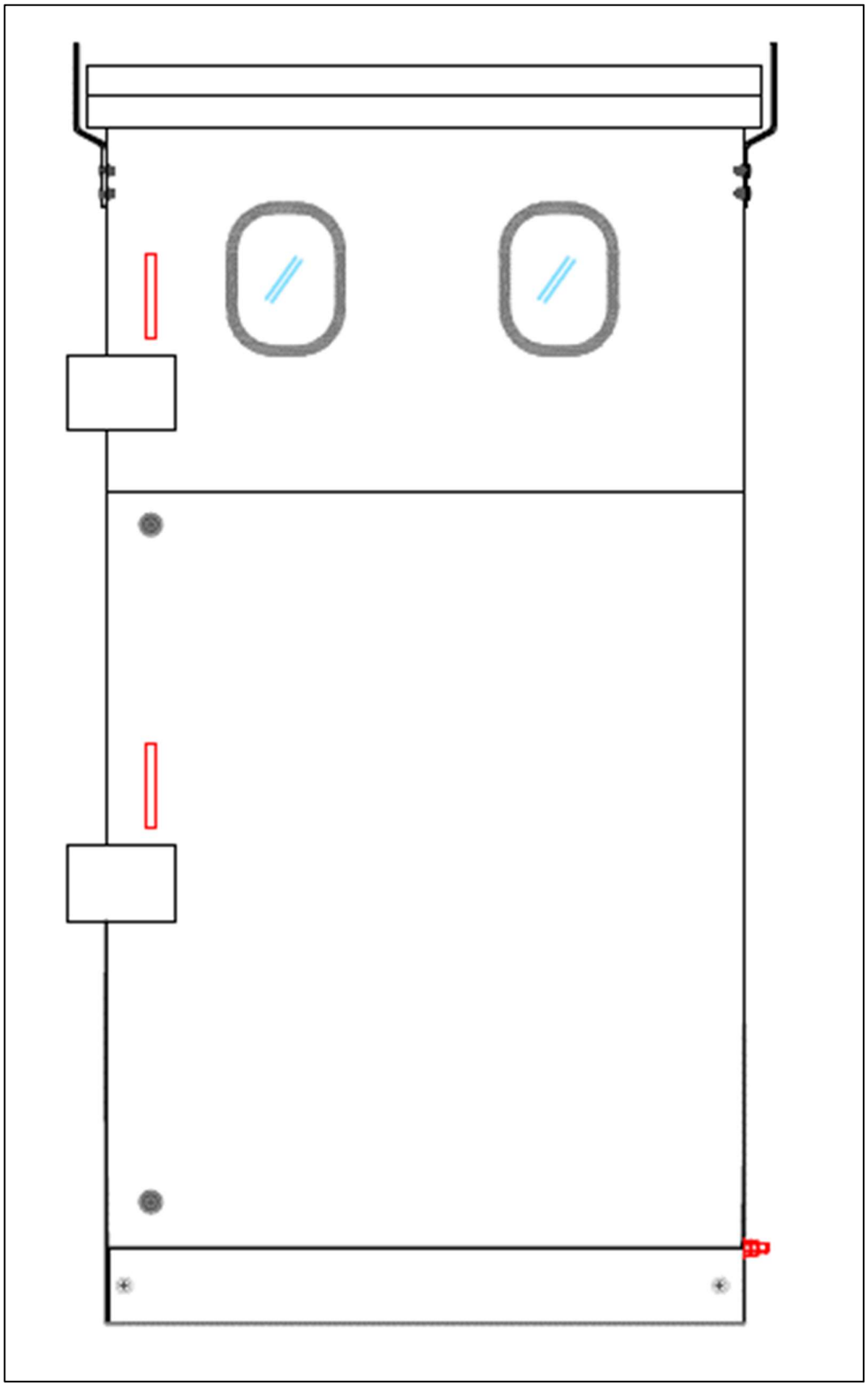
DRAWING NO 9C: 3 PHASE GROUP METERING



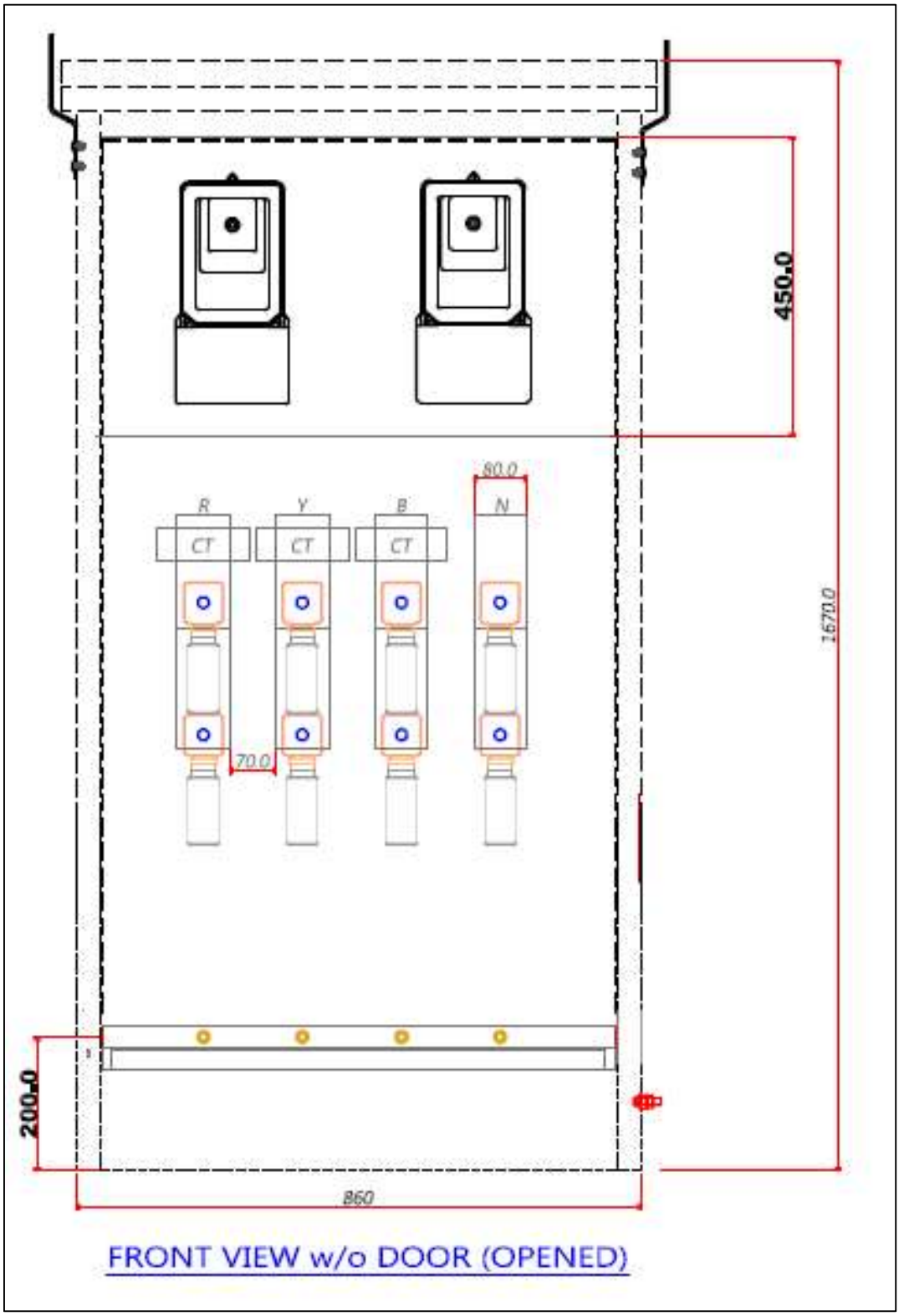
DRAWING NO 9D: 3 PHASE GROUP METERING



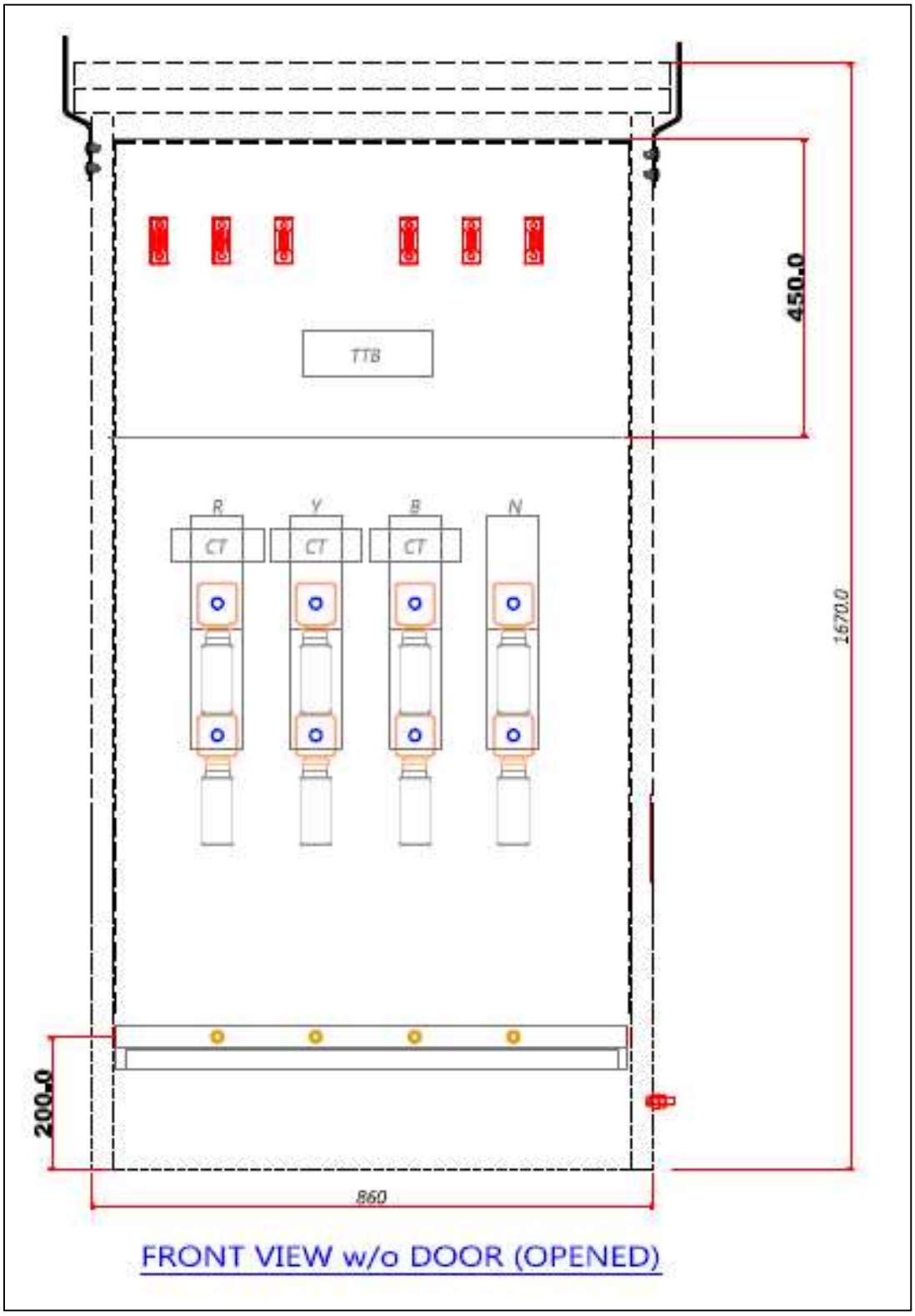
DRAWING 10 A: (I) LVCT GROUND MOUNTED METER KIOSK FRONT VIEW WITH DOOR CLOSED



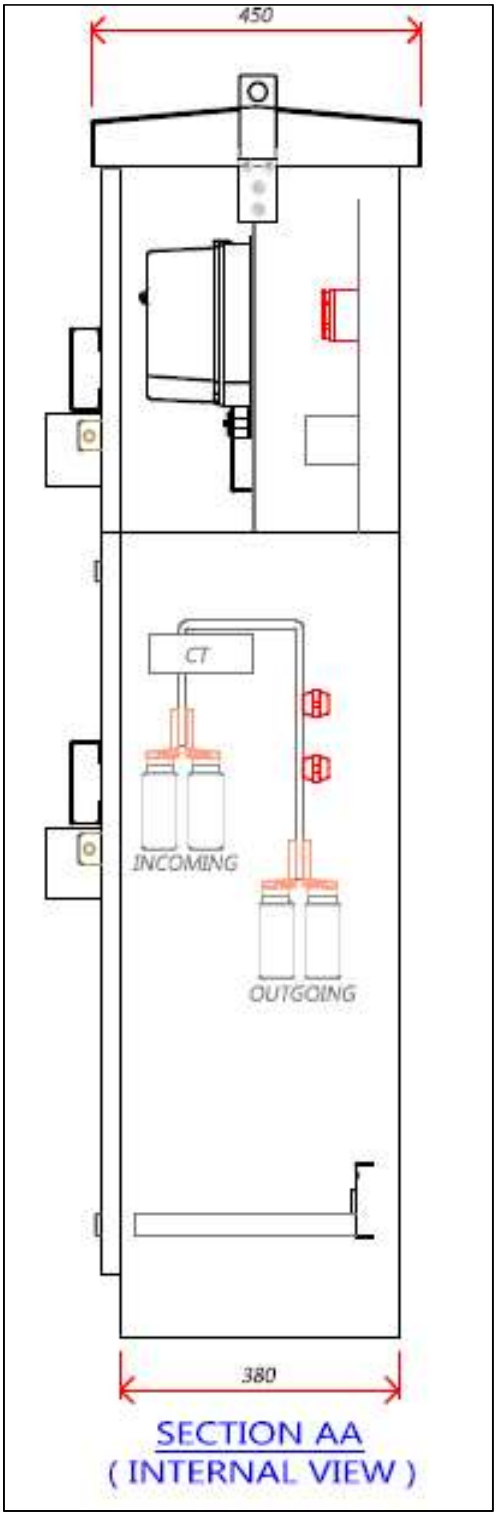
DRAWING 10 A: (II) LVCT GROUND MOUNTED METER KIOSK FRONT VIEW WITH DOOR OPENED



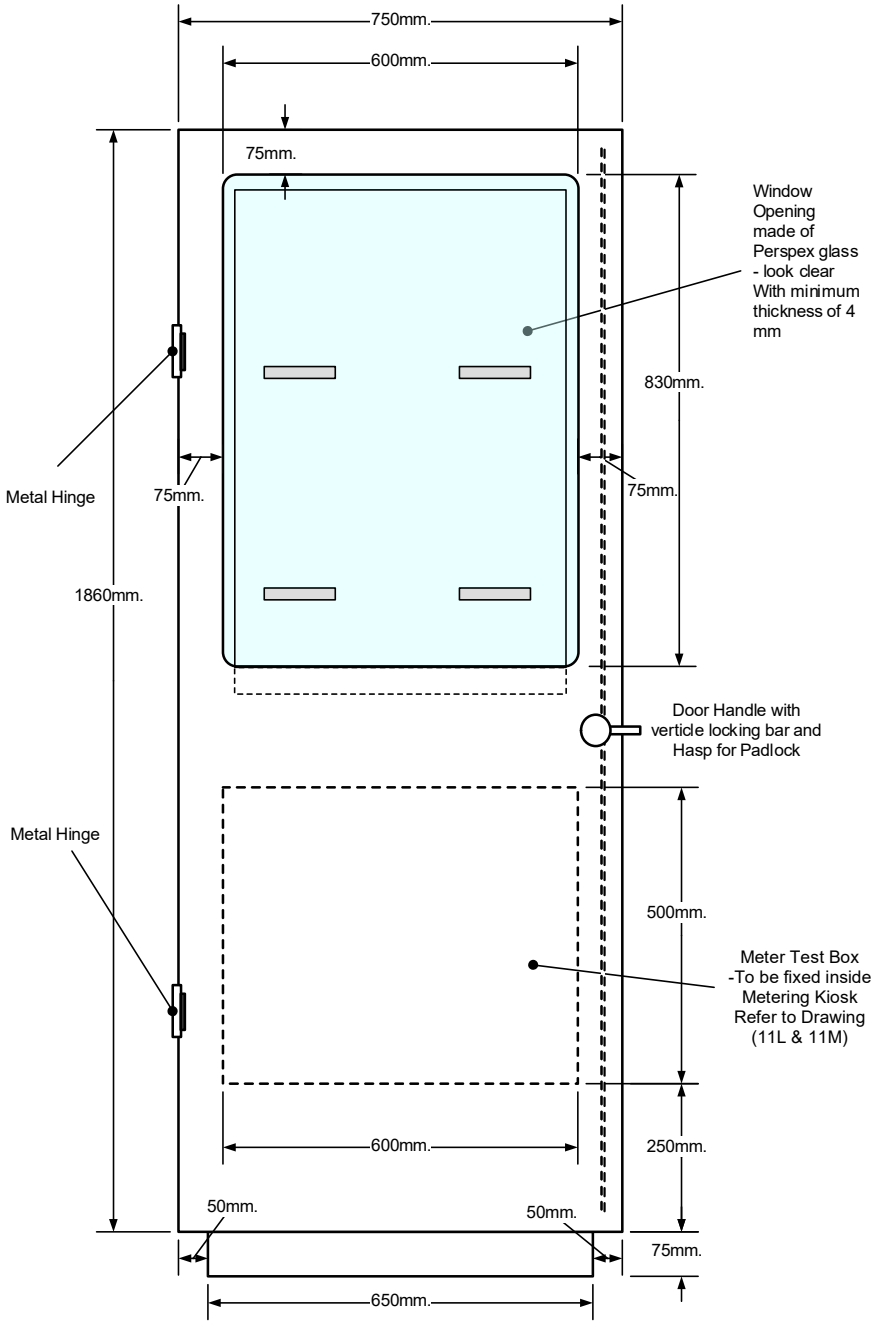
DRAWING 10 A: (III) LVCT GROUND MOUNTED METER KIOSK FRONT VIEW WITH DOOR OPENED BEHIND METERS



DRAWING 10 A: (IV) LVCT GROUND MOUNTED METER KIOSK SIDE VIEW

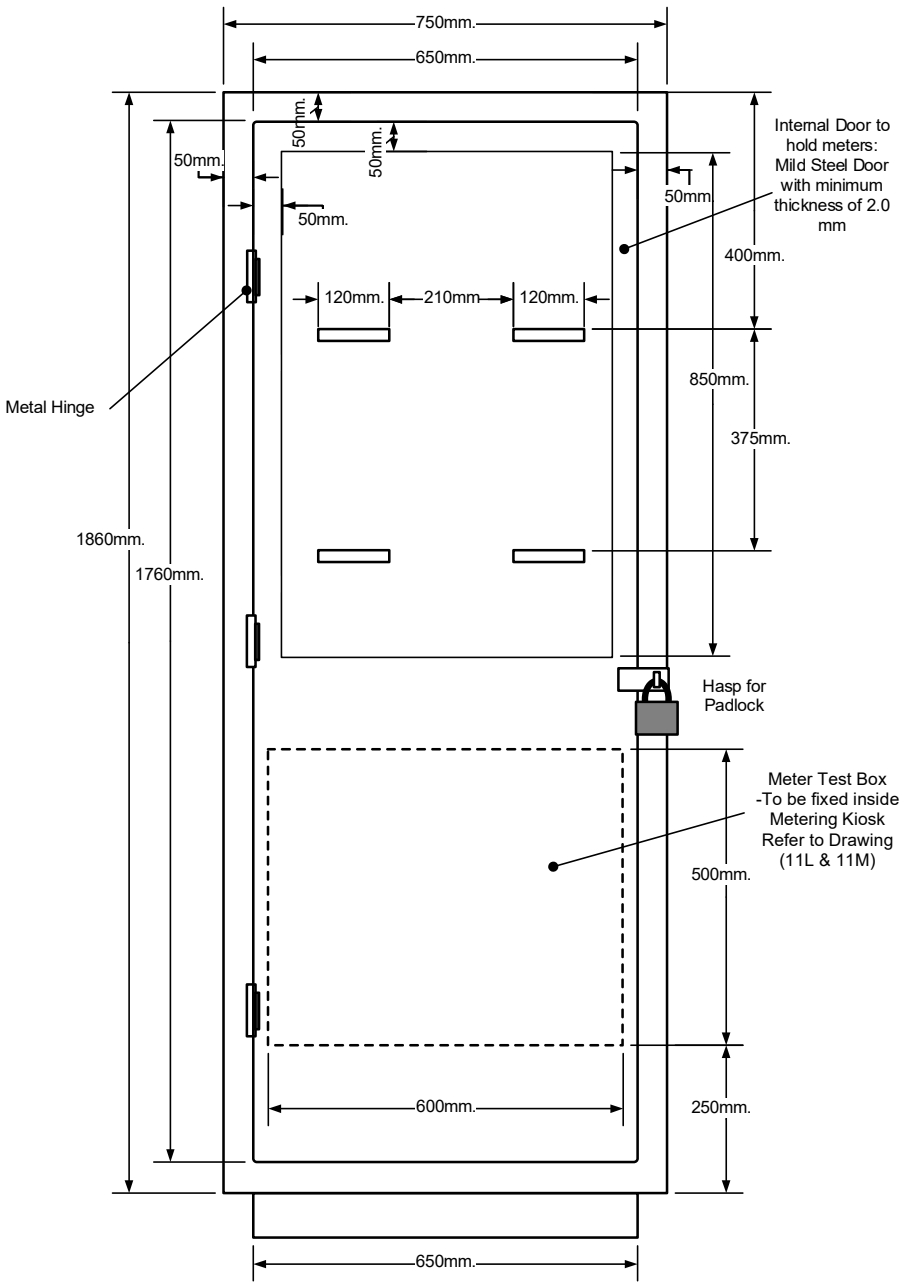


DRAWING 11A: MV/HV, 1 OR 2 FEEDER METERING KIOSK (FRONT VIEW OF EXTERNAL DOOR)



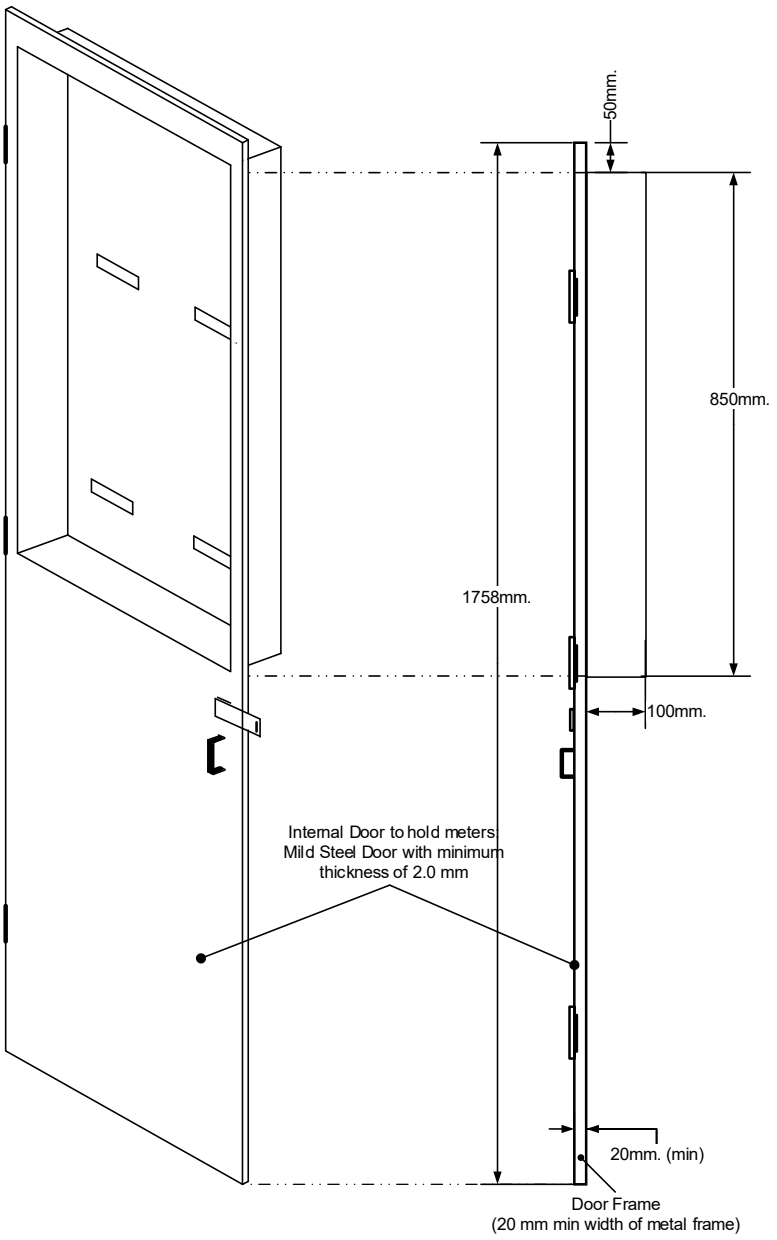
Drawing 11A: MV/HV, 1 OR 2 FEEDER METERING KIOSK - Front View of External Door		
Unit Metering		**September 2011**

DRAWING 11B: MV/HV, 1 OR 2 FEEDER METERING KIOSK (FRONT VIEW OF EXTERNAL DOOR)



Drawing 11B: MV/HV, 1 OR 2 FEEDER METERING KIOSK - Front View of Internal Door		
Unit Metering		**September 2011**

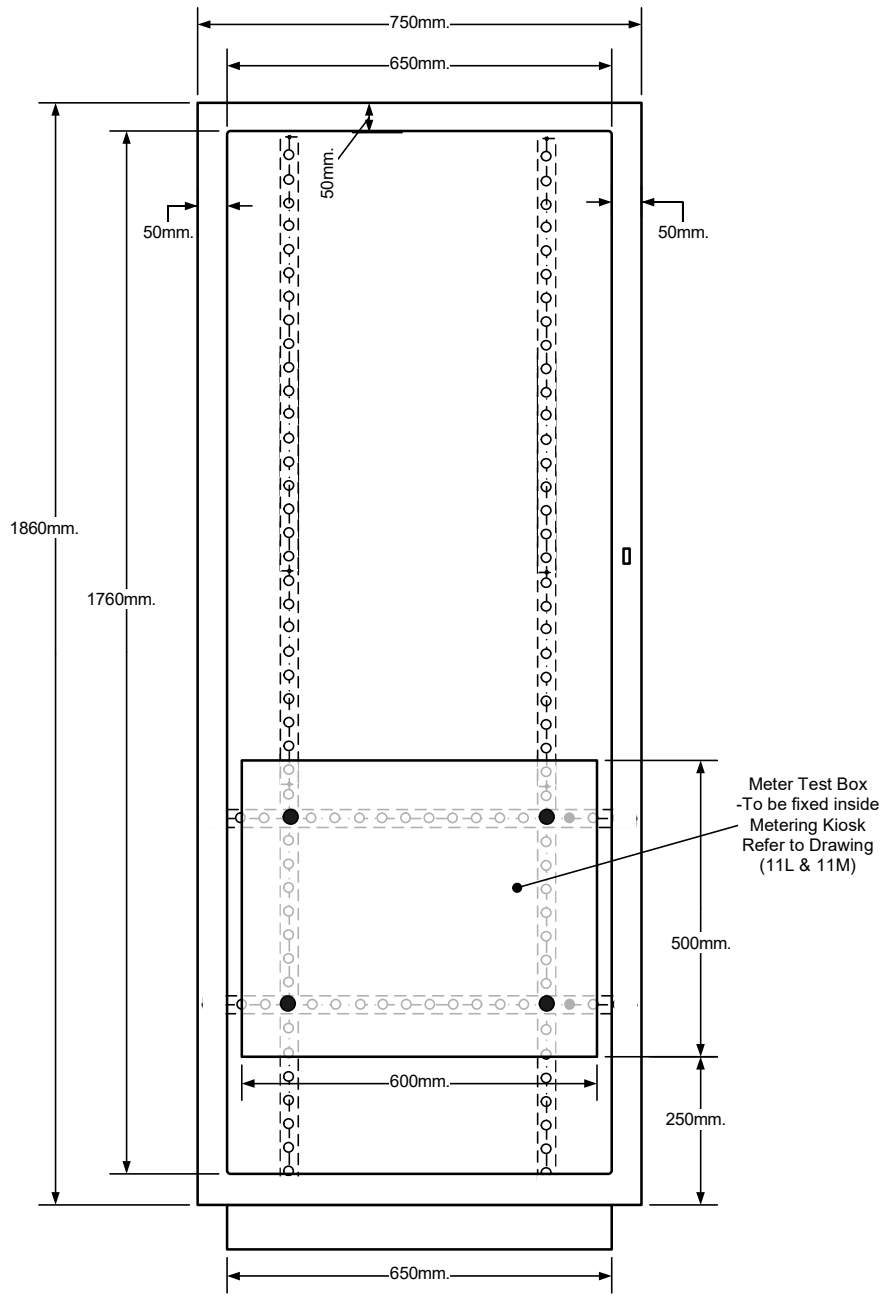
DRAWING 11C: MV/HV, 1 OR 2 FEEDER METERING KIOSK (INTERNAL DOOR – PERSPECTIVE AND SIDE VIEW)



PERSPECTIVE VIEW SIDE VIEW

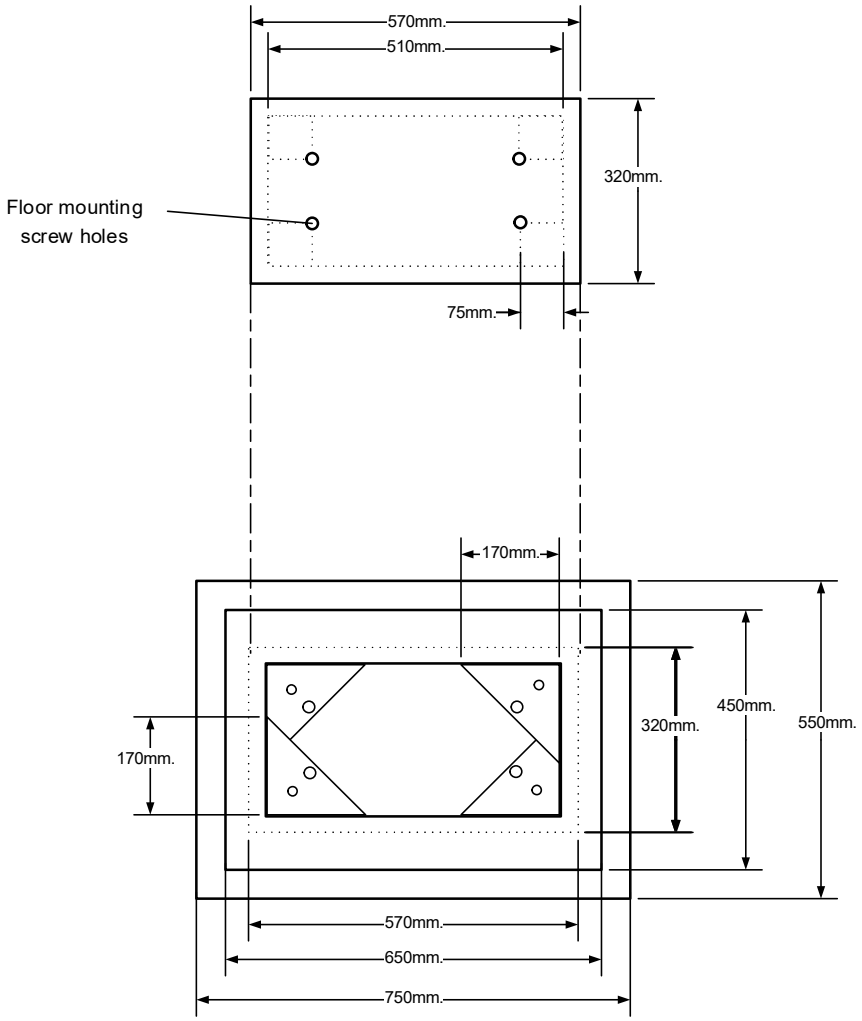
Drawing 11C: MV/HV, 1 OR 2 FEEDER METERING KIOSK : Internal Door – Perspective & Side View		
Unit Metering		**September 2011**

DRAWING 11D: MV/HV, 1 OR 2 FEEDER METERING KIOSK (FRONT VIEW OF KIOSK BASE)



Drawing 11D: MV/HV, 1 OR 2 FEEDER METERING KIOSK - Front View of Kiosk Base		
Unit Metering		**September 2011**

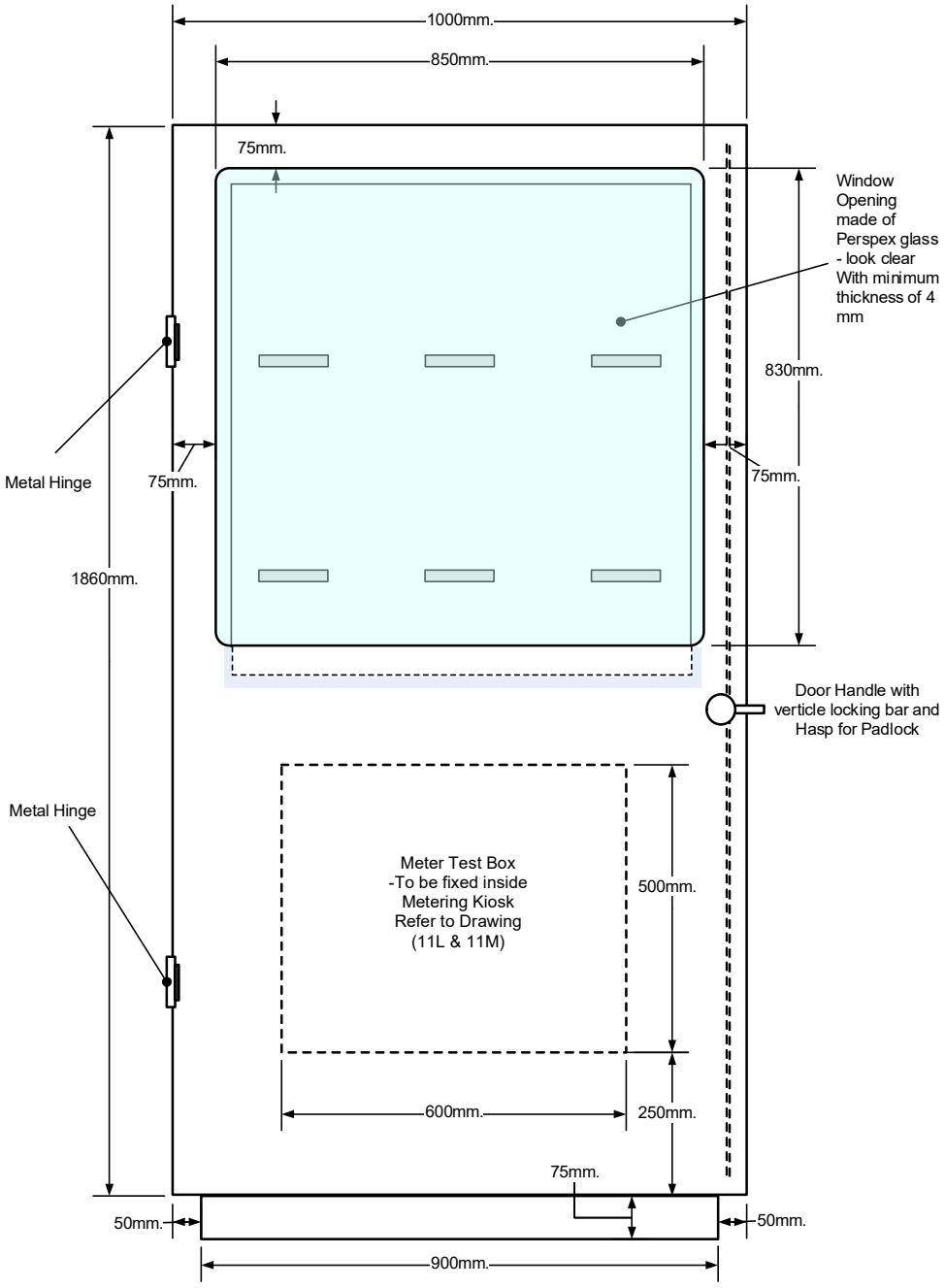
DRAWING 11E: MV/HV, 1 OR 2 FEEDER METERING KIOSK (TOP VIEW OF BASE)



MV/HV, 1 or 2 Feeder Base:
Top View

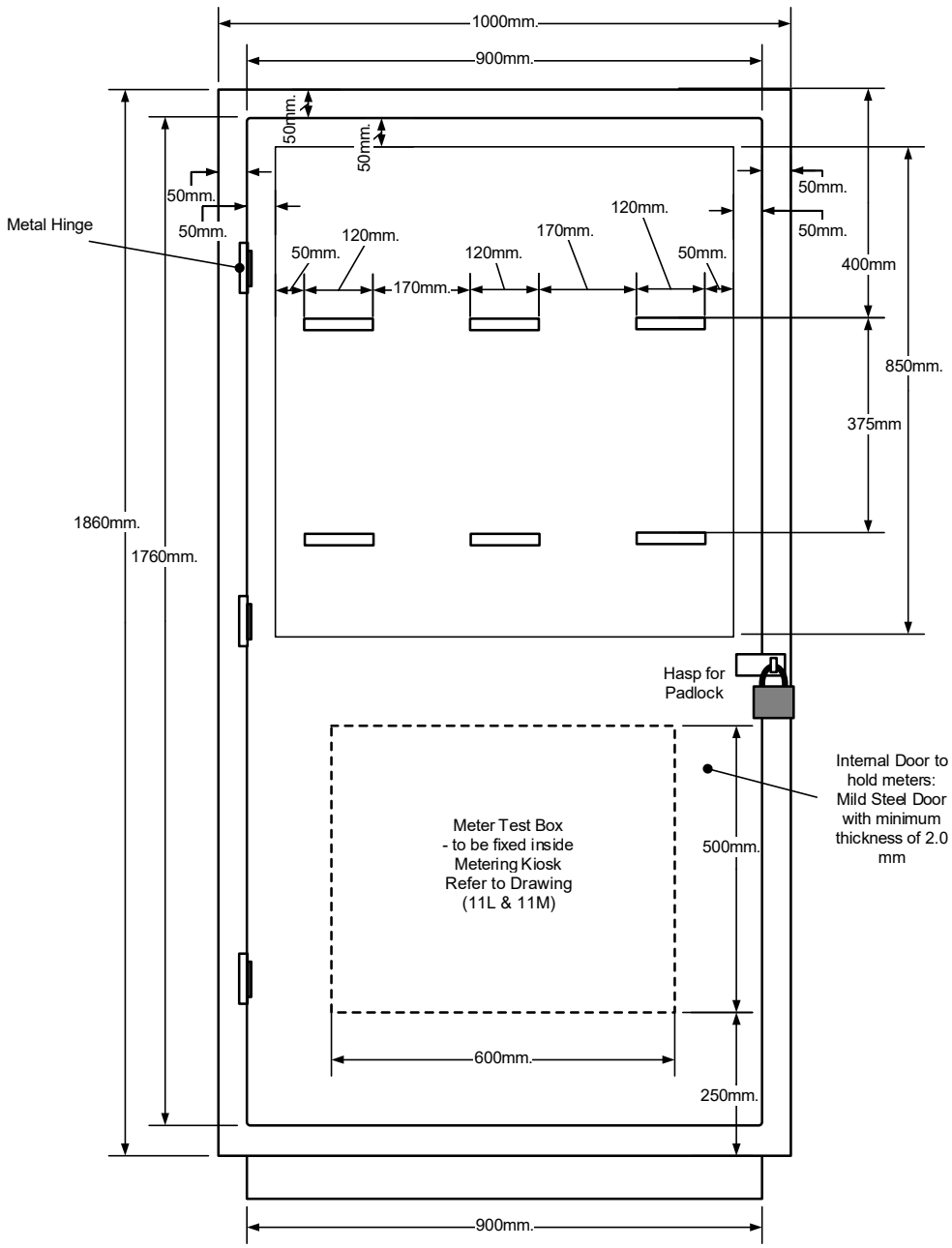
Drawing 11E: MV/HV, 1 OR 2 FEEDER METERING KIOSK BASE - Top View of Base		
Unit Metering		**September 2011**

DRAWING 11F: MV/HV, 3 FEEDER METERING KIOSK (FRONT VIEW OF EXTERNAL DOOR)



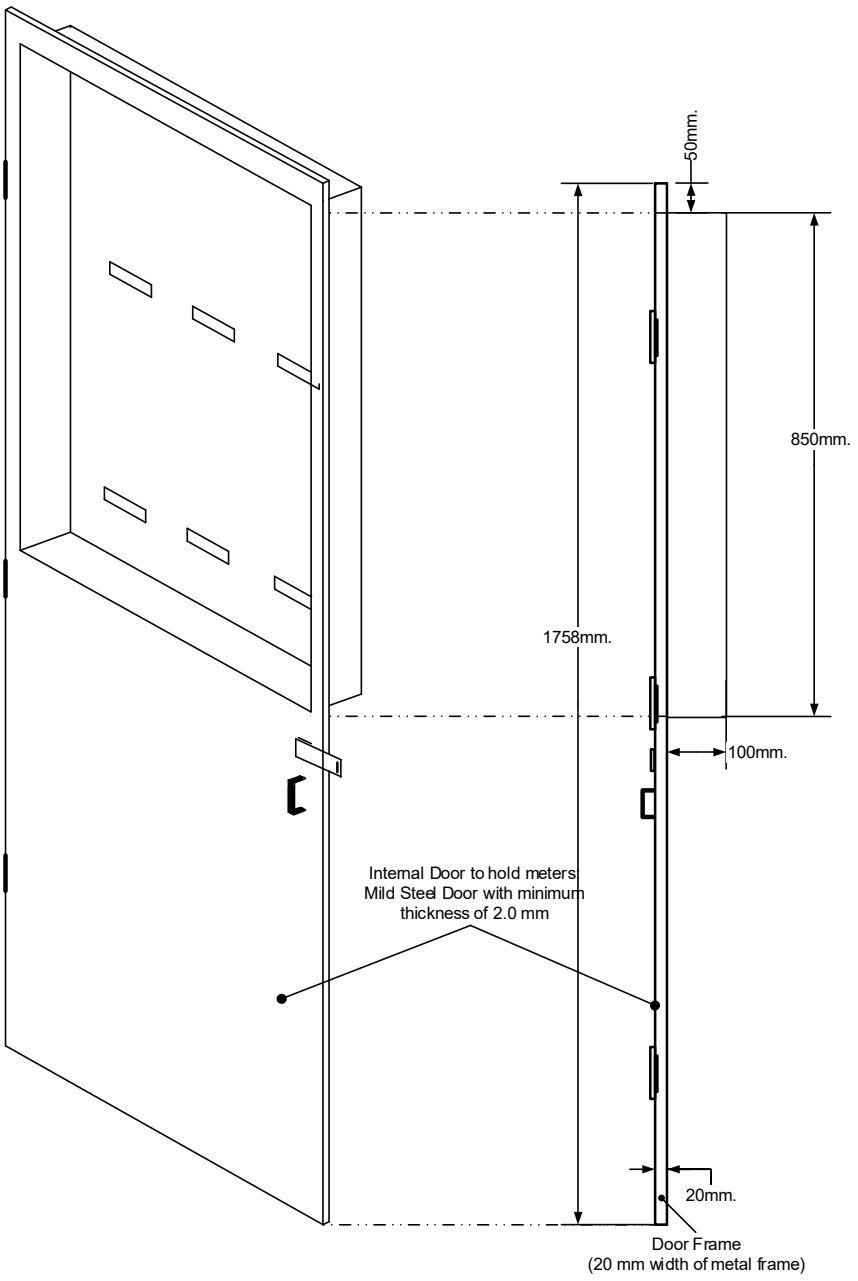
Drawing 11F: MV/HV, 3 FEEDER METERING KIOSK - Front View of External Door		
Unit Metering		**September 2011**

DRAWING 11G: MV/HV, 3 FEEDER METERING KIOSK (FRONT VIEW OF INTERNAL DOOR)



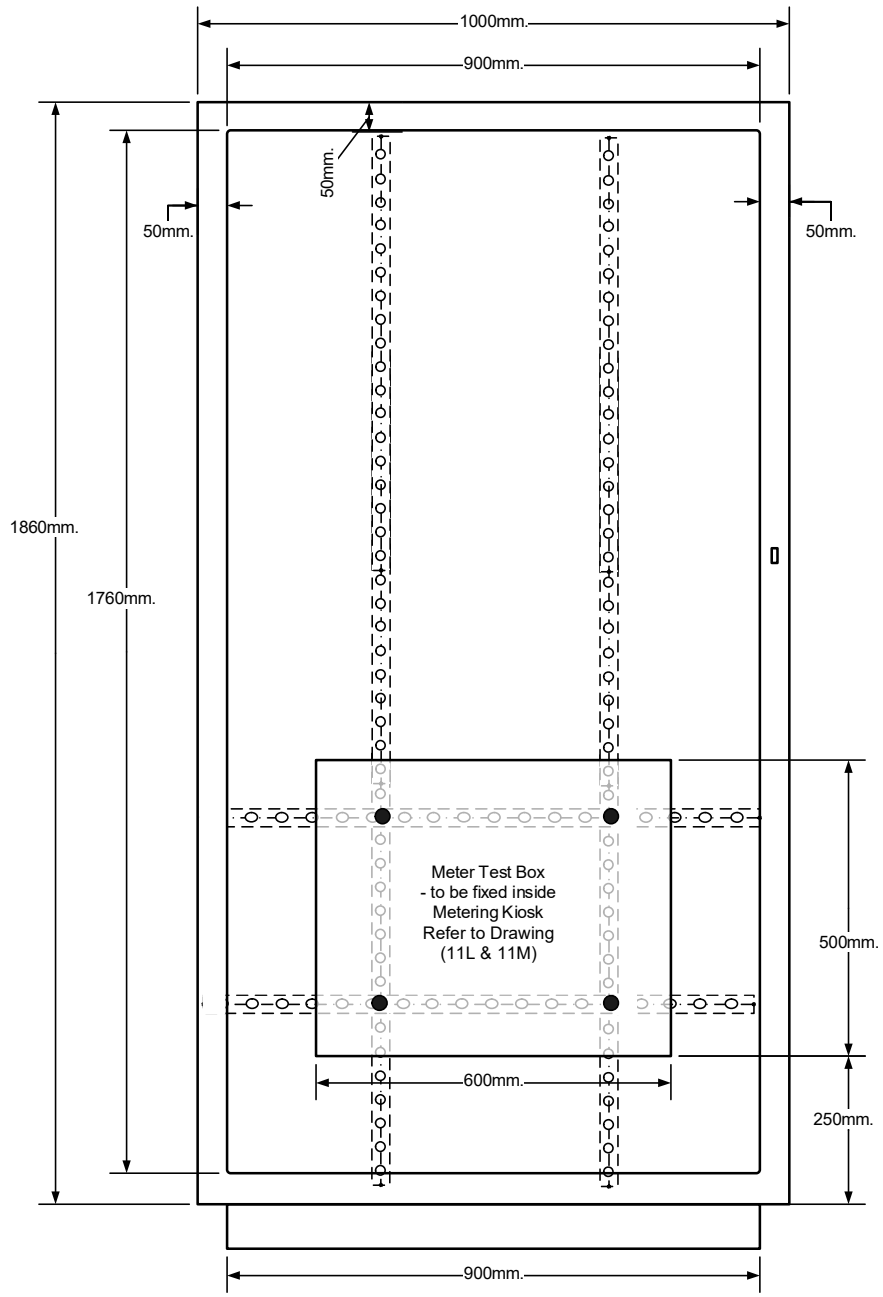
Drawing 11G: MV/HV, 3 FEEDER METERING KIOSK - Front View of Internal Door		
Unit Metering		**September 2011**

DRAWING 11H: MV/HV, 3 FEEDER METERING KIOSK (INTERNAL DOOR – PERSPECTIVE AND SIDE VIEW)



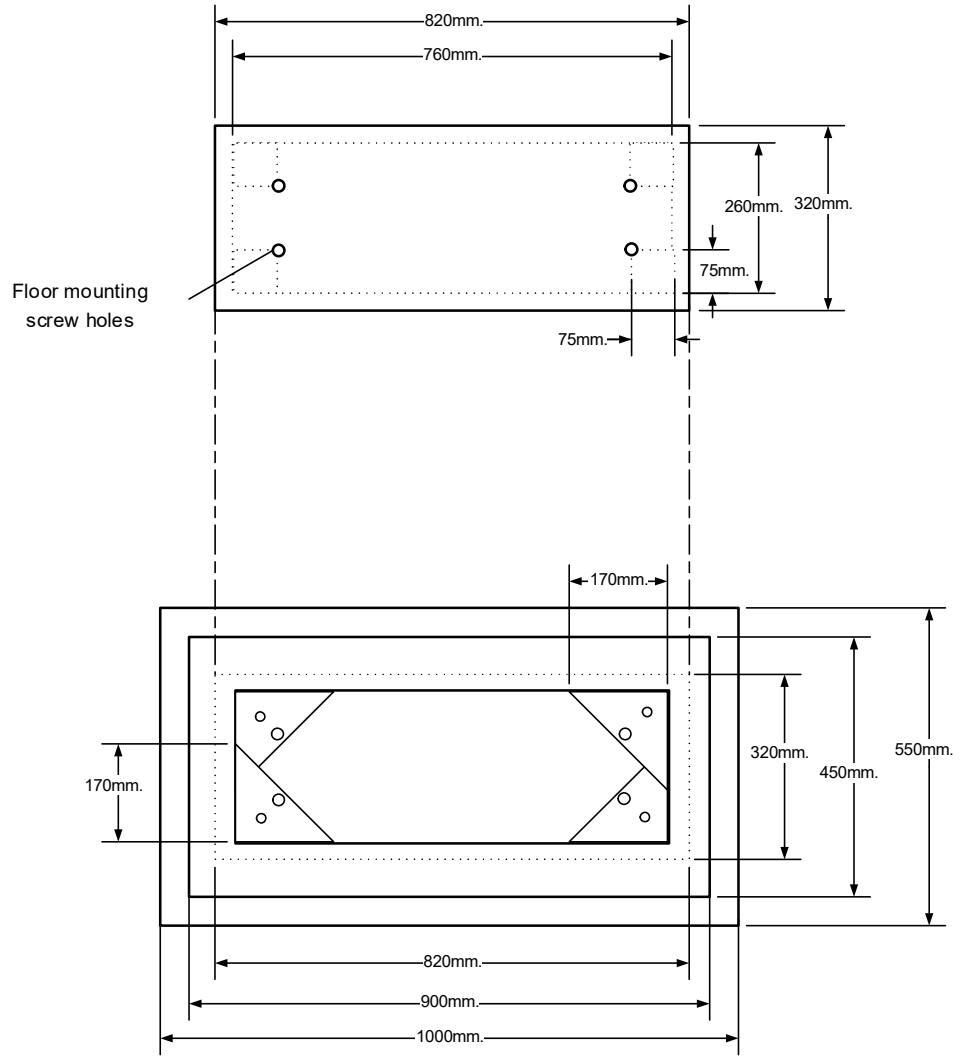
Drawing 11H: MV/HV, 3 FEEDER METERING KIOSK : Internal Door – Perspective & Side View		
Unit Metering		**September 2011**

DRAWING 11I: MV/HV, 3 FEEDER METERING KIOSK (FRONT VIEW OF KIOSK BASE)



Drawing 11I: MV/HV, 3 FEEDER METERING KIOSK - Front View of Kiosk Base		
Unit Metering		**September 2011**

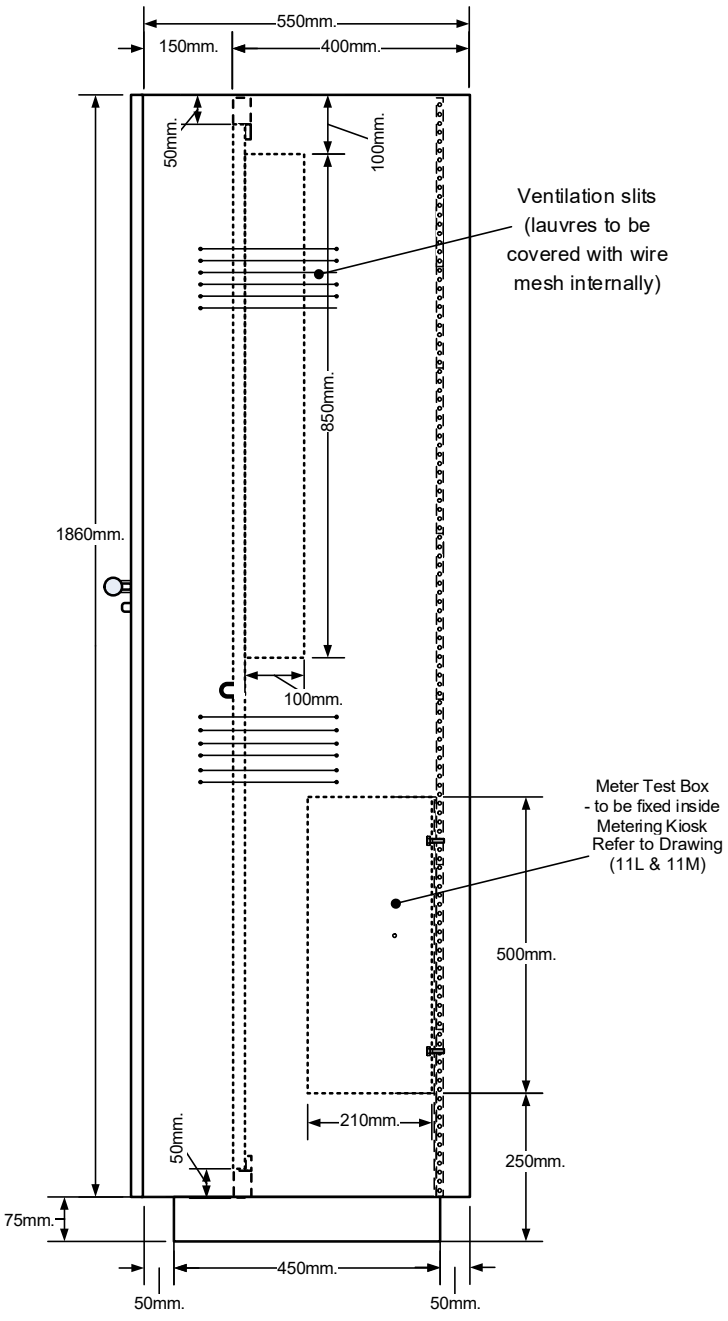
DRAWING 11J: MV/HV, 3 FEEDER METERING KIOSK (TOP VIEW OF BASE)



MV/HV,3 Feeder Base:
Top View

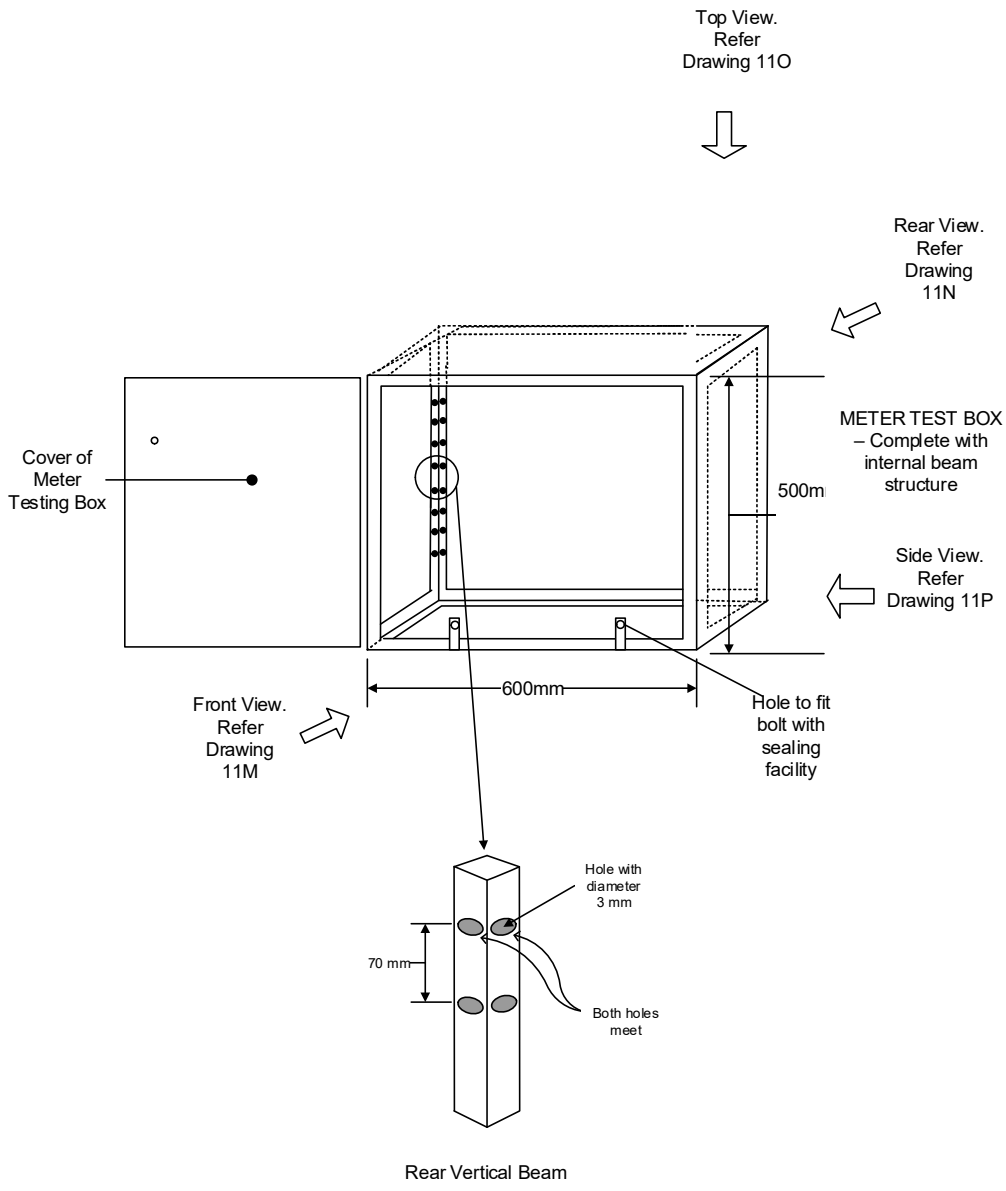
Drawing 11J: MV/HV, 3 FEEDER METERING KIOSK BASE - Top View of Base		
Unit Metering		**September 2011**

DRAWING 11K: MV/HV, 1 OR 2 OR 3 FEEDER METERING KIOSK (SIDE VIEW)



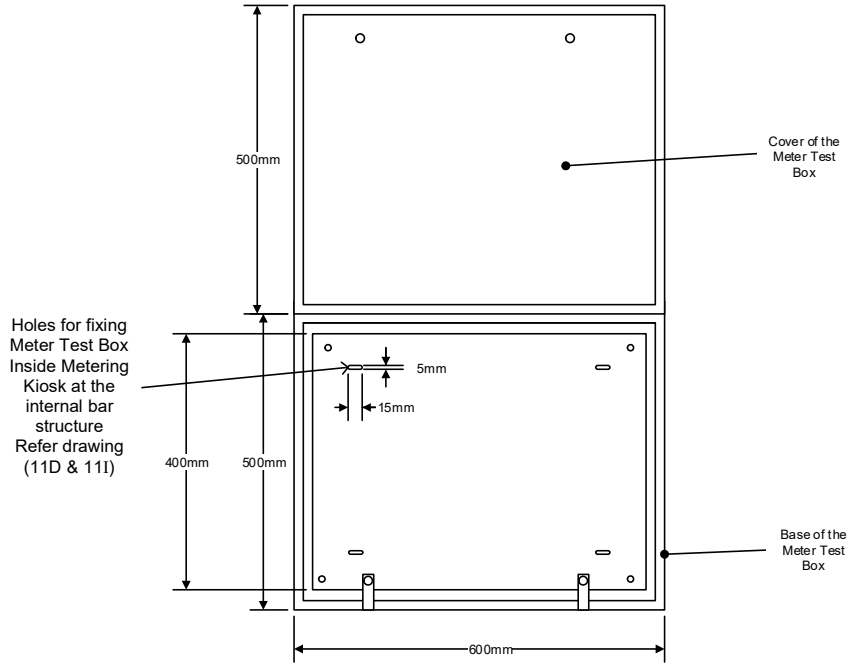
Drawing 11K: MV/HV, 1 OR 2 OR 3 FEEDER METERING KIOSK - Side View		
Unit Metering		**September 2011**

DRAWING 11L: MV/HV, 1, 2, 3 OR 4 FEEDER METER TEST BOX - TO BE PLACED INSIDE METERING KIOSK



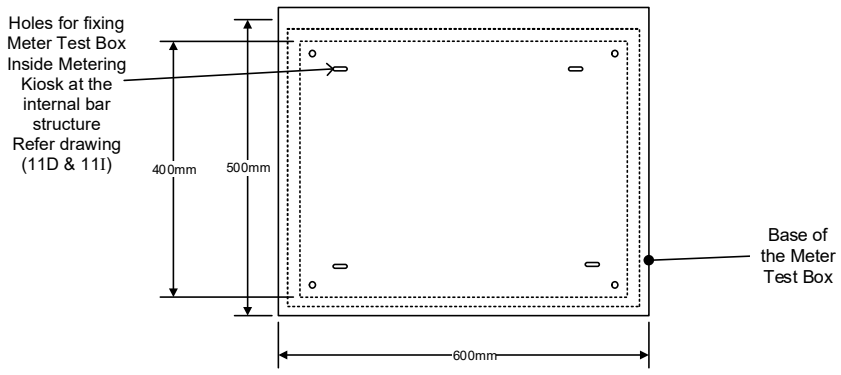
Drawing 11L: 1,2,3 OR 4 FEEDER METER TEST BOX - To be placed inside Metering Kiosk				
		UNIT METERING		September 2011

DRAWING 11M: MV/HV, 1, 2, 3 OR 4 FEEDER METER TEST BOX – FRONT VIEW



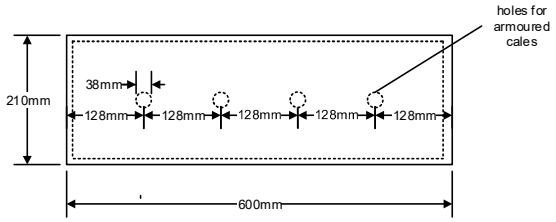
Drawing 11M: MV/HV, 1,2,3 OR 4 FEEDER METER TEST BOX - Front View				
		Unit Metering		September 2011

DRAWING 11N: MV/HV, 1, 2, 3 OR 4 FEEDER METER TEST BOX – REAR VIEW

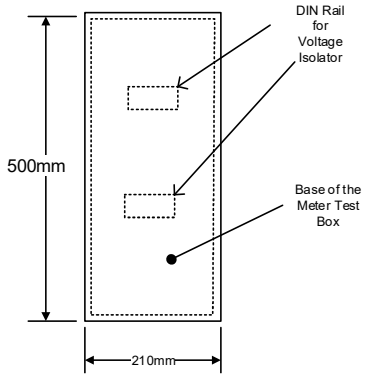


Drawing 11N: 1,2,3 OR 4 FEEDER METER TEST BOX - Rear View				
		UNIT METERING		September 2011

DRAWING 11O & 11P: MV/HV, 1, 2, 3 OR 4 FEEDER METER TEST BOX – SIDE VIEW AND TOP VIEW



Drawing 11O - Top View



Drawing 11P - Side View

Drawing 11O & 11P: MV/HV 1,2,3 OR 4 FEEDER METER TEST BOX - Side View & Top View				
		UNIT METERING		September 2011

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