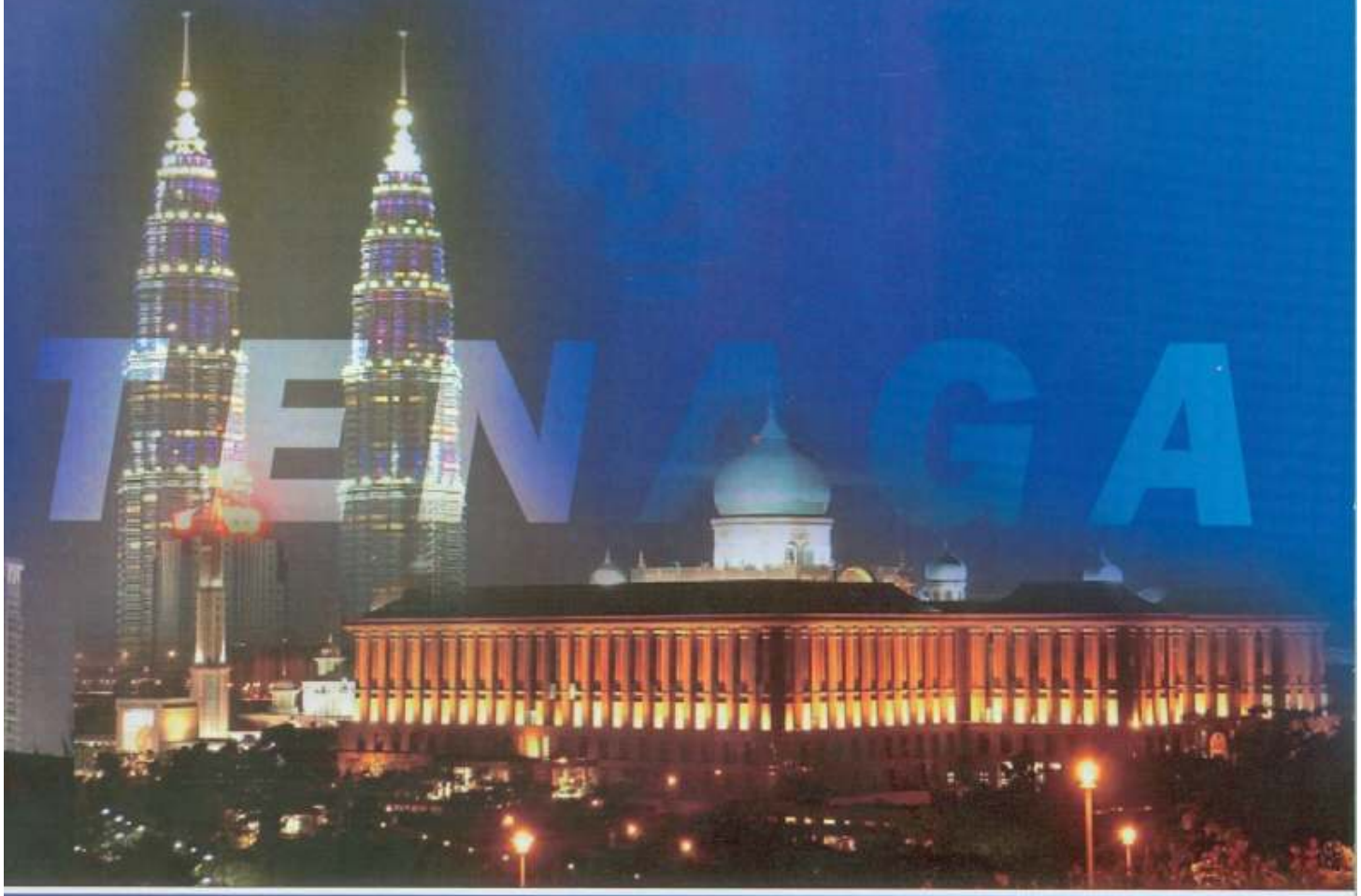
TENAGA NASIONAL BERHAD
(200866-W)

# ELECTRICITY SUPPLY APPLICATION HANDBOOK



# 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

Tenaga Nasional Berhad would like to acknowledge those that have actively contributed towards this effort in revisiting the TNB's Electricity Supply Application Handbook initially launched in 2001 and its subsequent Second (2nd) Edition in 2007.

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.

Special thanks to Federation of Malaysia Consumers Association (FOMCA), Federation of Malaysian Manufacturers (FMM), Association of Consulting Engineers of Malaysia (ACEM) , The Electrical and Electronics Association of Malaysia (TEEAM), Real Estate and Housing Developers' Association (REHDA), The Institution of Engineers, Malaysia (IEM), Masters Builders Association of Malaysia (MBAM), The Cement & Concrete Association of Malaysia (C&CA), Suruhanjaya Tenaga, Kementerian Tenaga, Teknologi Hijau dan Air (KETTHA), Kementerian Perumahan dan Kerajaan Tempatan (KPKT), Kementerian Kemajuan Luar Bandar dan Wilayah (KKLW) dan Jabatan Kerja Raya (JKR) for their comments and all others that have contributed in more ways than one to the publication of the 3rd Edition of the Electricity Supply Application Handbook.

# ELECTRICITY SUPPLY APPLICATION HANDBOOK

## CONTENT

# SUPPLY APPLICATION

## CONTENT

# 1.0 TENAGA NASIONAL BERHAD ELECTRICITY SYSTEM

## 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 3 Divisions :

- Generation Division
- Transmission Division
- Distribution Division

## 1.2 Distribution Division

Distribution Division supplies 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 Division is divided into 2 main regional operational areas where operational efficiency is further enhanced through the creation of 2 main regional areas, headed by the respective Senior General Managers which covers :

| Area | States |
|---|---|
| Region 1 | Selangor, Wilayah Persekutuan, Putrajaya/Cyberjaya, Negeri Sembilan, Melaka and Johor |
| Region 2 | Perlis, Kedah, Pulau Pinang, Perak, Pahang, Terengganu and Kelantan |

The States are comprised of main jurisdiction areas under the care of Area Managers. Some areas have smaller jurisdiction areas and are managed by Branch Managers and Small Branch Managers. All district offices (areas and branches) have one or more Pusat Khidmat Pelanggan under their jurisdiction.

Pusat Khidmat Pelanggan provides functions pertaining to Application for Electricity Supply, Billing & Collection, Upgrading of Services and other consumer related activities.

The technical aspects of the operations of the areas include planning, designing, construction, and system operation and maintenance that delivers electricity supply to the Consumer.

The support departments at the Distribution headquarters include Finance, Asset Management, Human Resource Management, Materials Management, Metering Services, Revenue Maximisation, Strategic Management and Organisational Development and Consumer Services and Marketing.

## 1.3 Pusat Khidmat Pelanggan

Pusat Khidmat Pelanggan is TNB's Service and Advisory Centre. It provides TNB's consumers with Consumer Service. There are numerous Pusat Khidmat Pelanggan centres throughout Peninsular Malaysia at your service. For complete information on Pusat Khidmat Pelanggan centres throughout Peninsular Malaysia can be obtain via TNB website (www.tnb.com.my). This list is subject to changes and may be reviewed from time to time.

Pusat Khidmat Pelanggan is where TNB as a caring and friendly utility touches base with its consumers. At Pusat Khidmat Pelanggan, you may experience directly our value-added services which we have specially made available to you, our valued consumers. Services provided at Pusat Khidmat Pelanggan include:

**a) One stop payment counter for all electricity and other utility 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 Pusat Khidmat Pelanggan, 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.**

- Pusat Khidmat Pelanggan shall provide clarification on any billing inquiries and it 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. Consumers are required to submit written application for meter to be tested. A fee will be charge for such testing.

## 1.4 Electrical System

### 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.

### 1.4.2 Supply Frequency

The supply frequency is 50Hz ± 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.

### 1.4.4 Earthing System

**Medium Voltage (6.6 kV up to 33kV) and High Voltage (66kV and above)**

- 3 phase configuration
- solidly earthed or impedance earthed
- overhead lines and underground cable are used extensively for medium and high voltage

**Low Voltage 400/230V**

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

### 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<br>(50kA , 1s for substation adjacent to Power Station, or within 500kV substation) |
| iii. | 132kV | 31.5 kA, 3s<br>(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 |

### 1.4.6 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) |

### 1.4.7 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.

## 1.5 Types of Supply

### 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.

**1) Supply Application For Load Up To 100 KVA**

- Supply from existing supply mains or establishment of new supply system (subject to system capability)
- Submission of applications to TNB by Electrical Contractor registered with the Energy Commission

**2) Supply Application For Load Exceeding 100 KVA**

- Supply from existing supply mains or establishment of new supply system
- 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 sub station/substations and its related ancillaries.

Supply Application for Streetlight can be categorize as follows based on TNB's prevailing policies and guidelines:

- Application made by the local authority/government department
- Application by developer
- Application by individual

For any supply involving co-generating, a separate licence need to be obtained from the relevant governing authority.

### 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.

### 1.5.3 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.

### 1.5.4 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.

### 1.5.5 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.

### 1.5.6 Multi Tenanted Premises

(a) Commercial Premises (excluding shoplots)

Multi tenanted commercial premises except shop lots shall be given bulk supply. It shall be the responsibility of the owner / developer of the multi tenanted commercial premises to obtain independent distribution license from Energy Commission.

(b) Domestic Premises

Multi tenanted domestic premises, the owner / developer / Joint Management Committee shall have the option of taking supply via bulk supply or individual supply to landlord and tenants. If on bulk supply it shall be the responsibility of the owner / developer of the multi tenanted commercial premises to obtain independent distribution license from Energy Commission.

(c) Shop Lots

Shop lots shall be given individual supply.

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

### 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.

## 1.6 Charges

### 1.6.1 Connection Charges

Please refer to the Statement of Connection Charges booklet available at Pusat Khidmat Pelanggan. The booklet is subjected to change as may be published from time to time.

### 1.6.2 Tariff

Please refer to the Tariff booklet available at the Pusat Khidmat Pelanggan or 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 Minister of Energy, Green Technology and Water.

### 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 the Pusat Khidmat Pelanggan. The booklet is subject to change as may be published from time to time.

## 1.7 Service Level Agreement (SLA)

### 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.

# 2.0 ELECTRICITY SUPPLY APPLICATION FOR LOAD UP TO 100 KVA

## 2.1 Purpose

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

## 2.2 What The Applicant Should Do

The applicant should take the following steps to apply for supply of electricity up to 100KVA for a single (1) phase and three (3) phase low voltage system.

| Steps | Action | Reference |
|---|---|---|
| 1 | Appoint an Electrical Contractor who will act on their behalf and submit the electricity supply application for the applicant using the Electricity Supply Application Form available at Pusat Khidmat Pelanggan. | Visit our web page: www.tnb.com.my<br><br>The Electrical Contractor must be registered with the Energy Commission |
| 2 | Settle connection charges billed by TNB (notice of connection charges) through the Electrical Contractor in order for TNB to start electricity infrastructure works. | |
| 3 | After completion of TNB's electricity infrastructure works (before installation of meter), the applicant shall:<br>• 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.<br>• Arrange appointment for meter installation with TNB<br>• Sign electricity supply contract with TNB through the appointed Electrical Contractor | |

## 2.3 What The Electrical Contractor Should Do

The Electrical Contractor appointed by the applicant should take the following action:

| Steps | Action | Reference |
|---|---|---|
| **1** | Submit electricity supply application for the applicant using the Electricity Supply Application Form available at Pusat Khidmat Pelanggan. All information in the Electricity Supply Application Form must be completed.<br><br>All documents in checklist must be completed, duly endorsed by the appropriate competent person(s) of the appropriate category and attached with the application. | **Appendix 1** – Submission Checklist |
| **2** | Settle connection charges after TNB has :<br>• Validated all information required as stated in Electricity Supply Application Form including any further information submitted as required by TNB and compliance to checklist<br>• conducted analysis of electricity supply connection<br>• confirmed the layout and schematic diagram including meter location with Electrical Contractor<br>• computed connection charges and issuance of notice of connection charges to Electrical Contractor | |
| **3** | After TNB has implemented electricity infrastructure works on site, the Electrical Contractor shall:<br>• Submit G and H form certifying the internal installations have been tested<br>• Arrange for applicant to sign electricity supply contract with TNB | |

## 2.4 TNB Supply Lead Time

The flowchart for the electricity supply application process is as outlined in **Appendix 2.** TNB supply lead-time will be based on TNB's Customer Charter.

## 2.5 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.

# 3.0 ELECTRICITY SUPPLY APPLICATION FOR LOAD EXCEEDING 100 KVA

## 3.1 Purpose

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

## 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.

## 3.3 Application Parts

There are two parts to the application:

| Part | Function | Reference |
|---|---|---|
| A | Authorities Approval Process | **Appendix 3** |
| B | TNB Application Process (Technical & Financial Approval (After completion of Part A) | **Appendix 4** |

**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 7 days to complete the comments for the relevant Local Authority. The main process can be summarised as follows:

| Stage | Description |
|---|---|
| 1 | **Submission Development Plan**<br><br>The Developer / Owner / Consultant Engineer submit development plan application for the proposed development to Local Authority / One Stop Centre (OSC).<br>All plans must be prepared by the party authorised by Local Authority.<br>Applicant must adhere to the requirements stipulated in the Development Plan Checklist (checklist available in http://jky.kpkt.gov.my) during the submission of Development Plan to Local Authority / One Stop Centre (OSC).<br>The comments from all relevant technical agencies including TNB are required prior to approval by Local Authority / One Stop Centre. |
| 2 | **TNB Register Application**<br><br>The local authority / One Stop Centre submits application to TNB complete with required details as in Development Plan Checklist TNB will:<br>• Acknowledge receipt and register development order plan in Development Order Comment Book.<br><br>Study the proposal. Match the existing system network and determine method of electricity supply. |
| 3 | **Mutual Understanding Of Plan**<br><br>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.<br><br>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**<br><br>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.<br>Local Authority approves the proposed development plan. The validity is subjected to:<br>- confirmation of layout details and pre-computation plans<br>- no changes in development<br>- 2 years extension or subject to respective Local Authority Development Order Plan validity requirement |
| **5** | **TNB Application for Electricity Supply above 100KVA 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 KVA as outlined in **Appendix 4**. 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**<br><br>The Electrical Consultant Engineer (registered with Board of Engineers Malaysia) on behalf of the developer/consumer submits application for the Electricity Supply Application to the nearest Pusat Khidmat Pelanggan using the reference of the approved Development Order Plan. Complete details as in **Appendix 5** must be submitted with the application.<br><br>TNB will issue an acknowledgement letter to the Electrical Consultant Engineer. |
| 2 | **Documentation Check And System Study**<br><br>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**<br><br>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**<br><br>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. Relevant documents (such as Form A (Borang hal tanah)etc.) related to substation site to be submitted during the payment of Connection Charge. |
| 5 | **Electricity Infrastructure Agreement (Optional)**<br><br>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**<br><br>After payment of Connection Charges, the Electrical Consultant Engineer will arrange for pre start work discussion. |
| 7 | **Construction Completion And Substation Energising**<br><br>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. 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. |

| Stage | Description |
|---|---|
| 8 | **Supply Application By The Electrical Contractor**<br><br>The Electrical Consultant Engineer shall advise the Electrical Contractor (Appointed by the Applicant) to submit supply application for load requirement up to 100kVA, normally for individual applicant after payment of connection charges. The process is similar as outline in Section 2. |

## 3.4 What The Applicant Should Do

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

| Steps | Action | Reference |
|---|---|---|
| **1** | • Appoint one (1) Electrical Consultant Engineer for each electricity supply application<br><br>• Submit an appointment letter of the Electrical Consultant Engineer allowing him to act on behalf of the applicant to TNB. | **Appendix 6** – 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 Pusat Khidmat Pelanggan.<br><br>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:<br>- Transfer the substation land at a nominal value of RM10.00 to TNB or;<br>- Leasing the substation land at a nominal value of RM10.00 to TNB.<br><br>• The Certificate of Completion and Compliance (CCC) of the substation building/compartment shall be handed to TNB.<br><br>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.<br><br>Delay in title transfer may affect project implementation.<br><br>TNB have the right to use the substation to supply electricity to other consumers. | |

| Steps | Action | Reference |
|---|---|---|
| **4** | Applicants are required to:<br><br>• 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.<br><br>• Sign electricity supply contract with TNB through the appointed Electrical Contractor. | |

## 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 Pusat Khidmat Pelanggan. 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.<br>b) Length of Underground Cable: max. 5km<br>c) Length of Transmission Line: max. 5km<br>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.<br>b) Length of Underground Cable: max. 5km<br>c) Length of Transmission Line: max. 10km<br>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.<br>b)Length of Underground Cable: max. 5km<br>c)Length of Transmission Line: max. 20km<br>d)Equipments To Be Procured Based on Equipments that Have Been Installed in TNB System. |

### 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<br>• All plans must be prepared by a Licensed Surveyor.<br>Liaise with TNB to come up with a mutual understanding of plan and to get approval by Local Authorities/ One Stop Centre. |

| | |
|---|---|
| **2** | Upon approval of the Development Order Plan, Electrical Consultant submits application for the electricity supply to Pusat Khidmat Pelanggan.<br>Complete details as outlined in **Appendix 5** and **Appendix 7** (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 :-<br><br>(i) Latest Development Order Plan approved by Local Authority<br>(ii) Site plan showing the lot number (s) and proposed substation sites<br>(iii) Layout plan of substation building<br>(iv) Single line diagram / schematic of installation<br>(v) Layout plan of proposed consumer switchroom (where applicable)<br>(vi) The approval of the building plans by the relevant Authorities<br><br>• Clearly state details of the applicants supply requirements.<br>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).<br>• Submit Power Quality Compliance Declaration Form (**Appendix 8**) Submit the metering requirements for CT Meters as in **Appendix 9** |
| **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.<br>• 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<br>• 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. |

### 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.

# 4.0 APPLICATION PROCESS FOR STREETLIGHT

## 4.1 Purpose

This procedure outlines the process for the application for streetlight.

## 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

## 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. |

## 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 Pusat Khidmat Pelanggan. |
| Installation involving additional poles | The applicant settles the full cost of additional new pole/poles installed. |

# CONNECTION GUIDELINES

## CONTENT

# 1.0 PLANNING AND DESIGN CRITERIA

TNB refers to Grid Code and Distribution Code in developing the connection system or supply infrastructure needs which are included in this section. It is available at the Energy Commission's office.

## 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 consumer metering must be planned to be maintained as is **Table 1-1** below:-

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

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

| Voltage level | % variation |
|---|---|
| 400V and 230V | +/- 10% |
| 6.6kV, 11kV, 22kV,33kV | +10 & -10% |
| 132kV & 275kV | +/- 10% |
| 500kV | -10% & +5% |

## 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**.

### 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 |

### 1.2.2 Supply Security Level to Consumers

In accordance to Guarateed Service Level (GSL), for supplies to consumers at voltage levels of 11kV, 22kV and 33kV, large part of the network are generally designed to facilitate an average supply restoration of less than 4 hours (Security Level 3). In some instances where alternative feedback source is not available consumers at voltage levels of 11kV, 22kV and 33kV may have supply restoration time of 12 hours.

For supplies at 230V and 400V, the restoration period may vary beyond 4 hours (Security Level 4) 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.

### 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.

## 1.3 POWER QUALITY

### 1.3.1 Power Quality Requirement

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 of this guideline.

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 voltage sag performance as indicated in **standards IEC 61000-2-4** and **IEC/TR 61000-2-8.**

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. The reliability of the supply system is evaluated 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 2.2.

1.3.1.4 The supply voltage and frequency may fluctuate for short duration outside the voltage ranges stated in section 2.1 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.

1.3.1.5 The consumer shall ensure that all equipment to be connected to TNB supply system is compatible with the frequency and voltage to be supplied.

### 1.3.2 Requirements of Consumer's Equipment

1.3.2.1 TNB specifies requirement that the consumer's must comply with in order to limit the impact of the potential short duration voltage and frequency fluctuations.

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** |

1.3.2.3 It is the responsibility of the consumer to ensure that his/her voltage sensitive equipment is able to function continuously through unanticipated voltage sags, 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.

1.3.2.4 The consumer must select modern equipment that is able to ride through many of these voltage sags. Consumers should ask their equipment manufacturers whether their equipment can function properly during the voltage sag conditions illustrated in the **European Standard EN 50160**, **IEC Standard 61000-2-2** and **IEC Standard IEC 61000-2-4**. If the equipment does not have any immunity to voltage sags, then the consumer should request from the manufacturers on measures to immune the equipment against voltage sags.

1.3.2.5 The recommended standards to refer for evaluating equipments' sensitivities and identifying immunity solutions to voltage sags, short interruption and voltage variations are **IEC Standard 61000-4-11** and **IEC Standard 61000-4-34**.

1.3.2.6 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

### 1.3.3 Declaration to Power Quality Requirement

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 8**.

## 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.

## 1.5 PROTECTION REQUIREMENTS

### 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.

### 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) must 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, 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.

ii. 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.

### 1.5.3 Protection System Evaluation Process

Consumer's installation to 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 effect the reliability of TNB's supply system.

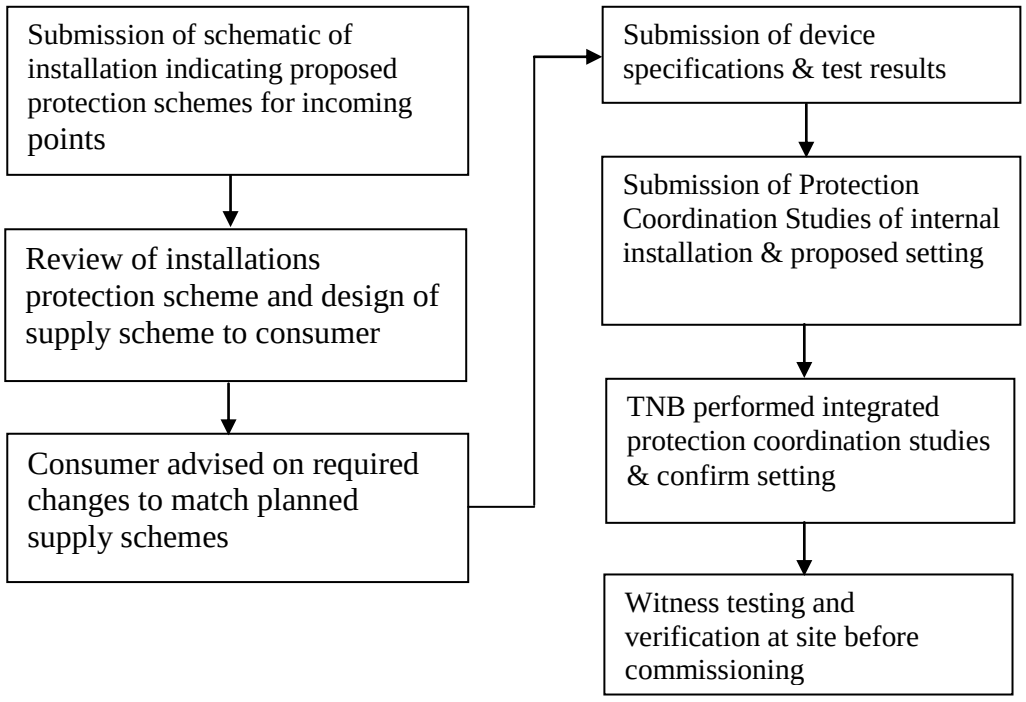



Figure 1-1 above illustrates the steps involved in the evaluation of protection schemes.

# 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.

## 2.1 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 underground system, every lot of shop house is required to have individual service cable termination chamber and isolator / fuse switch

**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.

**2.3 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 |

# 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.

## 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 | 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 |

| | | |
|---|---|---|
| 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 |

## 3.2 Substation Categories, Type & Design

### 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 Sub-station (Pencawang Elektrik – P/E)

Distribution sub-stations 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 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 laid and maintain 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). Standardized M & E design of SSU 11kV and 11/0. 4kV sub-station is available at TNB offices.

Compact Substation

Compact substation 11/0.4kV of 500kVA capacity is encouraged to be installed for new housing development (**domestic consumers** only) with the following guideline:

- Compact substation 500kVA to be placed close to the load centre.
- Compact substation 500kVA not to be placed at the corners of one development.
- Compact substation 500kVA cannot be placed close to each other to ensure efficient load distribution to the consumers
- Compact substation 500kVA is considered as 'special feature design schemes' in which special features cost is charged to the consumer as per Clause 8.0 of Statement Of Connection Charges 1994/1995.
- Appropriate distribution network design to ensure security & restoration time to consumers will not be affected:
    - ✓ If the housing development is more than 5MVA, 11kV switching station **shall** be provided by the developer within the housing development to support 11kV network connection to respective distribution substation.
    - ✓ For housing development that is < 5MVA, requirement of 11kV switching station depends on the existing network configuration & **constraints**.
    - ✓ A 11kV switching station is able to support a development of maximum 10MVA only.

Compact substation of bigger capacities has limited application and is to be strictly applied in selective situations under the following circumstances:-

- System reinforcement projects for highly built-up areas where substation land is difficult to acquire.
- Any request to use compact substation for dedicated supply to a single or limited group of low voltage consumers is subject to TNB approval in accordance to site constraints situation, and to be considered as 'special feature design schemes'.

### 3.2.2 Land Or Building Size Requirements For Sub-Stations

Table 3-3 : Land and building size requirements for sub-stations

| 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):<br><br>(a)132/33/11kV<br>(b) 132/33/11kV (with capacitor bank) | Gas Insulated Switchgear (GIS) Without outdoor switchyard | (a) 60.0m x 80.0m<br>(b) 140 m x 75m | Customized design to match land size building bylaws |

| | | | |
|---|---|---|---|
| Transmission Main Intake/Pencawang Masuk Utama (PMU):<br>(a) 132/33/11kV<br>(b) 132/33/11kV (with capacitor bank) | Air Insulated Switchgear (AIS) With outdoor switchyard | (a)130.m x 130.0m<br>(b) 160 m x 150 m | Customized design to match land size building bylaws |
| Main Distribution Substation (PPU)<br>(a) 33/11kV<br>(b) 22/11kV | Indoor type | 46.0m x 46.0m | Customized design to match land size building by laws (refer to Buku Panduan Piawai Baru Rekabentuk Pencawang Elektrik (Jenis Bangunan) Di Bahagian Pembahagian, TNB) |
| Main Switching Substation (SSU)<br>(a) 33kV<br>(b) 22kV(phasing out to 33kV) | Indoor | 30.0m x 30.0m | Customized design to match land size building by laws (refer to Buku Panduan Piawai Baru Rekabentuk Pencawang Elektrik (Jenis Bangunan) Di Bahagian Pembahagian, TNB) |
| Main Switching Station (SSU)<br>11kV (for LPC) | Conventional – Stand alone | 13.0m x 14.2m | Refer to Buku Panduan Piawai Baru Rekabentuk Pencawang Elektrik (Jenis Bangunan) Di Bahagian Pembahagian, TNB **Substation building colour shall be blended with the surrounding environment.** |
| Main Switching Station (SSU)<br>11kV (to support 11kV network connection to respective distribution substation (PE).) | Conventional – Stand alone | 30.0m x 30.0m | |
| Distribution Substation (P/E)<br>(a) 11/.415kV<br>(b) 22/.415kV | Conventional – Stand alone<br>(a)Single chamber | 13.6m X 14.8m | |
| | (b) Double chamber | 16.6 X 14.8m | |
| | (c) Compact substation | 9.0m x 11.0m | 3.0m x 2.0m |

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.

### 3.2.3 Type of fire fighting System for the Substations

Attached substation requires installation of fire fighting system by the consumer. 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 sub station
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.

### 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. A fully underground network and any application of compact sub-station shall be considered as special features.

(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.

# 4.0 CONNECTION GUIDELINE FOR EMBEDDED / DISTRIBUTED GENERATORS

The Connection Guideline for Embedded / Distributed Generators shall be in accordance to the Renewable Energy Act 2010 and its subsidiary legislation.

## METERING GUIDELINES

**CONTENT**

## ABBREVIATIONS:

| | |
|---|---|
| TNB | Tenaga Nasional Berhad |
| LV | Low Voltage |
| MV | Medium Voltage |
| HV | High Voltage |
| CT | Current Transformer |
| PT / VT | Potential Transformer / Voltage Transformer |

## 1.0 GENERAL REQUIREMENTS

1.1 All the necessary meters for measuring the consumption of electricity shall be provided and maintained by TNB. TNB shall determine the point at which every supply line shall terminate in any premise in view of ease of accessibility to TNB's personnel.

1.2 At any point in the premises at which supply line or lines terminate, the developer/consumer shall provide the meter board or meter panel or meter cubicle 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.

1.3 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.

1.4 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.

1.5 For medium voltage consumers, CTs and VTs shall be provided and installed by TNB at TNB's outgoing switchgear. However for situation whereby metering cannot be at TNB's control area, the CT and VT shall be provided and installed by the consumer.

1.6 For high voltage consumers, where the CTs are incorporated in switchgear panels, the consumer shall provide the metering CTs and VTs, where required and when necessary, according to TNB's specifications. The test certificates for the metering CTs and VTs from an accredited laboratory shall be submitted and approved by TNB before the metering installation if the CTs and VTs were to be provided by the consumer. The low voltage and medium voltage metering CTs shall be subjected to testing by TNB and a floor mounted metering cubicle must be provided.

1.7 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 Division Local Office.

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

## 2.0 SINGLE PHASE WHOLE CURRENT SUPPLY

### 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 Division Local Office for any enquiries.

### 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.

ii. Where it is necessary to terminate the service line in a position outside the premise and exposed to the weather, prior approval shall be obtained for such a location from TNB Distribution Division Local Office.

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 at the gate post is shown in **Appendix 10, Drawing No. 1A.**

iv. For domestic consumers without individual gate post, the meter shall be located at the premises or the nearest TNB electricity pole. For meter located at the premises, the consumers/developer shall provide meter box to enclose the meter, cut-out fuse and neutral link. This is to ensure safety to consumer / public. Meter box design and specification is shown in **Appendix 10, Drawing No. 1B & 1C.**

v. For non-domestic consumers whereby the meter is located outside consumer's perimeter/control, it shall be in a weather proof and ventilated panel/area which is suitable for meter installation and meter reading as per **Appendix 10 Drawing No. 1D**.

vi. Group metering for multi tenanted consumers or open commercial outlets shall be addressed in Section 4.0

vii. The installation of the meter board in kitchens, bedrooms, bathrooms, utility rooms and in location injurious to the metering equipment or to the safety of personnel **shall not** be permitted, e.g. above a cooker point, hot rooms, below the opening for rising mains, directly in a riser duct, over a trunking, etc.

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

## 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 1.65 m (top of the meter) above ground level.

ii. The height of the meter board at the gate post shall be between 1.2 m and 1.5 m above ground level.

## 2.4 Meter Board

i. The meter board shall be:

a) Any hard wood chemically treated against attack by termites (Plywood is NOT to be used).
b) Fibre board / plate with minimum thickness of 5.0 mm and / or mild steel with minimum thickness 1.5 mm.
c) Any new material shall be transparent and subjected to SIRIM's approval for non-hygroscopic, non-ignitable, ultra violet stabilized and distortion free under high outdoor temperature as well as subject to TNB's prior approval. Material from PVC or PE is not allowed.
d) Any conductive material shall be properly earthed.

ii. The thickness of board shall be at least 2 cm with a border 1.5 cm so that fixing screws for meter cannot penetrate and puncture the insulation of wires behind the board. The diagram of the board is shown in **Appendix 11, Drawing No 2A.** New meter board that are introduced (other than wood / fibre / steel), the thickness of the approved material shall be minimum 3 mm and the board's depth shall be 2 cm.

iii. The arrangement for the meter, cut out, termination wires and the recommended size of the board is shown in **Appendix 12, Drawing No. 3A and 3B.**

iv. 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.

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

vi. In the case of meter installation outside the consumer's premise, a suitable weather-proof, well-ventilated box with the transparent meter board 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. The meter box and board is shown in **Appendix 13, Drawing No. 4A**.

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

viii. 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 14, Drawing No. 5A.**

## 2.5 Wiring Arrangement

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

ii. The wiring at the meter board shall be on the surface.

# 3.0 THREE PHASE WHOLE CURRENT SUPPLY

## 3.1 Voltage And Current Rating

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

## 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 Height of Meter Position

The requirements given in 2.3 (i) – (ii) applies for the height of three phase meter.

## 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 15, Drawing No. 6A – 6C** respectively.

ii. The requirements given in 2.4 (i) (b) - (d) apply for the three phase meter board.

**iii.** The requirements given in 2.4 (iv) – (viii) apply for the three phase meter board with the drawings shown in **Appendix 15, Drawing No. 6A – 6C.**

## 3.5 Wiring Arrangement

i. The requirement given in 2.5 (i) – (ii) also applies for the three phase wiring arrangement.

**ii.** For external wiring, please refer to **Appendix 16 Drawing No. 7A, 7B and 7C.**

# 4.0 GROUP METERING FOR SINGLE PHASE AND THREE PHASE WHOLE CURRENT SUPPLY

## 4.1 Location and Height of Meter Position

4.1.1 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 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.

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

4.1.2 Commercial Premises (excluding shop lots)

Multi tenanted commercial premises except shop lots shall be given bulk supply. The meter shall be installed at the metering room of TNB's sub station.

4.1.3 Hawker Centre / Food Court/Food Stall

(a) Location of Meter Position

i. 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.

ii. The recommended size and arrangement of the meters, cut outs, and neutral link is as shown in **Appendix 17, Drawing No 8A – 8C** for single phase group metering

(b) Mounting of Meter

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

ii. The height from the top of the meter panel shall not exceed 2.1m.

iii. In the above requirements, all excess to the dedicated metering room or steel betting meter cage shall be equipped with cam lock for locking facility by TNB.

4.1.4 Shop Lots

(a) Location and Height of Meter Position

i. 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 18, Drawing No. 9A**

(b) Wiring Arrangement

i. The requirement given in 2.5 (i) – (ii) also applies for the three wiring arrangement.

ii. For external wiring, please refer to **Appendix 16 Drawing No 7A, 7B and 7C.**

## 4.2 Meter Panel

i. The meter panel can be of mild steel or other TNB approved material and of thickness not less than 1.5 mm.

ii. Each meter panel shall accommodate a maximum of 5 meters only.

iii. The recommended size and arrangement of the meters, cut-outs, and neutral link is as shown in **Appendix 17, Drawing No. 8A – 8C** for single phase group metering and **Appendix 18, Drawing No. 9B – 9D** for three phase group metering.

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

v. 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 $180^{o}$.

vi. The wiring arrangement shall follow:
   i. Single phase – Section 2 no. 2.5
   ii. Three phase – Section 3 no. 3.5

# 5.0 LVCT METERING

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

## 5.1 Location Of Meter Position

i. For supply scheme without substation, the Electrical Consultant Engineer / Electrical Contractor is required to arrange for a suitable space for the metering installation on a panel/cubicle separate from the main switchboard outside consumers perimeter/control nearest to the source of TNB supply i.e feeder pillar as shown in **Appendix 19 Drawing 10 A (i-iv)**.

ii. For supply scheme with substation, the meter panel/cubicle shall be installed inside TNB substation perimeters as shown in **Appendix 19 Drawing 10 B (i – iii).**

iii. The position of the meter panel/cubicle shall be determined by the type of LV supply. The final metering position and mounting type shall be decided by TNB.

iv. 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<br>VA | Secondary Rated Current<br>A | Cross Connection of Conductor<br>mm2 | Maximum Distance Allowable<br>m |
|---|---|---|---|
| 7.5<br>7.5 | 5<br>5 | 2.5<br>4.0 | 12.0<br>20.0 |

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

## 5.2 Meter Panel Requirement

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

ii. The meter panel shall be of electroplated mild steel sheets materials, and of a thickness not less than 1.5mm.

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

iv. Provisions shall be made for sealing of the meter panel/cubicle.

v. The panel cover and metal plate with TNB's meter(s) mounted thereon shall be able to swing or open out for at least one right angle i.e. $180^{o}$.

vi. The meter panel cover and metal plate shall have at least two metal hinges.

vii. Appropriate bushing shall be provided in all openings/ holes for the meter wiring.

viii. The Meter Panel cover shall be provided with lining made of rubber for protection against moisture.

ix. Meter Panel shall be earthed with copper wire connected to the ground for external protection.

x. All wiring arrangement inside the meter box shall be surface/external wiring.

## 5.3 LVCT Metering Installation Requirements

i. The height from the ground to the top of the meter panel shall not exceed 1.8 meters.

ii. The switchboard shall be completed with all its components and accessories installed, and shall be mounted securely in its final position before the TNB's meter(s) can be installed.

iii. There shall be working space of 1 m in front of the meter panel for the meter installation and meter reading. In the case of meter cubicle, there shall be working space of 1 m all round the cubicle.

iv. 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

v. 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.

## 5.4 Mounting of Metering Low Voltage Current Transformers (LVCTs)

i. For supply scheme with substation, current transformers shall be mounted on LV outgoing cables at feeder pillar or transformer tail.

ii. For supply scheme without substation, current transformers shall be mounted on TNB's meter panel before consumer incoming busbar as illustrated in **Appendix 19 Drawing 10 A (i-iv).**

iii. Proper bakelite clamps shall be provided to secure the metering current transformers in position.

iv. Adequate insulation shall be provided between the metering current transformers and the busbar.

v. A two leaf door provided with hasp for locking facility shall be used to close the CT chamber.

vi. There shall be working space of minimum 1 m from the back of the switchboard to the wall for installation of metering current transformers.

vii. Dimension for LV CTs are as shown in Table 2 for the appropriate sizing of the busbar. The LV CT shall be provided by TNB

**Table 2**

| C.T Ratio | Internal Diameter | External Diameter |
|---|---|---|
| 100/5 | 35 mm | 90 mm |
| 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 |
| 1600/5 | 100 mm | 140 mm |

viii. 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 Division Local Office.

# 6.0 MEDIUM VOLTAGE AND HIGH VOLTAGE METERING

## 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 as per **Appendix 20 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 9** are required to be send to TNB district offices and later forwarded to TNB Metering Services office for advice on metering requirements. All drawings must be signed by a Professional Engineer.

## 6.2 Specifications For Metering VTs And CTs

### Metering VTs

VTs shall be from inductive type.

For consumer taking 6.6 kV, 11 kV, 22 kV and 33 kV:

| | | |
|---|---|---|
| Ratio | : | $\frac{Vs \ / \sqrt{3}V}{110 \ / \sqrt{3}V}$<br>* *where Vs is the supply voltage given to the consumer* |
| Class | : | 0.5 |
| Burden | : | 50 VA minimum.<br>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 60044-2 (1997) |

For consumer taking 132 kV and above:

| | | |
|---|---|---|
| Ratio | : | $\frac{Vs \ / \sqrt{3}V}{110 \ / \sqrt{3}V}$<br>* *where Vs is the supply voltage given to the consumer* |
| Class | : | 0.2 |

| | | |
|---|---|---|
| Burden | : | 50 VA minimum.<br>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 60044-2 (1997) |

**Metering CTs**

For consumer taking 6.6 kV, 11 kV, 22 kV and 33 kV (indoor breaker):

| | | |
|---|---|---|
| Ratio | : | Is / 5A<br>** where Is is the primary ratio of the metering CT* |
| Class | : | 0.2 |
| Burden | : | 15 VA |
| Unit | : | 3 Nos. for each feeder |
| Standards | : | IEC 60044-1 (1996) |

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

| | | |
|---|---|---|
| Ratio | : | Is / 1A<br>** where Is is the primary ratio of the metering CT* |
| Class | : | 0.2 |
| Burden | : | 30 VA |
| Unit | : | 3 Nos. for each feeder |
| Standards | : | IEC 60044-1 (1996) |

## 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.

## 6.4 Metering Cubicle

Consumer shall provide an appropriate metering cubicle to specifications stated in **Appendix 20.** The maximum allowable distance between metering CTs and metering cubicle is shown in below table. Consumer shall send the cubicle to TNB Metering Services office for wiring up.

| CT Burden (VA) | Secondary Rated Current (Amps) | Cross Connection Of Conductor ($mm^2$) | 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 |

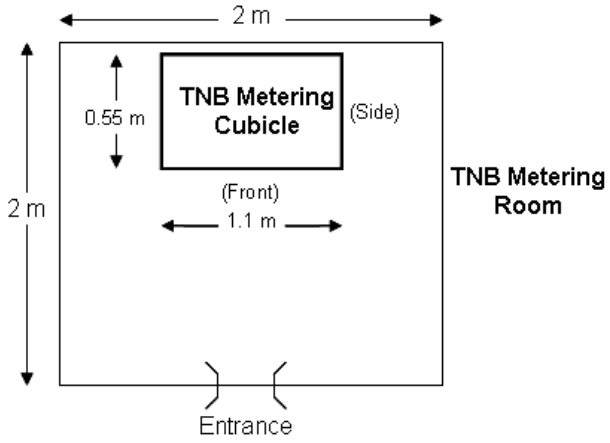
*Where meter burden for current circuit = 0.5 VA / ph*

### 6.5 Location Of Metering Cubicle

An enclosed locked room specifically for the purpose of installing floor mounted metering cubicle shall be provided. The minimum size of the room shall be 2.0 m x 2.0 m x 2.5 m (height). Key to the metering room shall be supplied and kept by TNB.

The location of the metering room shall be inside TNB's substation / switching station for consumers taking supply up to 33 kV. For consumers taking supply above 33 kV, the location of the metering room shall be at consumer's premise.

Location to install the metering cubicle inside the metering room shall be as in the layout below:




### 6.6 Power Supply Point For Maintenance Purposes

A 13 Amps Switch Socket Outlet (S.S.O.) is to be provided and installed at the top of the metering cubicle.

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

### 6.7.1 Indoor Breakers

The consumer shall provide and connect a 12-core PVC/SWA/PVC, Cu, 2.5 $mm^2$ cable or better between the consumer's high voltage switchboard and the metering cubicle. There shall be no intermediary joint.

The armoured cable shall not be buried or enclosed. It shall be preferably laid on cable tray.

### 6.7.2 Outdoor Breakers

A 'marshalling box' with independent sealing facility shall be provided by the consumer for the purpose of terminating the secondary circuit cabling of the current transformer and voltage transformer.

The consumer shall provide and connect a PVC/SWA/PVC, Cu, 4 $mm^2$ cable or better between the 'marshalling box' and the floor mounted metering cubicle.

## 6.8 Specification Of Mild Steel Cubicle For Medium Voltage And High Voltage Metering

### 6.8.1 General

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

Unless otherwise stated, all materials and accessories used in the fabrication of the cubicle shall be specified in **Appendix 20 (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.

### 6.8.2 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 $180^{o}$. The internal door shall be hinged inside the cubicle in which it can be opened approximately up to $100^{o.}$ 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 20 Drawing 11 E** for a 1 or 2 feeder cubicle and **Appendix 20 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 CTs And VTs Not Installed In TNB's Control Area)

Facility for sealing all metering wires connections and 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 Services engineer for confirmation and approval

## 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. |
| **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 equal to or greater than 50 kV. |
| **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 level less than 1000 volts or 1 kV. |
| **Medium Voltage or MV** | A voltage equal to or exceeding 1 kV but not exceeding 50 kV. |
| **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 than 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. |

# APPENDICES

**Appendix 1**

## Senarai Semak Permohonan Bekalan Elektrik Kurang Daripada 100kVA

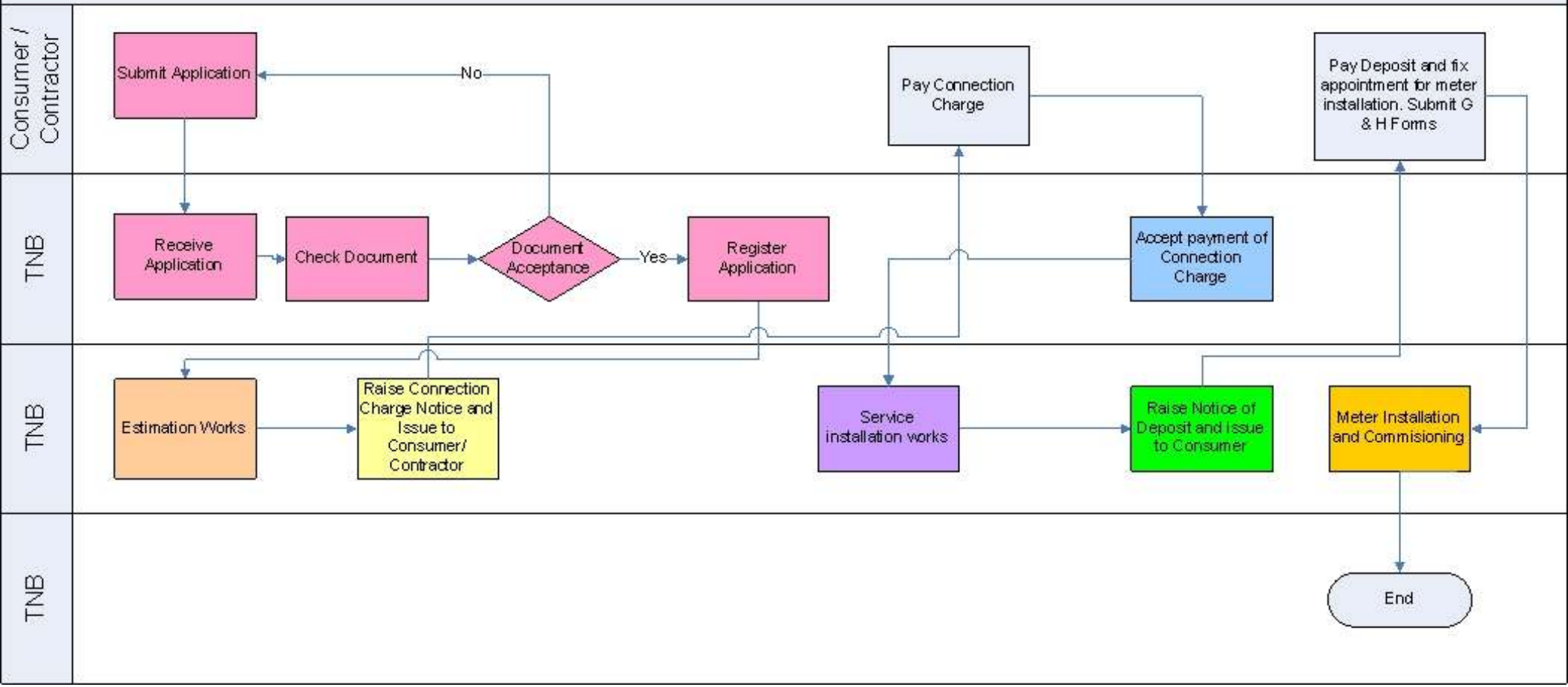
| Bil | Senarai Semak | Tanda (√) untuk Dokumen yang dikemukakan |
|---|---|---|
| **Bahagian A** | | |
| 1. | Borang Permohonan Bekalan Elektrik Yang Lengkap | |
| 2. | a) Salinan Kad Pengenalan (Untuk Individu/ Wakil Syarikat/ Perniagaan/ Badan Pengurusan Bersama/ Perbadanan Pengurusan/ Persatuan) | |
| | b) Surat Beri Kuasa (Untuk Syarikat/ Perniagaan/ Badan Pengurusan Bersama/ Perbadanan Pengurusan/ Persatuan/ Kerajaan/Agensi Kerajaan/JKR/Pejabat Daerah) | |
| 3. | Salinan Dokumen Bagi Permohonan Atas Nama Pihak-Pihak Berikut:- | |
| | a) Syarikat :- Borang 9 atau 49 | |
| | b) Perniagaan (*Business Enterprise*):- Borang E (Sijil Pendaftaran Perniagaan) | |
| | c) Badan Pengurusan Bersama (*Joint Management Committee*): - Sijil Perakuan Penubuhan oleh Pesuruhjaya Bangunan di bawah seksyen 7(2) Akta Bangunan dan Harta Bersama 2007. | |
| | d) Perbadanan Pengurusan (*Management Corporation*): - Sijil Perakuan Perbadanan Pengurusan yang dikeluarkan oleh Pendaftar di bawah seksyen 39(2A) Akta Hakmilik Strata 1985. | |
| | e) Persatuan :- Borang 3 (Pendaftaran Persatuan) daripada Pendaftar Persatuan | |
| | f) *Receivers & Managers* (R&M) :- | |
| | (i) Perintah Mahkamah | |
| | (ii) R&M dilantik oleh Bank | |
| | g) Pelikuidasi (*Liquidator*)<br>(i) Perintah mahkamah | |
| 4. | Borang G & H yang Lengkap (termasuk rajah skimatik pepasangan dalam premis) – Dimajukan semasa membayar wang cagaran (*deposit*) serta setem hasil berjumlah RM 10. | |
| **Bahagian B:- Pemohon adalah Pemilik Premis** | | |
| 1. | Salinan Geran atau hak milik tanah atau hak milik strata **Atau** | |
| 2. | a) Salinan Perjanjian Jual Beli (Perjanjian yang telah dimatikan setem di Pejabat Setem) **Atau** | |
| | b) Salinan Perjanjian Jual Beli (Perjanjian tidak dimatikan setem di Pejabat Setem) dan Menandatangani Surat Akujanji & Tanggung Rugi (Surat yang ditandatangani perlu dimatikan setem di Pejabat Setem oleh pemohon) **Atau** | |
| 3. | Individu : Surat Akujanji dan Tanggungrugi dan/atau apa-apa dokumen sokongan (terpakai dalam kes rumah lelong) | |
| 4. | Bukan Individu : Surat Akujanji dan Tanggungrugi **Dan** Surat Beri Kuasa (Untuk Wakil Syarikat/ Perniagaan/ Badan Pengurusan Bersama/ Perbadanan Pengurusan/ Persatuan/ Kerajaan/Agensi Kerajaan/JKR/Pejabat Daerah) | |

**Senarai Semak Permohonan Bekalan Elektrik Kurang Daripada 100kVA**

| Bil | Senarai Semak | Tanda (√) untuk Dokumen yang dikemukakan |
|---|---|---|
| **Bahagian C:- Pemohon adalah Bukan Pemilik Premis** | | |
| 1. | a) Salinan Perjanjian Sewa yang masih berkuatkuasa (Perjanjian perlu dimatikan setem di Pejabat Setem) dan Surat Beri Kuasa (Untuk Wakil Syarikat/ Perniagaan/ Badan Pengurusan Bersama/ Perbadanan Pengurusan/ Persatuan/ Kerajaan/Agensi Kerajaan/JKR/Pejabat Daerah) **Atau** | |
| | b) Salinan Perjanjian Sewa yang masih berkuatkuasa (Perjanjian tidak dimatikan setem di Pejabat Setem) dan Menandatangani Surat Akujanji & Tanggung Rugi (Surat yang ditandatangani perlu dimatikan setem di Pejabat Setem oleh pemohon) dan Surat Beri Kuasa (Untuk Wakil Syarikat/ Perniagaan/ Badan Pengurusan Bersama/ Perbadanan Pengurusan/ Persatuan/ Kerajaan/Agensi Kerajaan/JKR/Pejabat Daerah) **Atau** | |
| 2. | Individu : Surat Akujanji dan Tanggungrugi dan/atau apa-apa dokumen sokongan (terpakai dalam kes menduduki tanah/kawasan milik kerajaan) | |
| 3. | Bukan Individu : Surat Akujanji dan Tanggungrugi **Dan** Surat Beri Kuasa (Untuk Wakil Syarikat/ Perniagaan/ Badan Pengurusan Bersama/ Perbadanan Pengurusan/ Persatuan/ Kerajaan/Agensi Kerajaan/JKR/Pejabat Daerah) | |

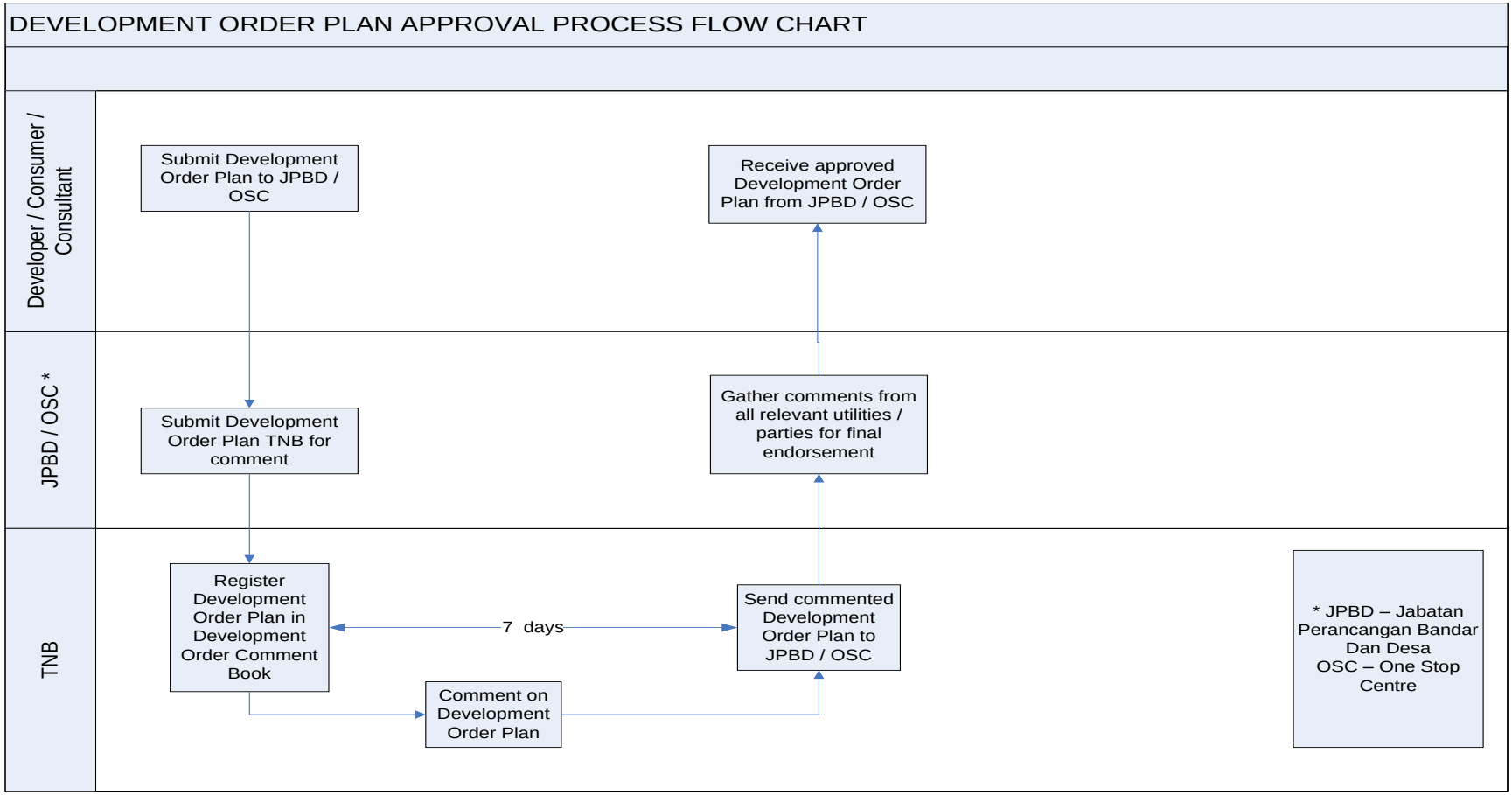
# Flowchart for Individual Supply Application < 100kVA

**Appendix 2**



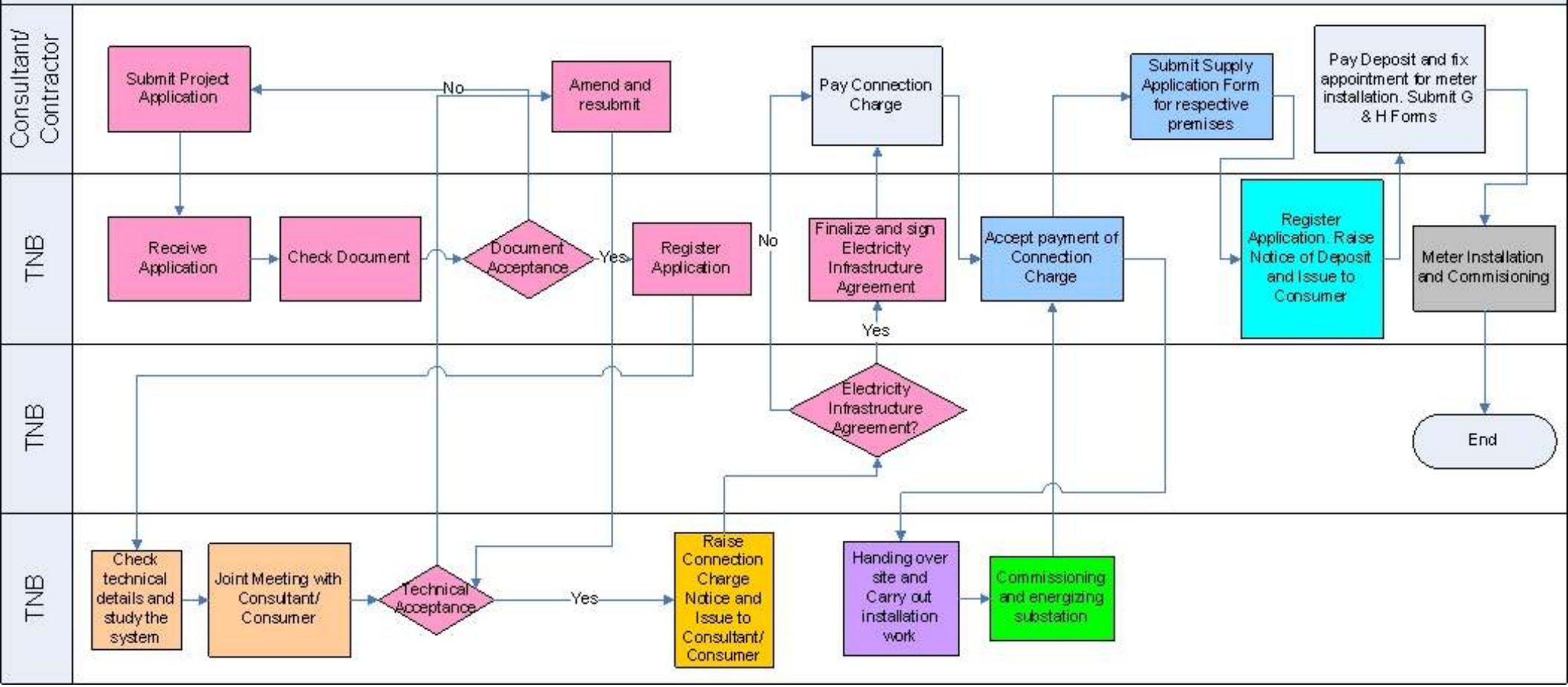
**Appendix 3**

## PART A: DEVELOPMENT ORDER PLAN APPROVAL PROCESS FLOW CHART



# Flowchart for Individual Supply Application > 100kVA

**Appendix 4**



TENAGA NASIONAL BERHAD

**Appendix 5**

## ELECTRICITY SUPPLY APPLICATION EXCEEDING 100KVA
## 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 Architect | Y / N | |
| | | Name & Address of Surveyor | Y / N | |
| | | Name & Address of Owner / Developer | Y / N | |
| | | Name & Address of Consultant Engineer | Y / N | |
| | | Name & Address of Electrical Contractor | | Y / N |
| | | Type of Premise | Y / N | |
| | | Voltage Level (275kV, 132 kV, 33 kV, 22 kV, 11 kV, 0.415kV) | Y / N | |
| | | Supply Scheme (O/H or U/G; Bulk IPD) | Y / N | |
| | | Total Load Required (kW) | Y / N | |
| | | Date Supply Required | Y / N | |
| | | | | |
| A | 2. Plan & Drawings | Latest Development Order Plan approved by local authority | Y / N | |
| | | Site 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 (certified by C&S Consultant) | Y / N | |
| | | Location & Layout Plan of Main Switch Room | Y / N | |
| | | Single Line Diagram / Schematic of Installation | Y / N | |
| | | Diskette / CD for all the above plans (JUPEM standard map) | 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 | |
| | | | | |
| | 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 6**

**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

**Appendix 7**

## SUMMARY OF LOAD FOR DEMAND EXCEEDING 100kVA(~140A)

| | 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.

| B. Load Details | | | | | |
|---|---|---|---|---|---|
| Load Category | Connected Load Information | | | | Load after Coincident kW @ coincident factor |
| | Nos. | kVA | Power Factor | kW | |
| Total lighting points and load (kW) | | | | | |
| Total air-conditioning points and load (kW) | | | | | |
| Total motor nos. and loads<br>- Single Phase<br>- Three Phase | | | | | |
| Other special loads (arc welding, ar, arc furnace & others)<br>1.<br>2.<br>3.<br>4.<br>5. | | | | | |
| Total load (kW)<br>- Maximum | | | | | |
| Total (kW)<br>- Minimum | | | | | |

** Minimum values need to be specified for customer taking supply at above 6.6 kV*

**Borang Map: C**

## C: BUTIRAN KEPERLUAN JANGKA

**NO PROJEK:**

**TAJUK PROJEK**

| KATEGORI PELANGGAN | VOLTAN BEKALAN <6.6kV | | | | | | | VOLTAN BEKALAN > 6.6kV | | CATATAN |
|---|---|---|---|---|---|---|---|---|---|---|
| JENIS PELANGGAN | DOMESTIK 1 FASA | | DOMESTIK 3 FASA | | KOMERSIL / INDUSTRI | M/TENANT COMPLEX | | KOMERSIL | INDUISTRI | |
| | KOS RENDAH < RM25,000 | > RM 25,000 | T/ATAS (O/H) | KABEL (U/G CABLE) | | OWNER | TENANT | | | |
| JUMLAH BILANGAN JANGKA PELANGGAN | | | | | | | | | | |
| KEHENDAK MAKSIMA (kW) (bagi setiap unit pelanggan) | | | | | | | | | | |
| SAIZ C.T. | | | | | | | | | | |

| 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 | | | |

**Appendix 8**

# Power Quality Declaration Form

## Declaration of Equipment Conformity on Power Quality Requirement

1.0 Name of customer:

2.0 Area/State:

3.0 Type of industry:

4.0 Voltage level (kV):

| Types Of Disturbances | Reference Standards | Declaration |
|---|---|---|
| Voltage Step Change | UK's Engineering Recommendation P28 | |
| Voltage Fluctuation and Flicker | UK's Engineering Recommendation P28 | |
| Harmonic Distortion[2] | Engineering Recommendation ER G5/4 | |
| Voltage Unbalance | Engineering Recommendation ER P29. | |
| Short duration (voltage sags etc) | IEC 61000-4-11 & IEC 61000-4-34 | |

The above standards promote the minimum requirement to achieve Electromagnetic Compatibility (EMC). I understand that any non-compliance to these standards is my sole responsibility.

**Customer's signature**

Signature: …… Name: ……

Date: ……

**Consultant's signature**

Signature: …… Name: ……

Date: ……

**Appendix 9**

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

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

**Pengguna**

| | | | |
|---|---|---|---|
| Nama | | | |
| Alamat Tapak Bangunan | | | |
| Jenis Perusahaan | | Tarif | |

| | Jurutera Perunding | Kontraktor Elektrik |
|---|---|---|
| Nama | | |
| Alamat | | |
| Telefon | | |
| Faksimili | | |

**Butir - butir Bekalan Masuk Pengguna Yang Dicadangkan**

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

Makluman - makluman berikut hendaklah dikepilkan:

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

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

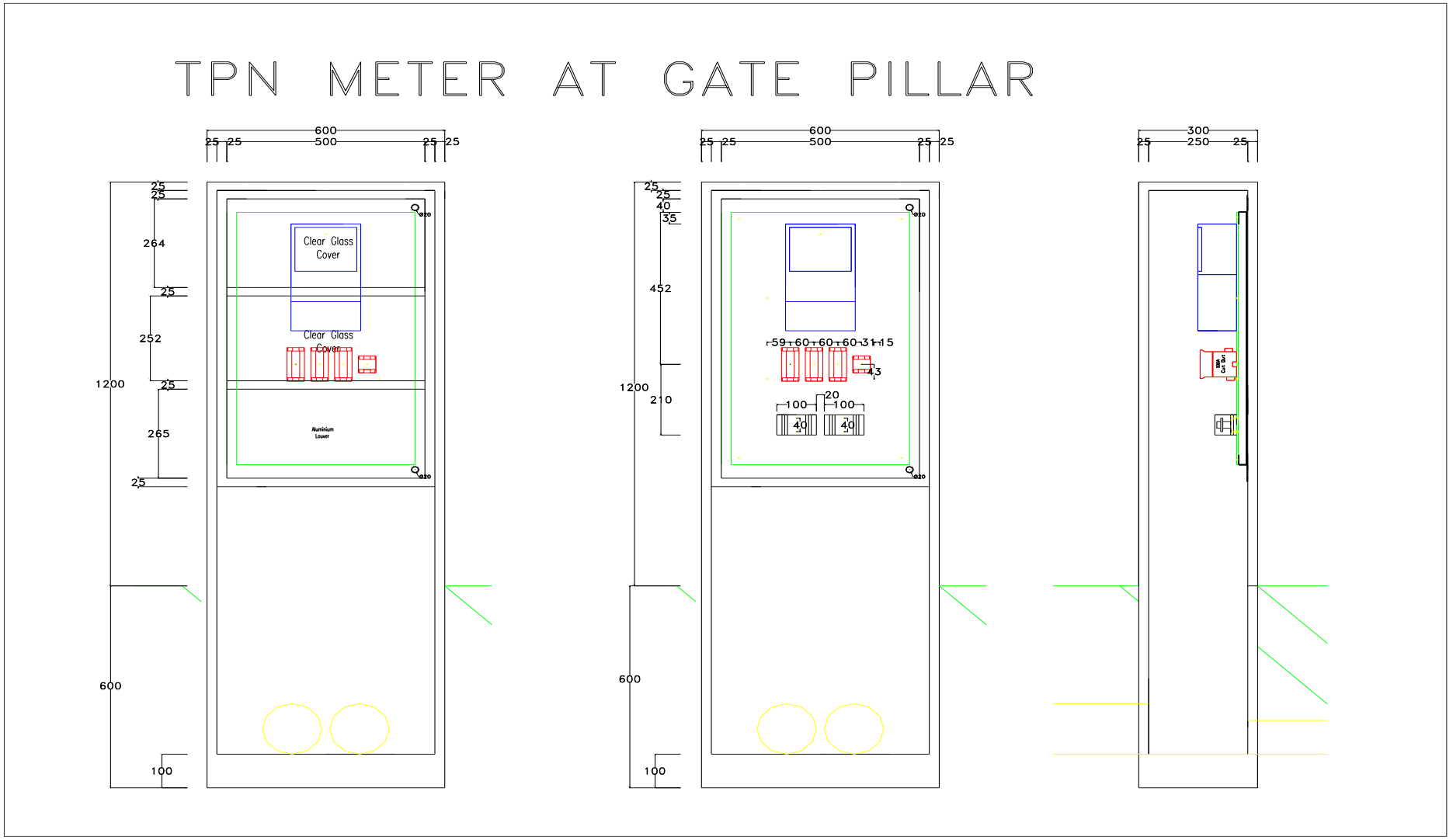
Disediakan Oleh: Diperakukan Oleh:

_____ _____

(Wakil Pengguna) (Pengurus Kawasan / Cawangan)

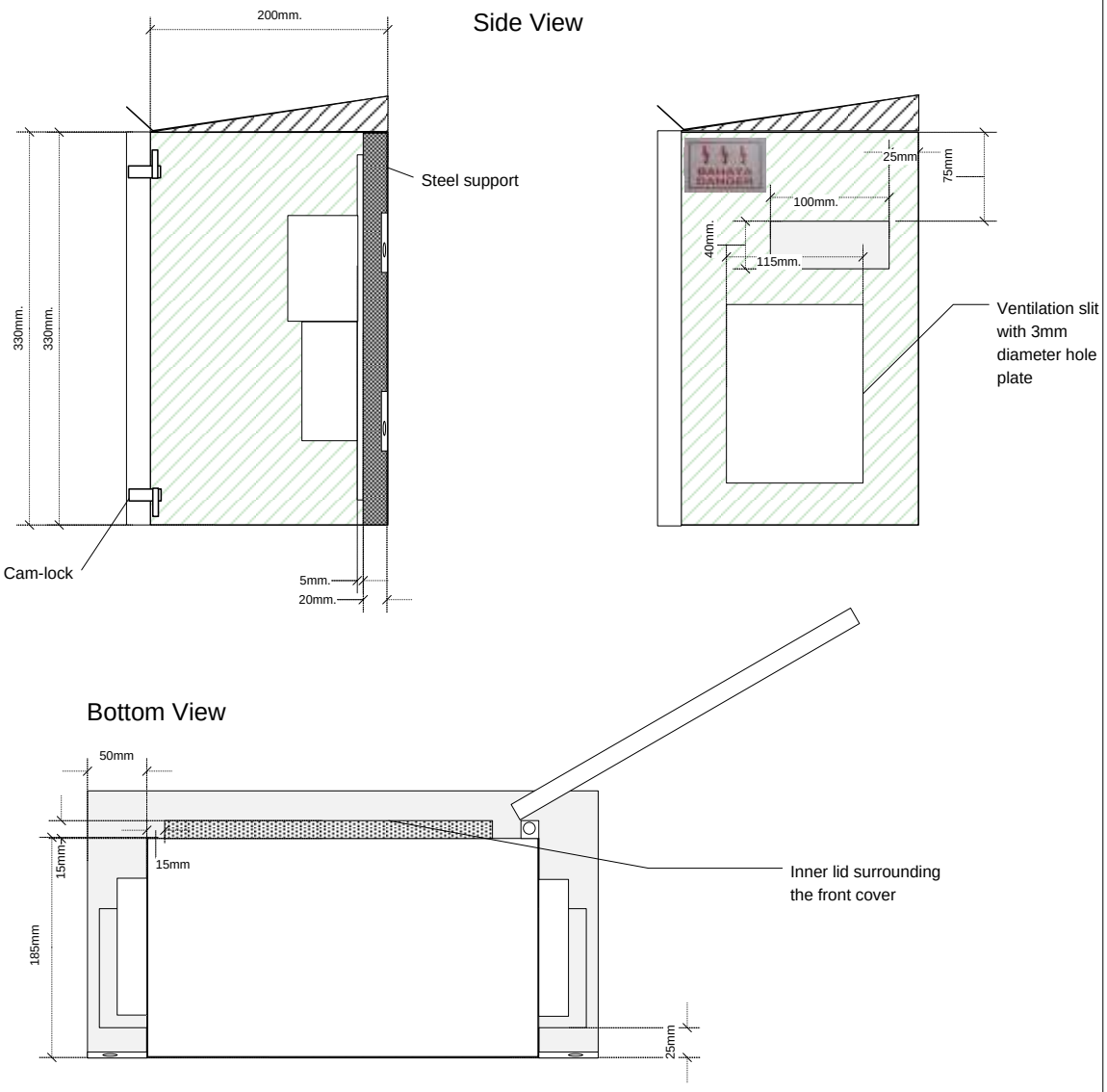
**APPENDIX 10**

## DRAWING NO 1A : METER AT GATE POST



**APPENDIX 10**

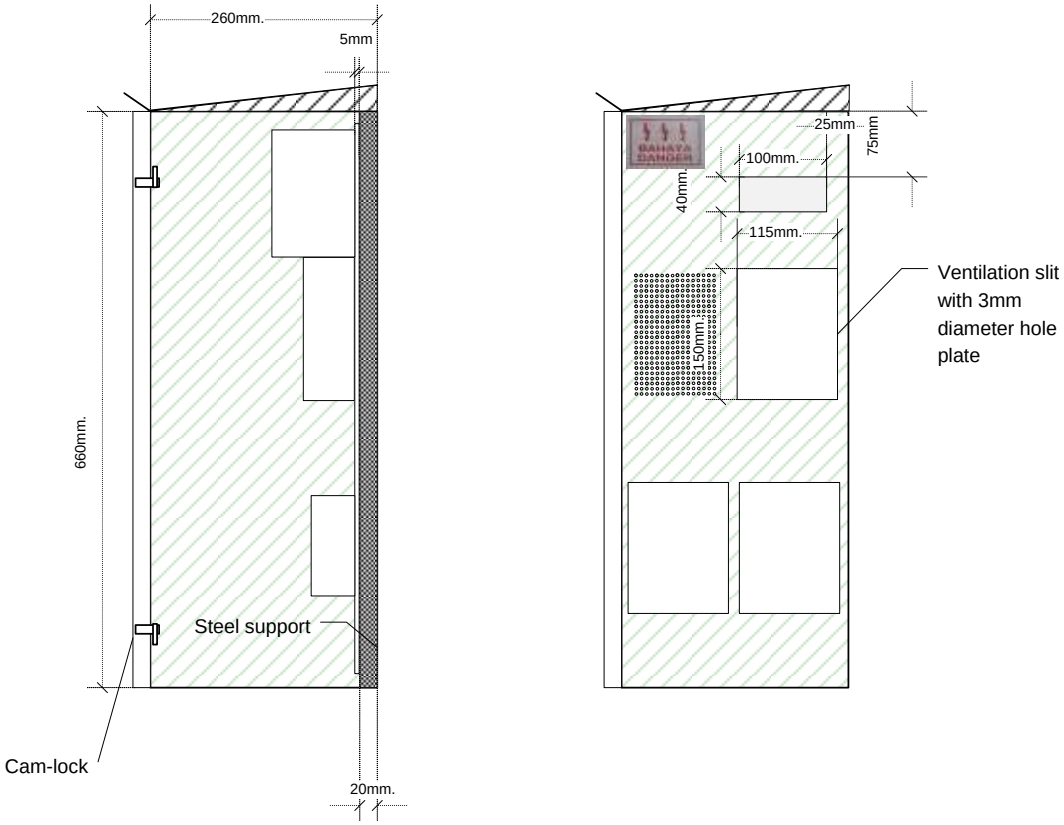
## DRAWING NO. 1B : METER BOX DESIGN



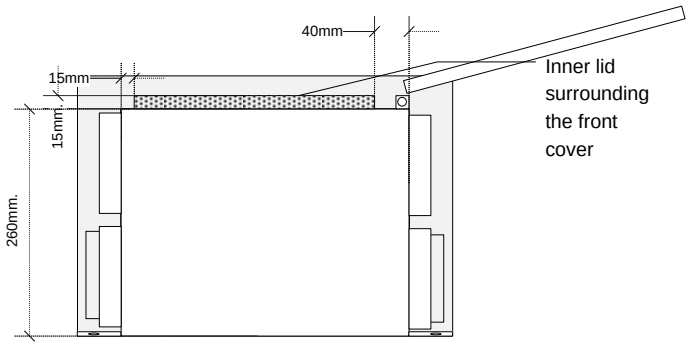

TENAGA NASIONAL BERHAD

| | 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

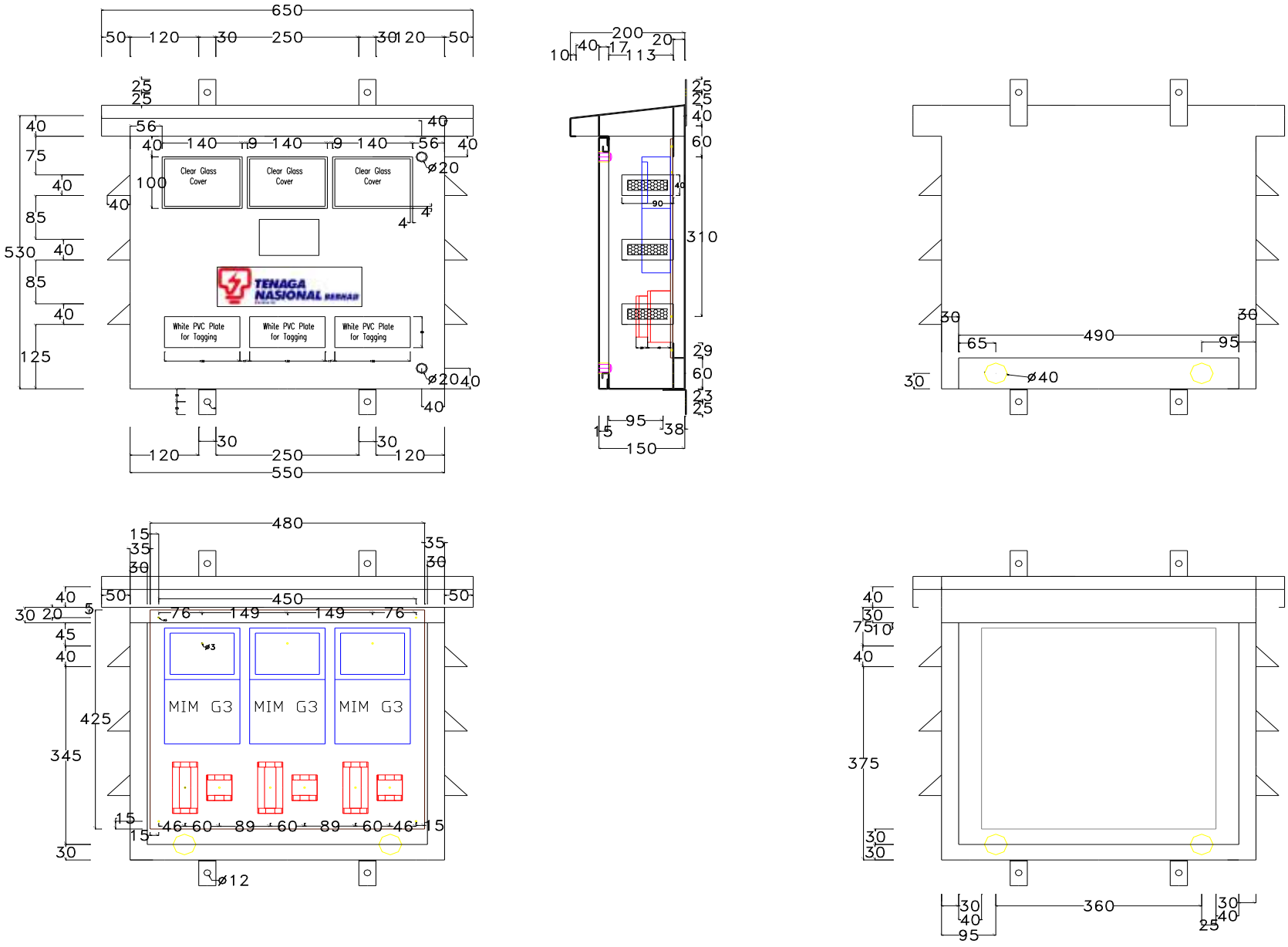


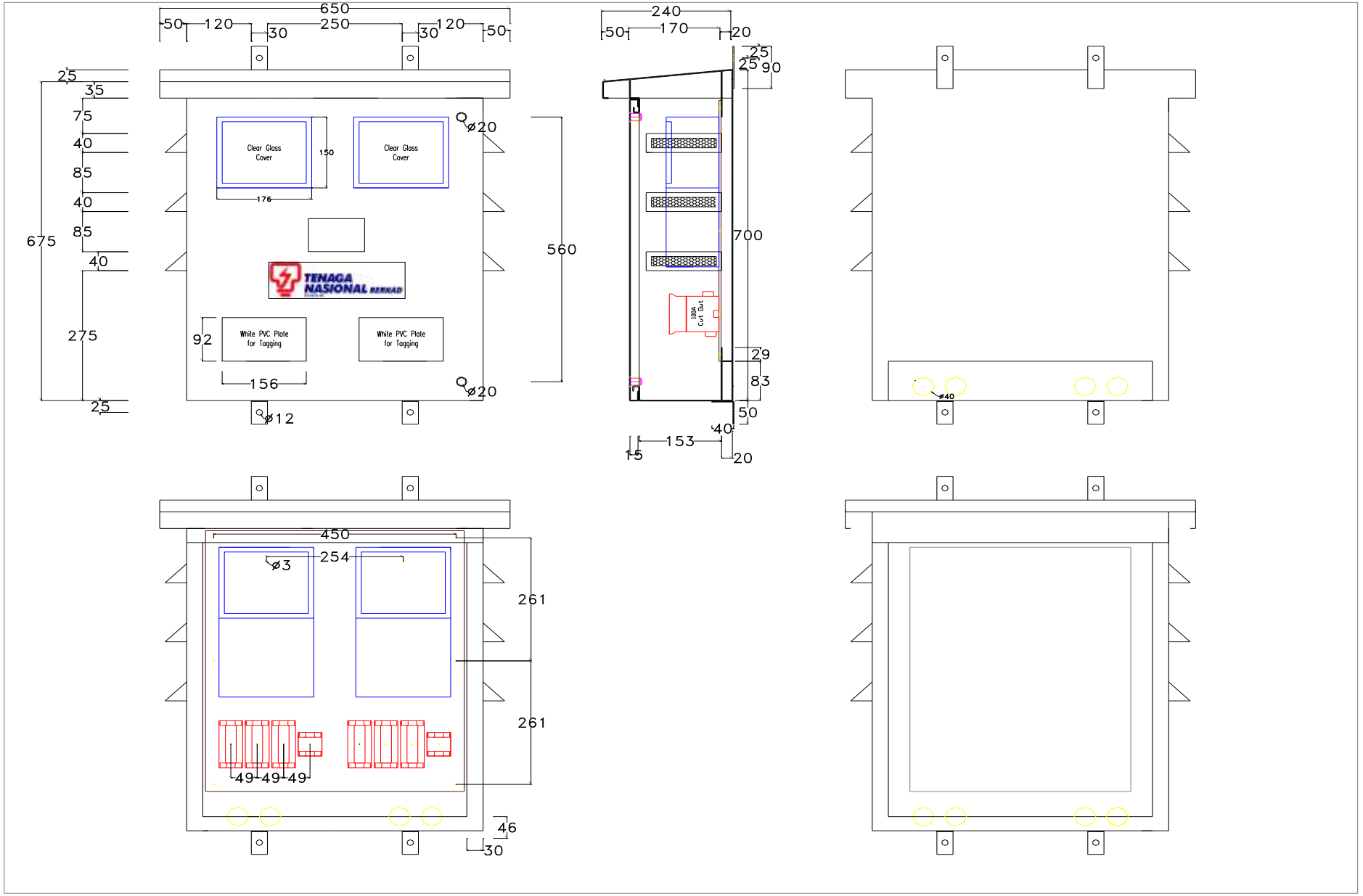

## Bottom View



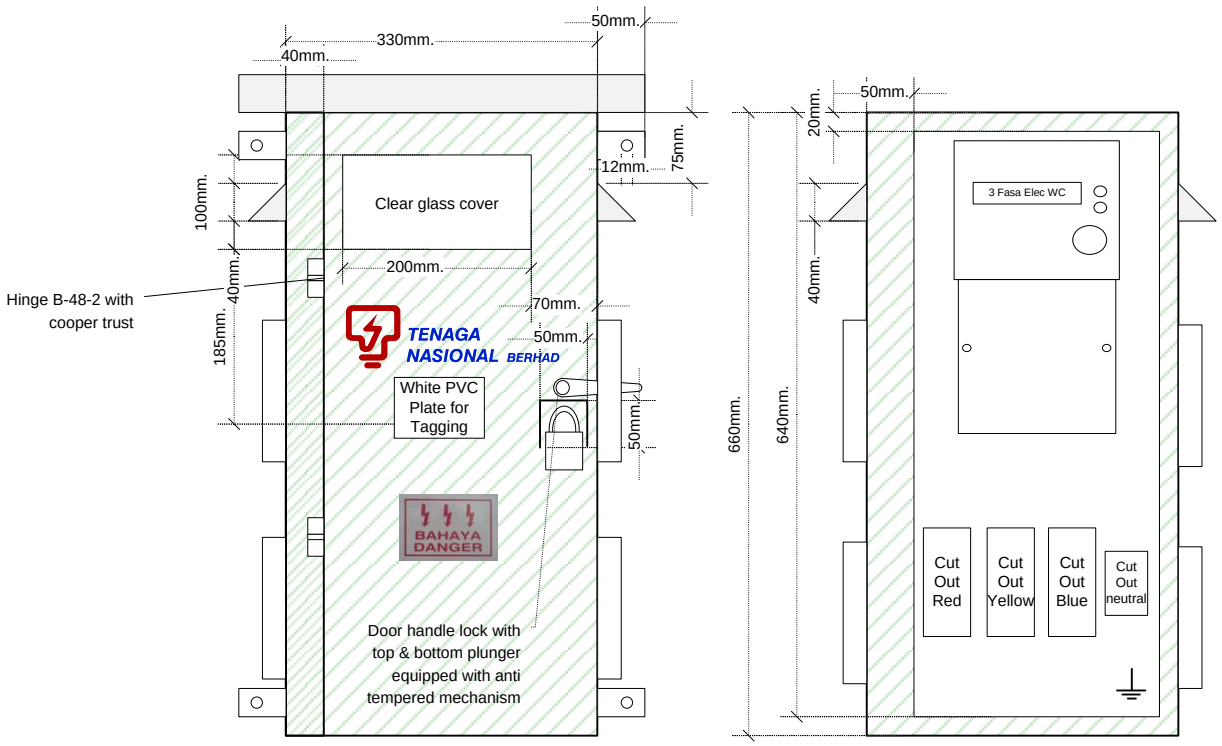

TENAGA NASIONAL BERHAD

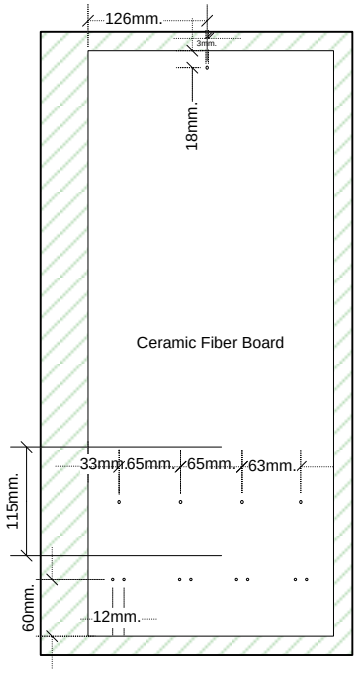
| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/4/2009 |
| APPROVED BY | Tn Haij Aminuddin Wahab | 20/4/2009 |
| TITLE | Whole Current Three Phase Outdoor Wall Mounted | |
| PAGE 2 OF 2 | | SCALE 1.5" = 305mm |
| DATE 20/4/2009 | | VERSION 1.0 |


Clear Glass Cover
Clear Glass Cover
Clear Glass Cover
TENAGA NASIONAL BERHAD
White PVC Plate for Tagging
White PVC Plate for Tagging
White PVC Plate for Tagging
MIM G3
MIM G3
MIM G3


650
50
120
30
250
30
120
50
25
35
75
40
85
40
85
40
675
275
25
Clear Glass Cover
150
176
Clear Glass Cover
ø20
560
TENAGA NASIONAL BERHAD
92
White PVC Plate for Tagging
White PVC Plate for Tagging
156
ø20
ø12
240
50
170
20
25
25
90
700
100A C.B.T. Unit
29
83
50
40
153
15
20
ø40
450
ø3
254
261
261
49
49
49
46
30

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

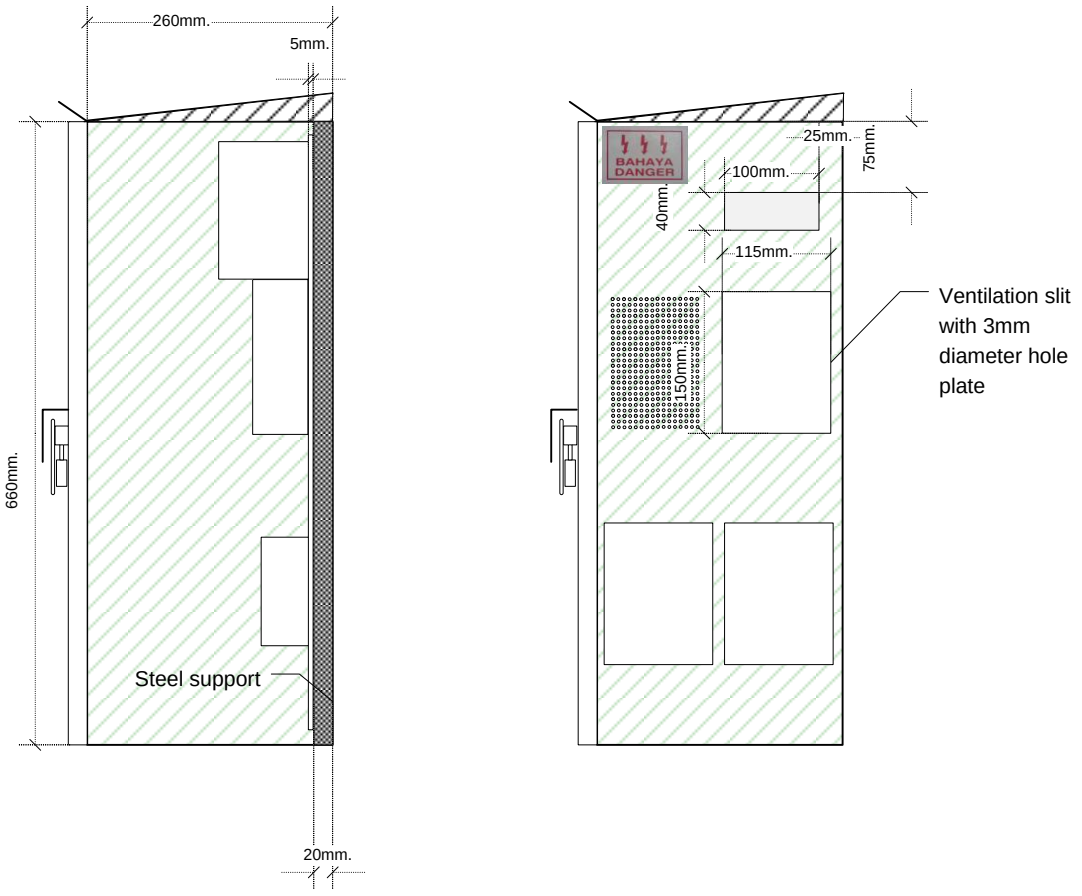


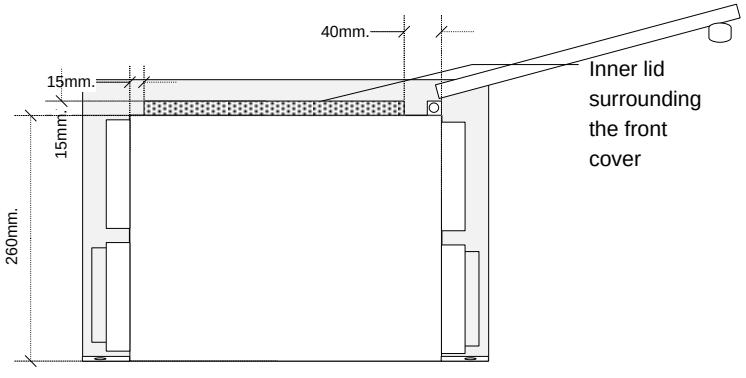

TENAGA NASIONAL BERHAD

| | 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 |

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



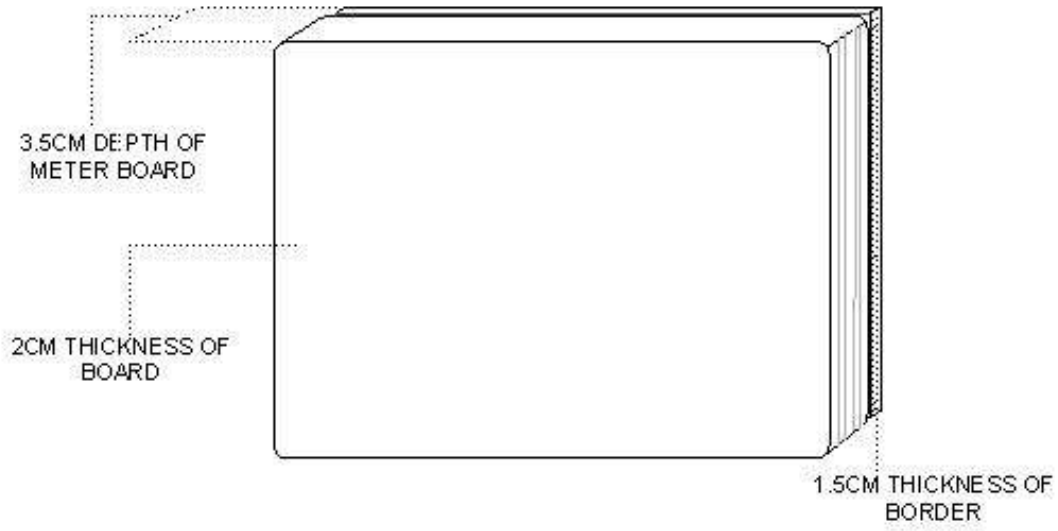

## Bottom View



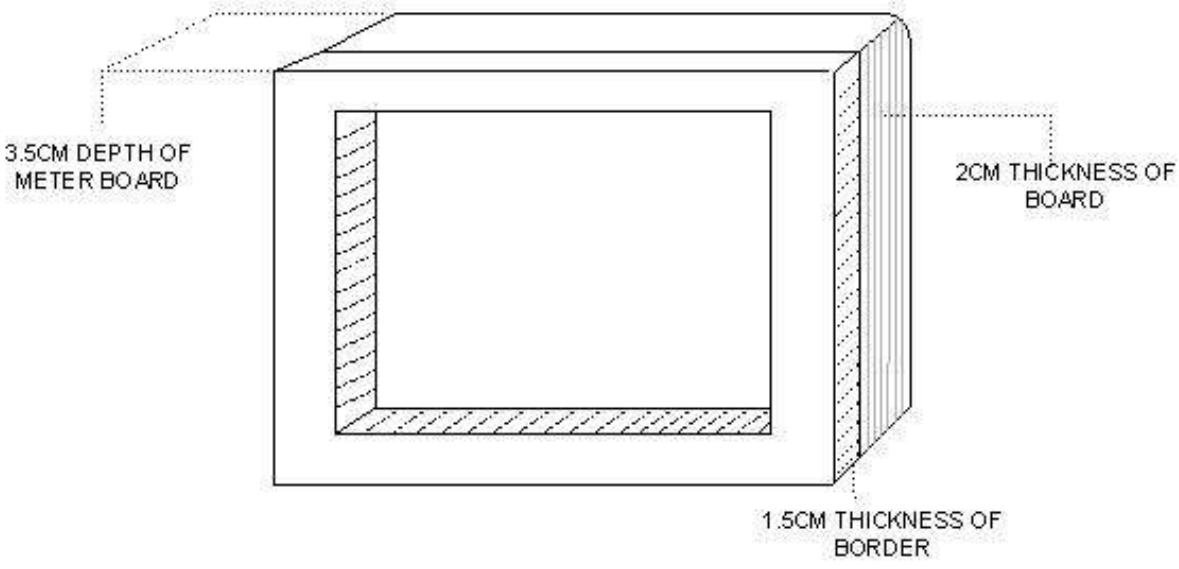

TENAGA NASIONAL BERHAD

| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/4/2009 |
| APPROVED BY | Tn 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 2A : SINGLE PHASE METER BOARD (HARDWOOD)



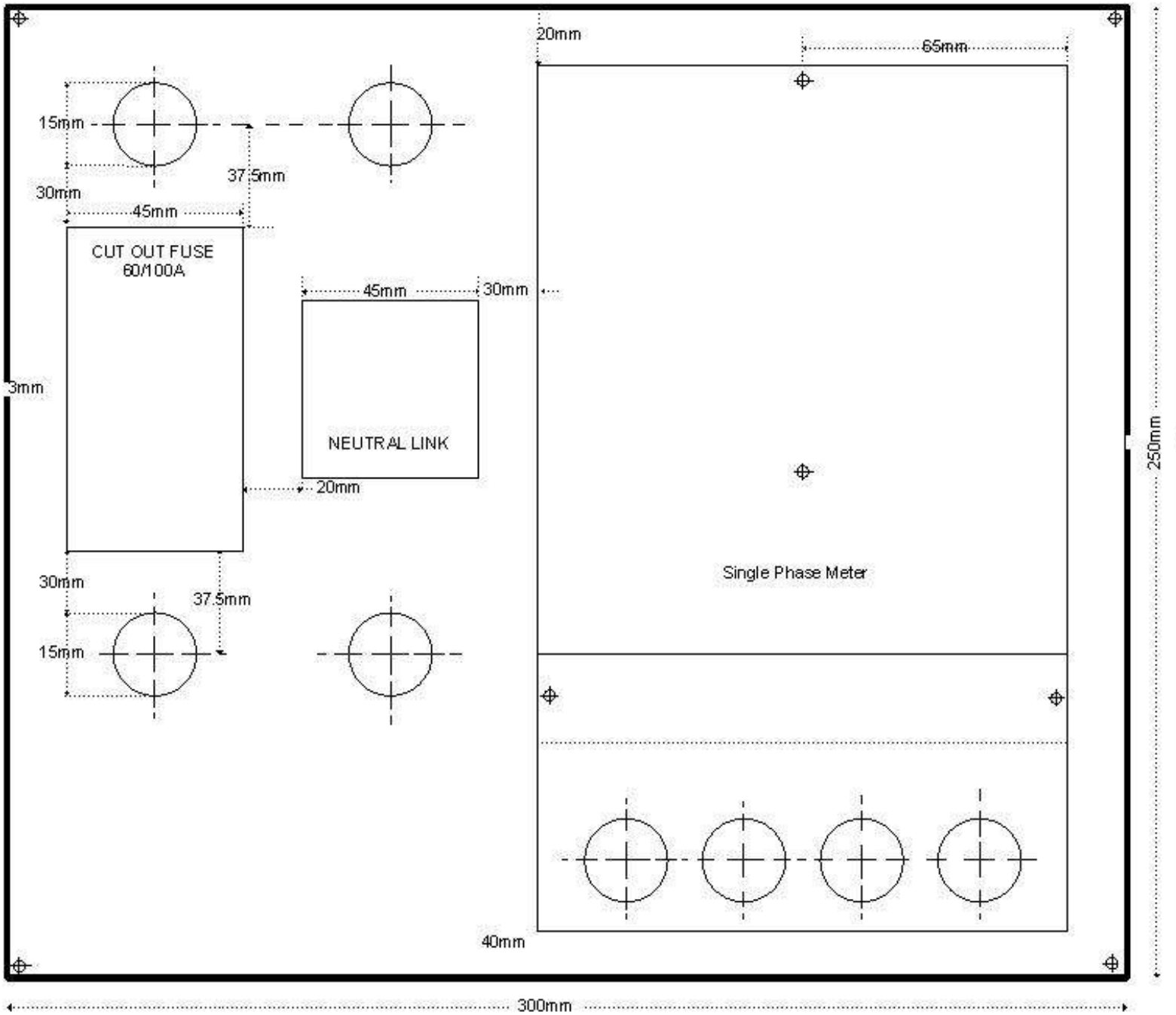

**FRONT VIEW OF STANDARD METER BOARD (HARD WOOD)**



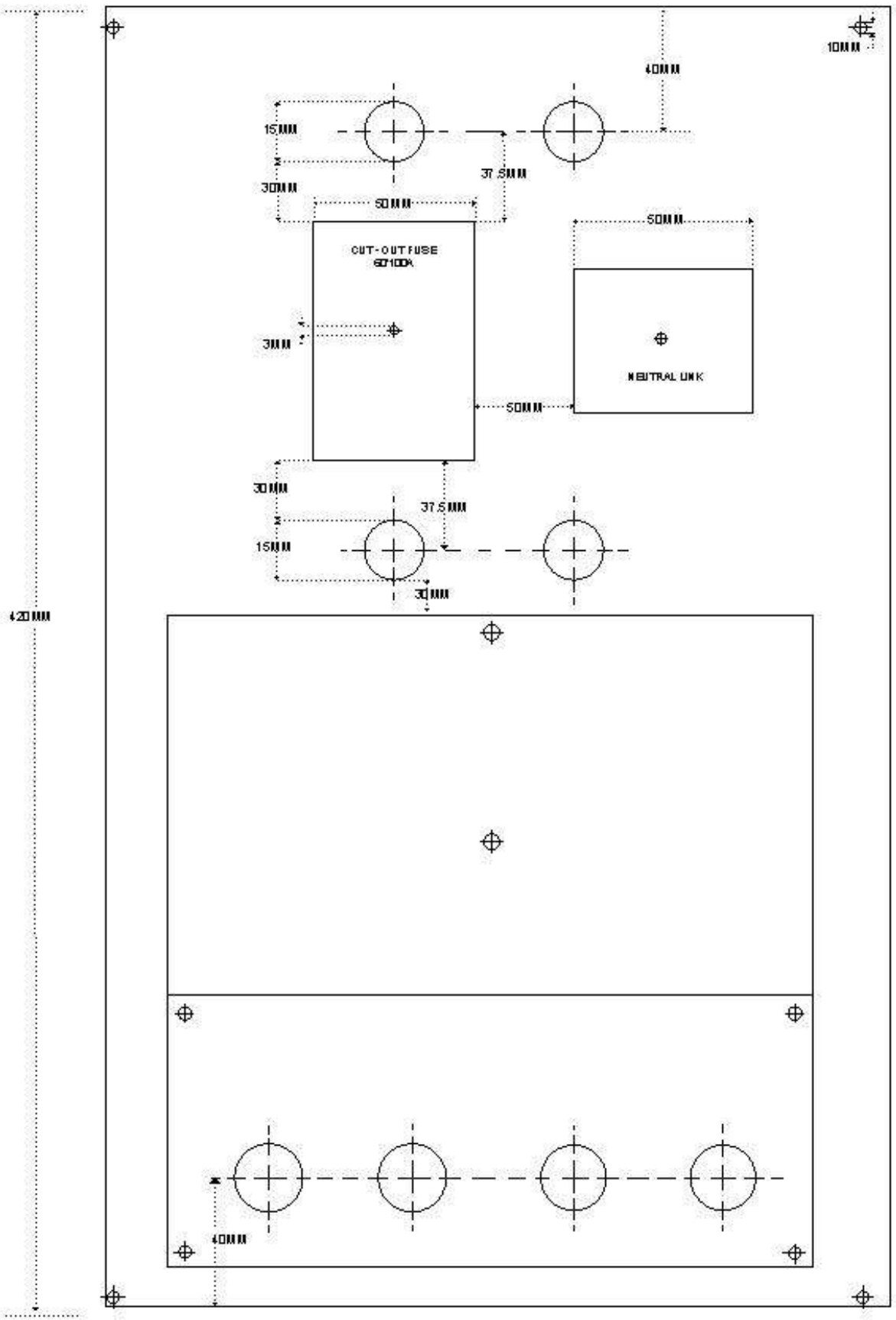

**BACK VIEW OF STANDARD METER BOARD (HARD WOOD)**

APPENDIX 12

# DRAWING NO 3A : SINGLE PHASE METERING ARRANGEMENT

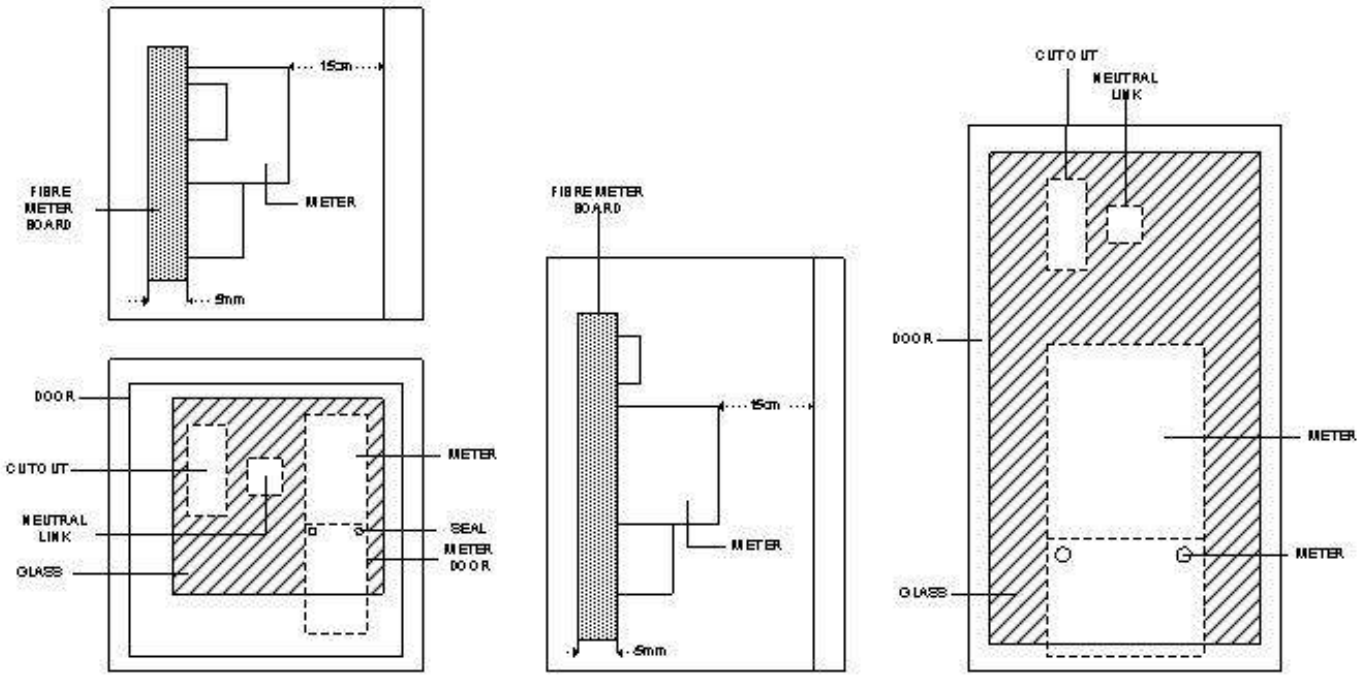


# DRAWING NO 3B : SINGLE PHASE METERING ARRANGEMENT



# DRAWING NO 4A : OUTDOOR METERING PANEL

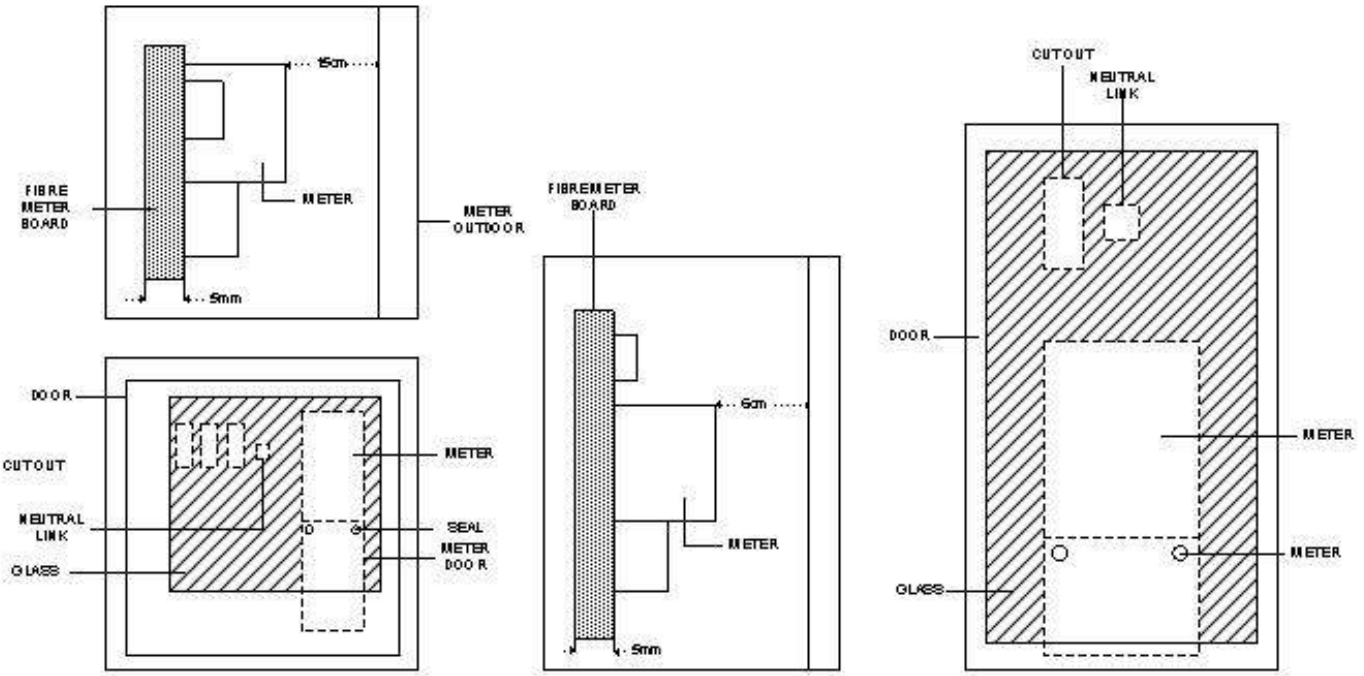
## SINGLE PHASE METER




TYPE - A

TYPE - B

## THREE PHASE METER

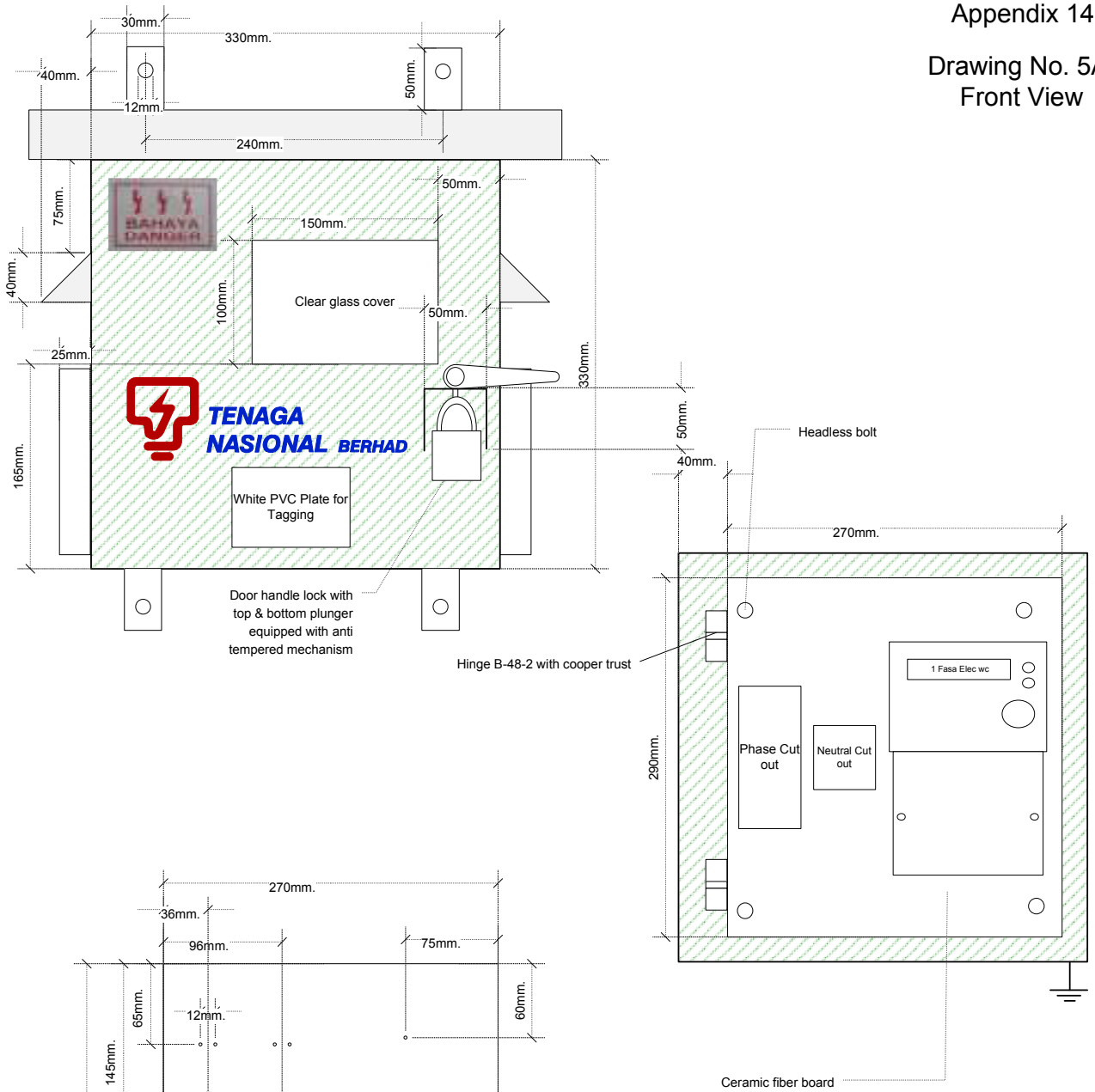


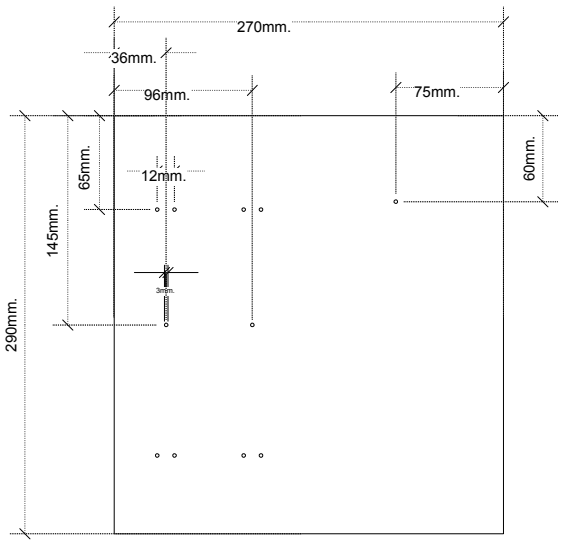

TYPE - A

TYPE - B

Appendix 14

Drawing No. 5A:
Front View

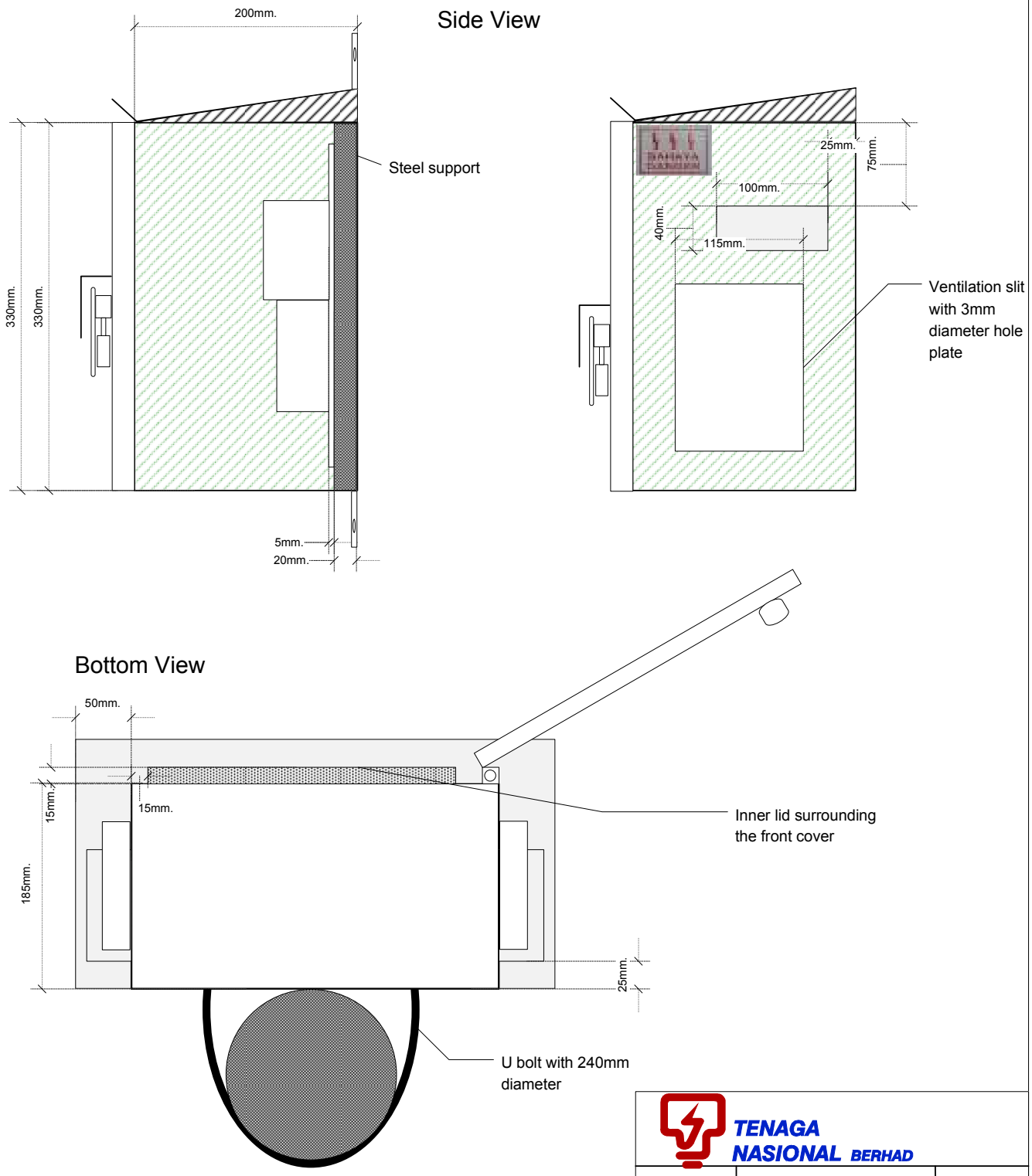



| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/4/2009 |
| APPROVED BY | Tn Haji Aminuddin Wahab | 20/4/2009 |
| TITLE | Whole Current Single Phase Outdoor Pole Mounted | |
| PAGE | 1 OF 2 | SCALE 1" = 125mm |
| DATE | 20/4/2009 | VERSION 1.0 |

Appendix 14

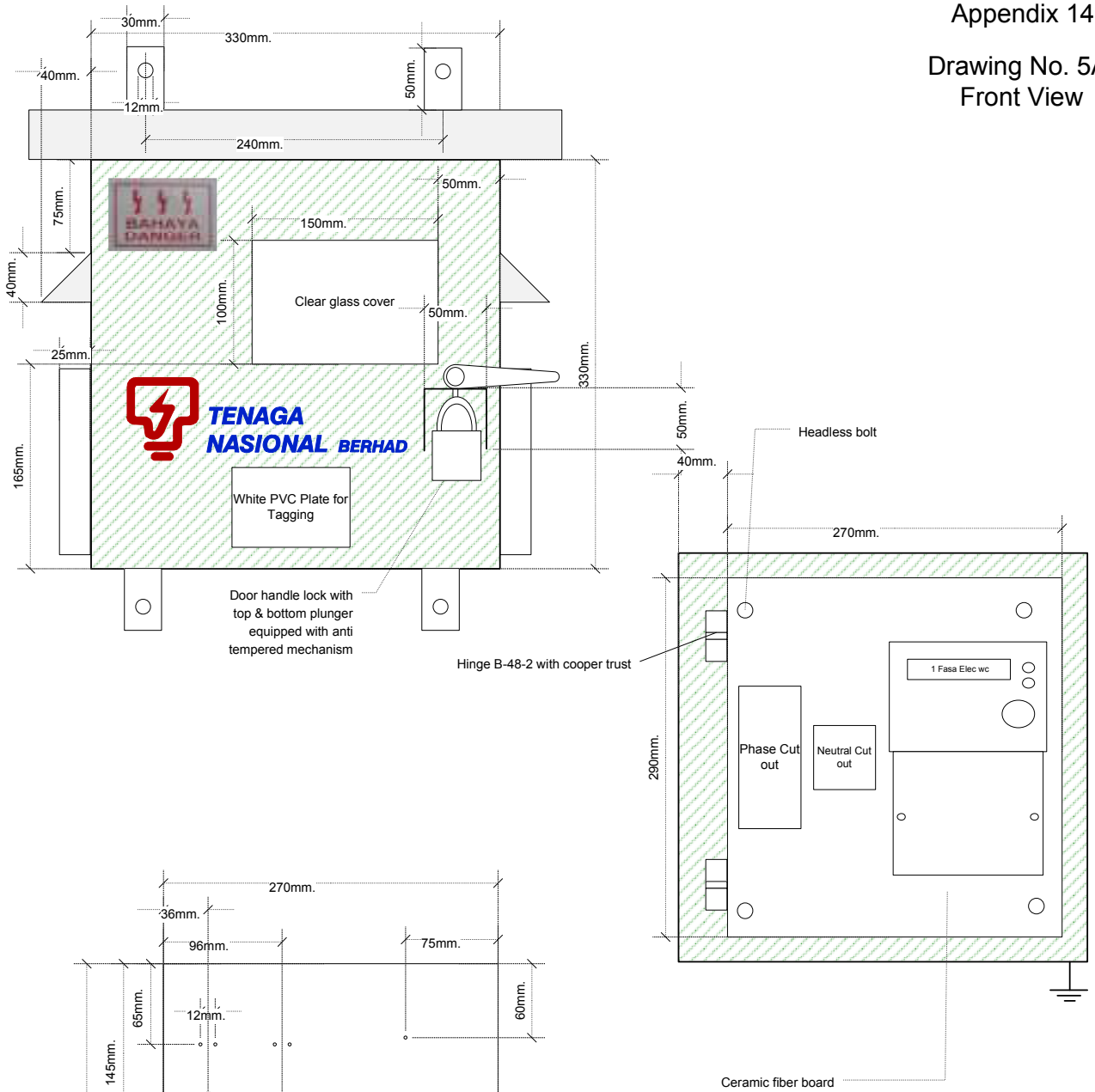
Drawing No. 5A:
Side View

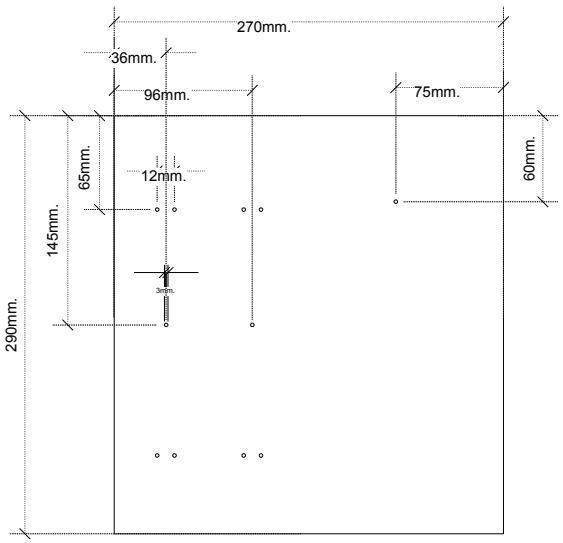



| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/4/2009 |
| APPROVED BY | Aminuddin Wahab | 20/4/2009 |
| TITLE | Whole Current Single Phase Outdoor Pole Mounted | |
| PAGE | 2 OF 2 | SCALE 1" = 125mm |
| DATE | 20/4/2009 | VERSION 1.0 |

Appendix 14

Drawing No. 5A:
Front View



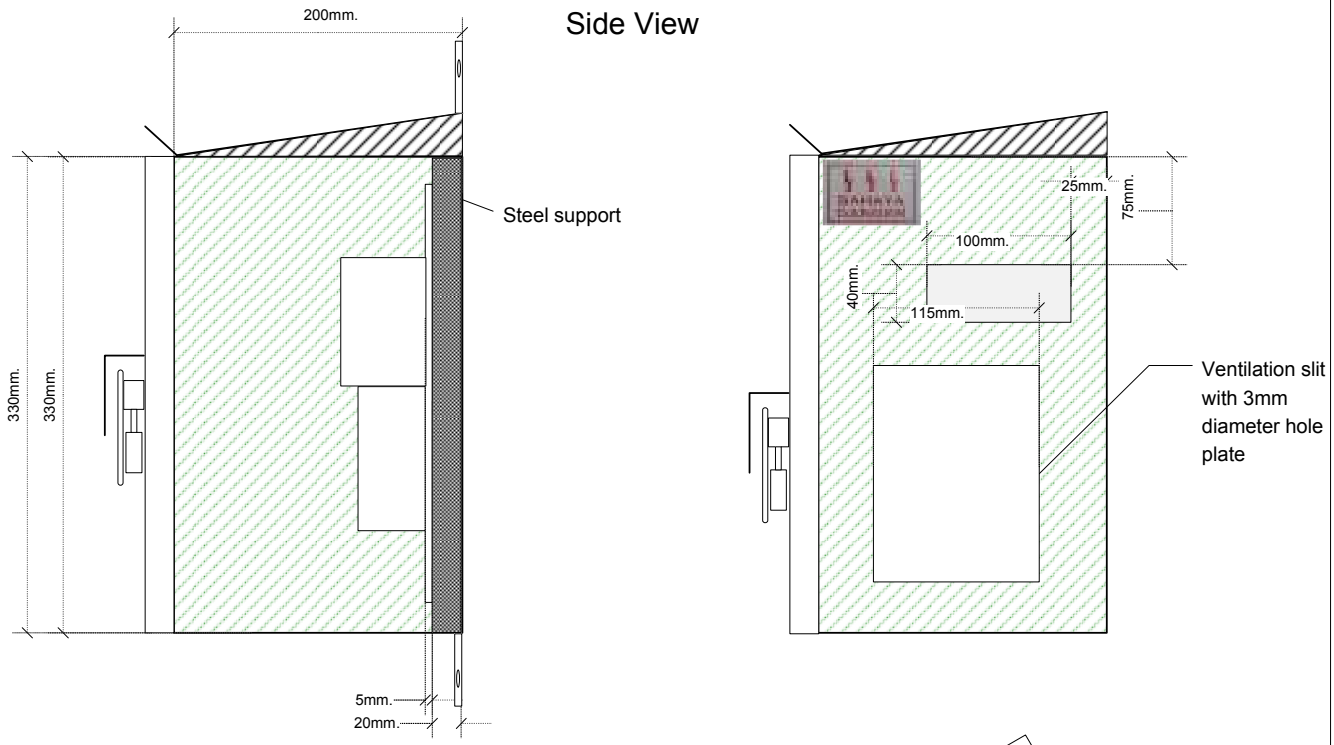




| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/4/2009 |
| APPROVED BY | Tn Haji Aminuddin Wahab | 20/4/2009 |
| TITLE | Whole Current Single Phase Outdoor Pole Mounted | |
| PAGE | 1 OF 2 | SCALE 1" = 125mm |
| DATE | 20/4/2009 | VERSION 1.0 |

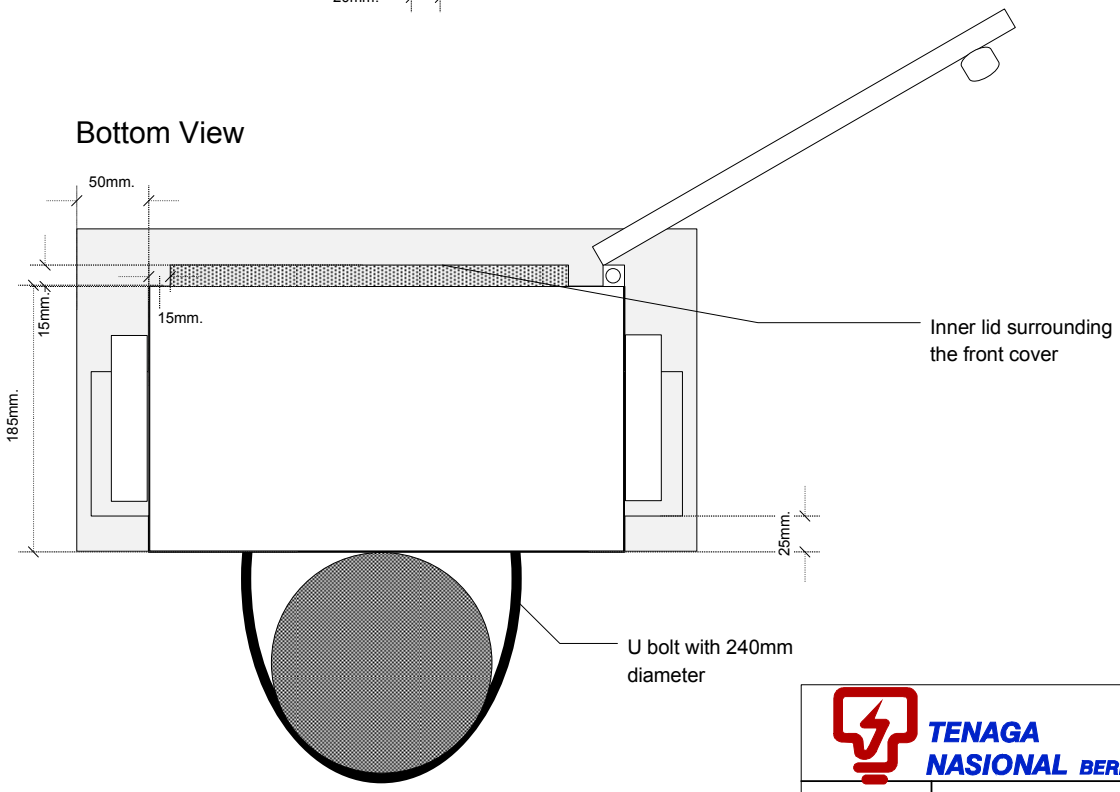
Appendix 14

Drawing No. 5A:
Side View

## Side View




## Bottom View

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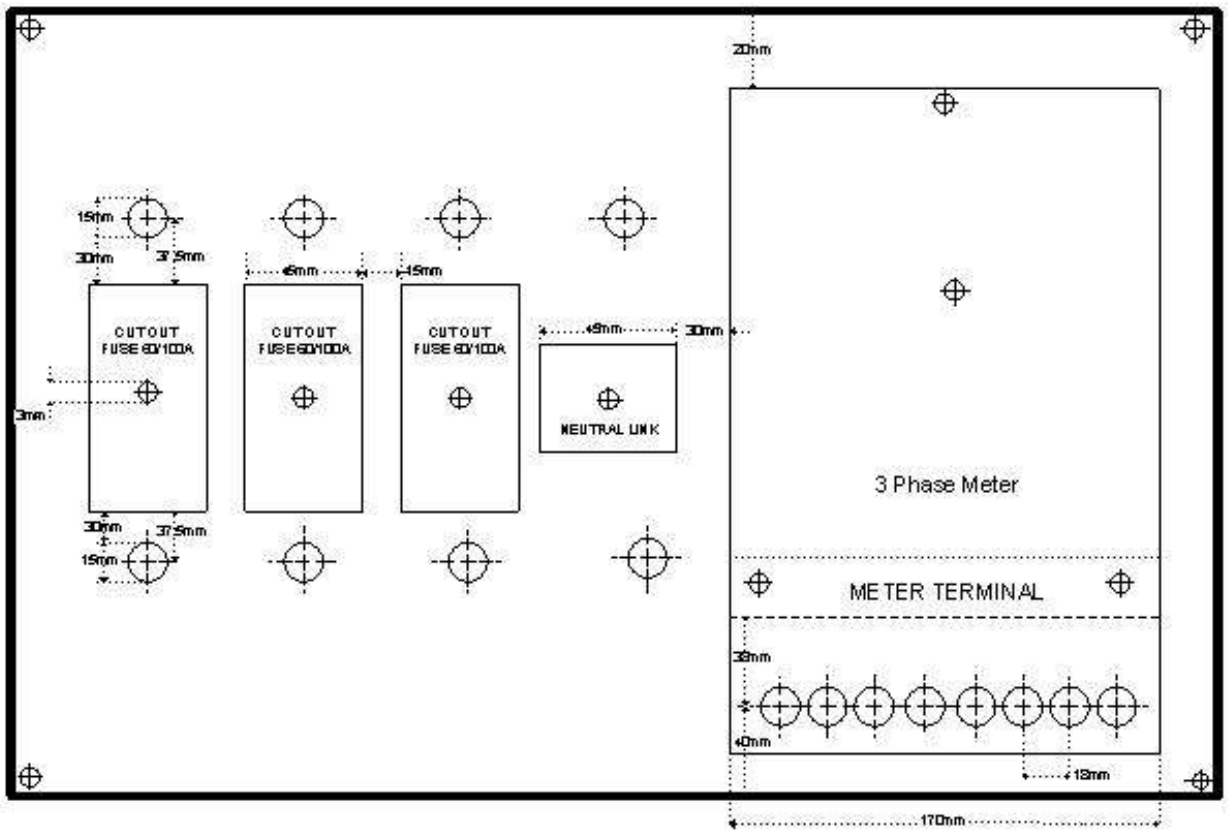
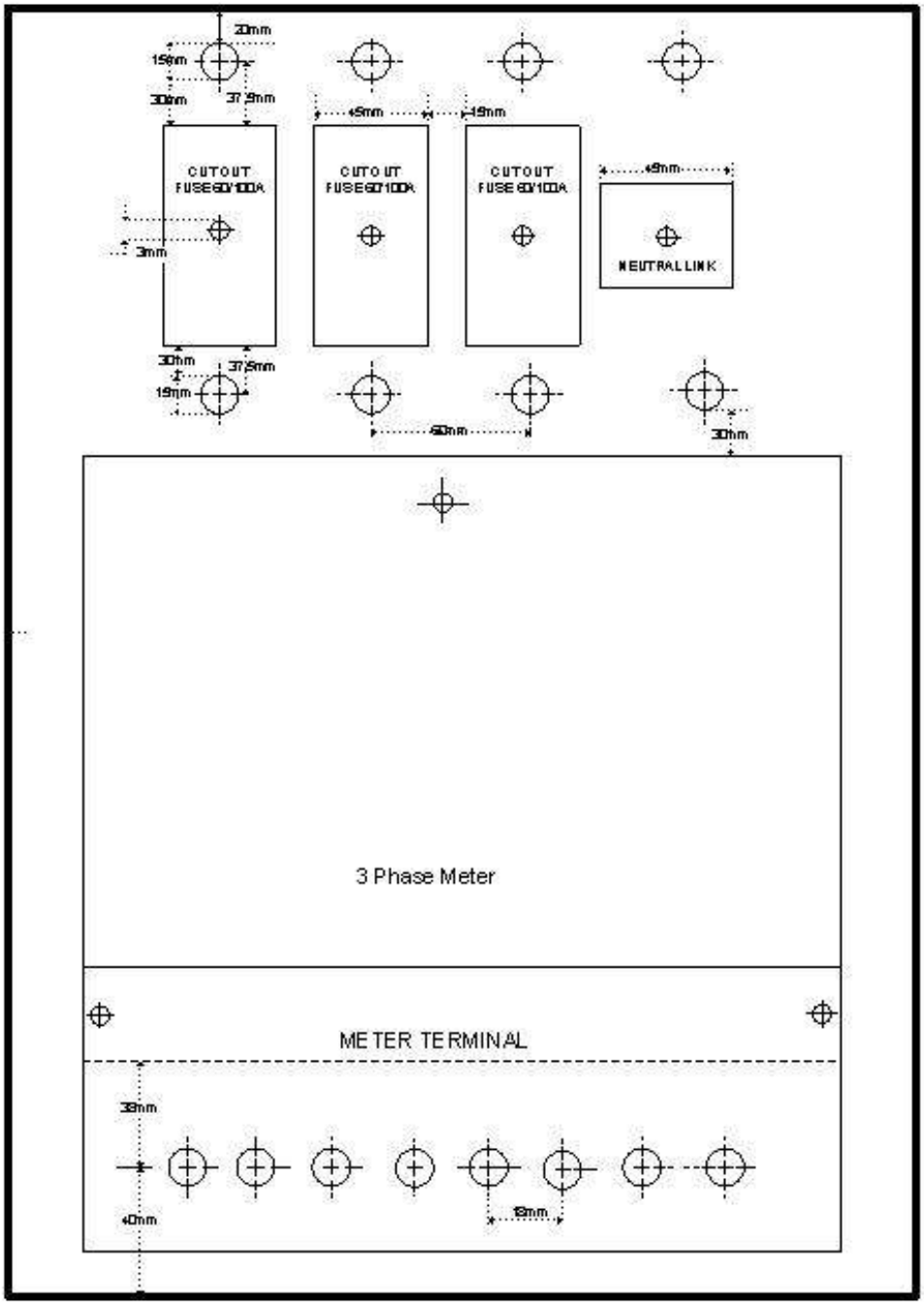
| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/4/2009 |
| APPROVED BY | Aminuddin Wahab | 20/4/2009 |
| TITLE | Whole Current Single Phase Outdoor Pole Mounted | |
| PAGE | 2 OF 2 | SCALE 1" = 125mm |
| DATE | 20/4/2009 | VERSION 1.0 |

# DRAWING NO 6A : 3 PHASE OVERHEAD INCOMING

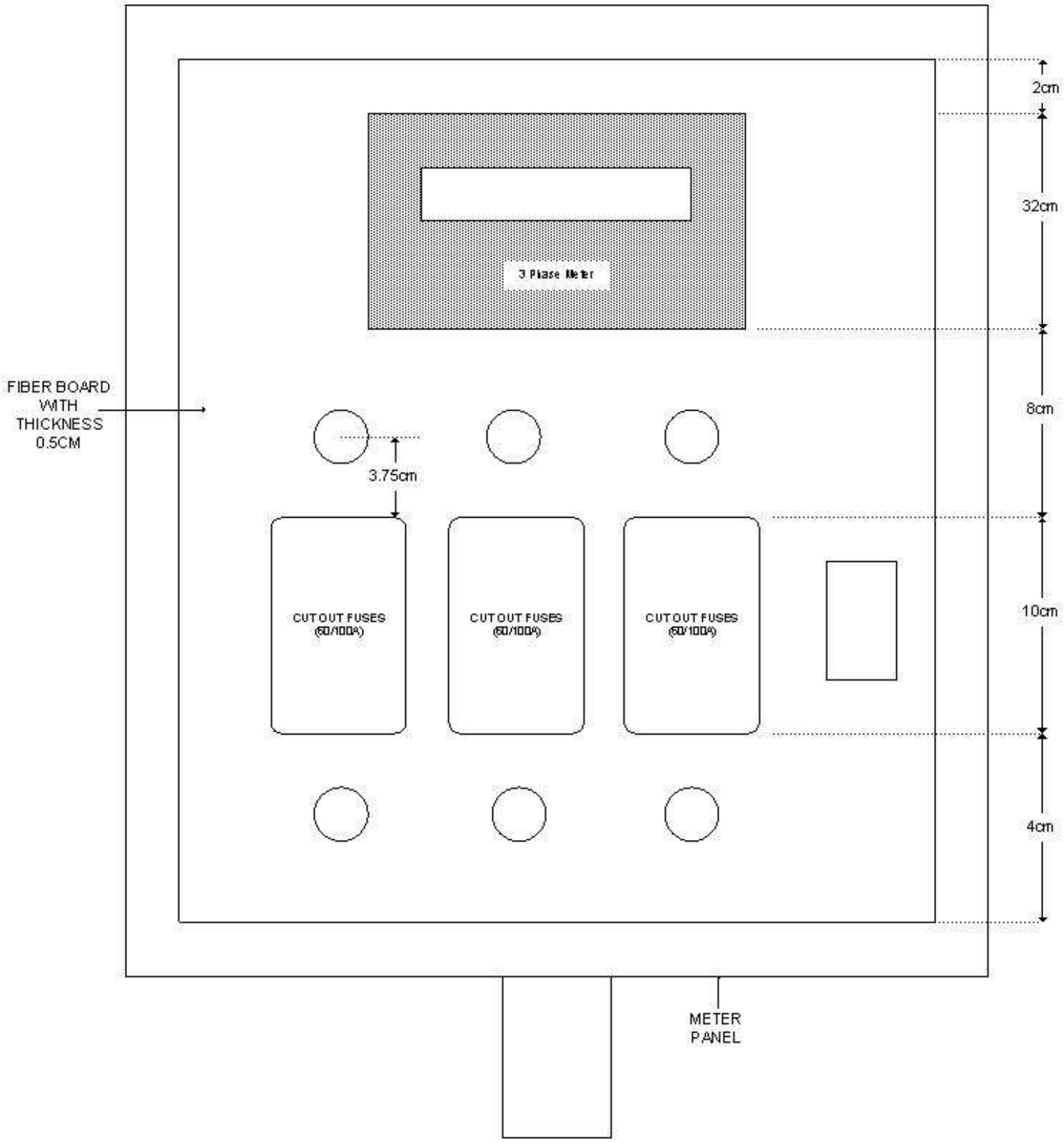


# DRAWING NO 6B : 3 PHASE OVERHEAD INCOMING

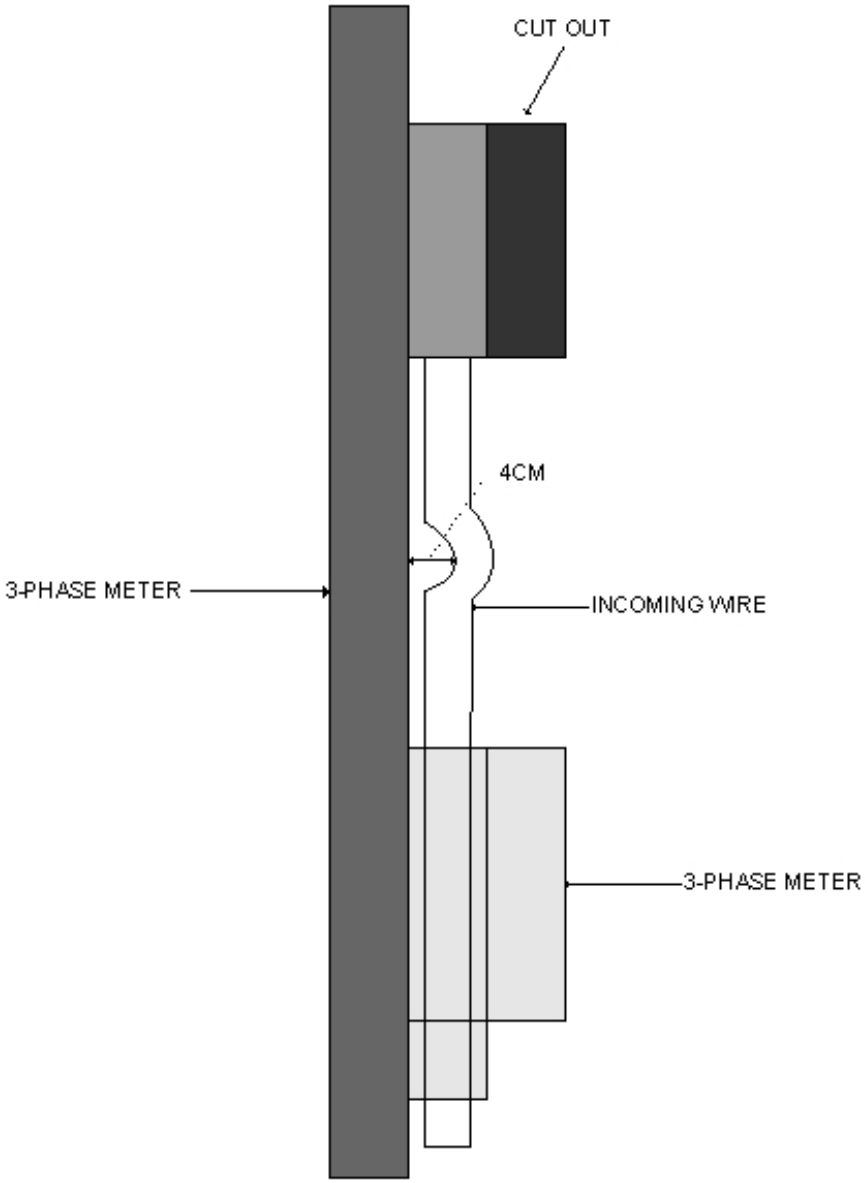


APPENDIX 15

# DRAWING NO 6C : 3 PHASE UNDERGROUND INCOMING



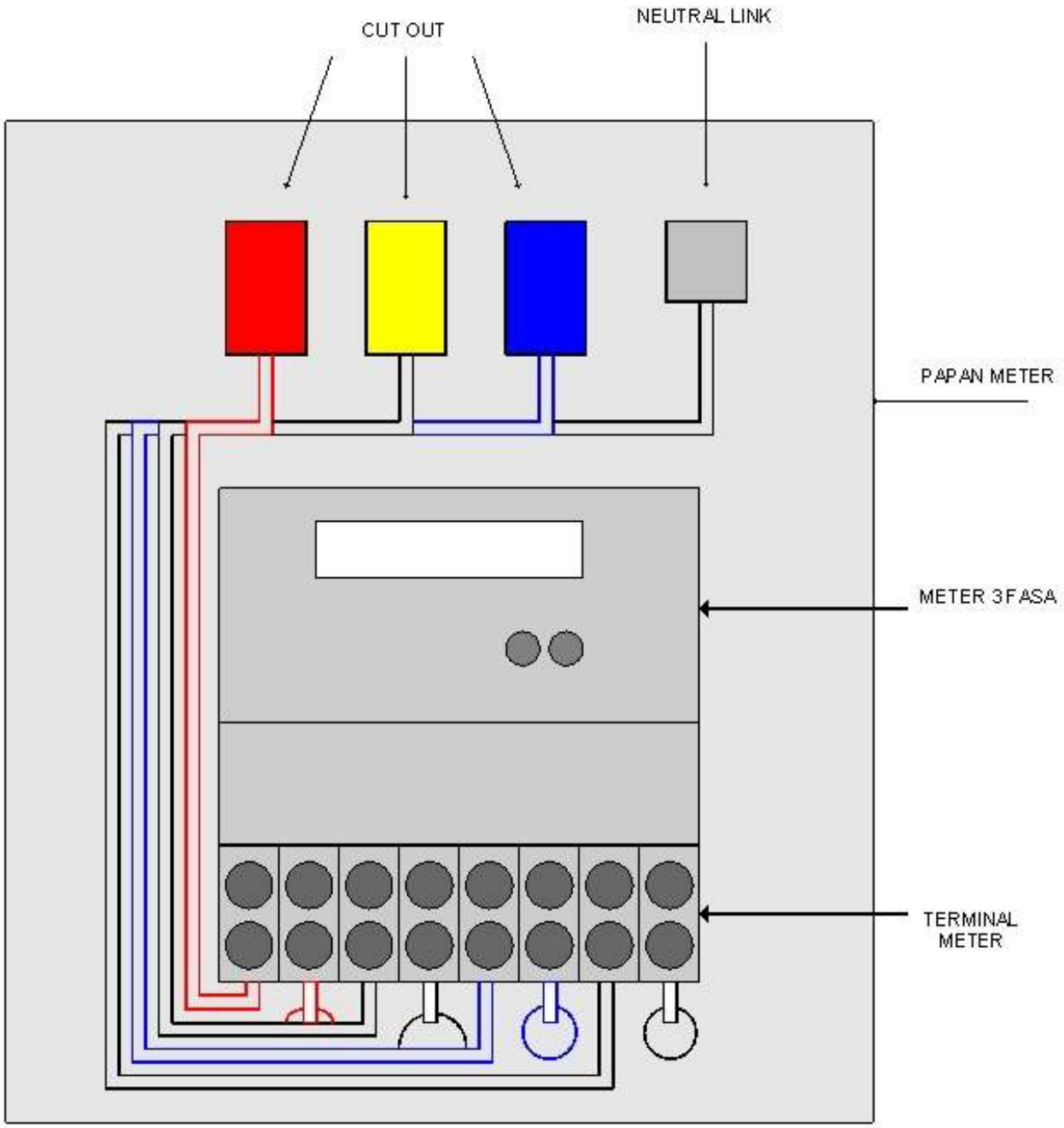
# DRAWING NO 7A : EXTERNAL SURFACE WIRING




SIDE VIEW

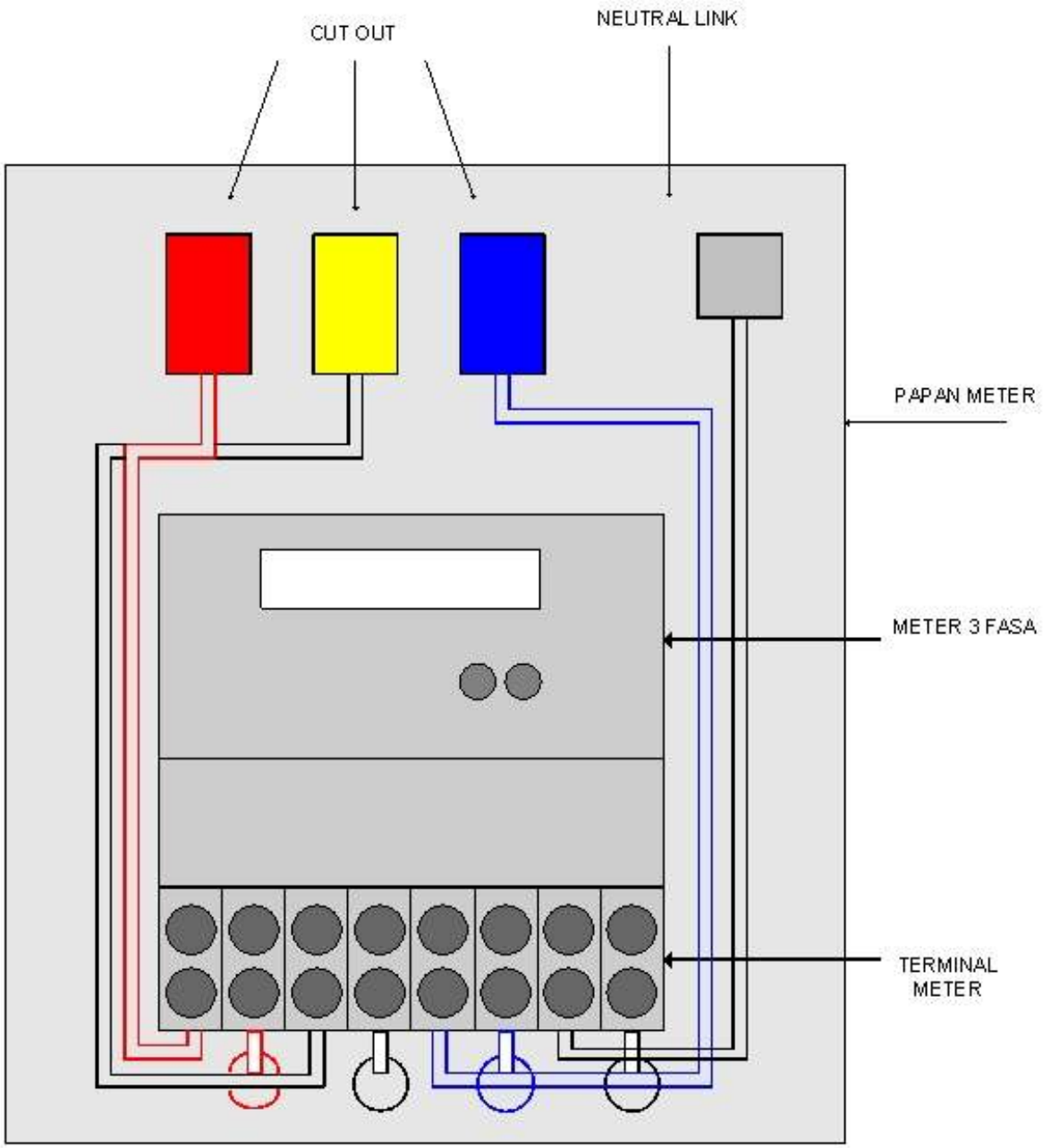
APPENDIX 16

# DRAWING NO 7B



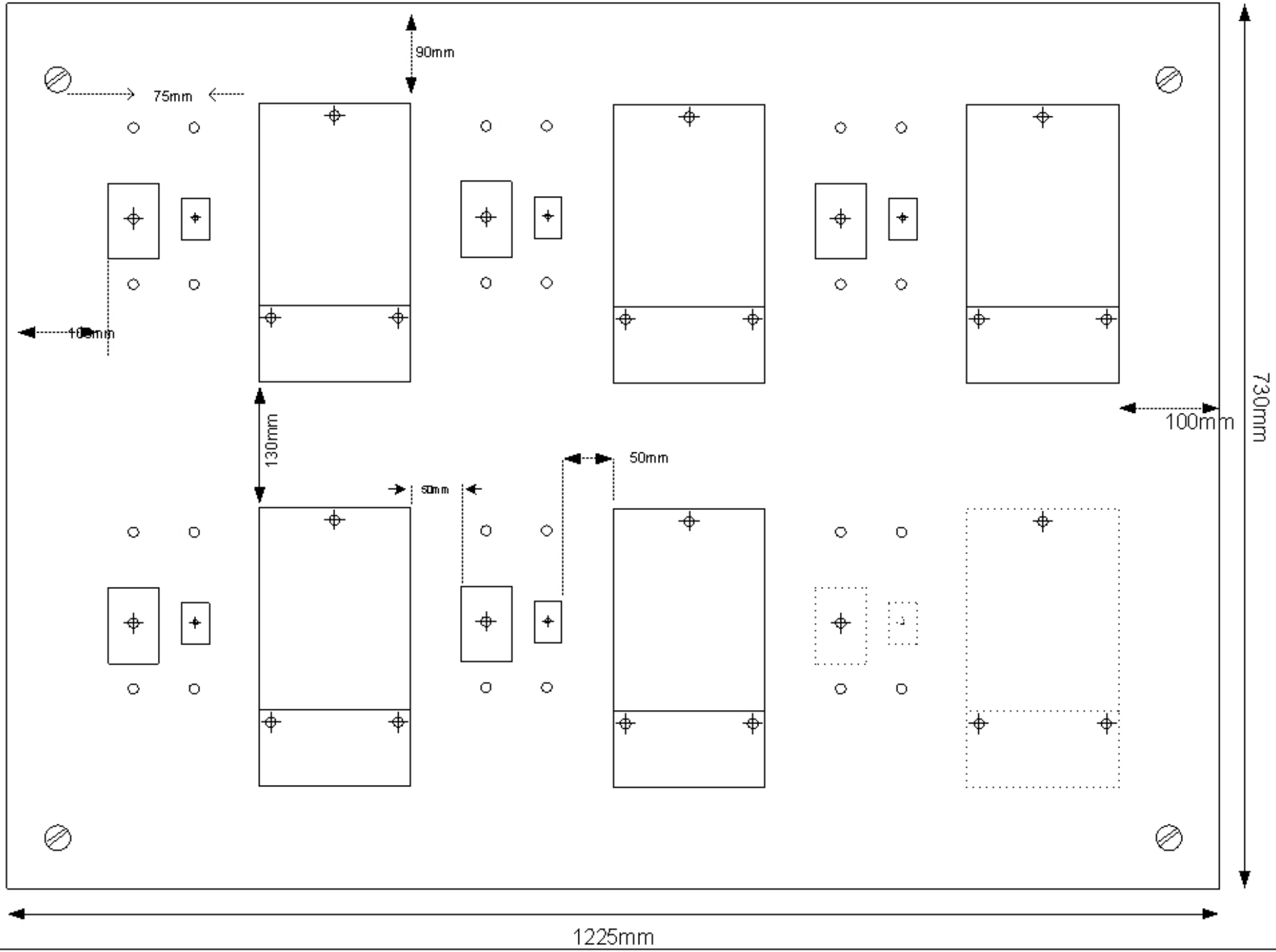
APPENDIX 16

# DRAWING NO. 7C

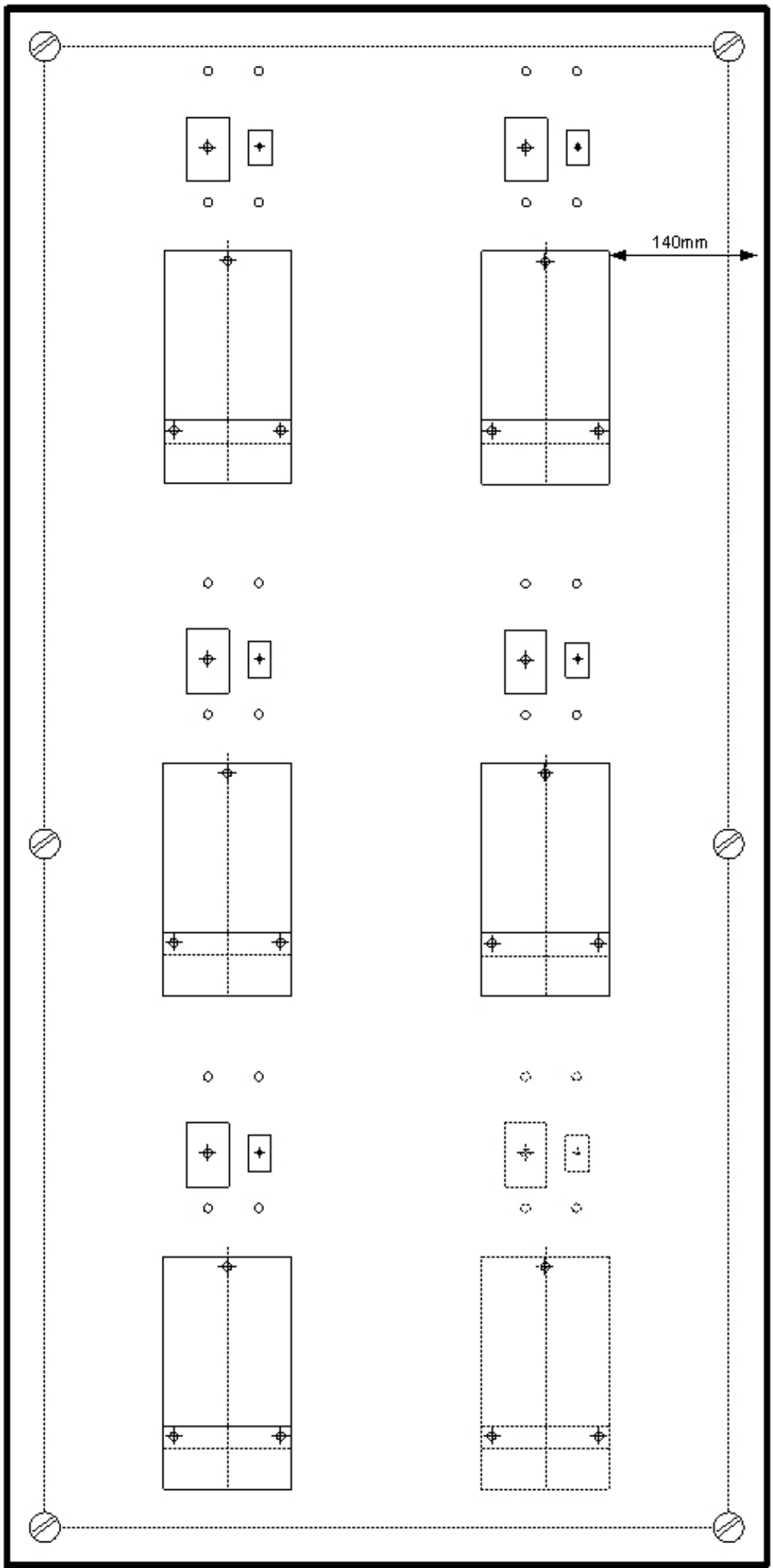


APPENDIX 17

# DRAWING NO 8A : SINGLE PHASE GROUP METERING

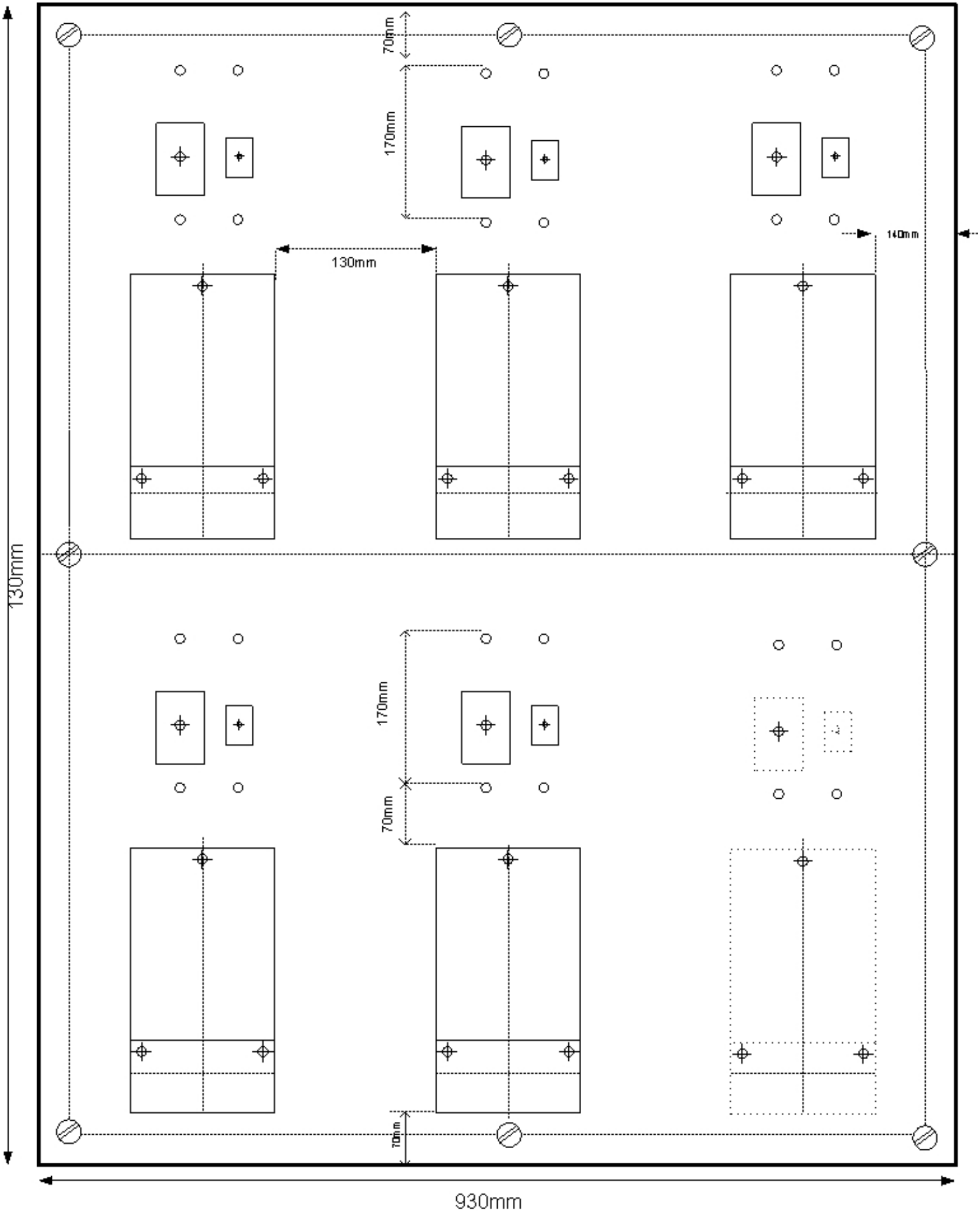


DRAWING NO 8B : SINGLE PHASE GROUP METERING APPENDIX 17



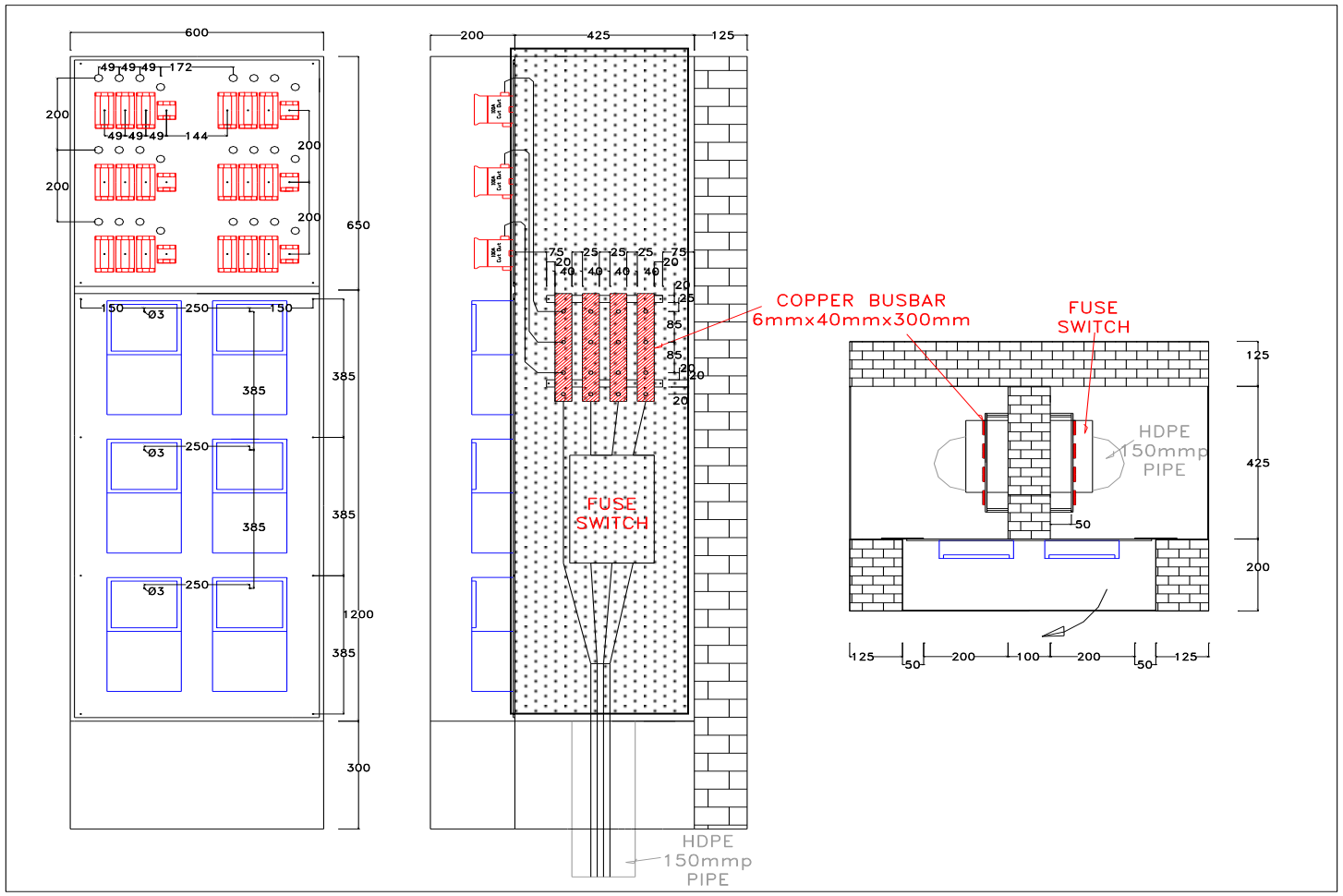
APPENDIX 17

# DRAWING NO 8C : SINGLE PHASE GROUP METERING



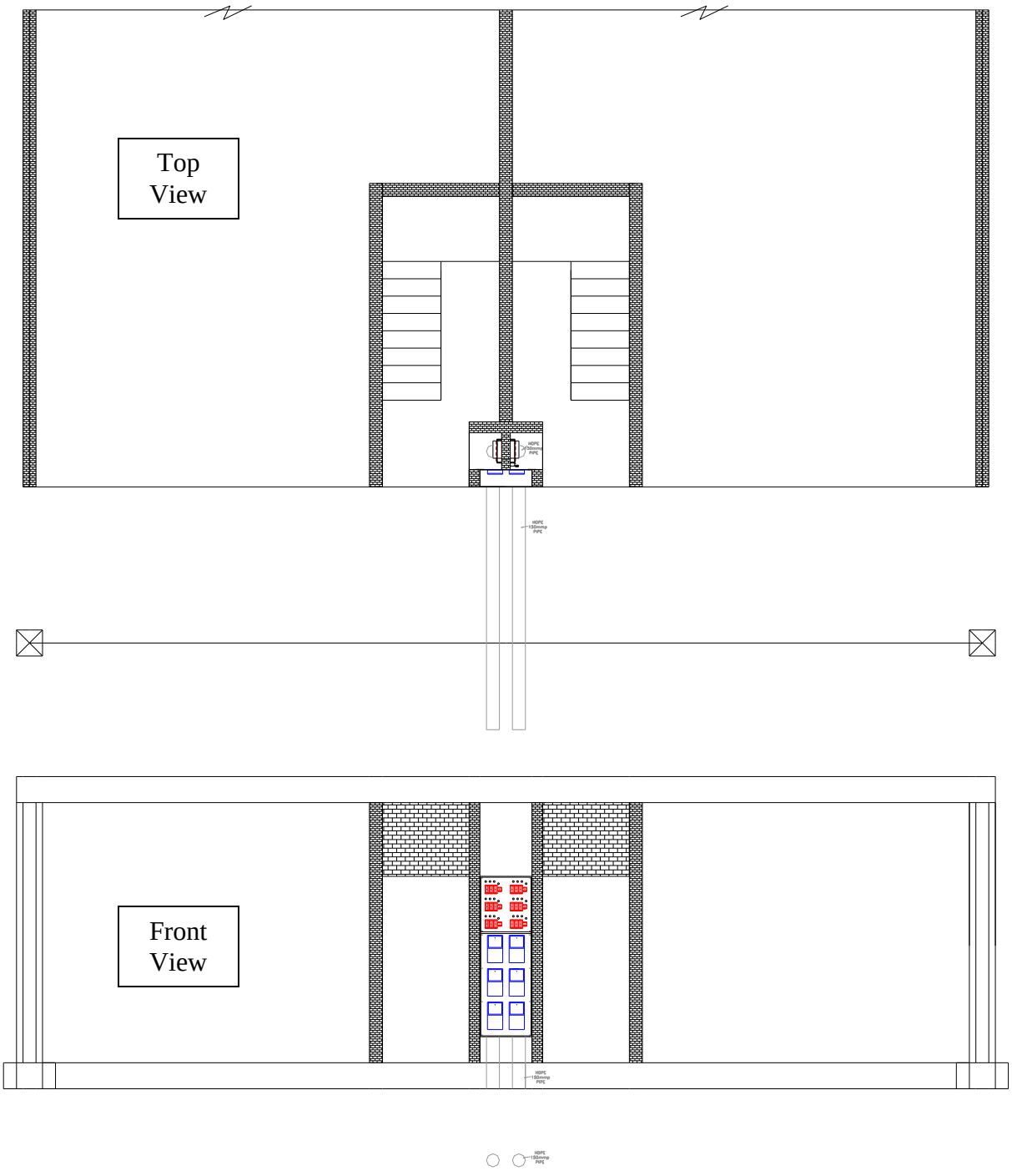
**APPENDIX 18**

# DRAWING NO 9A (i) : SHOP LOTS METER PANEL



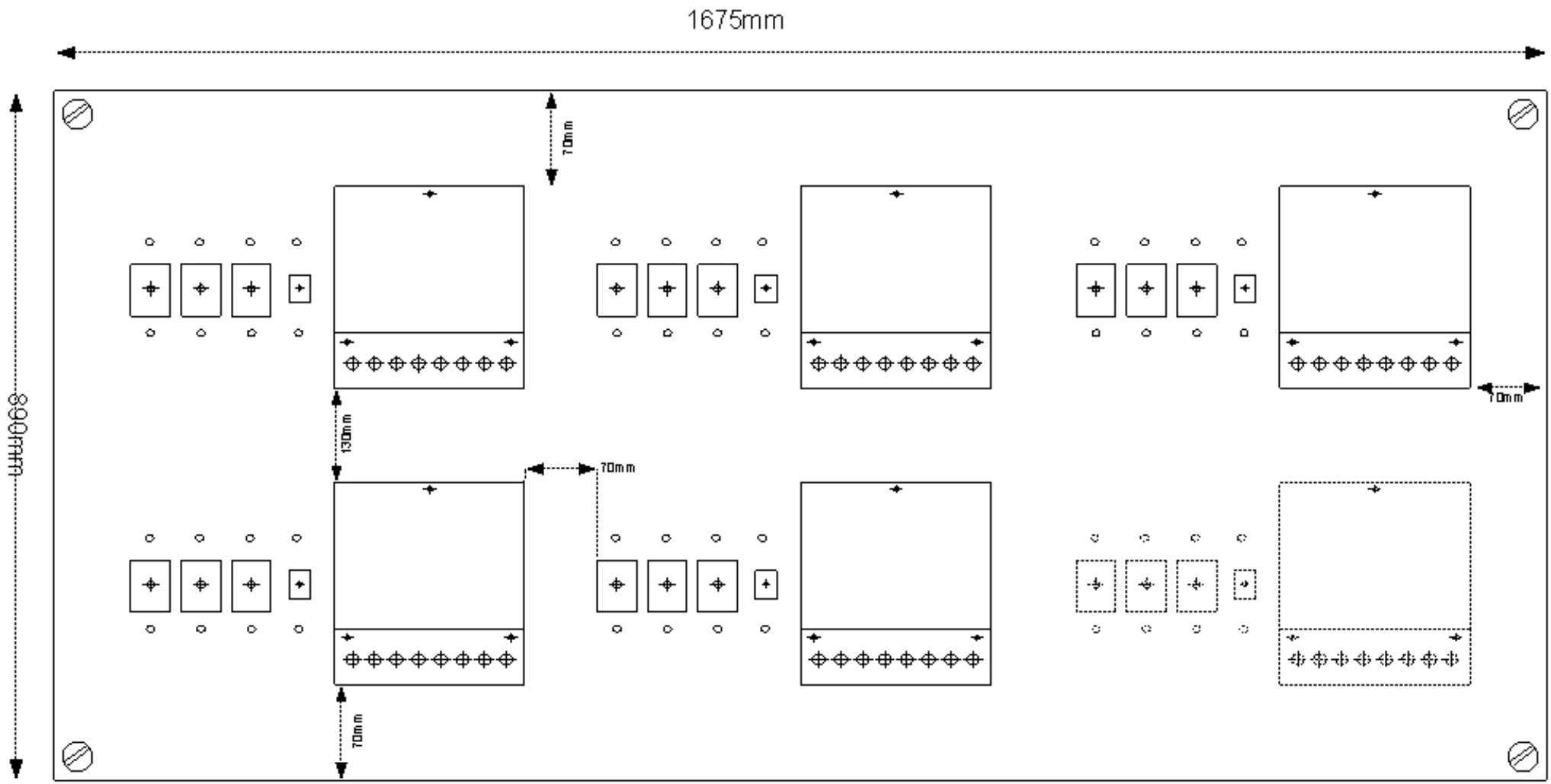
**APPENDIX 18**

## DRAWING NO 9A (ii) : SHOP LOTS METER PANEL

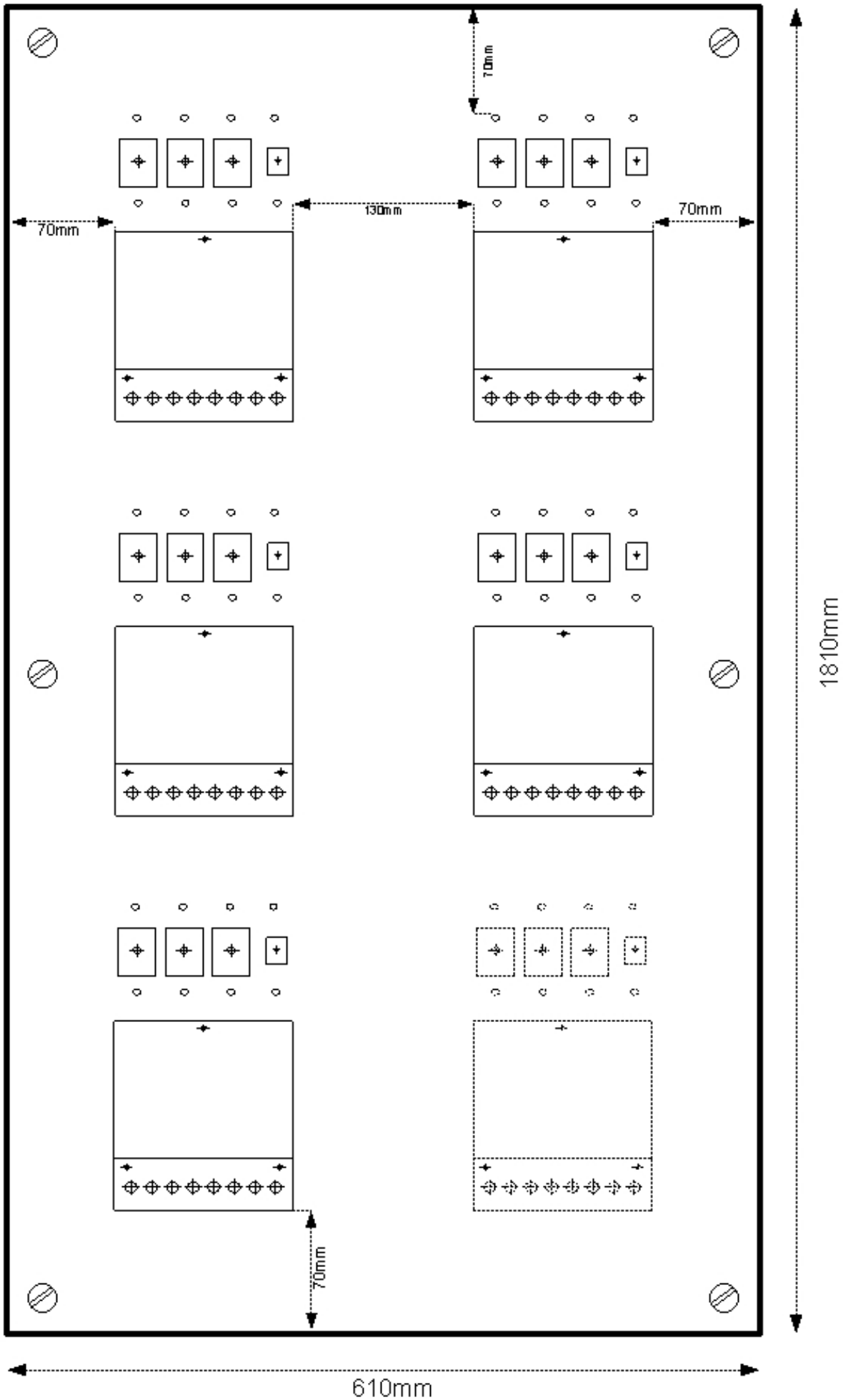


APPENDIX 18

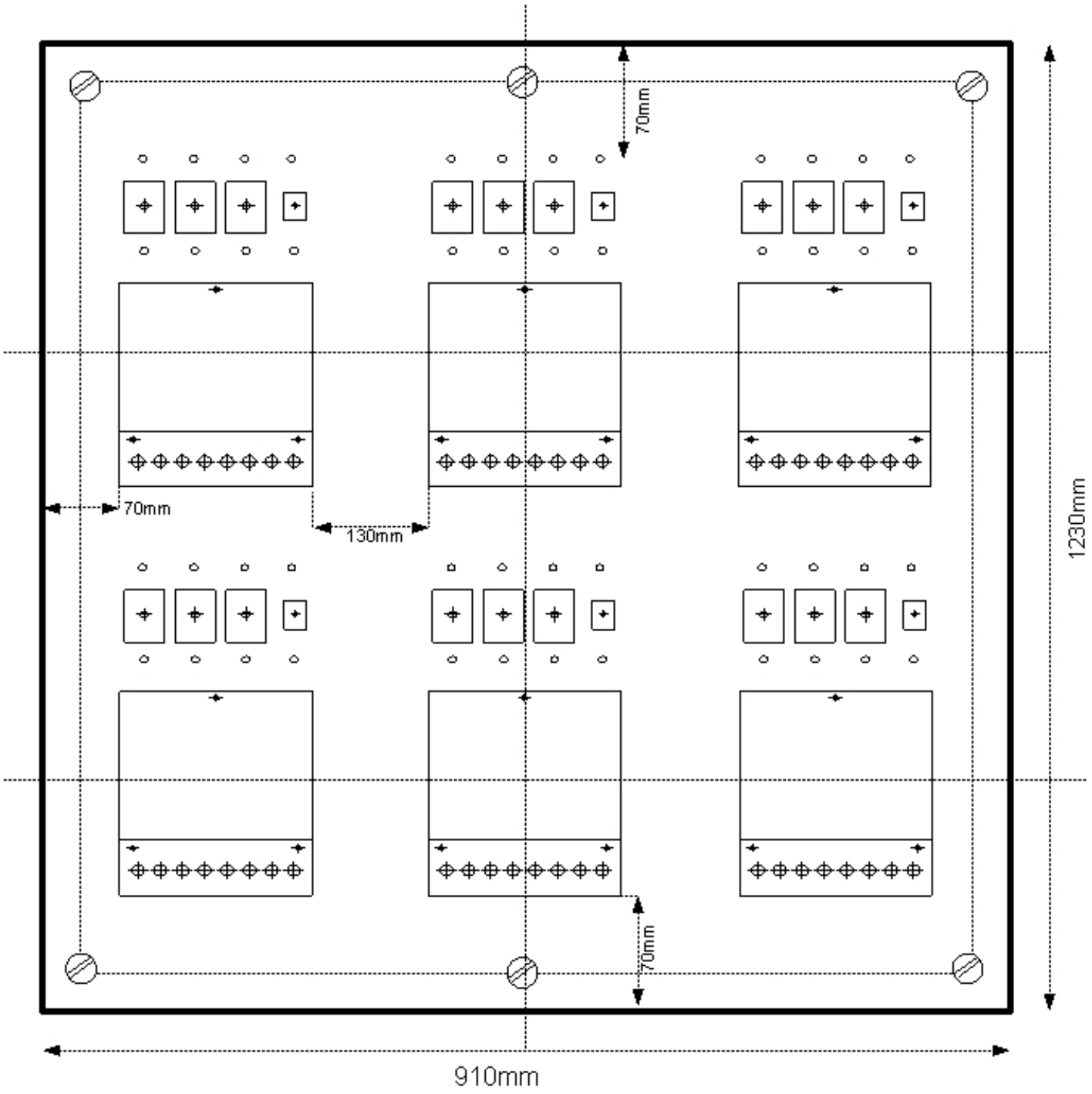
# DRAWING NO 9B: 3 PHASE GROUP METERING



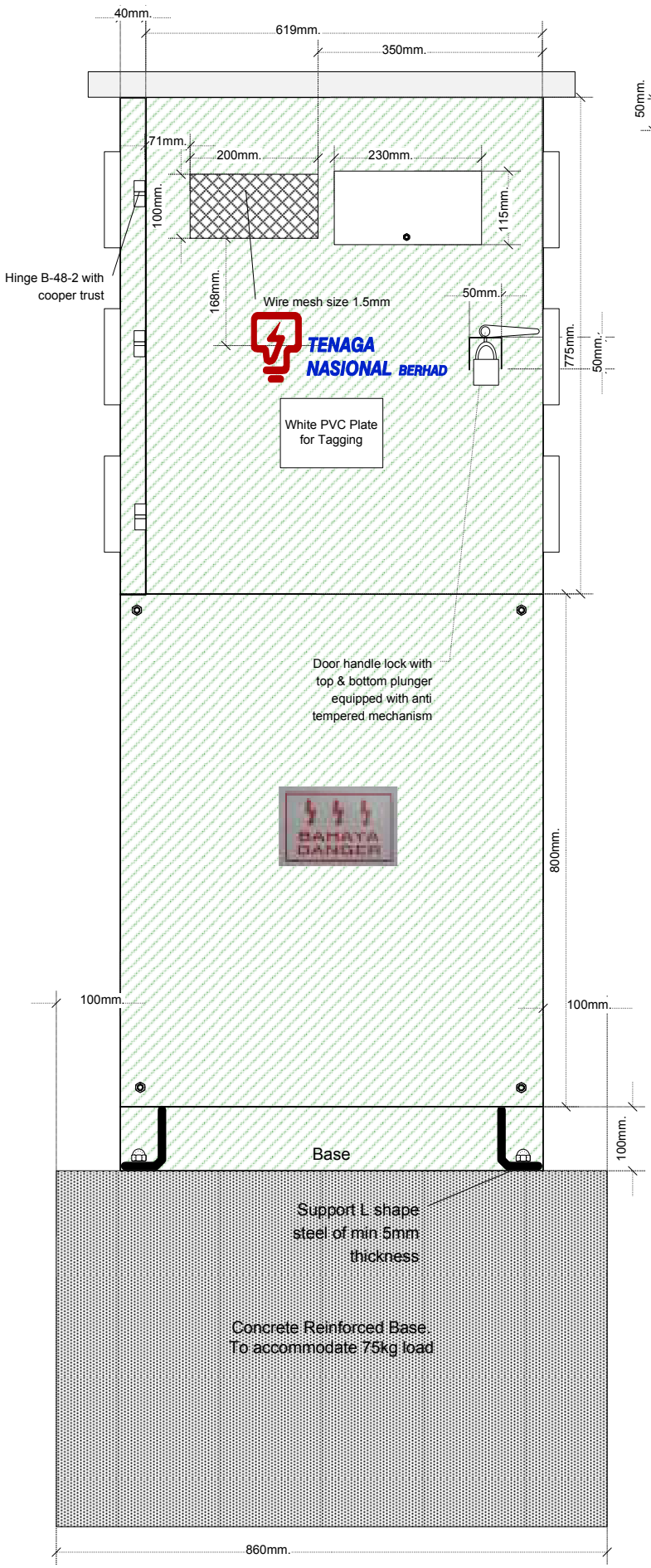
# DRAWING NO 9C : 3 PHASE GROUP METERING

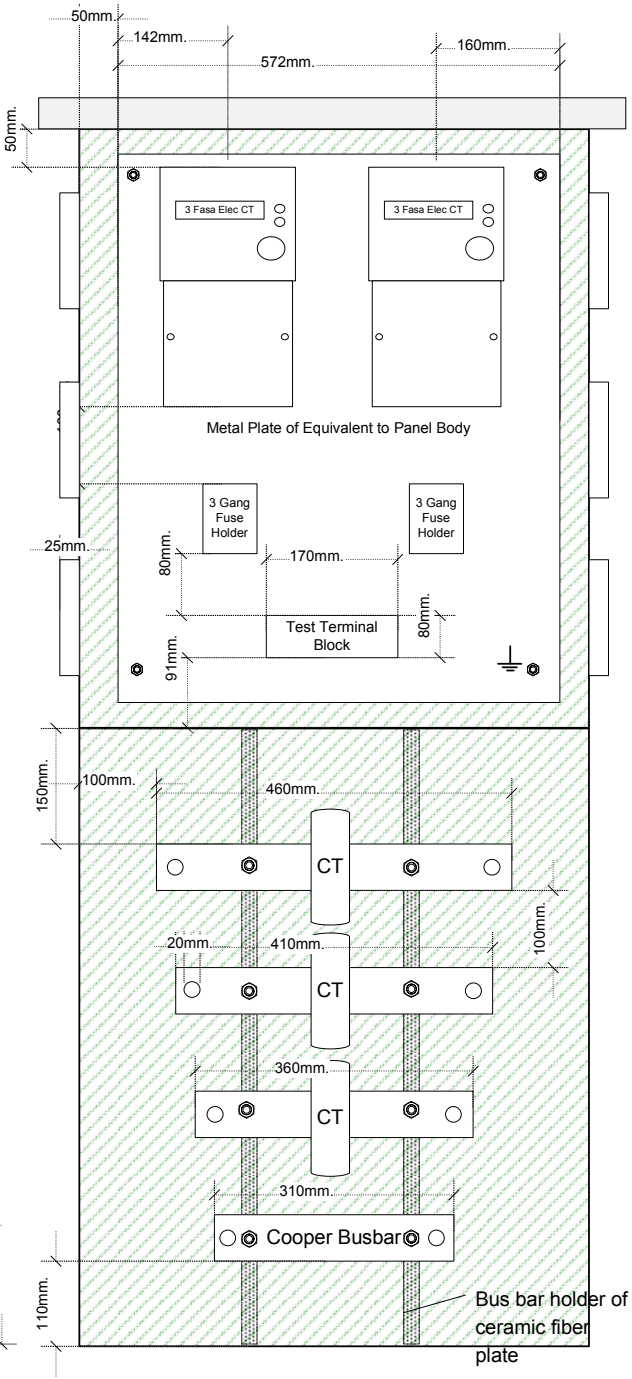


# DRAWING NO 9D : 3 PHASE GROUP METERING



# Appendix 19 Drawing 10 A : (i) Front View



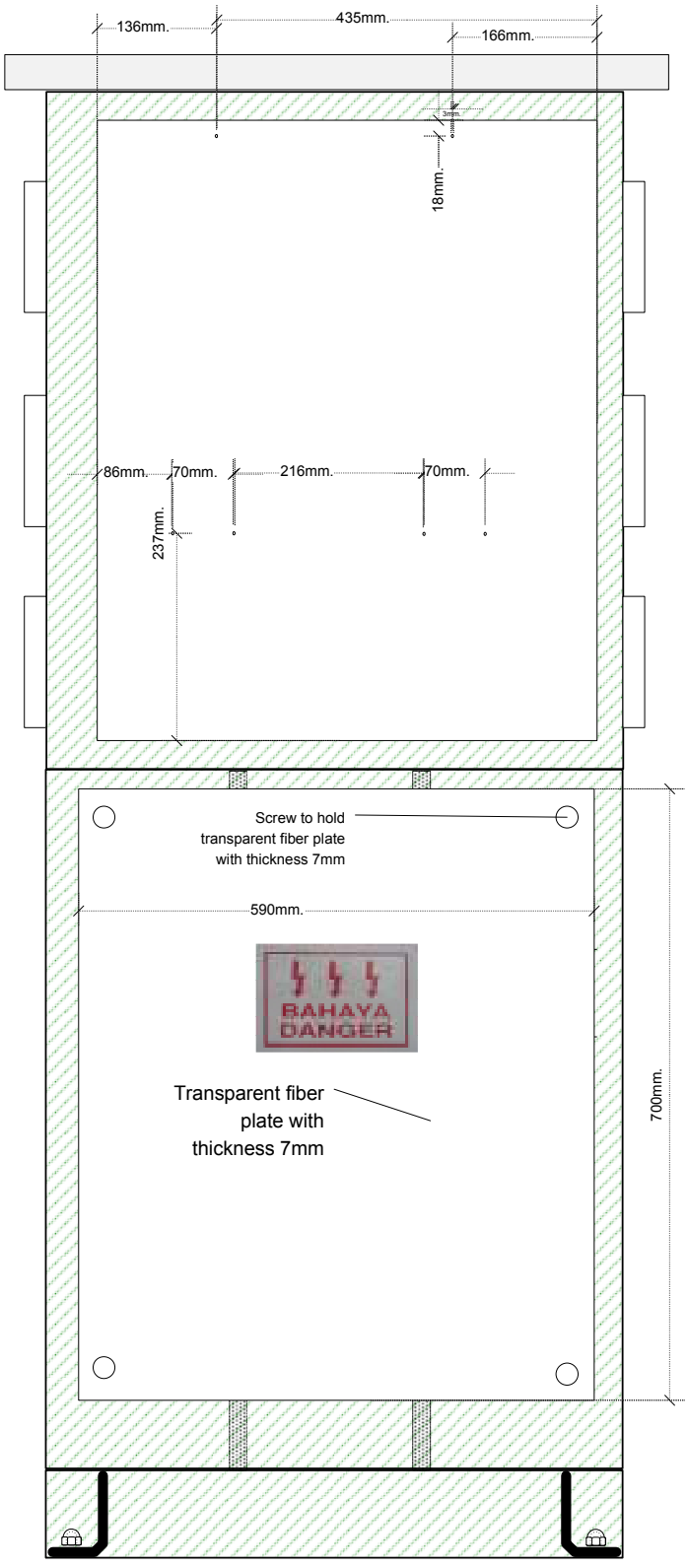

Bus bar dimension depending on load. Min clearance between bus bars and bus bar to body is 100mm

TENAGA NASIONAL BERHAD

| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/7/2009 |
| APPROVED BY | Tn Haji Aminuddin Wahab | 20/7/2009 |

| | | | |
|---|---|---|---|
| TITLE | Current Transformer Three Phase LV Outdoor Ground Mounted | | |
| PAGE | 1 OF 4 | SCALE | 1.5" = 350mm |
| DATE | 20/7/2009 | VERSION | 1.0 |

# Appendix 19 Drawing 10 A : (ii)



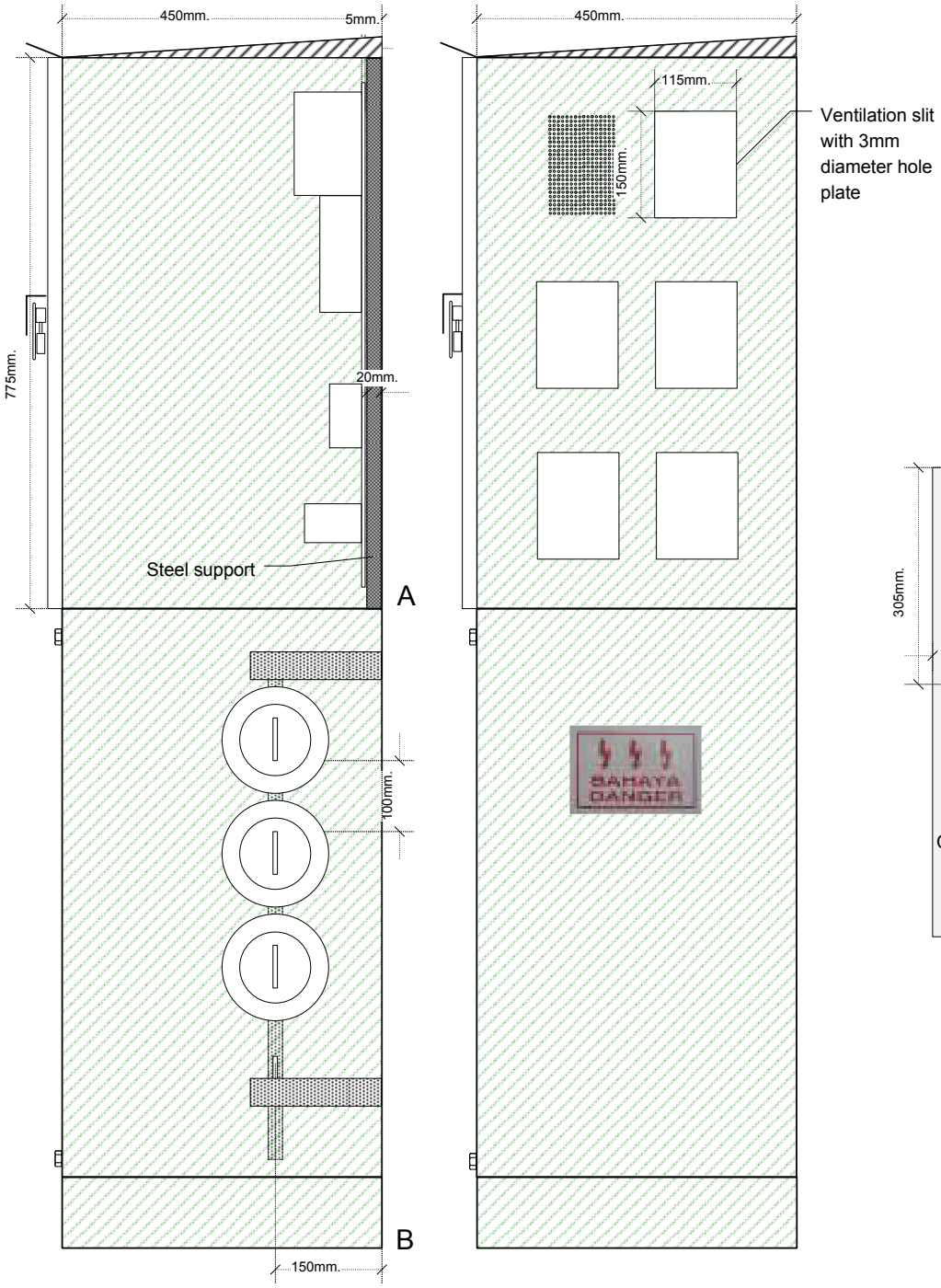

TENAGA NASIONAL BERHAD

| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/7/2009 |
| APPROVED BY | Tn Haji Aminuddin Wahab | 20/7/2009 |

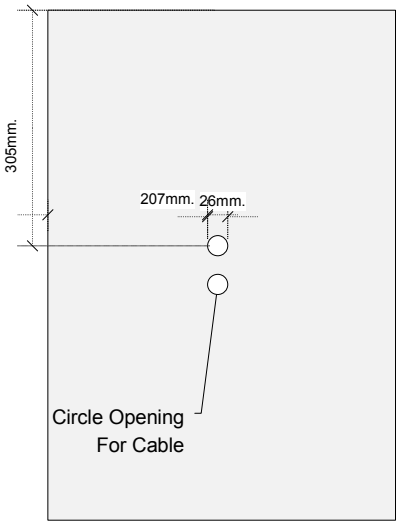
| | |
|---|---|
| TITLE | Current Transformer Three Phase LV Outdoor Ground Mounted |

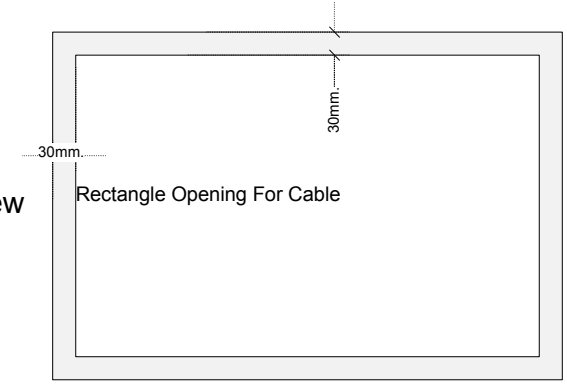
| | | | |
|---|---|---|---|
| PAGE | 2 OF 4 | SCALE | 1.5" = 305mm |
| DATE | 20/7/2009 | VERSION | 1.0 |

# Appendix 19 Drawing 10 A : (iii) Side View




Cross Sectional View at Point A



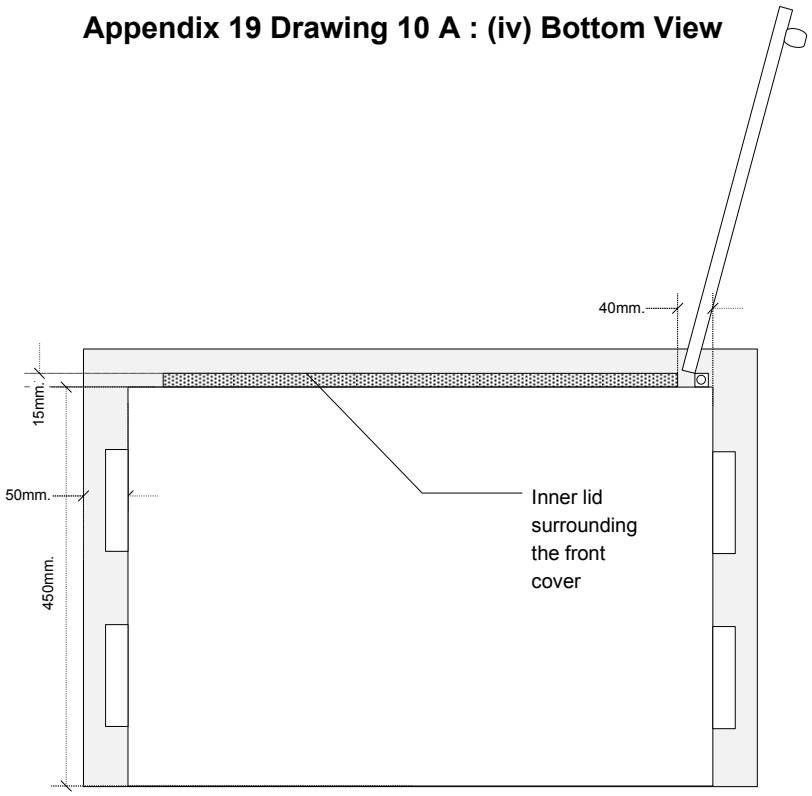

Cross Sectional View at Point B

TENAGA NASIONAL BERHAD

| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/7/2009 |
| APPROVED BY | Aminuddin Wahab | 20/7/2009 |

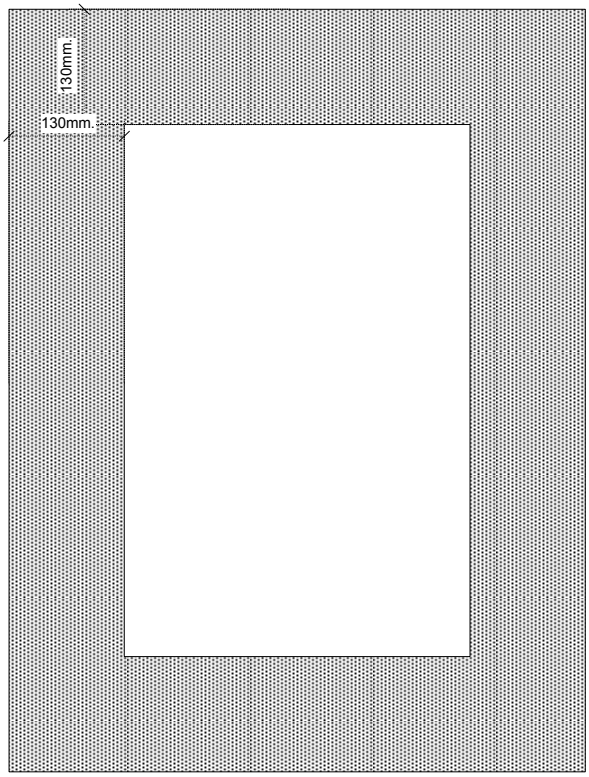
| | | | |
|---|---|---|---|
| TITLE | Current Transformer Three Phase LV Outdoor Ground Mounted | | |
| PAGE | 3 OF 4 | SCALE | 1.5" = 350mm |
| DATE | 20/7/2009 | VERSION | 1.0 |

## Appendix 19 Drawing 10 A : (iv) Bottom View

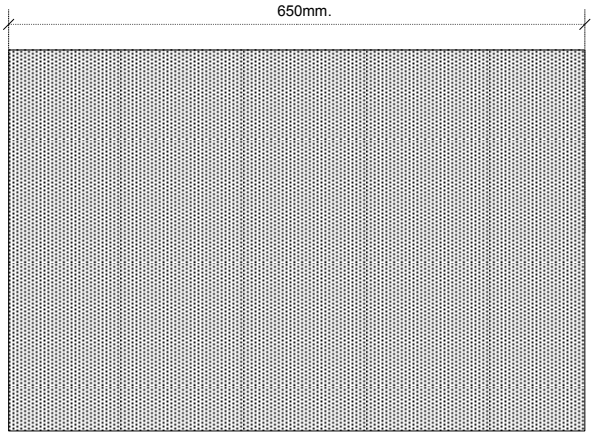



Reinforced
Concrete Base

Top View




Side View



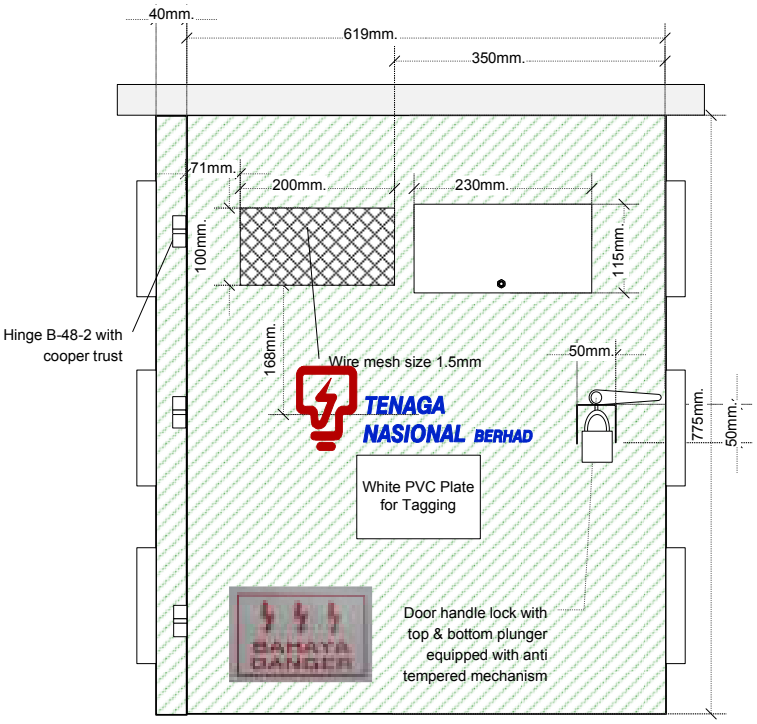

TENAGA NASIONAL BERHAD

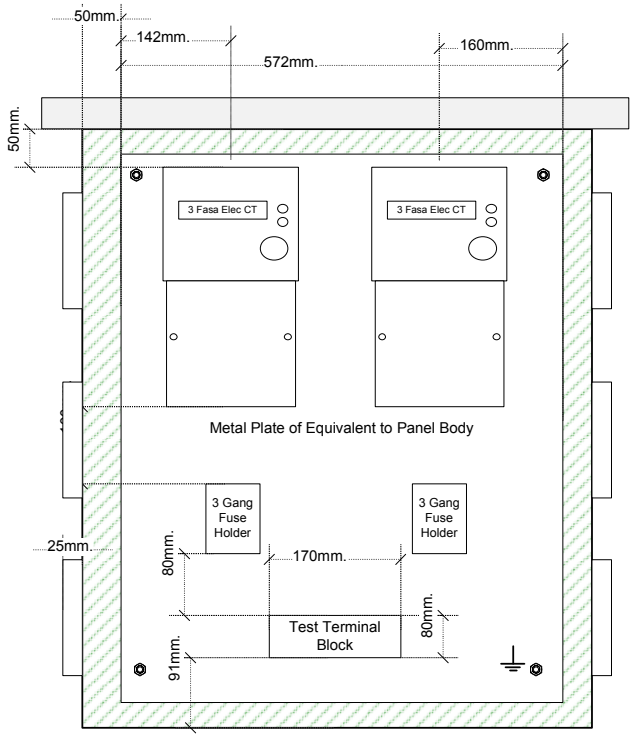
| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/7/2009 |
| APPROVED BY | Tn Haji Aminuddin Wahab | 20/7/2009 |

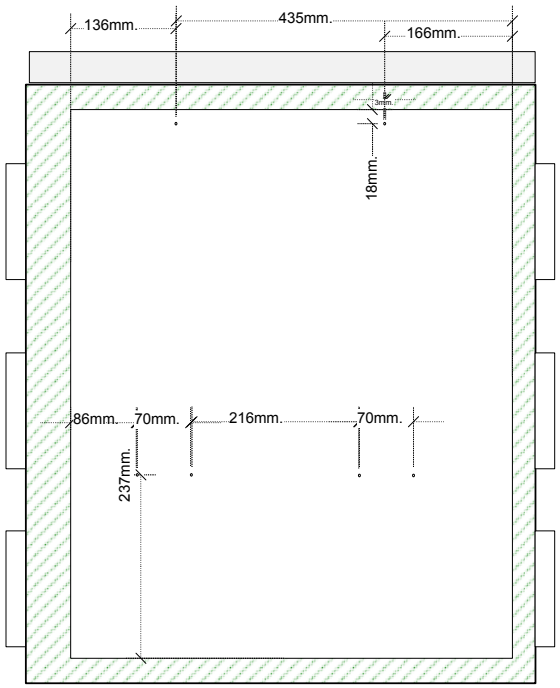
TITLE: Current Transformer Three Phase LV Outdoor Ground Mounted

| | | | |
|---|---|---|---|
| PAGE | 4 OF 4 | SCALE | 1.5" = 350mm |
| DATE | 20/7/2009 | VERSION | 1.0 |

# Appendix 19 Drawing 10 B : (i) Front View




TENAGA NASIONAL BERHAD

| | NAME | DATE |
|---|---|---|
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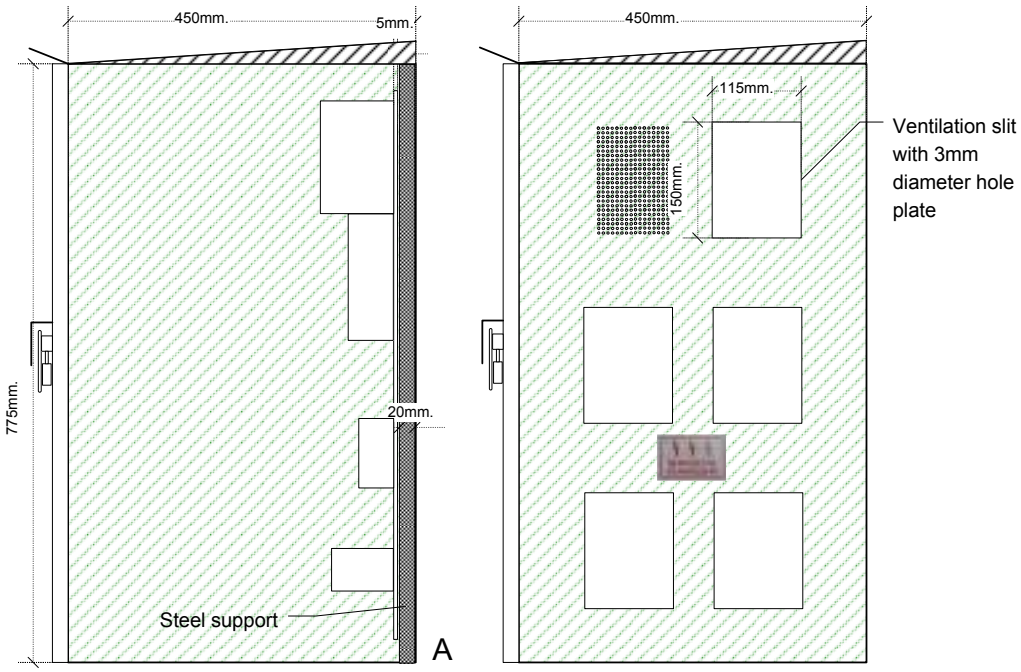
| APPROVED BY | Tn Haji Aminuddin Wahab | 20/4/2009 |

| | | | |
|---|---|---|---|
| TITLE | Current Transformer Three Phase LV Outdoor Wall Mounted | | |
| PAGE | 1 OF 3 | SCALE | 1.5" = 350mm |
| DATE | 20/4/2009 | VERSION | 1.0 |

# Appendix 19 Drawing 10 B : (ii) Side View

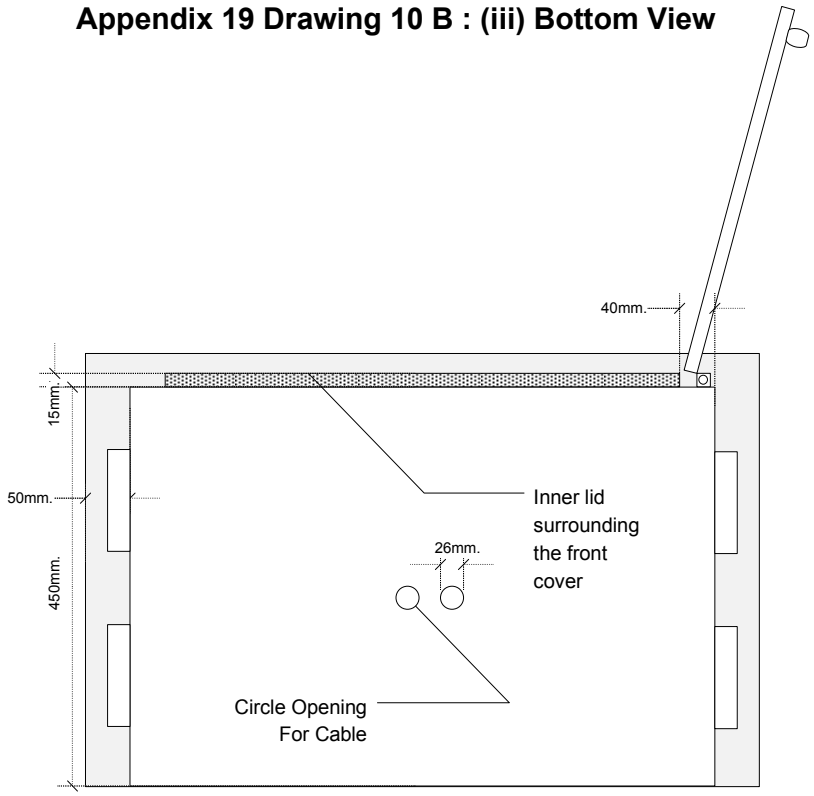



TENAGA NASIONAL BERHAD

| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/4/2009 |
| APPROVED BY | Tn Haji Aminuddin Wahab | 20/4/2009 |

| | | | |
|---|---|---|---|
| TITLE | Current Transformer Three Phase LV Outdoor Wall Mounted | | |
| PAGE | 2 OF 3 | SCALE | 1.5" = 350mm |
| DATE | 20/4/2009 | VERSION | 1.0 |

## Appendix 19 Drawing 10 B : (iii) Bottom View

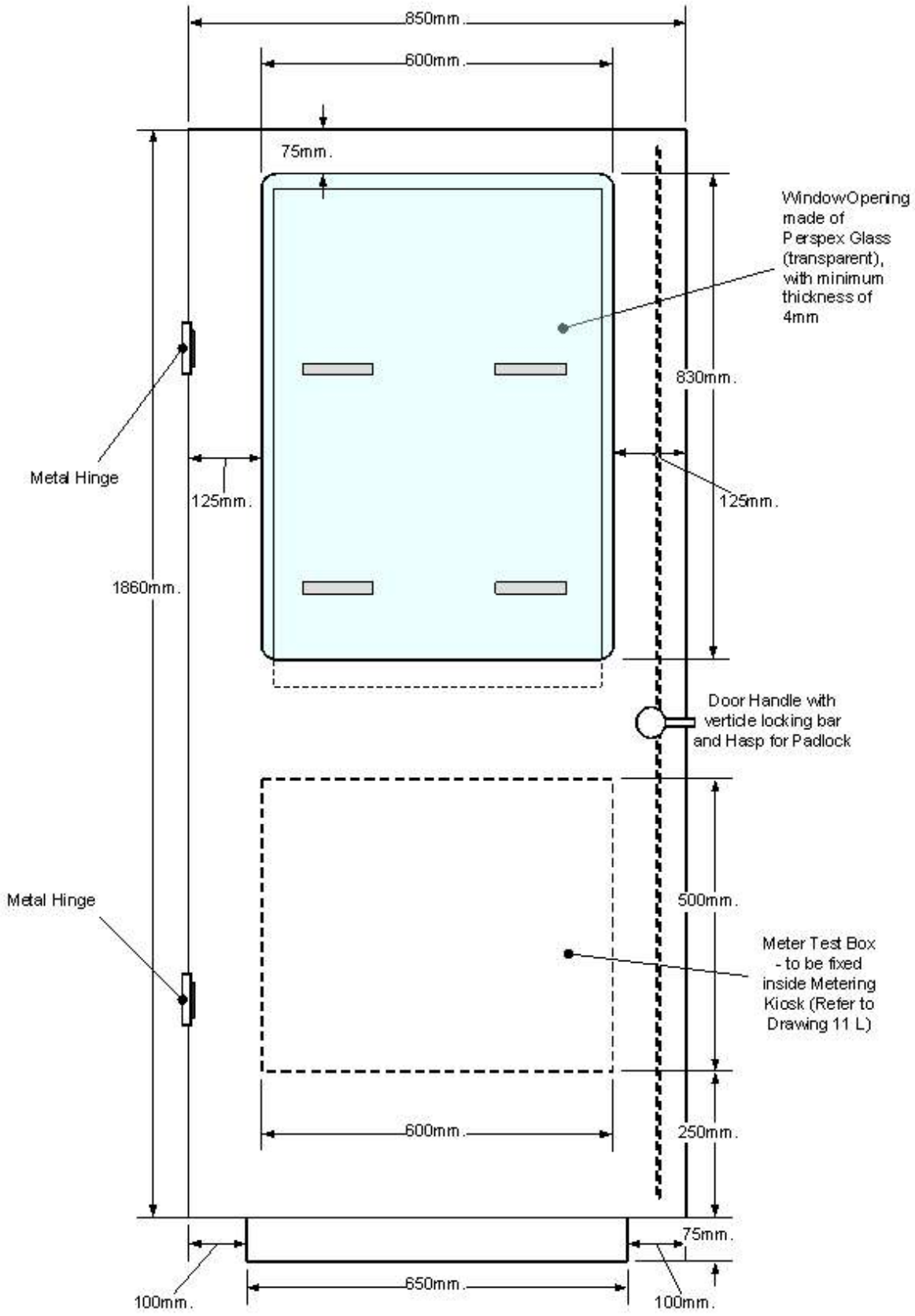



TENAGA NASIONAL BERHAD

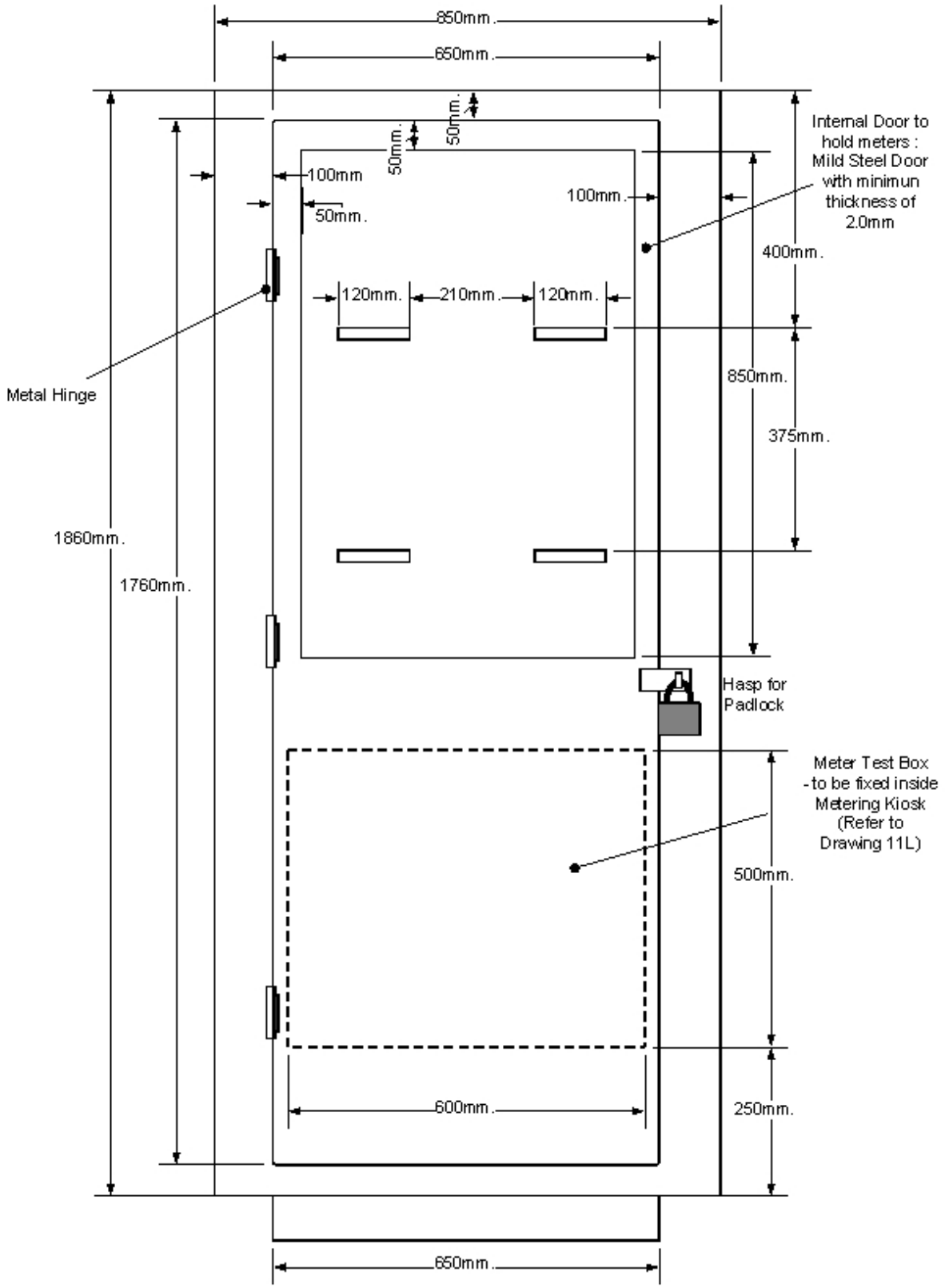
| | NAME | DATE |
|---|---|---|
| DRAWN BY | Ir Wan Mohd Nazdi Wan Abd Rahman | 15/4/2009 |
| APPROVED BY | Aminuddin Wahab | 20/4/2009 |

TITLE: Current Transformer Three Phase LV Outdoor Wall Mounted

| | | | |
|---|---|---|---|
| PAGE | 3 OF 3 | SCALE | 1.5" = 350mm |
| DATE | 20/4/2009 | VERSION | 1.0 |

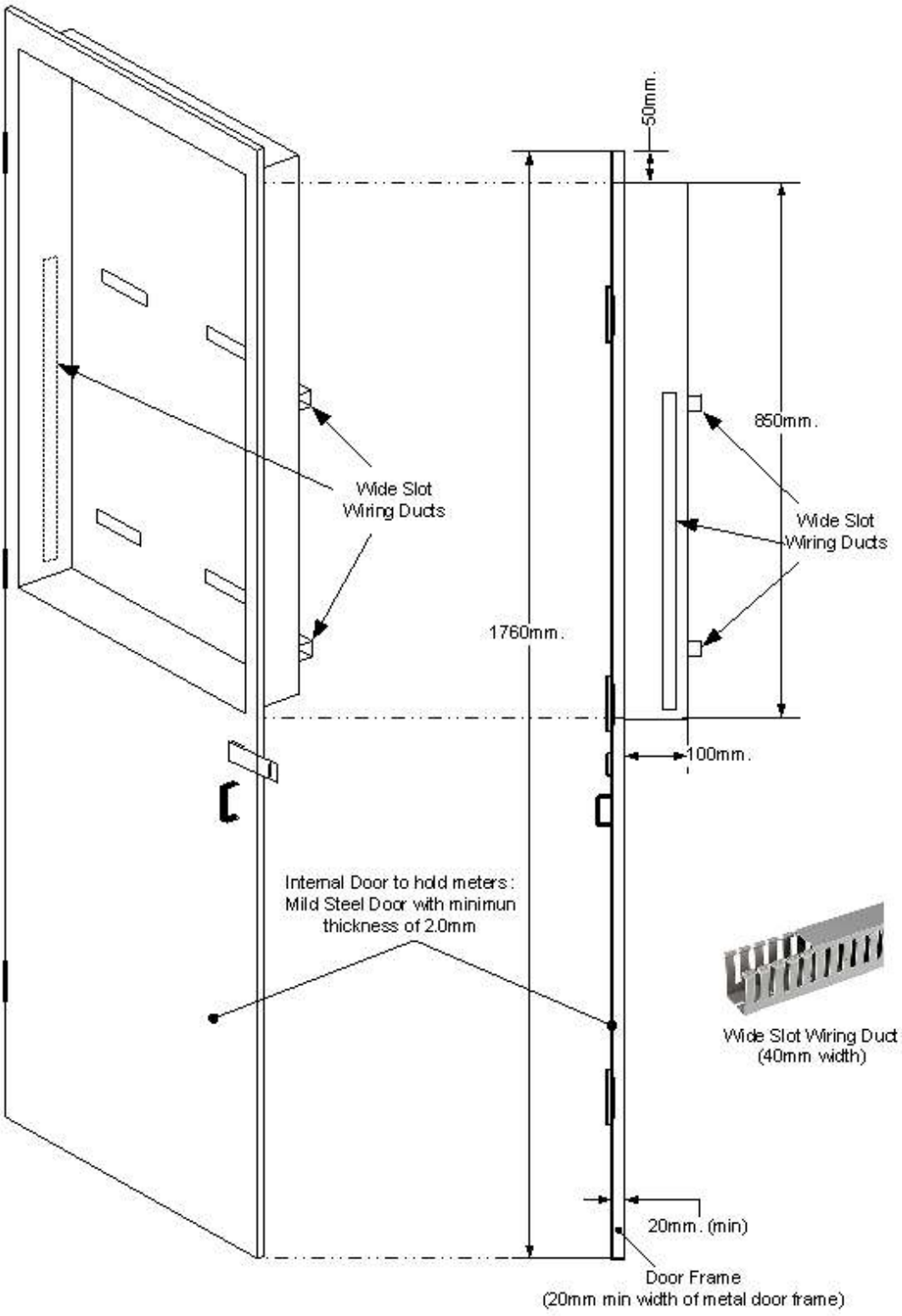



**Drawing 11 A : MV/HV, 1 OR 2 FEEDER METERING KIOSK - Front View of External Door**




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

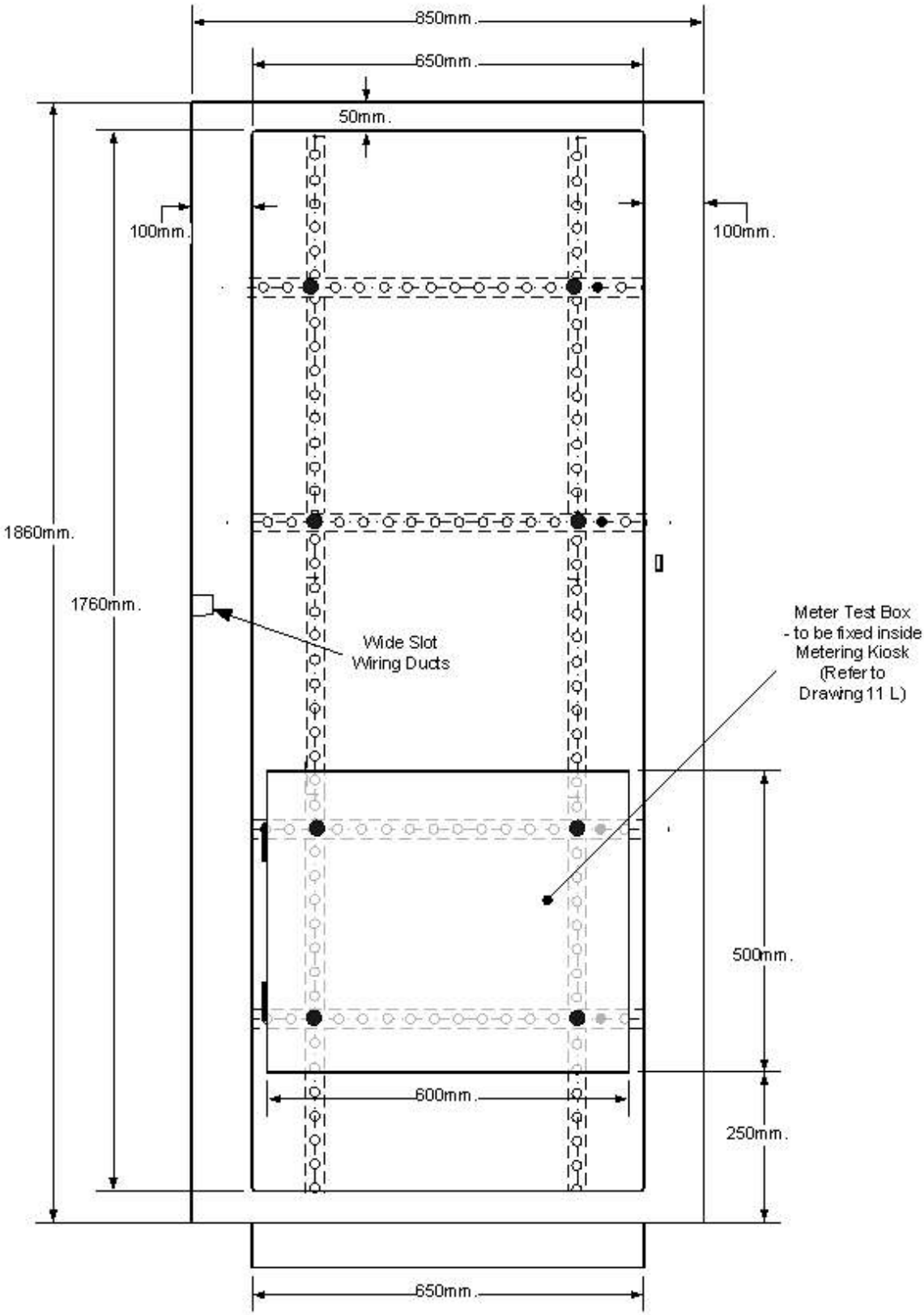
| Jabatan Perkhidmatan Perjangkaan | APPENDIX 20 | September 2011 |
|---|---|---|



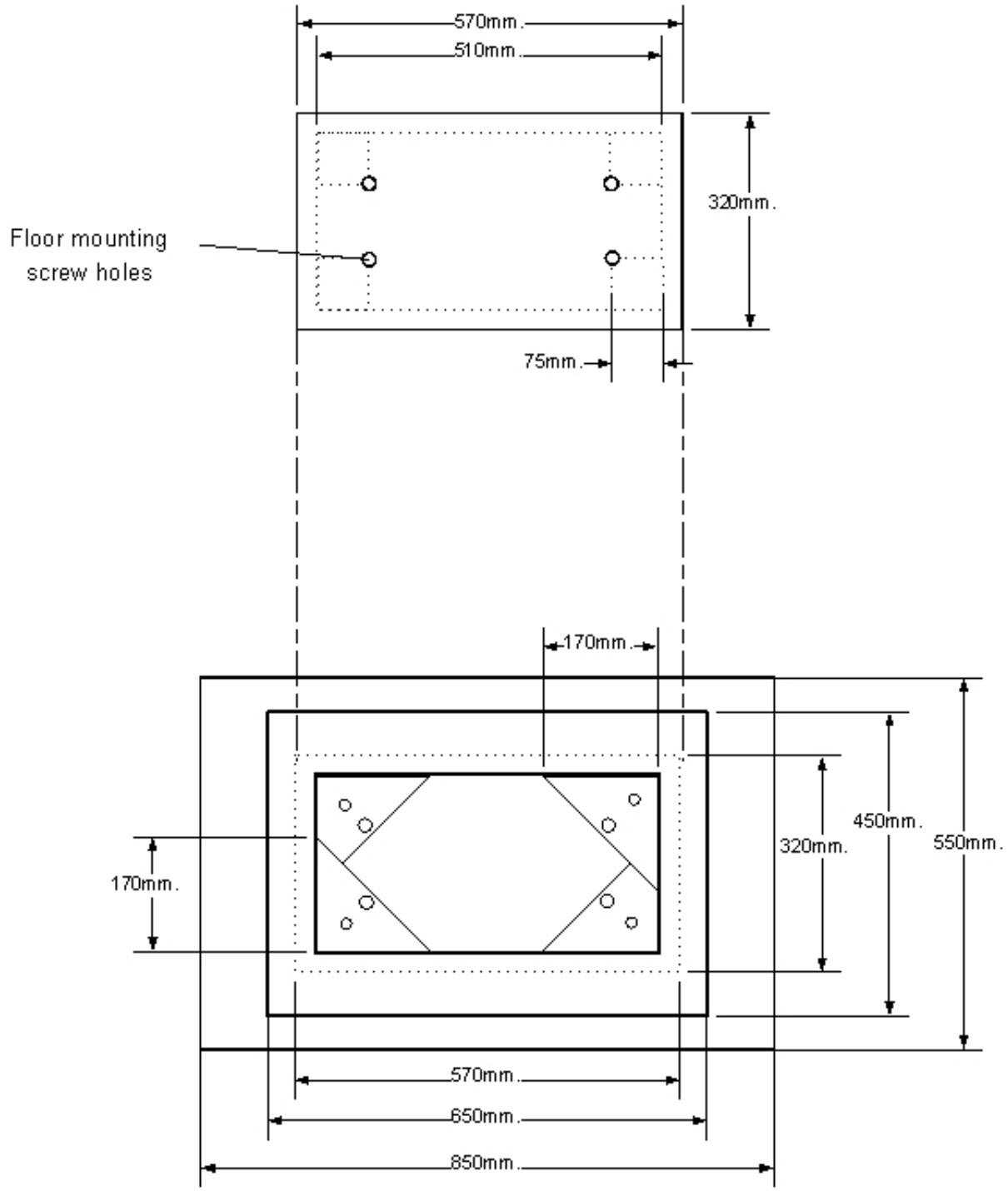

PERSPECTIVE VIEW

SIDE VIEW

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

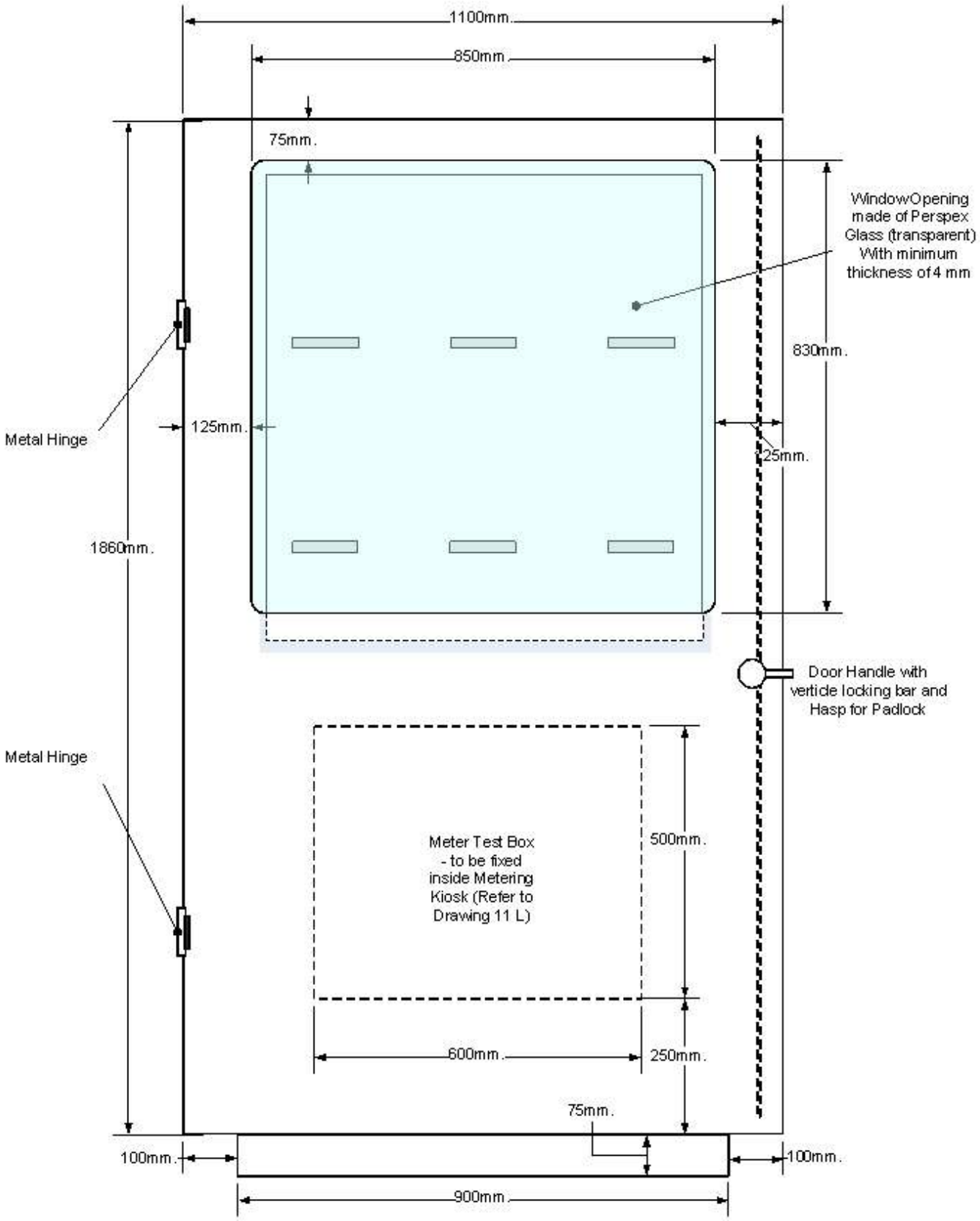



**Drawing 11 D : MV/HV, 1 OR 2 FEEDER METERING KIOSK - Front View of Kiosk Base**

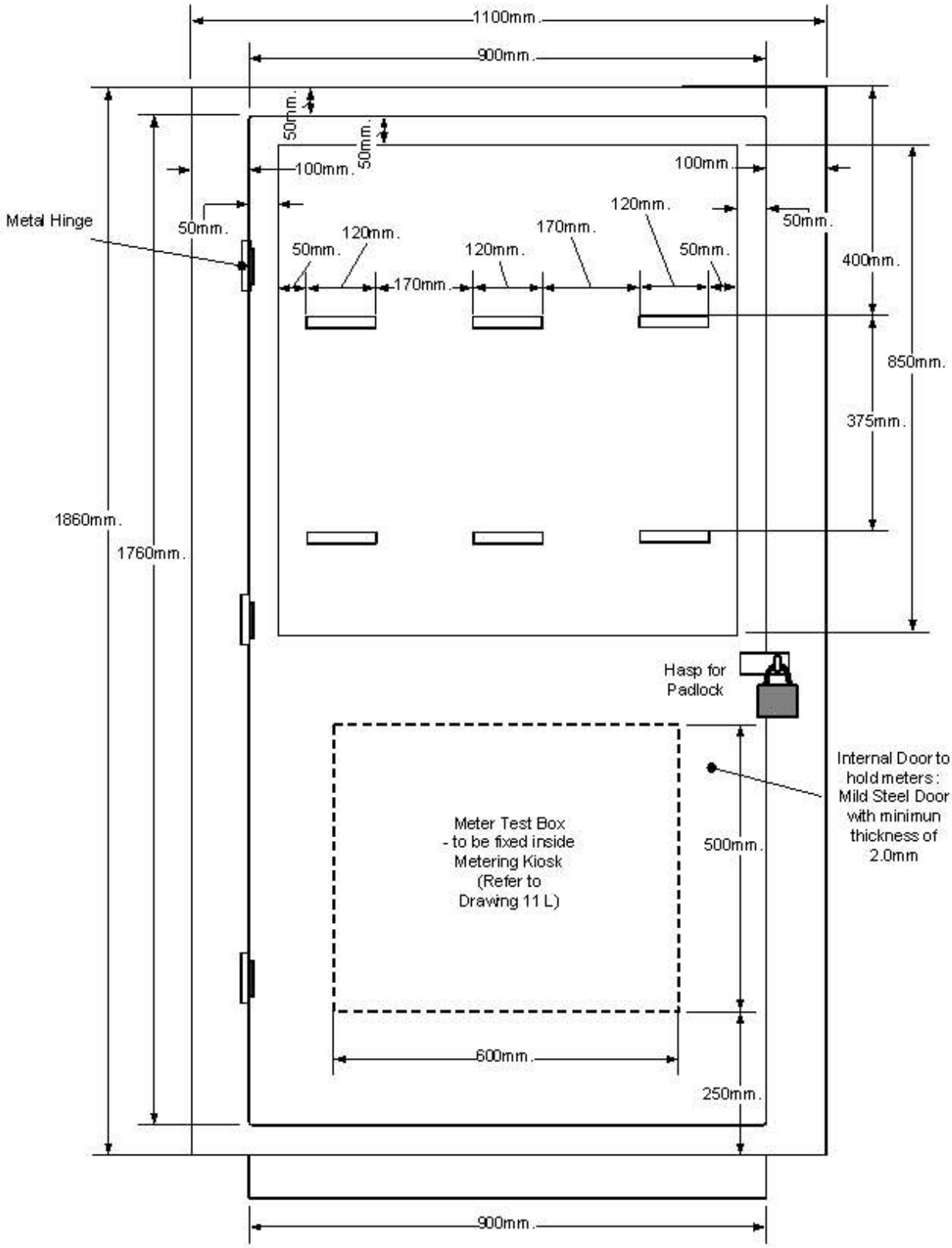



**MV/HV, 1 or 2 Feeder Base:**
**Top View**

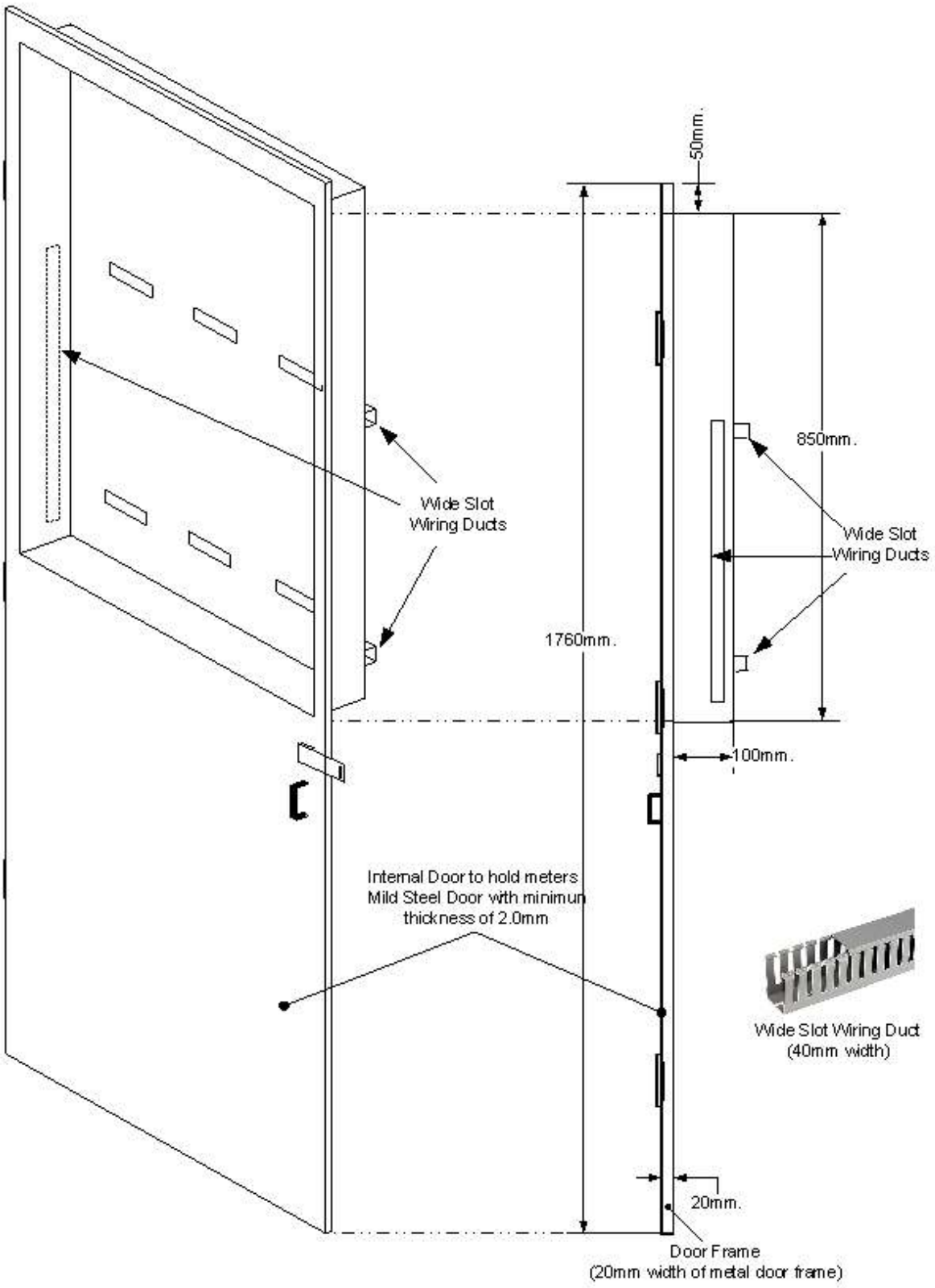
**Drawing 11 E : MV/HV, 1 OR 2 FEEDER METERING KIOSK BASE - Top View of Base**



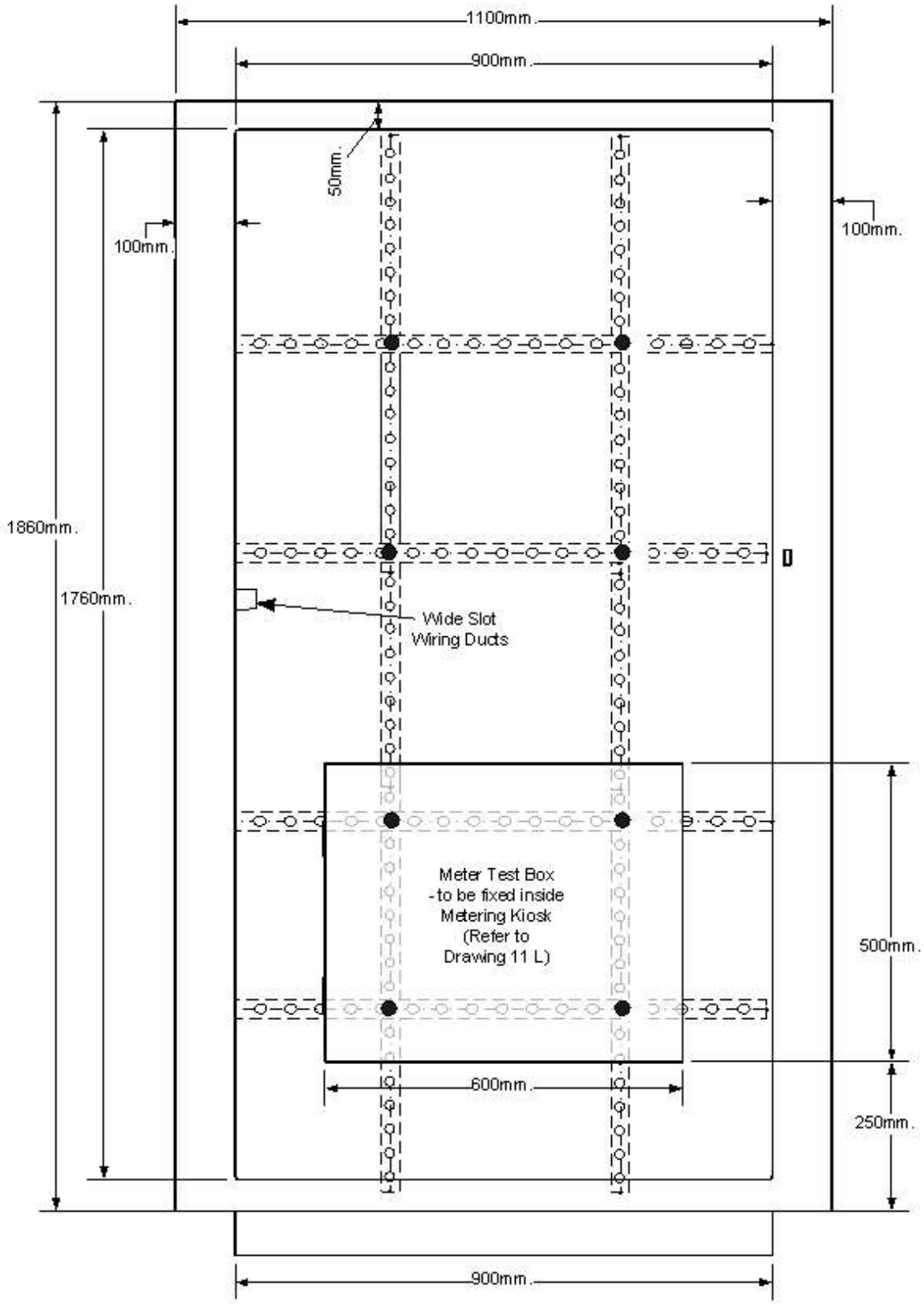

**Drawing 11 F : MV/HV, 3 FEEDER METERING KIOSK - Front View of External Door**



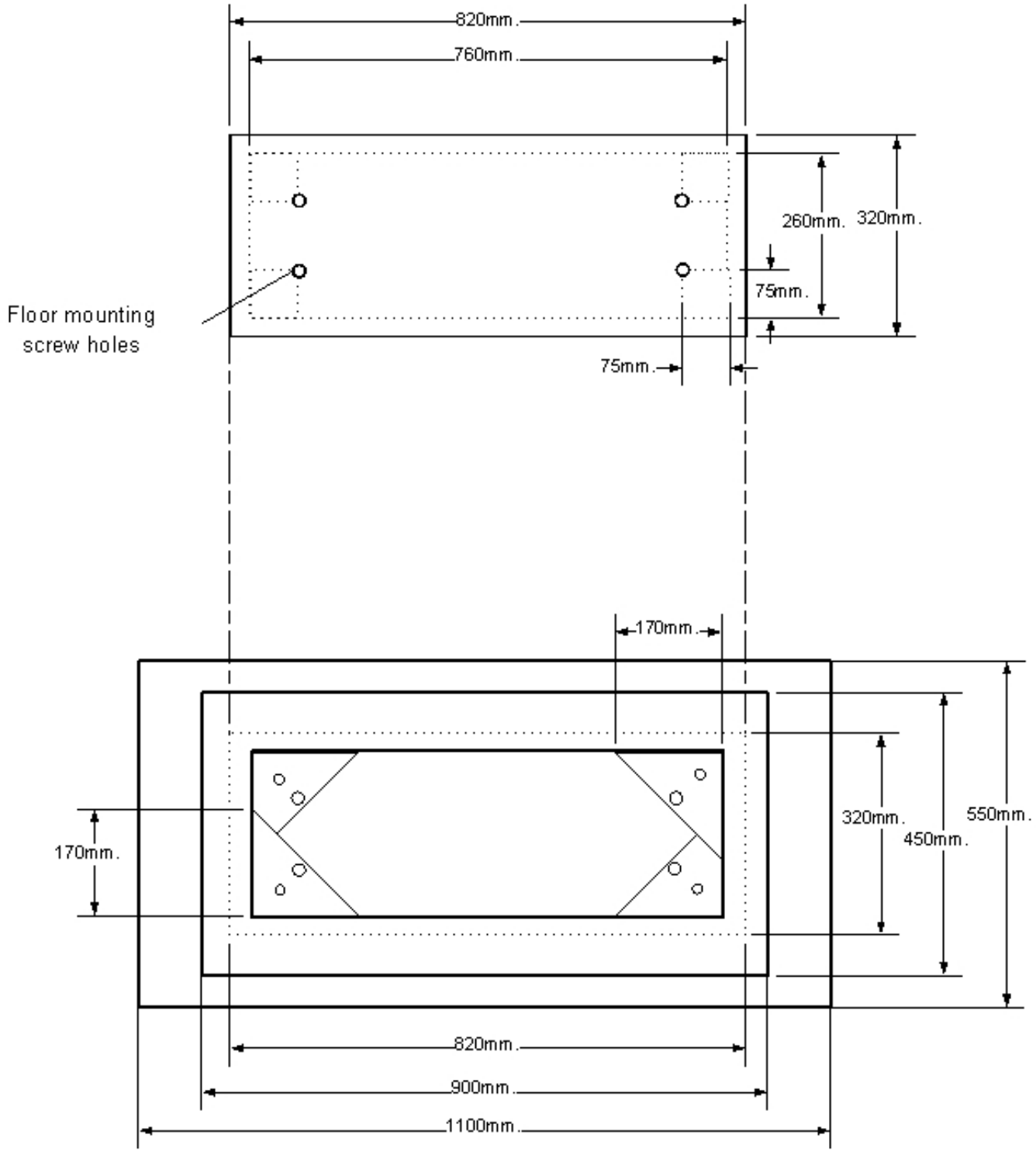

**Drawing 11 G : MV/HV, 3 FEEDER METERING KIOSK - Front View of Internal Door**




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

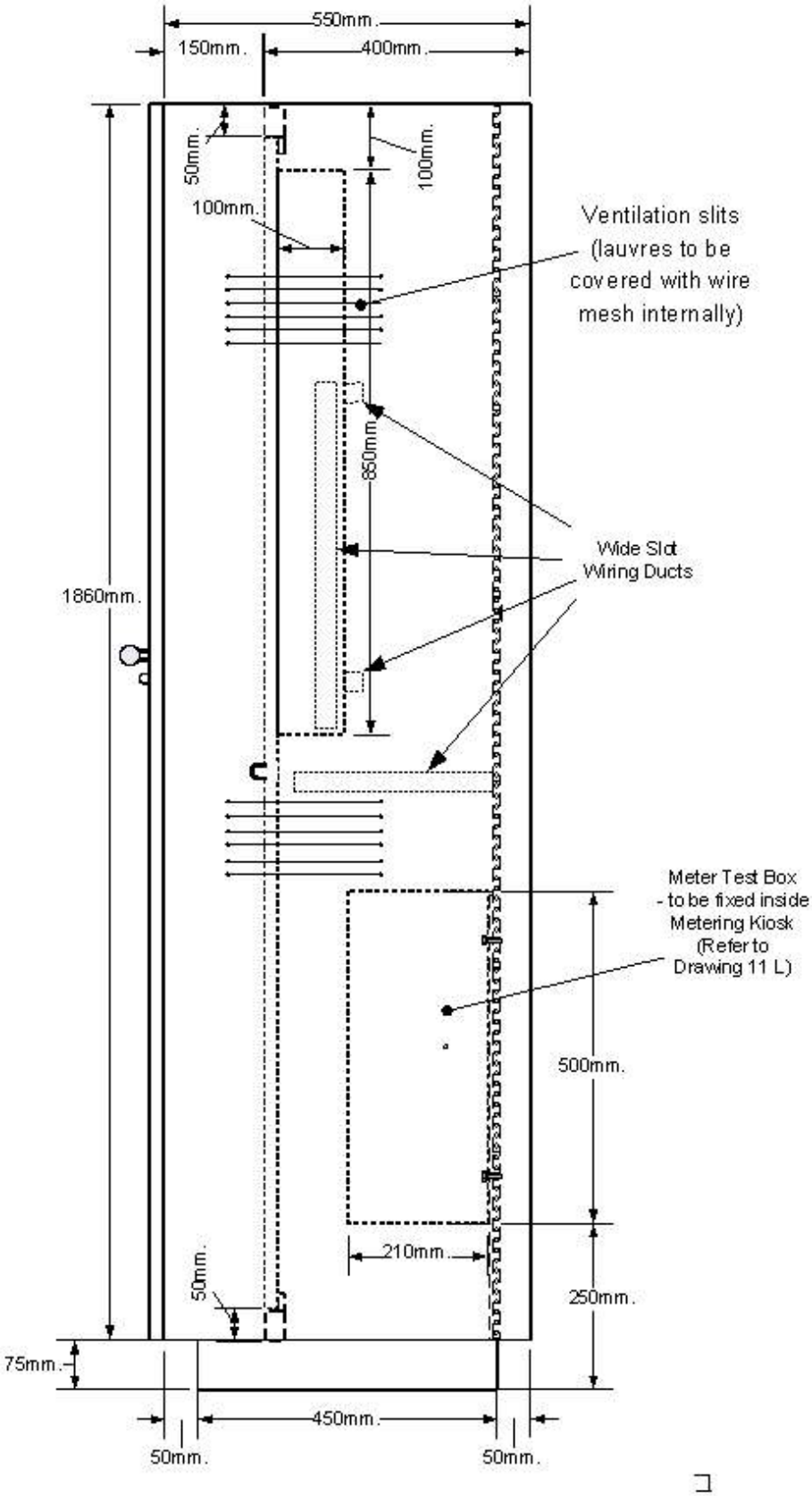



**Drawing I : MV/HV, 3 FEEDER METERING KIOSK - Front View of Kiosk Base**

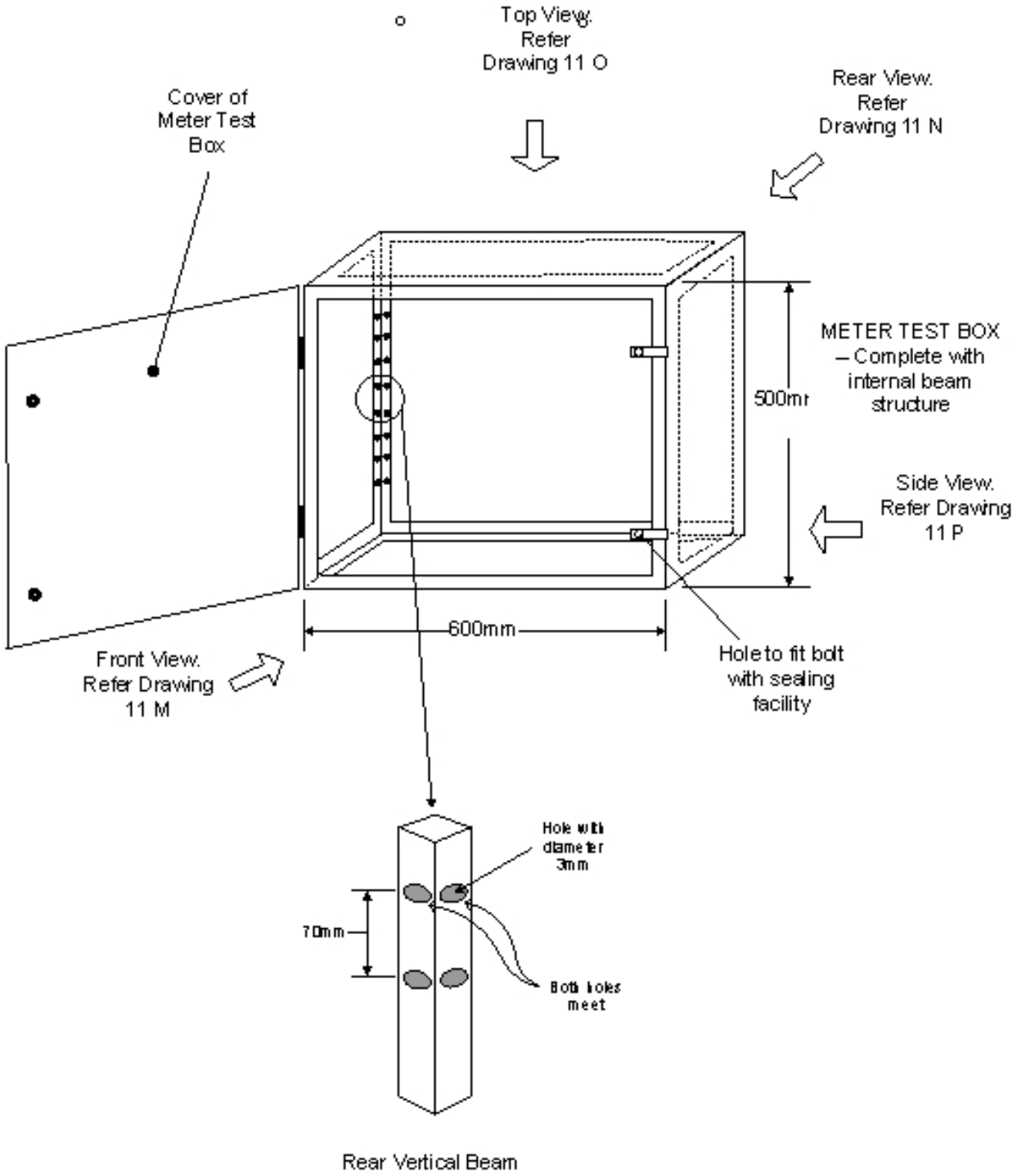



**MV/HV,3 Feeder Base:**
**Top View**

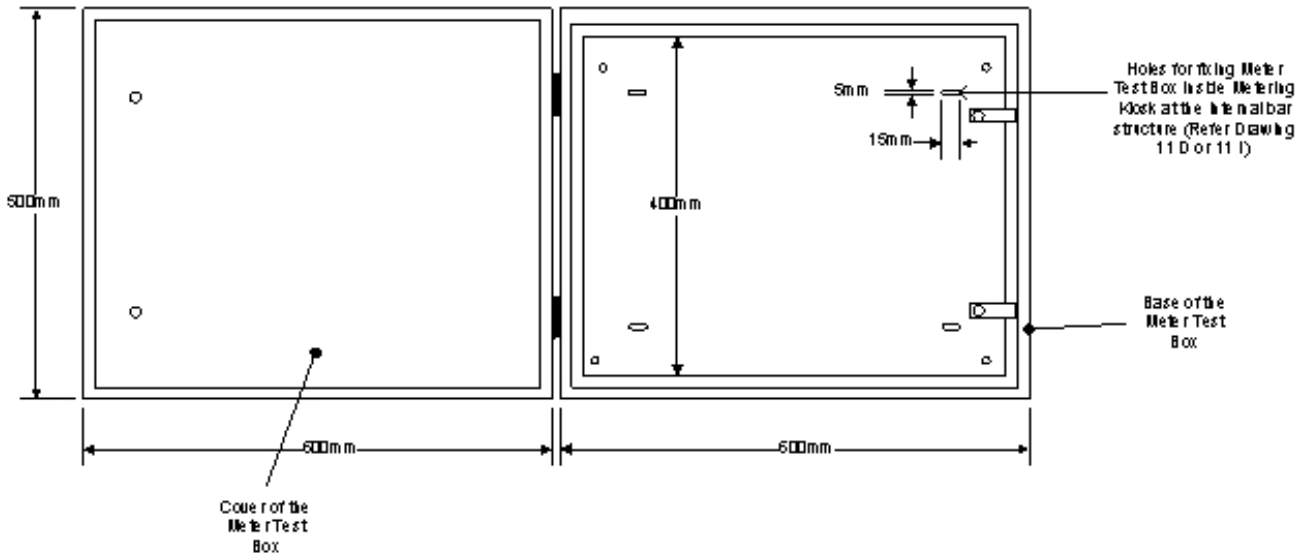
**Drawing 11 J : MV/HV, 3 FEEDER METERING KIOSK BASE - Top View of Base**



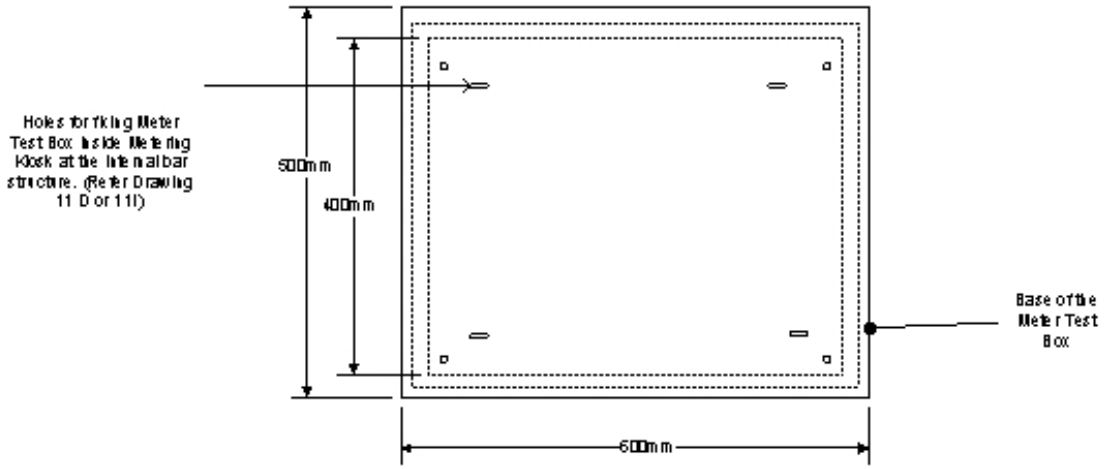

**Drawing 11 K : MV/HV, 1 OR 2 OR 3 FEEDER METERING KIOSK - Side View**



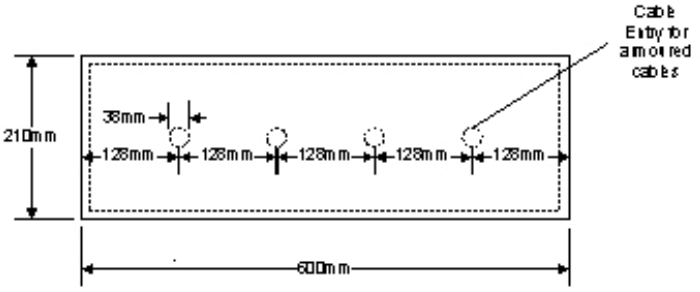

**Drawing 11 L: 1,2,3 OR 4 FEEDER METER TEST BOX - To be placed inside Metering Kiosk**



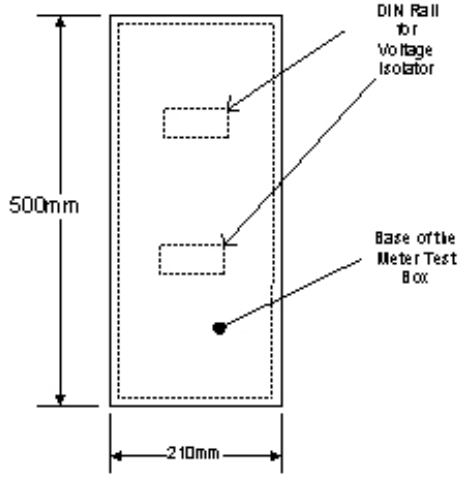

**Drawing 11 M : MV/HV, 1,2,3 OR 4 FEEDER METER TEST BOX - Front View**




**Drawing 11 N : 1,2,3 OR 4 FEEDER METER TEST BOX - Rear View**




**Drawing 11 O- Top View**




**Drawing 11 P - Side View**

**Published by:**

**Distribution Division**
**Tenaga Nasional Berhad**
**Website: http://www.tnb.com.my**

**Electricity Supply Application Handbook**
**Third Edition November 2011**

http://www.tnb.com.my

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