SPgroup
Empowering the Future of Energy

How to Apply For Electricity Connection

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Important Contact Numbers

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Testing and Turn-on Appointment	
Supply Application Section	6916 7200
Installation Section	6916 7744 / 6916 7430
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Enquiry	1800-222 2333
Endorsement of Substation Drawings	
East zone	6916 8557
West zone	6916 8679
Installation of Meters	
Elect Meters	6916 8555

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1 General Information

1.1 Introduction

1.1.1 SP Services Ltd (SPSL), SP PowerAssets Ltd (SPPA) and SP PowerGrid Ltd (SPPG) are subsidiaries of Singapore Power Ltd. SPSL provides support services for the electricity market. It receives requests for electricity service connection; offers terms and conditions of service connection; arranges for service connection energisation/turn-on; and collects transmission charges, security deposits and charges for other services on behalf of SPPA. SPSL also bills customers for consumption. SPPA is the Transmission Licensee and owner of the transmission and distribution network. SPPG, the managing agent for and on behalf of SPPA, develops, operates and maintains the transmission and distribution facilities.

1.1.2 The supply of electricity and electrical installation practices are governed by the Electricity Act and its subsidiary legislation.

1.1.3 All clauses, provisions and requirements set out in this handbook shall be read and construed in conjunction with the Transmission Code. It is the responsibility of the customers to manage and direct their agents to ensure that their agents comply with SPPA and Transmission Code requirements. In the event of any inconsistency between SPPA and Transmission Code requirements, the Transmission Code shall take precedence.

1.1.4 "Customer" and "consumer" shall have the same meaning in this handbook.

1.2 Connection Voltages and Supply Frequency

1.2.1 In Singapore, customers' installations are connected at the following voltages:

(a) Transmission voltage of 66kV, 230kV and 400kV

(b) Distribution voltage of 230V, 400V, 6.6kV and 22kV (may vary within ± 6%)

1.2.2 The supply voltages are classified in the following categories:

(a) Low Tension (LT) refers to 230V, single-phase and 400V, 3-phase

(b) High Tension (HT) refers to 22kV and 6.6kV

(c) Extra-High Tension (EHT) refers to 66kV

(d) Ultra-High Tension (UHT) refers to 230kV and 400kV

1.2.3 The following connection schemes are provided, according to customers' load requirements. It shall apply to new and existing customers, including customers who are revising their Contracted Capacity. The power factor shall be based on 0.85.

(a) Low Voltage, 50 Hz:

- 230V, single-phase, up to a maximum of 23kVA, 100A
- 400V, 3-phase, 4-wire system, up to a maximum of 5000kVA per substation

(b) 22kV, 50 Hz, 3-phase, 3-wire system for a Contracted Capacity:

- between 1,700kW and 12,750kW for 2 HT 22kV services
- between 12,751kW and 25,500kW for 4 HT 22kV services

(c) 66kV, 50 Hz, 3-phase, 3-wire system for a Contracted Capacity:

- between 25,501kW and 84,999kW for service connection from the nearest feasible 66kV substation
- between 85,000kW and 169,999kW for service connection from the nearest feasible 66kV source station

(d) 230kV, 50Hz, 3-phase, 3-wire system for a Contracted Capacity

- between 85,000kW and 424,999kW for service connection from the nearest feasible 230kV source station

(e) 400kV, 50Hz, 3-phase, 3-wire system for connection with minimum Contracted Capacity of 425,000kW

1.2.4 Where the customer requires a connection voltage and/or frequencies that differ from those specified above, the customer is required to provide, install and maintain the necessary transformation equipment.

1.3 Submission of Application

1.3.1 SPSL serves as a one-stop customer service centre. It receives all application forms on behalf of SPPA, and responds to all applications made by the Licensed Electrical Worker (LEW), who acts as the customer's agent for connection to the transmission system. SPSL may, in its sole and absolute discretion, deal with the customer directly.

1.3.2 For developments in the conception or planning stage that require a new connection or an upgrade/increase in Contracted Capacity/approved load to an existing connection, the customer is advised to engage SPPG at the early stage of project planning for consultation and/or submission of an electricity connection application. The early engagement allows SPPG to assess network requirements which includes considerations such as the provision of a substation, modifications to an existing substation/connection, and lead time required for service connection. The lead time is subject to network conditions and includes any network reinforcement that may be necessary to support the required load.

1.3.3 Customers applying for their installations to be connected to SPPA's transmission system must submit their applications through their LEWs. Every application must be accompanied by all supporting documentation requested by SPSL, including a letter of consent as shown in Appendix 1. The applications must be submitted via Singapore Power (SP) eBusiness Portal at *www.spgroup.com.sg*. A user manual can also be downloaded from the website.

1.3.4 For data centre developments, customers will need to include IMDA acknowledgement email as part of application submission. Please refer to Singapore Power (SP) eBusiness Portal for more information.

1.3.5 For applications relating to Revision of Contracted Capacity (ROCC), please refer to Chapter 2: Application for Grid Connection.

1.4 Provision of a Substation

1.4.1 Direct service connection from SPPA's LT network to the customer's installation is available for a small load requirement not exceeding 280kVA (400A). However, the provision of a direct service connection is dependent on the available network capacity in the vicinity. If there is insufficient capacity, the customer is required to provide a substation for the connection.

1.4.2 For a larger load requirement exceeding 280kVA (400A), the customer has to provide a substation for SPPA to install necessary equipment to cater for the load.

1.5 Domestic Premises and Load Requirement not exceeding 45kVA

1.5.1 For premises where the electricity meter has already been installed by SPPA and no extension or rewiring work is required, customer may submit for an opening of utilities account to SPSL directly. Turn on of electricity service connection will happen on customer's requested turn on date, subject to availability of appointment slots.

1.5.2 For premises where there is no electricity meter or where extension or rewiring work is required, the customer has to engage a LEW and submit an application for load connection.

1.6 Meter

1.6.1 All meters required for measuring a customer's electricity consumption and demand (where applicable) are provided and maintained by SPPA. The customer has to provide meter boards, compartments, kiosks, etc. as SPPA requires them for the installation of its metering equipment.

1.6.2 Master- And Sub-Metering

(a) A "Master-meter" is a meter measuring the consumption for all units and common areas in a building or cluster of buildings, which are used or occupied by multiple consumers. For master-metering scheme, the common services load must be at least 10% of the total load for the premise.

(b) A "Sub-meter" is a meter measuring the consumption for a unit in a building or cluster of buildings used or occupied by multiple consumers, whose electricity is taken through a Master-meter.

(c) A master and sub-metering scheme is applicable for multi-tenanted premises. Under this scheme, the electricity supply is metered at the intake point and each tenant's supply is also separately metered and billed under the appropriate tariff. The owner/ developer/ landlord shall be billed for the difference in the consumption between the consumption metered at the intake point and the summated consumption of the tenants. Where the owner/ developer/ landlord takes supply at high tension and is responsible for stepping down the supply to 230V/ 400V for distribution to tenants, a rebate of 2.5 % on the summated consumption of the tenants will be granted.

(d) The owner/developer/MCST/landlord is to ensure that the owners (for self-occupied units) or tenants (as the case might be) of individual units apply for the requisite utility account immediately upon taking possession of such units. The owner/developer/MCST/landlord is to maintain strict access controls over the switchboard, which contains the switches for the electricity supply from the main supply received from the network operator to the individual units at the supplied premises. The owner/developer/MCST/landlord shall be responsible for any charges arising as a result of unauthorised consumption of electricity by individual units or otherwise in the supplied premises.

1.6.3 Multi-Metered Premises

The following are categories of multi-metered premises:

(a) Residential premises which have landlord and tenant supply connections

(b) Commercial complexes which have landlord and tenant supply connections

(c) Multi-storey factories or industrial complexes which have landlord and tenant supply connections

(d) All multi-metered premises fall under the Master and Sub-metering scheme with the exception of HDB residential premises.

1.7 Tariffs for Non-Contestable Customers

1.7.1 Tariffs are currently charged for low tension, high tension and extra-high tension electricity consumption.

1.7.2 Tariffs are subject to change and are published by SPSL quarterly. Online information on the latest electricity tariffs is available at *www.spgroup.com.sg*.

1.8 Payments for Electricity Charges by Contestable Customers

1.8.1 Contestable customer pays to SPSL or authorised retailers, charges for electricity consumption as ascertained by meters, and transmission charges and other fixed

charges as determined by SPSL. Payment for electricity charges must be made on or before the due date specified in the bill.

1.9 Opening Account and Payment of Security Deposit for Use of System (UOS) Charges

1.9.1 The customer must open an account and place a security deposit for UOS charges with SPSL upon application for energisation of service connection.

1.10 Termination of Account

1.10.1 Non-contestable customers must give 4 business days' notice and contestable customers must give 7 business days' notice to terminate an account. Termination can be submitted to SPSL via the digital channels available, unless the contestable customer is under an electricity retailer which in this case termination should be submitted to the electricity retailer. The customer must also request for removal of service cable (if necessary) upon notice to terminate the account. Upon receipt of a completed form, electricity supply will be terminated on the 8th business day for contestable customers. For High-Tension (HT) consumers, LEW is required to be present and to ensure the premise is ready for cut-off on the appointment date.

1.11 Disconnection of Service Cables upon Termination of Account

1.11.1 Disconnection work involves the de-energisation of service cables. It may also involve the removal of service cables and/or equipment if they are no longer required.

1.11.2 Where the removal of service cables and/or equipment is involved, the following are indicative lead times for the work:

(a) After the de-energisation of LT service cable, the lead-time is about 5 business days for the removal of LT service cables where road-opening work is not involved.

(b) Where road opening work is involved, a lead-time of 2 months is required.

(c) After the de-energisation of 6.6KV and 22KV service cables, the lead-time is about 3 months.

(d) For disconnection of 66kV and 230kV service cables, the lead-time for the de-energisation of service cables/ equipment is about 10 business days, subject to the approval of the Power System Operator (PSO). The subsequent removal of service cables and equipment will depend on the operational requirement and approval of the PSO.

1.11.3 Customers should take note the disconnection of service cables and termination of account are separate process. The respective lead time required must be catered for by the customer to the respective SP entities.

1.12 General

1.12.1 The customer agrees to comply with the terms of this document and to procure that its officers, agents and representatives shall so comply.

1.12.2 None of SPSL, SPPA, SPPG, Singapore Power Limited or any of Singapore Power Limited's affiliates (a "**SP Entity**") will be liable (including without limitation, for negligence or any other category of liability whatsoever) for any action taken by any of them under or in connection with the matters arising under or out of this document. No customer or any of a customer's officers, employees, agents or other representatives may take any proceedings against any officer, employee or agent of any SP Entity in respect of any act or omission of any kind by that officer, employee or agent in relation to any matter arising under or out of this document.

1.12.3 Each of SPSL, SPPA and SPPG retains the right, at its sole and absolute discretion, to amend, vary and/or supplement any terms of this document from time to time and its interpretation of any terms of this document shall be final and binding.

1.12.4 No failure on the part of each of SPSL, SPPA and SPPG to exercise, and no delay on its part in exercising, any right or remedy under this document will operate as a waiver thereof, nor will any single or partial exercise of any right or remedy preclude any other or further exercise thereof or the exercise of any other right or remedy. The rights and remedies provided to SPSL, SPPA and SPPG in this document are cumulative and not exclusive of any other rights or remedies (whether provided by law or otherwise).

1.12.5 Nothing in this document shall in any way affect the obligations of a customer and its officers, employees, agents or other representatives to comply with applicable provision of the Electricity Act and all regulations and codes promulgated thereunder.

2 Application for Grid Connection

2.1 Load Connection

2.1.1 Each premise, as identified by the house or block number issued by IRAS, is limited to a single customer intake connection point. For modification of connection (such as upgrading of the load requirement) to existing premises, the customer is required to amalgamate all existing service connection into one intake.

2.2 Consultation

2.2.1 For developments in the initial planning stage, the customer is can seek consultation with SPPG to ascertain SPPA's requirements for a new or modified connection to the transmission system. The LEW is required to submit the online Consultation Form via Singapore Power (SP) eBusiness Portal at *www.spgroup.com.sg*, together with a site/location plan to SPPG.

2.3 Application

2.3.1 For developments in the conception or planning stage that require a new connection or an upgrade/increase in Contracted Capacity/approved load to an existing connection, the customer is advised to engage SPPG at the early stage of project planning for consultation and/or submission of an electricity connection application. The early engagement allows SPPG to assess network requirements which includes considerations such as the provision of a substation, modifications to an existing substation/connection, and lead time required for service connection. The lead time is subject to network conditions and includes any network reinforcement that may be necessary to support the required load.

2.3.2 The online Application Form[1] together with a letter of consent (Appendix 1) and a copy of the site/ location plan must be submitted via Singapore Power (SP) eBusiness

[1] The 5-year load projection provided by the Customer in the CS1 application form is for planning purpose. Securing of network capacity is achieved by confirmation of Contracted Capacity in Customer Connection Agreement or approval of Revision of Contracted Capacity by the Transmission Licensee.

Portal at *www.spgroup.com.sg* by the LEW for new or modified connections of new or existing premises to the transmission system.

2.3.3 For data centre developments, customers will need to include IMDA acknowledgement email as part of application submission. Please refer to Singapore Power (SP) eBusiness Portal for more information.

2.4 Revision of Contracted Capacity (ROCC) Application for Existing HT & Above Customer

2.4.1 For contestable accounts supplied through an electricity retailer, the customer shall approach their electricity retailer, who will submit the ROCC application on the customer's behalf through SP's eBusiness Portal.

2.4.2 For non-contestable accounts, the customer's Building Licensed Electrical Worker (LEW) shall submit the ROCC application on the customer's behalf through SP's eBusiness Portal.

2.4.3 For further details on the application requirements, assessment criteria, and approval process, please refer to the Transmission Service Rate Schedule set out on the *www.spgroup.com.sg/resources* website.

2.5 Processing of Application

2.5.1 Generally, SPSL responds to applications within 10 business days.

2.5.2 The responses are made according to the following customer categories:

(a) Contestable Customer

- A Consumer Connection Agreement, containing the service connection charge payable, the offer letter and the standard terms and conditions with respect to the distribution service connection.

- If a substation is required, a letter stipulating the requirements will be forwarded to the customer. It will be followed by an Agreement subsequently after the substation plans are endorsed.

(b) Non-Contestable Customer

- A Quotation, containing service connection charge payable and the conditions of service with respect to the distribution service connection.

- If a substation is required, a letter stipulating the requirements will be forwarded to the customer. A Supply Agreement including the service connection charge payable and the terms & conditions with respect to the distribution service connection, is offered after the substation plans are endorsed.

2.6 Commencement of Work

2.6.1 SPPG commences work only when the Agreement has been signed and received by SPSL, together with payment of service connection charges.

2.6.2 Customers are expected to prepare their premises to receive electricity supply within 1 year from the date of payment of the service connection charges. If the premises are not ready within this period, the quotation may be cancelled. Customers who wish to proceed after this period may be required to pay revised service connection charges based on prevailing requirements.

2.7 Type of Premises

2.7.1 Multi-Metered Premises

(a) Multi-metered premises are premises where the landlord/ MCST (i.e. a master-metered consumer or directly connected consumer) receives bulk intake service connection from SPPA, and transforms/ reticulates the supply to all the tenants (i.e. sub-metered consumers) within the premises. Any application for new or modified connection (includes upgrading) for the bulk intake to the multi-metered premises must be made by the landlord through its LEW.

(b) A master-metered consumer means a consumer that is responsible for the common usage of a master-metered installation, which is connected to the transmission system.

(c) A master-metered installation means an installation in which supply is received by a master-metered consumer and sub-metered consumers

(d) A master-metered installation shall have an independent address and its own dedicated access.

(e) A sub-metered consumer means a consumer, other than a master-metered consumer, that receives supply in a master-metered installation via the electrical system owned by a master-metered consumer.

2.7.2 The landlord/ MCST or HDB, in the case of HDB premises, must ensure that the total applied load requirement for service connections to the multi-metered premises meet the total existing and future load requirements for all tenants. All tenants applying for any upgrading of load must do so through their master-metered consumer. In this regard, the master-metered consumer must approve the load of all tenants within the premises.

2.7.3 If the landlord's existing approved load is insufficient to cater for the tenants' load requirement, the landlord, as a master-metered consumer, must submit an application to SPSL for modification (upgrading) of service connection to the existing premises. In this case, the existing service cables are amalgamated with the new intake. Hence, there will not be separate direct connections to the tenants of such premises.

2.8 Premises in Private Housing, Industrial Estates, Commercial Developments Requiring Provision of Low Tension (LT) Distribution Network

2.8.1 For connection to premises where several parcels of land are to be sold or leased individually, one or more substations must be provided by the developer. Where the individual parcels of land are to be sold prior to development of these substations, details of the substation requirements and approved load must be included in the sales agreement by the future land parcel's owner or lessee.

2.8.2 The developer must provide the development's total load requirement and include the breakdown of the individual premises' load requirement (as specified in the sales agreement) and the communal load requirement, if applicable.

2.8.3 In the case of landed housing estate development, the LEW must liaise with relevant Authorities, applicant's appointed Architects/Civil & Structural Qualified Person and owner of the house for the siting of proposed overground distribution boxes on turfed areas. SPPA will provide and install the LT distribution network and service connection cables for the development.

2.8.4 Premises Involving Temporary Connection with Provision of Substation:

(a) Special terms and conditions apply in such cases for temporary connection to construction worksites and other temporary premises. The term granted for temporary connection is usually 24 months.

(b) Where there is a need for the provision of a temporary substation, the customer must provide the site and construct the structure of the substation according to the requirements of SPPA.

(c) There will be a need to install the necessary cables and equipment to facilitate the temporary connection to the distribution network. The customer pays outright costs for the cables and a monthly hiring charge for the use of the equipment during the term for temporary connection.

2.8.5 Developers are advised to connect residential developments to the LT distribution network. Opting for a HT supply intake setup will subject the landlord/MCST to the following:

(a) Monthly Contracted Capacity charges

(b) Operating costs associated with HT equipment setup

2.9 Provision of Substation

2.9.1 When an application for load connection necessitates the provision of a substation (Appendices 9 and 10), a site must be provided and a substation constructed by the customer at its own cost.

2.9.2 The customer can either choose his substation to be a dedicated or non-dedicated one (Appendix 35). If the customer opts for a dedicated substation, he has to inform SPPG when he applies for connection. Otherwise, it shall be assumed that the substation would be non-dedicated.

2.9.3 The substation is to be sited at an inconspicuous location, away from the main entrance of the development and major public roads. It is recommended to harmonise, blend and integrate the substation with the overall design of its development. The siting of the substation must ensure continuous and unobstructed vehicular access to the substation and the associated lead-in pipes at all times, to facilitate equipment delivery, operational activities, maintenance and cabling works by SPPG.

2.9.4 SPPG's officers and vehicles will have full and unrestricted access to the substation at all times (Appendix 15).

2.10 Service Connection Cables

2.10.1 Generally, SPPA supply, install and maintain customer service cable. However, if the customer's switchroom is not abutting to SPPA's switchroom or at different level to the substation building, or service cable to be installed in cable tray/ ladder, or the cable termination to the customer switchboard is not via bottom entry, the customer shall supply, install and maintain the service cable. In the event that customer supplies the service cable, the customer's LEW shall ensure that the service cable complied with SPPA cable specification, and submit cable sample and specification to Distribution Engineering Section for approval prior to procurement. The general type of cables for service connection is shown in Appendix 36.

2.10.2 For service cable that is supplied, installed and maintained by SPPA, customer shall provide UPVC lead-in pipes from intake point to 300mm beyond boundary line or the roadside drain abutting public road at a depth not exceeding 2.0m from the finished road level. All installed pipes to pass through Mandrel Tests prior to inspection by SPPG (see Appendix 15.1). For service connection at 66kV or above, the lead-in pipes shall be installed under drain / box culvert / utility service duct immediately outside site boundary and are to be extended up to 300mm beyond the road kerb where applicable.

2.10.3 Draw pit(s) shall be provided strategically including each turn of the service cable to facilitate the installation of the service cable.

2.10.4 The distance between surface of trench and service cable termination point shall be at least 900mm.

2.11 Opening of Account for Upgrading/ Downgrading of Electricity Supply (Assuming No Change in Contestability Status)

2.11.1 The consumer is not required to open a new account if the electricity supply remains at low voltage (LV)

2.11.2 The consumer is required to open a new account if the electricity supply is upgraded from LV to high voltage (HV), and the existing LV supply is cut off before the new HV supply is turned on.

2.11.3 The consumer is required to open a new account if the electricity supply is changed from LV to HV, HV to LV or HV to HV at different voltage level (e.g. 6.6kV to 22kV),

when the new and existing supply intakes are to run concurrently during transition period.

2.12 Consultation for Transmission Connection

2.12.1 A customer may choose to seek preliminary comments from SPPG via the connection consultation process before submitting a formal application. This practice is encouraged as incorporating SPPA's requirements in a developer's preliminary proposal would expedite the application process at a later stage.

2.12.2 To initiate the connection consultation process, the customer has to submit the online Consultation Form through an LEW via Singapore Power (SP) eBusiness Portal at *www.spgroup.com.sg*.

2.13 Application for Transmission Connection

2.13.1 The following are steps in the application for service connection:

(a) The customer submits the online Application Form [2] through an LEW via Singapore Power (SP) eBusiness Portal at *www.spgroup.com.sg*, together with a letter of consent (Appendix 1) and IMDA acknowledgement email (for data centre applications only).

(b) A connection proposal, duly endorsed by the PSO, is given to the customer. It outlines the connection scheme, connection voltage, connection equipment and facilities required of the customer and the estimated connection charges. SPPG endeavours to respond to the customer within 60 business days and 100 business days for 66kV connections and 230kV connections respectively.

2.13.2 Where the application requires the provision of an EHT substation, the customer must adhere to the general requirements (Appendix 16).

2.13.3 Once customer acknowledges acceptance of SPPG's connection proposal, SPPG proceeds to execute the Consumer Connection Agreement through SPSL. The Agreement contains an Offer Letter, the standard terms and conditions associated with the connection and an estimation of the connection charges.

2.14 Lead-Time for Application of Transmission Connection

2.14.1 The timely provision of electricity supply to a development involves the joint efforts of SPSL, SPPG, and the customer and their agents, such as the LEW. While SPSL and SPPG will make every effort to engineer and implement the connection scheme, it is at the same time essential for the new customers and their agents to co-operate via timely submission of applications and plans, timely acceptance of the terms and conditions of connection and compliance with the necessary SPPA or Transmission Code requirements. It is the responsibility of the customers to manage and direct their

[2] The 5-year load projection provided by the Customer in the CS1 application form is for planning purpose. Securing of network capacity is achieved by confirmation of Contracted Capacity in Customer Connection Agreement or approval of Revision of Contracted Capacity by the Transmission Licensee.

agents to ensure that their agents comply with the necessary SPPA or Transmission Code requirements.

2.14.2 As a guide for the customer and their agents, the typical lead-times for the events leading to the energisation of 66kV service connections, for a service cable length of approximately 2km, are listed in the box below. The actual lead time for energisation may vary for each connection, depending on the actual service cable length and the progress of intermediate events leading to completion of service connection works. Customers will be informed accordingly either at the point of application or at any time a review is required. For 230kV service connections, the customer will be informed of the lead-time only at the point of application.

2.14.3 Estimated Lead Time for Energisation of 66kV Service Connection

Events	New 66kV connection from SPPA's nearest existing substation
From day of execution of consumer connection agreement to energisation of service connection	26 Months[1]

Notes:

1 Lead time is based on a service cable length of approximately 2km and is subject to change based on length of service connection cables. Note that this lead time excludes additional time required to comply with requirement from URA Infrastructure Planning Authority Group (IPAG). The customer needs to consult SPPG at least 5-8 years in advance to cater for advanced planning.

2.15 Technical Requirements of Distributed Generation and New Extra / Ultra High Tension Connection

2.15.1 The details of technical requirements at the electricity supply network Point of Common Coupling (PCC)/Connection Point (CP) for Distributed Generation (DG) and New Extra / Ultra High Tension (EHT/UHT) connection are highlighted in Appendix 46. For the purposes of this handbook, the terms Point of Common Coupling (PCC) and Connection Point (CP) shall be considered equivalent unless otherwise specified.

2.15.2 The Consumer shall ensure that multiple sources of transmission, and/or distribution, systems are not connected in parallel at any time, and that any switching between circuits is undertaken on "black changeover" or "break before make" basis.

2.15.3 Some of the requirements are covered in the Transmission Code issued by Energy Market Authority (EMA). The appointed LEW shall ensure the connection is compliant with the Transmission Code, and shall consult SP Group with regards to the application process and technical requirements if further clarifications are required.

2.16 Technical Requirements for Non-Residential Solar Photovoltaic (PV) Connection

2.16.1 The details of technical requirements at the electricity supply network Connection Point (CP) for Solar Photovoltaic (PV) connection are highlighted in Appendix 39 & Appendix 46. For more information on PV requirements, please refer to the SP Group website at www.spgroup.com.sg. The appointed LEW shall ensure the technical requirements are to be fully compliant. In the event of non-compliance of the technical requirements, the appointed LEW shall disconnect the Solar PV Connection until all technical requirements are met.

2.16.2 The appointed LEW shall ensure that the installed capacity of the Low Tension (LT) embedded Solar PV Connection, in kVA, is within the premise's/precinct's approved load.

2.16.3 The appointed LEW shall ensure that the Solar PV Connection's generation is balanced on all High Tension (HT) service connection cables at all times.

2.16.4 The appointed LEW shall ensure that the Solar PV system is automatically disconnected in the event of loss of supply from the grid.

2.16.5 The permissible capacity for solar PV systems varies across individual network due to local network conditions. Consumers intending to install solar PV systems are advised to consult SPPG through the LEW to determine the permissible capacity at their required location before making investment decisions.

2.17 Technical Requirements for Residential Solar PV Connection

2.17.1 The details of technical requirements at the electricity supply network Connection Point (CP) for Solar Photovoltaic (PV) connection are highlighted in Appendix 39 & Appendix 46. For more information on PV requirements, please refer to the SP Group website at www.spgroup.com.sg. The appointed LEW shall ensure the technical requirements are to be fully compliant. In the event of non-compliance of the technical requirements, the appointed LEW shall disconnect the Solar PV Connection until all technical requirements are met.

2.17.2 The appointed LEW shall ensure that the installed capacity of the Low Tension (LT) embedded Solar PV Connection, in kVA, is within the premise's/precinct's approved load.

2.17.3 The appointed LEW shall ensure that the Solar PV system is automatically disconnected in the event of loss of supply from the grid.

2.17.4 Voltage levels at the Connection Point (CP) may fluctuate depending on the prevailing network conditions such as the presence of connected solar PV systems. In the event of an overvoltage, the Customer's generating facility may experience a temporary reduction in generation and/or export to the network.

3 Transmission Charges

3.1 Connection Agreement

3.1.1 All consumers are required to enter into a Connection Agreement with SPPA and pay Use of System (UOS) charges. All consumers having a direct connection to the transmission system must also pay a service connection charge.

3.1.2 The Connection Agreement for consumers taking HT supply at 6.6 kV or 22 kV, EHT supply at 66 kV or UHT supply at 230 kV and above will, inter alia, state the Contracted Capacity, which is deemed to be the requirement for a period of five years. Consumers cannot reduce their Contracted Capacity until the expiry of the 5-year binding period. Furthermore, a consumer who terminates the Connection Agreement during the 5-year binding period will be required to pay SPPA through SPSL/Retailer, the Contracted Capacity Charge for the unexpired portion of the 5-year binding period.

3.1.3 UOS charges are payments for the use of transmission services. The UOS charges are paid for electricity transmission services at each metered intake supply point in accordance with the voltage at which a consumer receives the electricity supply. The UOS charges are subject to annual review and the revised UOS charges will be published by SPPA.

3.1.4 In the case of HT and EHT supply to multi-metered premises, the landlord has to enter into a Connection Agreement for the network capacity required for his own load only, i.e. supply for common services, etc.

3.2 Use of System (UOS) Charges

3.2.1 The UOS charges shall be paid for electricity transmission services at each metered intake supply point in accordance with the voltage at which a consumer receives the electricity supply. Please refer to the Transmission Service Rate Schedule set out on the www.spgroup.com.sg/resources website.

4 Energisation and Turn-On Procedures

4.1 General

4.1.1 The term 'energise', in the case of a customer's installation that is directly connected to the transmission system, refers to the closing of a circuit breaker or other isolating device that is owned and controlled by SPPA. "Energisation", "de-energisation" and "re-energisation" and all grammatical variations of the term shall be interpreted accordingly.

4.1.2 Arrangements need to be made with SPSL for energisation of the service connection and turn-on of a customer's electrical installation. This is taken care of by the LEW.

4.2 Premises Electrical Installations that are previously Inspected and Energised

4.2.1 Non-Domestic Premises with Load Requirement not exceeding 45kVA, and Domestic Premises where Electrical Installations are provided and Pre-Inspected or Previously Inspected and Energised

(a) This category includes all new HDB apartments and dwelling units in some private residential developments where electrical installations are provided and inspected in advance. It also includes non-domestic premises with supply capacity not exceeding 45kVA and domestic premises where the existing electrical installations and service connections are intact and only the supply is required to be re-energised.

(b) The customer has to open an account with SPSL for electricity service connection (Appendix 6).

(c) The customer is given an appointment for turn-on of service connection. For electrical safety reasons, the customer or his representative must be present at the premises for the turn-on of electricity service connection.

4.2.2 Non-Domestic Premises with Load Requirement exceeding 45kVA where Electrical Installations are previously inspected and energised

(a) This category includes non-domestic premises (supply capacity exceeding 45kVA) where the existing electrical installations, meters and service connections are intact and only the supply is required to be re-energised.

(b) The customer has to open an account with SPSL for electricity service connection (Appendix 6).

(c) The customer has to apply for a licence from Energy Market Authority (EMA) to use or operate the electrical installation through an appropriate class of licensed electrical worker.

(d) Upon submission of the licence, the customer is given an appointment for turn-on of service connection. The licensed electrical worker must be present at the premises to issue a copy of the licence to SPSL during the turn-on of electricity service connection.

4.2.3 Non-Domestic Premises with Load Requirement exceeding 45kVA where Electrical Installations are previously inspected and is still energised

(a) This category includes non-domestic premises (supply capacity exceeding 45kVA) where the existing electrical installations, meters and service connections are intact and a new customer is taking over the electrical installation.

(b) The new customer has to open an account with SPSL for electricity service connection.

(c) The new customer has to apply for a licence from Energy Market Authority (EMA) to use or operate the electrical installation through an appropriate class of licensed electrical worker.

(d) Upon submission of the licence, the new customer is given an appointment date for meter reading for account transfer. The licensed electrical worker or a customer/representative must be present at the premises to issue a copy of the licence to SPSL.

(e) If an AMI meter is installed at the premise, a copy of the licence must be submitted together with the account opening form before an appointment date can be given to effect the account transfer.

4.3 Premises with Direct Connection from SPPA'S Transmission System

4.3.1 Domestic Premises (all load requirements)

(a) The customer opens an account with SPSL, if an account has not already been opened.

(b) Upon completion of the electrical installation and receipt of notification from SPPG on energisation/ readiness of the service connection, the LEW books an appointment with SPSL for inspection and turn-on of the customer's installation.

(c) For load below 45kVA, this is done by submitting online Form CS/5 Application for Inspection of Electrical Installation via Singapore Power (SP) eBusiness Portal at *www.spgroup.com.sg*, together with a letter of consent (Appendix 1) and the Certificate of Compliance, COC, (Appendix 37) to Supply Application of SPSL. Application for Electrical Installation Inspection test up to 45kVA (Appendix 40) is also required. For retest application, the required documents for submission to be sent via email to install@spgroup.com.sg are Certificate of Compliance, COC, (Appendix 37), receipt for payment of retest fee and Application for Electrical Installation Inspection test up to 45kVA (Appendix 40).

(d) For load above 45kVA, this is done by submitting the Inland Revenue Authority of Singapore, IRAS, letter stating the official addresses, COC, Form E – Certificate of Fitness of Residential Unit (Appendix 44) and the as-build Single Line Drawing, SLD, to Elect Installation Section of SPSL.

4.3.2 The electrical installation is connected to SPPA's transmission system on the scheduled turn-on date if the electrical installation is safe to receive electricity supply.

4.3.3 The LEW must be present during inspection of the electrical installation by SPSL. For electrical safety reasons, the customer or his representative must also be present at the premises for the turn-on of electricity service connection. A 'PASS' Inspection Report will be issued by SPSL on-site upon successful turn-on of the customer's installation.

4.4 Non-Domestic Premises

4.4.1 Load Requirement Not Exceeding 45kVA

(a) The customer opens an account with SPSL, if this has not already been done.

(b) Upon completion of the electrical installation and receipt of notification from SPPG on energisation of the service connection, the LEW books an appointment with SPSL for inspection and turn-on of the electrical installation.

(c) This is done by submitting online Form CS/5– Online Application for Inspection of Electrical Installation via Singapore Power (SP) eBusiness Portal at *www.spgroup.com.sg*, together with a letter of consent (Appendix 1) and the COC form (Appendix 37) to Supply Application of SPSL. Application for Electrical Installation Inspection up to 45kVA (Appendix 40) is also required.

4.4.2 The electrical installation is connected to SPPA's transmission system on the scheduled turn-on date if the electrical installation is safe to receive electricity supply. The LEW must be present during inspection of the electrical installation by SPSL. For electrical safety reasons, the customer or his representative must also be present at the premises for the turn-on of electricity service connection. A 'PASS' Inspection Report for the customer's installation is issued by SPSL upon successful turn-on.

4.4.3 Load Requirement Exceeding 45kVA

(a) The customer submits an application for an account, to SPSL if this has not already been done, and applies for a licence from Energy Market Authority (EMA) to use or operate an electrical installation.

(b) Upon completion of the electrical installation and receipt of notification or advance notification from SPPG on the readiness of service connection, the LEW must inspect and test the electrical installation before booking an appointment with SPSL's Elect Installation Section for the installation of meter and energisation of service connection by SPPG. This is done by submitting a letter confirming the readiness of the service connection and the COC form. Alternatively, the LEW can submit the Application for Appointment for Energisation of the Service Connection (Appendix 23) by email to largeinstall@spgroup.com.sg.

(c) The LEW requesting for energisation of supply line has to arrange for the LEW responsible for the operation of the electrical installation and the customer (or his representative) to be present during the energisation.

(d) The electrical installation is connected to SPPA's transmission system on the scheduled energisation date if the electrical installation is safe to receive electricity supply. The LEW must issue a Certificate of Readiness (COR) form (Appendix 20) to SPPG at site, prior to energisation of the service connection.

(e) Upon successful energisation of service connection to the customer's installation from SPPA's direct connection, all parties are to acknowledge on the Statement of Turn-On of Electricity.

4.5 Booking an Appointment

4.5.1 Before booking an energisation and turn-on appointment, the LEW must ensure the following:

(a) Metering requirements, where applicable, have been submitted and formal clearance has been given by SPPG's Electrical Meters Section. All necessary meters have been installed.

(b) The customer's main incoming switchgear, protection system and earthing system have been successfully tested by an LEW. The HT metering panel has been provided, and testing of the metering current transformers/voltage transformers have been carried out and meters installed by Electrical Meters Section.

(c) The service cables to the installation are ready to be energised.

(d) A utilities account has been opened, an Agreement has been signed, and a security deposit for UOS charges has been paid by the customer.

(e) A licence to use or operate the electrical installation, where applicable, has been obtained from EMA.

(f) For service connection at a system voltage level of 66kV and above, the final clearance for the EHT switching procedure must be obtained from the PSO prior to the confirmation of the first energisation date.

Notes:

- The EHT switching procedure must be jointly prepared and endorsed by the LEW, who is authorised to perform EHT switching (at customer's installation), and SPPG's Project Engineer.

- For 66kV and above, the LEW must submit the COC form to SPPG's Project Engineer.

4.6 Making an Appointment for Energisation of Service Connection Direct from SPPA's Transmission System - Load Requirement not Exceeding 45kVA

To make an appointment to turn-on electricity supply, the LEW shall submit online Form CS/5 – Online Application for Inspection of Electrical Installation on behalf of the customer, together with a letter of consent (Appendix 1) and the COC form (Appendix 37), to request for an inspection and turn-on to the premises. The LEW is required to submit application via online portal at Singapore Power (SP) eBusiness Portal at *www.spgroup.com.sg*.

4.7 Load Requirement Exceeding 45kVA Up to 22kV Supply Voltage

4.7.1 An appointment for energisation of electricity service connection of load requirements greater than 45kVA and up to 22kV supply voltage can be made as follows:

(a) LEW can submit the Application for Appointment for Energisation of the Service Connection (Appendix 23) together with COC Form (Appendix 37) and relevant supporting documents by email at largeinstall@spgroup.com.sg to Elect Installation Section. The original copy of the COC Form must be submitted to SPPG on the scheduled energisation date.

(b) A lead-time of 14 business days is required for the LEW to request for the energisation of SPPA's service connection and turn-on of the customer's installation.

(c) Energisation of service connection involves several parties. An officer at SPSL's Elect Installation Section co-ordinates with SPPG for the energisation of the service connection for supply taken directly from SPPA's transmission system.

4.8 Submission of Application for New EHT and HT Consumers who wish to be Contestable at Time of Turn-On

4.8.1 The LEW shall proceed to liaise directly with Electrical Meters Section of SPPG to have the AMI meter installed.

4.8.2 Upon completion of the installation of the AMI meter, the consumer shall submit a copy of the duly completed APPLICATION FOR CONTESTABILITY STATUS & MARKET SUPPORT SERVICES ("MSS") ACCOUNT (Appendix 41) to MSSL Ops at contestableappln@spgroup.com.sg at least 12 business days prior to your arrangement for the turn-on appointment.

4.8.3 If the customer chooses to purchase electricity from a Retailer with effect from the turn-on date, the Retailer must submit the contestability application detailed in Section 4.8.2 minus the security deposit on behalf of the customer to MSSL Ops. Thereafter the Retailer must submit the electronic business transaction for a transfer request to SPSL at least 1 business day before the turn-on date.

4.8.4 Otherwise, SPSL will arrange to buy electricity for the customer from the wholesale electricity market and the customer will be charged for the electricity consumption at prevailing wholesale spot prices. In this case, a security deposit to SPSL is required.

4.8.5 The LEW shall proceed to apply to EMA for EI Licence.

4.8.6 The LEW shall submit a copy of COC, EI Licence, IRAS's Letter stating official address and book an appointment for energisation of service connection via email at largeinstall@spgroup.com.sg to Elect Installation Section of SPSL for HT Supply or at respective Regional Projects Section (East/West) of SPPG for EHT Supply.

4.9 Premises with Indirect Connection - Load Requirement not Exceeding 45kVA (i.e. Premises in a Multi-Metered Development)

4.9.1 The customer opens an account with SPSL if this has not already been done.

4.9.2 The customer submits online Form CS/5 – Online Application for Inspection of Electrical Installation via Singapore Power (SP) eBusiness Portal at *www.spgroup.com.sg* through the LEW together with a Letter of Consent from the Landlord/Management Corporation or HDB (Appendices 3 and 4). The LEW can also book an appointment for inspection of the electrical installation at the time of submission of the application and, in the meantime, proceed to carry out the wiring/extension work.

4.9.3 The LEW is responsible for arranging the energisation of the service connection with the relevant party responsible where connection is taken via the landlord's switchboard - such as in HDB, JTC or other private multi-metered buildings.

4.9.4 Service connection will be turned-on on the scheduled inspection date if the electrical installation is safe to receive electricity supply. The LEW must be present during the inspection. A 'PASS' Inspection Report for the customer's installation will be issued by SPSL upon successful turn-on. The LEW must issue a Statement of Turn-On of Electricity and this must be acknowledged by the relevant parties.

4.10 Load Requirement Exceeding 45kVA (Multi-Metered Building Scheme)

4.10.1 When the premise is ready for installation of meters, the customer shall proceed to open a utilities account with payment of security deposit to SPSL.

4.10.2 The LEW shall proceed to apply to EMA for EI Licence before the electricity supply is turned on.

4.10.3 The LEW shall submit Form CS/3 (Appendix 3) or Form CS/3H (Appendix 4), Form CS/7 - Request for Installation of Electricity kWh Meter (for Load Exceeding 45kVA) (Appendix 22) and a copy of COC and EI Licence to SP Services declaring the account activation date (which is the proposed turn-on date).

4.10.4 The LEW shall proceed to liaise with Electrical Meters Section of SPPG to install meters.

4.10.5 For HT Supply, the consumer is required to sign an agreement with SPPG before SP Services can process the application for installation of TOD meter.

4.10.6 The LEW shall be responsible for arranging the energisation of the service connection with the relevant party where the connection is taken via landlord's switchboard such as HDB, JTC or private multi-tenanted buildings.

4.10.7 Landlord's LEW shall issue the Statement of Turn-On of Electricity (SOTO) upon successful turn-on.

4.11 Modification to an Existing Electrical Installation

4.11.1 Modification work (e.g. extension, rewiring, shifting of meter) carried out to an existing electrical installation where a licence to use or operate is not required, must be inspected by SPSL before the new/modified portion of the wiring can be used.

4.11.2 The LEW must submit an application for inspection online Form CS/5 via Singapore Power (SP) eBusiness Portal at *www.spgroup.com.sg* together with a letter of consent (Appendix 1) for the modified electrical installation.

4.12 Submission of Completion Certificate for Modification of Small Electrical Installation (Exempted from Licensing)

4.12.1 The LEW shall submit to SPSL the duly completed online Form CS/5, together with Form CS/3 (Appendix 3) or Form CS/3H (Appendix 4) and the Completion Certificate for Modification of Electrical Installation (Appendix 43) on behalf of the customer. (Note: First-time inspection is free-of-charge and Form CS/3 or Form CS/3H is not required for HDB residential premises)

4.12.2 SPSL conducts spot-checks for those system-selected applications.

4.12.3 For those applications not selected, acknowledgement letters will be sent to both the customer and the LEW.

4.12.4 If the inspection is "Failed", the LEW will have to come to SPSL with a copy of the "Failed" letter to arrange for a re-inspection. A re-inspection fee is payable.

4.12.5 If the inspection is "Passed", acknowledgement letter will be sent to both the customer and the LEW.

4.13 Licence to Use or Operate an Electrical Installation

4.13.1 For service connection to non-domestic premises, residential buildings and condominiums with an approved load greater than 45kVA, and temporary connection for building construction and engineering work, irrespective of connection load, the customer must obtain a licence from EMA to use or operate the electrical installation.

4.13.2 It must be noted that SPPG cannot energise the service connection until such a licence is issued to the customer.

4.14 Certificates and Statements for First Energisation of Service Connection

4.14.1 Certificate of Compliance (COC)

The LEW must ensure that the electrical installation complies with the requirements of the Electricity Regulations, Singapore Standards 638, relevant technical requirements and all other applicable standards. This compliance must be made in the COC form

(Appendix 37). The copy of COC form shall be submitted to SPPG through SPSL when requesting for an energisation appointment and the original COC must be handed over to SPPG on the actual date of supply energisation.

4.14.2 Certificate of Readiness (COR)

The LEW has to certify the readiness of the installation. This certification must be made in the COR form (Appendix 20). The LEW must hand over the COR form to SPPG's Project Officer on the actual date of first energisation.

4.15 Statement of Turn-On of Electricity

4.15.1 Immediately after the successful first energisation of the service connection, SPPG will issue a Statement of Turn-On of Electricity (Appendix 38). All parties are to acknowledge by signing the form. The completed form will be given to all parties and a copy forwarded to SPSL.

4.16 Amalgamation of New and Existing Connections

4.16.1 The customer/LEW shall ensure there is only one customer's intake connection point for the premise after the energisation of the new/upgraded connection. The customer/LEW shall inform the assigned SPPG Project Officer immediately to remove the existing connection upon energisation of the new/upgraded connection. The customer/LEW is not allowed to remove the existing connection at their own initiative.

4.17 Lead-Times for Application for Service Connection

4.17.1 The timely provision of electricity supply to a development involves the joint efforts of SPSL, SPPG, and the customer and his agents, such as the LEW. While SPSL and SPPG will make every effort to engineer and implement the connection scheme, it is at the same time essential for the new customers and their agents to play their part such as the early submission of applications and plans, the acceptance of terms and conditions of connection including making the necessary payments and the compliance of the necessary SPPA or Transmission Code requirements. It is the responsibility of the customers to manage and direct their agents to ensure that their agents comply with the necessary SPPA or Transmission Code requirements.

4.17.2 As a guide for the customer and his agents, the normal lead-times for the various events are listed on the following page. Depending on the progress and completion time of precedent events, the actual completion dates of events leading to the energisation of the service connection may need to be reviewed and adjusted.

4.18 Normal Lead Time for Energisation of Service Connection Up to 22kV

	Installation with existing Service Connection Not Exceeding 45kVA or Domestic Premises		Non-domestic Installation with Existing Service Connection Exceeding 45kVA	New Connection from SPPA's Low Tension Mains	New Connection from New Substation
	Pre-inspected Installation or Reconnection	Inspection Required			
Submission of application to SPSL	NA	14 days*	4 weeks	3 months	6 months
Submission of substation plans to SPPG	NA				5½ months
Acceptance of Agreement§	4 days	14 days	14 days	7 weeks**	11 weeks*
Handover of substation and lead-in pipes to SPPG+	NA				10 weeks*
Opening of account with SPSL	4 days	14 days	14 days	14 days	11 weeks
Arrangements to inspect customer's installation (not exceeding 45kVA) by SPSL	NA	10 days	NA		
Application to EMA for licence to use or operate an electrical installation	NA		3 days	3 days	3 days
Request for energisation of service connection	NA		14 days	14 days	14 days

* These are critical events. Failure to adhere to the schedule may result in delay in the turn-on of supply.

§ Implementation of connection work shall only be effected upon the payment of service connection charge and execution of the Connection Agreement by the customer.

** Energisation of service connection will normally take place within 4 to 6 weeks from the date customer's premises is ready to receive the service cable. This lead-time may vary from case to case, depending on the customer's schedule, road opening approval from relevant authorities, amount of network reinforcement required and length of cable to be installed to effect the connection.

+ Energisation of service connection will normally take place within 10 weeks of handing over of substation and lead-in pipes. This lead-time generally applies to applied load of up to 2MVA and may vary from case to case, depending on the customer's schedule, road opening approval from relevant authorities, amount of network reinforcement required and length of cable to be installed to effect the connection.

4.19 Fast Track Connection Scheme

4.19.1 To promote investment and entrepreneurship, industrial development applying Low Tension supply may be considered for fast track connection scheme. Eligible applicant should meet the following criteria:

(a) Load application of 76 to 140 kVA; and

(b) Point of supply connection not exceeding 150m away from existing network source.

Application to EMA for licence to use or operate an electrical installation can be done concurrently with the submission of application to SPSL. Applications under such fast track connection scheme will receive their supply in 19 days from date of submission of application to SPSL (5 days for application process and 14 days for project implementation after site is taken over by SPPG).

4.19.2 As a guide for the customer and his agents, the normal lead-times for the various events are listed below. Depending on the progress and completion time of precedent events, the actual completion dates of events leading to the energisation of the service connection may need to be reviewed and adjusted.

No.	Procedures	Time to complete
1	The customer has to engage and appoint a LEW to submit an application to SPSL to connect to the grid system, along with 2 copies of the site plan. The LEW could submit the Certificate of Compliance to SPSL in this procedure. A quotation for the connection will be offered for the customer to follow up if the submitted site plan by the LEW is in order. LEW will arrange to make payment and open an account.	5 days
2	SPPG will carry out the project implementation after the payment is made and customer site is readied to receive connection. An arrangement will be made with the LEW within the 14 days on the supply turn-on.	14 days

4.20 Notes to be Read in Conjunction with Application Procedure

4.20.1 Licensed Electrical Worker

There are three classes of LEW, namely Licensed Electrician, Licensed Electrical Technician and Licensed Electrical Engineer. Licensed electrical workers of various classes are licensed to design, install, repair, maintain, operate, inspect and test an electrical or supply installation in accordance with the condition stated below:

Electrical Workers	Approved Load of Installation	Voltage
Electrician	Not exceeding 45kVA	Not exceeding 1,000V
Electrical Technician	Design: Not exceeding 150kVA Install: Not exceeding 500kVA	Not exceeding 1,000V
Electrical Engineer	No limit	Subject to licence conditions

4.20.2 The customer should appoint an LEW appropriate to the capacity and voltage of the proposed installation, and inform SPSL immediately of any change of LEW during the course of the project by submitting the notice of change of LEW in Appendix 45 or in such other form as SPSL may in its sole and absolute discretion accept.

4.21 Opening an Account

4.21.1 Before supply to an installation can be turned on, the customer must open an account with SPSL. An application to open an account for electricity supply can be made personally online through www.spgroup.com.sg or via the SP Utilities Mobile App.

4.21.2 Application in person can be made at the e-Kiosk located at SPSL's Flagship Customer Services Centre, 490 Lorong 6 Toa Payoh #09-11, HDB Hub Biz Three Lift Lobby 1, Singapore 310490

4.21.3 The following documents must be attached at the time of application:

(a) Application under personal name: Copy of Identity Card/Passport of applicant**
(b) Application under company name: Latest ACRA detailed Business Profile or Bizfile***
(c) Letter of Authorisation (only applicable for application under company name)
Notes: To be authorised by Director listed in the recent ACRA detailed Business Profile/Bizfile on the letterhead issued by company, indicating the company's representative's name and identification number i.e NRIC or FIN.
(d) Documentary proof of occupancy of premises
(e.g Tenancy Agreement or property tax)
(e) Copy of completed and signed Acknowledgement of Electrical Installation License Requirement Form EIL Form, if the electricity load is above 45 kVA. For more information on the license, please refer to www.ema.gov.sg
(f) For temporary supply of electricity, the Quotation for Electricity Supply Connection and LEI issued by EMA are required.

**not required if using Myinfo during application.
***not required if using Myinfo Business during application.

4.21.4 An initial deposit is payable on opening an account. Customers may look up online for information on the opening and closing of accounts.

4.21.5 For domestic premises, the deposits are as follows:

Type of Premises	Singaporean or Permanent Resident		Foreigners	
	GIRO Customers	Non-GIRO Customers	GIRO Customers	Non-GIRO Customers
HDB 1 or 2 Rooms	$40	$60	$80	$120
HDB 3, 4 or 5 Rooms	$70	$100	$140	$200
HDB Executive / HUDC Flat / Condominium / Private Apartment	$100	$150	$200	$300
Terrace House / Semi-Detached House	$150	$250	$300	$500
Bungalow / Penthouse / Townhouse	$250	$400	$500	$800

4.21.6 The deposit for non-domestic premises varies according to the electricity load required, the estimated water consumption, the floor area and type of operations. For enquiry on the amount of deposit required, please refer online for information.

4.22 Handover of Completed Substation

4.22.1 The handover of substation to SPPG for installation of equipment is a key event, which determines the earliest date when supply can be made available.

4.22.2 One week prior to the intended handover of the substation, the LEW must submit a Request to Handover Substation form (Appendix 5) to Head of Section (Customer Projects - East / West / Distribution Network (DN) – I / II / III / IV / V / VI, SPPG, copy to Head of Section (Distribution Facilities Management (DFM). Before this is done, the LEW must ensure that the customer/developer has accepted the terms and conditions of connection, including the payment of necessary charges.

4.22.3 It must be emphasised that SPPG will take over the substation only when it is completed in accordance with plans and specifications approved by SPPG and the relevant authority. The LEW must ensure that the lead-in pipe connection point for SPPG is clear from underground services, road furniture and practical for excavation work to be carried out. It is the responsibility of the LEW to arrange mandrel test to demonstrate that the provision of lead-in pipe is clear from construction debris from SPPG connection point. LEW must also ensure that the lead-in pipes installed are watertight. It is also particularly important that the access to the substation must be clear and passable for transportation of heavy equipment.

4.22.4 For HDB projects, the Underground Piping System (UPS) shall be completed, customer switchroom (CSR) shall be locked and customer's main switchboard (MSB) shall be mounted and tested before handover of completed substation.

4.22.5 For upgrading of substation, the customer shall make all necessary arrangements required for the implementation of the electricity supply connection works. This includes facilitating access, planned electricity shutdowns, temporary supply arrangements, relocation of equipment and coordination with affected occupants and relevant parties where required. Delays in making such arrangements may affect the completion date of the electricity supply connection works.

4.22.6 Floor frames are needed for some types of switchgear. The LEW is to liaise with and notify the project engineer-in-charge to make arrangements for the floor frame to be installed, if it is necessary prior to the handover.

4.22.7 Requirements on handover of a completed distribution substation are given in Request to Handover Substation form (Appendix 5).

4.23 Installation of Current Transformer Operated Meters

4.23.1 On the appointed day of meter installation, the LEW or his representative must be present to provide a 230V 13A single-phase supply for testing of the meters.

4.24 Procedure for Application for Licence to Use or Operate an Electrical Installation

4.24.1 Under The Electricity Act, electrical installations in non-domestic premises, residential buildings and condominiums with an approved load greater than 45kVA are required to be licensed. In addition, certain premises classified as engaging in dangerous trades, are also required to be licensed even though they may have approved electrical loads not exceeding 45kVA.

4.24.2 Customer is required to appoint an appropriate class of licensed electrical worker to take charge of his electrical installation and submit application for Electrical Installation licence through his appointed licensed electrical worker via EMA website at *www.ema.gov.sg*. The validity of the licence is for a period of 12 calendar months.

4.25 Conditions for the Issue of the Licence

4.25.1 Conditions for the issue of the electrical installation licences are governed by EMA.

4.25.2 The minimum grade of LEW required to take charge of the electrical or supply installation is determined by the total approved load. The grades of Electrical Workers and their authorisation conferred under the respective EMA licences are shown in the table in section 4.18.1.

4.26 Procedure for De-Energisation / Disconnection of Service Cables

4.26.1 De-Energisation of Service Cable for Maintenance Purpose

(a) The LEW who needs to de-energise an existing service cable for the purpose of maintenance or upgrading of the customer's installation must submit the ADRE form at Resources (spgroup.com.sg) to SPPG 7 business days in advance. For Contestable Customers, an advance notice of 14 business days is required.

(b) The SDRE form (Appendix 19) must be used to ensure that the service cable is safely isolated after de-energisation and fit to be energised before re-energisation. Both SPPG's officer in-charge and the LEW must duly complete and sign Part I and Part II of the form after de-energisation and before re-energisation of the service cable respectively. For Contestable Customers, the LEW must duly complete and sign Part III of the SDRE form.

5 Customer's Installation Requirements

5.1 Requirements for HT and LT Connection for 22kV and below

5.1.1 Short-Time Withstand Current Ratings of Switchgear

For electrical installations taking electricity supply directly from SPPA's network, the customer's main supply incoming switchgear must comply with the following short-time withstand current ratings.

(a) For supply at high tension,

Voltage Supply	Short-time Withstand Current Ratings
22kV	25kA for 3 sec
6.6kV	20kA for 3 sec

(b) For supply at low tension,

Voltage Supply	Rated Breaking Current / Short-time Withstand Current Ratings
230V (1 Phase)	6kA for supply capacity up to 15kVA
	9kA for supply capacity more than 15kVA and up to 23kVA
400V (3 Phase)	9kA for supply capacity up to 75kVA
	25kA, 3 sec for supply capacity more than 75kVA and up to 180kVA
	36kA, 3 sec for supply capacity more than 180kVA and up to 1000kVA
	43kA, 3 sec for supply capacity more than 1000kVA and up to 1500kVA

Note: The 3-second duration is not applicable to switchgear incorporating direct acting tripping devices.

5.1.2 For electrical installations taking electricity supply from the landlord's or management corporation's electrical installations, advice on protection requirements must be sought from the LEW responsible for the respective licensed electrical installation. The LEW in-charge must ensure that the customer's main supply incoming switchgear is capable of withstanding the prospective short-circuit current at the connection point.

5.1.3 Typical schemes and the protection requirements for customer's HT and LT main incoming switchgear taking electricity supplies from SPPA's system are shown in Appendix 17. It must comply in general to conditions as set out in the Transmission Code, Section 6.3 and Appendix F3.

5.1.4 Interim Electricity Supply via a Mobile Generator

5.1.4.1 On a goodwill basis, in order to assist Customers during localised electricity network supply interruption, subject to the Customer's agreement and compliance with the terms and conditions of this paragraph 5.1.4, SPPA/SPPG, at its option, offers to use commercially reasonable efforts to provide a mobile generator(s) rated up to 1 MVA at 400V to supply electricity to Customer's premises during the interim while the electricity network supply is being restored. A maximum of two mobile generators to a single site may be provided, subject to the availability of mobile generators and operational availability. "Localized electricity network supply interruption" means an outage due to a fault in the equipment and cables in the substation or Overground Box (OG Box) serving the Customer's premises or installation.

5.1.4.2 With effect from 1 October 2020, it is mandatory for new Customers in the Central Business District ("CBD") area receiving electricity supply from SPPG's electric distribution substation via customer's electrical in-take substation and operating consumer's Low Tension ("LT") electrical switch-room, or buildings housing critical infrastructures (physical and/or info-comm), to agree to and comply with this paragraph 5.1.4. The CBD boundary plan will be referenced to URA's website, while the respective Government Agencies overseeing buildings housing critical infrastructures have been informed.

5.1.4.3 Other Customers may opt to and comply with this paragraph 5.1.4 by indicating that they agree to and will comply with paragraph 5.1.4 in their transmission services agreement with SPS or SPPA, as the case may be.

5.1.4.4 In order for Customers complying with this paragraph 5.1.4 to receive the interim electricity supply via a single mobile generator rated up to 1 MVA at 400V at the Consumer LT switchboard during a localised electricity network supply interruption, they shall ensure the following requirements are met:

(a) Consumer LT switchroom shall be located at the same level as and adjacent to SPPA substation.

(b) Customer must maintain an unimpeded access road that is 4 metres wide, with 4.5 metres of headroom clearance and 13m for turning radius, throughout the entire route within the Customer's premises for the deployment of the mobile generator.

(c) Access road must be able to withstand 35 tonnes, the weight of the mobile generator.

(d) Parking space of not less than 14 metres (L) by 3.7 metres (W) by 4.5 metres (H) within the customer's premises shall be made available at or near Consumer LT switchroom (i.e. within 20 metres) for at least one number of the mobile generator in times of emergencies. A gradient greater than 1:15 is not acceptable.

(e) Cable termination into the Consumer LT switchboard shall be via bottom entry only.

(f) 3 sets of 4x300mm^2 1C CU cables with lug size 16.5mm shall terminate at the Consumer LT switchboard to allow connection of one number of mobile generator which is rated up to 1 MVA at 400V. Earthing terminal shall be provided for termination of earth conductor with lug size 12mm.

(g) The fire suppression system in the Customer's premise shall take into consideration of the exhaust emitted during the operation of the mobile generator.

(h) Customer shall determine the critical loads to be supported via the mobile generator.

(i) A remote connection point may be proposed to allow connection of one number of mobile generator which is rated up to 1 MVA at 400V, and complying with the above requirements. The connection point shall be provided with a circuit breaker of adequate breaking capacity, complete with overcurrent and earth fault protection. The busbar shall be extended and with height clearance of at least 0.9 metres for the termination of 3 sets of 4x300mm^2 1C CU cables with lug size 16.5mm via bottom entry. Earthing terminal shall be provided for termination of earth conductor with lug size 12mm. There must be electrical and mechanical interlock to prevent any possible parallel operation of the incoming services.

5.1.4.5 If the Customer does not comply with the requirements in paragraph 5.1.4.4, the Customer may not receive or may experience delay in receiving the interim electricity supply via the mobile generator.

5.1.4.6 Nothing in this paragraph or any other provision of this Handbook shall exempt Consumers from complying with any requirements under any applicable legislation, Act(s), Regulation(s), Code(s) or directions from a competent Government authority or body.

5.2 Requirements for 22kV and 6.6kV Customer Connection

5.2.1 The main protection for the 22kV customer connection must be pilot wire differential protection. The current transformers of ratio 500/5 must be of Class X (BS EN 61869-2) and the CT secondary star-point must be towards the protected line. The customer shall check that the 22kV main protection relay is compatible with SPPG's end. The standard overcurrent/earth fault setting for the incomer is shown in Appendix 17. For customer installation connected with DG, the pilot wire protection relay used shall be Solkor-Rf relay.

5.2.2 To effect fast fault clearance on connection circuit, the 22kV cable terminations and metering CTs/VTs installed at the incomers must be included in the 'Protected Zone' of the cable's Unit Protection, as shown in Appendix 17.

5.2.3 The LEW of the customer installation is responsible for proper specification, setting / commissioning of the protection system at the customer incomers.

5.2.4 The LEW shall ensure that there should not be any earthing facilities in customer switchboard at the main incoming panel.

5.2.5 Customer's transformer configuration shall not contribute zero sequence current to SPPG's end during fault.

5.3 Requirements for LT Supply Connection

5.3.1 The customer's incoming circuit breaker shall be set according to the approved load. For approved load exceeding 300A, external overcurrent relays of IDMTL or DTL characteristics and earth fault protection (DTL) must be provided at the incoming switchgear. The current transformer must be of Class 5P10, 15VA or better (BS EN 61869-2). Details of the CT requirement and relay setting are shown in Appendix 17.

5.3.2 Every low tension electrical installation of supply capacity exceeding 75kVA must be provided with short-circuit protection in the form of direct acting trip element at the incoming switchgear as follows:

Approved Load	Direct Acting Trip Setting
Above 1500A	Up to 4500A
400A< Approved Load $\leq$ 1500A	Up to 3200A
260A < Approved Load $\leq$ 400A	Up to 2400A
200A < Approved Load $\leq$ 260A	Up to 2000A
200A and below	Up to 1200A

Alternatively, a backup HRC fuse may be used in place of direct acting trip.

5.4 Requirements for EHT Connection for 66kV, 230kV and 400kV

5.4.1 Short-Time Withstand Current Ratings of Switchgear

For electrical installations taking electricity supply directly from SPPA's network, the customer's main supply incoming switchgear must comply with the following short-time withstand current ratings:

Voltage Supply	Short-time Withstand Current Ratings
230kV and 400kV	63kA for 1 sec
66kV	40kA/ 50kA* for 3 secs

* Rating to be used is dependent on the substation which the customer is proposed to be connected to.

5.5 Requirements for 66kV, 230kV and 400kV Customer Connection

5.5.1 Engineering details and protection settings will be discussed with the customer during the consultation period.

5.5.2 The protection system for the connections has to comply in general to the conditions as set out in the Transmission Code. It must comply in general to conditions as set out in the Transmission Code, Section 6.3 and Appendix F3.

5.5.3 The relays used for a unit protection scheme, and the characteristics of its associated current transformers should be matched. For reason of obsolescence or availability, the type of protection relays, signalling equipment and the protection schemes is subject to review and confirmation during the consultation period.

5.5.4 Wherever applicable, protection signalling equipment is to be provided for tele-protection function and for end-to-end transfer of intertrip and interlock (control/ safety) signals.

5.5.5 A selective switch to block/isolate the trip signals of the relay is to be provided at each unit protection system of the incomer. This is to facilitate check/investigation of an alarm on the unit protection system on the energised circuit.

5.5.6 Generally, the star-point of the current transformer secondary circuit must be towards the protected object / zone. For feeder's unit protection, it is preferred to have the same CT ratio as SPPG's end.

5.5.7 Generally, the location of the current transformers for the protection system of the connection circuit and that of the customer's installation must be overlapped to eliminate protection blind zone.

5.5.8 Current transformers supplied for unit protection must be rated in accordance with IEC 61869-1, IEC 61869-2 and IEC 61869-6 or equivalent. They must be adequately dimensioned and of an accuracy class meeting the specified relay's requirement. To ensure stability, the characteristic of the current transformers for the unit protection installed at both ends of the connected circuit must be closely matched with each other.

5.5.9 Customer shall engage local professional engineer who has experience on 400/230/66kV protection system to carry out relay setting, testing and commissioning, to ensure proper commissioning of the protection system.

5.5.10 Generally, the proposed setting for the backup protection for the typical 66KV customer incomer is as shown below:

Protection Relay		General Setting	
		CT Ratio	Setting
Over Current Protection (IDMTL)	Feeder Circuit	(1000/5) (800/5)	150% 0.15 200% 0.15
	Customer 75MVA Transformer	(1000/5) (800/5)	100% 0.20 Instantaneous Hi-Set 125% 0.16 Instantaneous Hi-Set
Earth Fault Protection (IDMTL)	Feeder Circuit	(1000/5) (800/5)	10% 0.10 15% 0.10
	Customer 75MVA Transformer	Instantaneous Balanced Earth Fault	

Notes:

- The above recommended setting for the backup protection is applicable to the standard protection scheme proposed for a feeder or feeder-transformer type customer connection and is applicable to radial feed connection only. (Appendix 17)
- Customer incomer shall install 'instantaneous' Overcurrent Hi-Set and instantaneous Balanced Earth Fault protections to protect its own transformer.
- The overcurrent and earth fault setting are subjected to periodic review by SPPG.

5.6 Information on SPPA Network Earthing System for 230kV, 66kV and 22kV

5.6.1 Where customer is connected directly to SPPA's network, customer shall note the following earthing system at each voltage level.

(a) 230kV - Solidly earthed system

(b) 66kV - Resistive earthed system with neutral ground resistor (NGR) of 19.5 ohms

(c) 22kV - Resistive earthed system with neutral ground resistor (NGR) of 6.5 ohms

5.6.2 Customer shall ensure that all equipment including CTs, VTs, and protection systems connected to SPPA network meet the technical specification required for the respective earthing system in accordance with the relevant standards.

6 Metering Requirements

6.1 General

6.1.1 All metering requirements must comply with EMA's Metering Code. SPPG will determine the location where the supply line terminates in the premises, based on ease of accessibility to SPSL and SPPG personnel.

6.1.2 "Electricity Meter" means the electrical device capable of measuring the flow electrical power. It is owned, supplied, and maintained by SPPG acting as an agent of SPPA.

6.1.3 "Meter Installation" refers to everything that facilitates the Electricity Meter to be installed on. It includes, but is not limited to, the meter boards, incoming miniature circuit breakers (MCBs), outgoing isolators, electrical wiring, current and/or voltage transformers and all other electrical or mechanical ancillaries that enable the flow of electricity.

6.1.4 The meter installation (excluding the electricity meter) ie. the meter boards, incoming miniature circuit breakers (MCBs), outgoing isolators, electrical wiring and all other electrical or mechanical ancillaries that makes up the meter installation are owned, supplied and maintained by the "Owner" - refers to the person / entity that developed / built / installed / maintained the electrical installation of which the meter installation is part thereof. For avoidance of doubt, examples of the "Owner" will refer to, but not limited to, the account holder / estate developer / estate manager or MCST / Landlord / Tenant / any contracted contractors working on the meter installation / Town Councils etc. The "Owner" is solely responsible for the maintenance of and upkeep (replacement of faulty / worn / damaged etc) of all components of the meter installation with the exception of components owned and supplied by SPPG e.g. incoming MCBs and fuses from the Grid supply cable. The components after the outgoing terminals of these SPPG supplied components will be under the Owner's responsibility.

6.1.5 The Incoming and Outgoing MCBs of the meter are to be clearly labelled accordingly with "Incoming" and "Outgoing" for clear indication and operation. The Incoming MCB shall be installed on the left-hand side of the Meter Board and the Outgoing MCB shall be installed on the right-hand side of the meter board to ensure consistent identification, safe operation, and ease of maintenance. Where space is insufficient for the left-right arrangement, the Incoming and Outgoing MCB may be installed in a top-bottom configuration, with the Incoming MCB positioned above the outgoing MCB. Both MCBs shall be labelled accordingly.

6.1.6 The "Owner" and its appointed representative for the entire electrical licenced installation which the meter installation is part of, is solely responsible for the maintenance eg. checking and tightening of connections of the meter installation and its ancillaries including that at the meter terminals where the electrical wires belonging to the "Owner" terminate as part of its licensee obligation. "Owners" are allowed to

break the SPPA seals and carry out the works by informing Electrical Meters Section so that it can be re-sealed post maintenance.

6.1.7 For "Owners" who install meter box over the meter installation, it is mandatory to submit to Electrical Meters Section the product datasheet for the meter box indicating the IP ratings that ensure the UV-resistance and weather-hardiness of the meter box to withstand the local weather conditions in Singapore. For meter box found at legacy HDB blocks, "Owners" are to provide the meter box datasheet from HDB as per their design specifications. This would apply for upgrading or re-wiring that will affect position / wiring of the electricity meter. It is **not required** to provide a meter box if the meter installation is located within an enclosure (meter compartments / risers / ducts etc) that shields the meter installation from the elements. "Owners" should take the chance to remove the meter box from such locations wherever practically reasonable if such had meter box installed historically.

6.1.8 Electrical Meters Section reserves the rights to decline any express service meter installation request submitted less than 4 business days before the scheduled date of electrical turn-on, due to the lead time required for schedule and resource availability allocation. Applicants are to note that express service charges do not supersede the 4 business days lead time due to finite resources.

6.1.9 For bulk sub meter installation requests involving 30 or more meters for HDB flats, private condominiums, or strata landed houses, the standard lead time shall be between 2 to 3 weeks from the date the application is received. All lead times are indicative and may be adjusted based on site conditions, resource allocation, and other operational factors. Requests for express service will not be entertained if submitted less than 48 hours in advance.

6.1.10 Meters can be mounted on any of the following types of meter boards:

(a) Teak board or any hardwood board chemically treated against attacks by termites and is resistant to moisture and heat. The material should not warp easily. Plywood or fibreboard is not allowed. The meter board must be at least 20mm thick and rigidly fixed with a minimum of 4 fixing screws.

(b) Metal panel with nylon inserts accurately positioned to accommodate the meter.

(c) Glass reinforced polyester base fitted with nylon inserts accurately positioned to accommodate the meter.

6.1.11 If the meter is located inside an enclosure (meter box / meter compartments / riser ducts / cupboard etc), the depth (from surface of meter board) to the inner surface of the enclosure door must be between 200mm to 300mm for safety purposes. This requirement is mandatory and non-compliance will result in meter installation failure on appointment date.

6.1.12 The LEW in charge must ensure that all related metering requirements listed in this guide are complied with, and submit, at the planning stage, all relevant drawings on meter locations, meter board size, meter rooms, meter compartments / riser ducts / cupboard / boxes, etc to Electrical Meters Section for approval. Sample units of each approved type of meter compartment / riser duct / cupboard / box and meter board must be provided for final inspection and approval by Electrical Meters Section before meters are installed.

An undertaking letter must be provided by owners of meter boxes, indicating the requirement for the owners to make good and repair the full meter boxes due to

damages arising from misuses, vandalism and materials deterioration beyond the usual period of warranty for the new meter boxes.

No payment is required for normal meter installation request received 4 business days prior to the energisation date. For other metering services that are chargeable, LEWs are to contact Electrical Meters Section to issue a quotation with a payment link. Payment will be made to SP PowerAssets Ltd.

6.1.13 If meters are housed within enclosures (meter rooms / compartments / riser ducts etc.) the width of the door frame opening **must** be of at least:

(a) 600mm width for meter rooms

(b) 500mm width for meter riser ducts

(c) 450mm width for meter compartment / cupboards

(d) The sidewalls of the enclosure entrance must not impede the accessibility and block the full view of any portion of the metering installation and its ancillaries (incoming MCB and outgoing isolator) when one is standing infront of the enclosure entrance for safety purposes. Failure to comply will result in non-compliance and will result in meter installation failure on appointment date.

6.1.14 If the access doors (as per 6.1.4) or access leading up to the enclosure are to be **locked**, they must be fitted with locksets from the following master key series from the authorised suppliers indicated:

(a) Abloy master key code reference MK 911047
Address: 1008 Toa Payoh North #04-18 Singapore 318996

(b) Chubb (Union) master key code reference G1HBG
Address: 60 MacPherson Rd #08-08 Blk 1 Siemens Centre Singapore 348615

(c) Yale master key code reference MK48
Address: 60 MacPherson Rd #08-08 Blk 1 Siemens Centre Singapore 348615

Developers are to take note that **only** above authorised master series key brands are allowed. Any non-compliance (usage of non-approved master series key brands) will be rejected during new meter installation compliance checks and developer/contractor, etc would have to arrange for rectification. Developers or LEW in-charge are to handover the keys to the "Owners" post-handover of development or to direct "Owners" to above authorise suppliers to procure the master keys during the maintenance and operation phase of the development.

6.1.15 During installation appointment, security access systems installed in any premises must not impede access by SPSL and SPPG personnel. Escort must be provided should there be any need for SPSL and SPPG personnel to enter the premises.

6.1.16 The developer or "Owner" is to ensure access to meters must not be obstructed at all times post meter installation for SPSL and SPPG personnel to carry out meter reading and maintenance works. Any removed Master key series lockset shall be reinstated without delay.

6.1.17 For installations with embedded generation systems e.g. PV systems, bi-directional meter will be installed if customer is under net settlement scheme.

6.2 Location of Meter

6.2.1 The service board accommodating SPPG's service MCBs and meters shall be located near the termination of the service line. The meter / service position shall be easily accessible at all times to SPSL and SPPG personnel for maintenance and reading of meters. Meters shall be installed outside the unit in an enclosed space. Where this is not feasible due to site constraints or building layout limitations, the applicant's LEW shall submit to Electrical Meters Section for waiver approval prior to installation. Any approval granted shall be subject to Electrical Meters Section's requirements and conditions.

6.2.2 Meters must be installed in a safe location with adequate working space where they will not be damaged or be a cause of danger to personnel (viz, in a clean and dry location, not exposed to weather, mechanical damage, vibrations, extremes of temperature or dampness, away from traffic hazards).

6.2.3 The access way to the Meter Installation must be safe and be of permanent structure. If the meter installation is situated above or below ground level that require access via stairs / ladders (eg. Above 1.8m from the floor, rooftops or basements), permanent staircase that comply with standard building codes must be made available for safe access to the meter board/panel. This is mandatory and non-compliance will result in failure during meter installation appointment date.

6.2.4 The meter board must be mounted such that the height of the meter register must be between 0.8m and 1.8m above ground level, and the depth of the compartment for installation of meters must be between 200mm and 300mm.

6.2.5 If the meter is inside an enclosure (compartment / cupboard etc.) with an access door - the depth measured from the meter board surface to the access door must be between 200mm to 300mm. "Owners" are to rectify if non-compliant to ensure maintenance (replacement / installation) of meter is not hindered.

6.3 Grouped Location of Meters

6.3.1 Meters must be installed outside each tenant unit in a safe and accessible location with sufficient working space for ease of meter reading, maintenance, etc. This shall apply to all public and private commercial tenants' units. Any failure to comply with the requirements will result in non-compliance and meter installation will only proceed upon rectification.

6.3.2 Grouped Meters in Meter Compartments / Risers

(a) Meters are to be grouped on the same floor as the tenant units. Where this is not possible for practical reasons, meters may be grouped together in easily accessible centralised meter rooms or meter compartments / riser ducts in multi-metered premises.

(b) There may be more than one grouped metering location on each floor.

(c) There must be adequate lighting and switch socket outlet provision (where possible) in the group meter location to facilitate meter installation / maintenance and meter reading.

(d) Meter boards for such grouped meters must be such that meters are mounted facing the doors fully seen and accessible without being blocked by the entrance sidewalls.

(e) The meter board must be mounted at a height and depth as stated in Section 6.2.4.

(f) Premise unit numbers for the meters are to be clearly and permanently labelled. They must be engraved or embossed on metal or weather hardened plastic material and firmly riveted or screwed onto their respective meter board. It is "Owners" responsibility to ensure there is no transposing of the wirings behind the meter board to the premise units indicated on the meter board.

(g) Meter compartments housing such grouped meters must have clear viewing windows provided on the doors for ease of meter reading. The clear viewing window must not be less than 200mm (W) x 300mm (H) x 6mm (thickness) and must be correctly positioned in front of the LCD display of each individual meter with the meter serial and meter reading clearly visible.

6.3.3 Meters installed in Meter Box

(a) Meter Box are typically applicable only for HDB developments and it is not necessary if the meters are installed within an enclosure and shielded from the elements eg. risers / ducts.

However, should Meter Box be required, requirements are as per below:

(a) Meters must be installed inside a weather hardened and UV-resistant meter box and easily accessible to SPSL and SPPG personnel.

(b) A clear transparent viewing window of at least 100 mm (W) X 120 mm (H) shall be provided and must be positioned in front of where the meter is to be installed.

(c) There must be at least three hinges connecting the meter box base and the cover. The hinges for the meter box must be made of good quality.

(d) The keyless lock, if any, shall be made of a rust-resistant material.

(e) The interior of the meter box should be at least 260 mm (H) X 230 mm (W) with a depth of at least 200 mm (D) with a base fitted with nylon inserts accurately positioned to accommodate the meter.

(f) Unit numbers must be engraved or embossed on metal or plastic material and firmly riveted or screwed onto respective meter board. It is "Owners" responsibility to ensure there is no transposing of the wirings behind the meter board to the premise units indicated on the meter board.

6.3.4 Meters in Riser Ducts

(a) Meters are to be on the same floor as the tenant units.

(b) There must be adequate lighting and switch socket outlet provision (where possible) in the riser duct to facilitate meter installation / maintenance and meter reading.

(c) Meter boards must be such that meters are mounted facing the doors fully seen and accessible without being blocked by the entrance sidewalls.

(d) All meter riser ducts where meters are installed are to be clearly and permanently labelled. Tenant unit numbers must be engraved or embossed on

metal or weather hardened plastic material and firmly riveted or screwed onto respective meter board.

(e) The depth measured from the meter board surface to the riser access door must not be less than 200mm.

(f) There must be adequate flat standing space of 600mm in front of the meter provided to facilitate meter reading, installation and maintenance work.

(g) If there is slope built on the ground of the meter riser duct which made the riser duct inaccessible, the depth measured from the meter board surface to the riser inner access door must be between 200mm to 300mm.

6.3.5 Meters in Centralised Meter Rooms

(a) The height of the meter board or panel must be such that meters can be mounted with the highest row of the meter register not exceeding 1.8m above floor level and the lowest row not less than 0.8m above floor level.

(b) There must be standing space of at least 600mm in front of the meter panel. However, if the meters are mounted on a free-standing panel, a clearance of 600mm all-round panel is required.

(c) The meter board or panel must be rigidly and vertically mounted. The doors of the panel must be hinged.

(d) Unit numbers must be engraved or embossed on metal or plastic material and firmly riveted or screwed onto respective meter board.

(e) The meter room must not be used as a storeroom.

6.3.6 Meters Installed in Landed Properties

(a) The meters and service cables must be installed in a weatherproof compartment located at the gate pillar or perimeter wall. For supply capacity up to 100A 3–phase, the technical requirements for this compartment are as given in Appendix 24. For supply capacity greater than 100A 3-phase where a CT-operated meter will be installed, the LEW has to submit the technical requirements to Electrical Meters Section for approval.

(b) If there is no gate pillar or fencing around the perimeter of the landed properties, meters must be installed inside a weatherproof meter box / compartment and easily accessible to SPSL and SPPG personnel. Meters must not be installed inside the house.

(c) Concrete or hinged galvanised steel grating must be provided in front of the meter compartment mounted at gate post / pillar if a drain exists.

(d) The meter board must be mounted at a height and depth as stated in Section 6.2.4. The enclosure door is to be aligned with outer walls for ease and safety during installation.

(e) Unit numbers must be engraved or embossed on metal or weather hardened plastic material and firmly riveted or screwed onto respective meter board.

6.3.7 Meters Installed in Over-Ground Box (OG Box)

(a) Meters must be installed inside a weatherproof meter box and easily accessible to SPSL and SPPG personnel.

(b) The OG Box must have clear viewing windows provided on the doors for ease of meter reading. The clear viewing window must not be less than 200mm (W) x 300mm (H) x 6mm (thickness) and must be correctly positioned in front of the LCD display of each individual meter with the meter serial and meter reading clearly visible.

(c) Provision shall be made to prevent any stagnation of water within the compartment. Sufficient ventilation shall be provided to avoid high humidity and condensation within the meter compartment.

(d) There must be adequate safe standing space of at least 600mm in front of the meter panel to facilitate meter reading, installation and maintenance work.

6.3.8 Meters Installed in Co-shared locations

(a) This applies for locations other than those stated from Sections 6.3.2 through 6.3.7.

(b) Meters must be installed inside a weatherproof meter box in a safe and unobstructed area in such locations, examples include but not limited to indoor/outdoor carparks, rooftops within tenanted premises.

(c) For avoidance of doubt, unobstructed would refer to the minimum clearance as stated in Section 6 of this handbook. Meters must be housed within a weatherproof meter box/compartment with served unit label permanently riveted unto the compartment for clear identification.

(d) Minimal horizontal clearance of 300mm around the meter installation on all accessible side and at least 600mm in front of the meter panel to ensure safe access for maintenance personnel and prevent accidental contact or obstruction by other nearby users or objects.

(e) For avoidance of doubt, safe area would imply the front of the meter compartment is not facing or exposed to high traffic (vehicular or human), in particular - It must be sited away from parking lots. Safety barriers such as bollards must be installed as additional protective measures for the safety of the maintenance crew.

(f) The meter compartment housing the meter must be designed to eradicate water ingress and collection. Appropriate ventilation louvres must be incorporated if the meter compartment is exposed to the elements.

6.4 Meter Service Board Specifications (Single-Phase and 3-Phase Services, not Exceeding 100A per Phase)

6.4.1 The meter/service board for SPPA's service MCBs and meters is specified in Section 6.3 and in accordance with the drawings in Appendices 25, 26 and 27.

6.4.2 The meter board must be equipped with necessary incoming and outgoing electrical safety devices, including but not limited to MCBs, isolators, and other relevant components.

6.5 Wiring, Layout of Meters, MCBs, etc. in Centralised Meter Rooms, Meter Compartments / Riser Ducts / Cupboards

6.5.1 All wiring leading in and out of the group meter location must comply with SS 638. The landlord's wiring must be segregated from the tenant's wiring.

6.5.2 Meters are to be mounted together with their associated service MCBs / neutral connectors such that each meter can be visually identified with its associated service MCBs. Each meter position must be clearly labelled according to the tenant unit number. There should be a space of 70mm between vertically mounted meters.

6.5.3 Meters are to be mounted in neat vertical columns and/or horizontal rows.

6.5.4 Service MCBs shall be sealable. MCBs must be clearly labelled according to the tenant units served. The labelling must also correspond to the labels used for the meters.

6.5.5 All wiring on the meter boards from service MCBs / neutral connectors to the meters and from the meters to the customer's main switches must be neatly run on the surface - horizontally and/or vertically. Multiple-strand flexible-type meter wire is not acceptable. Hard-drawn wire is acceptable.

6.5.6 If the meter is inside an enclosure (compartment / cupboard / duct / riser etc.) with an access door - the depth measured from the meter board surface to the inner access door must be between 200mm to 300mm. “Owners” are to ensure compliance to avoid failure of meter installation / replacement on appointment date.

6.5.7 No water meter, gas meter or other facilities shall be placed within the same electricity meter enclosure (compartment / cupboard / duct / riser etc.) for safety reasons. Where this may not be feasible, the electricity meter must be physically segregated away from them (an impervious piece of concrete slab). For such layout, the LEW has to submit the relevant drawings endorsed by the LEW in-charge to the Electrical Meters Section for approval.

6.6 Submission of Layout Plans

6.6.1 The layout of the meter rooms, meter compartments / riser ducts / cupboards, including the dimensions required for electrical meter installation, shall be submitted and endorsed by the LEW at the planning stage for verification by Electrical Meters Section to ensure compliance to metering requirements as per the relevant clauses in Section 6. This submission is not for other electrical aspects of the electrical installation for which the LEW in-charge shall be responsible.

6.7 Meters for 3-Phase Low Tension Connection (Exceeding 100A per Phase)

6.7.1 Meters for connections exceeding 100A per phase are operated from metering current transformers and are to be fixed on a pre-wired metering panel on the customer’s main switchboard. However, where the length of the connecting leads are not excessive, the pre-wired metering panel may, with the prior approval of Electrical Meters Section, be wall-mounted away from the main switchboard or in a separate meter room.

The pre-wired metering panel with Electrical Meters Section approved type test terminal block, 6A (10kA) 4-pole Type C MCB and metering cables to the busbars and the three metering current transformers, must be provided by the customer. Incoming MCB must be rated according to applied load approved by SP. Terminal lugs of ring-

type should be used for wiring terminations in the metering panel. Drawings of the pre-wired metering panel may be requested from Electrical Meters Section if required.

6.7.2 Meter Panel Specifications:

(a) Meter panels must be of mild steel of at least 1.6mm thickness or other materials subject to approval by Electrical Meters Section.

(b) The panels must be detachable and of a size given in Appendix 28.

(c) There must be a minimum depth of 100mm between meter panel and its base.

(d) There must be openings with appropriate bushing for the meter wires.

(e) The cover must have at least 3 hinges and be able to swing and open out at least 90°.

(f) Facilities for sealing must be provided. Methods of sealing are illustrated in the drawings in Appendix 29.

6.8 Meter Installation Requirements

6.8.1 An electrically trained representative or LEW shall be present during meter installation appointment to support site verification activities and confirm compliance with metering and installation requirements.

6.8.2 With reference to Section 6.8.1, the representative or LEW is expected to perform necessary testing activities to demonstrate the CTs are installed in the correct polarity with respect to the incomer supply/MCB in the presence of Electrical Meters Section officer before the installation and commissioning of the 3-Phase Low Tension Meter (exceeding 100A per phase).

6.8.3 The LEW or switchboard representative must be present for 3-Phase Low Tension Meter (exceeding 100A per phase) installation.

6.8.4 The switchboard must be complete and securely mounted in its final position before meters can be installed.

6.8.5 The height of the meter board or panel must be such that meters can be mounted not exceeding 1.8m above floor level and not less than 0.8m above floor level.

6.8.6 A 50mm x 50mm trunking of metal or other approved material between the switchboard and the meter panel must be provided to house the meter cables (voltage cable to be $4mm^2$ and current cable to be $6mm^2$) if the latter is installed away from the customer's main switchboard.

6.8.7 A 6.0mm tap-hole plus screw or bolt and nut with washer on each busbar must be provided to facilitate connection of the voltage cables to the meter voltage coils.

6.8.8 If the meter panel is away from the customer's main switchboard, sealable 30A HRC fuse for each phase and a sealable 4-pole MCB of 6A 10kA rating must be provided on the front of the switchboard panel near the metering CT enclosure for the protection of the meter voltage wiring. The MCB must be appropriately labelled.

6.9 Low Tension Current Transformer Enclosure

6.9.1 A rigid enclosure of mild steel plate of thickness not less than 1.6mm must be provided solely for housing the metering current transformers and voltage tap off points. The enclosures must have facilities for sealing. Appendix 30 shows the specifications of the enclosure.

6.9.2 The customer is advised to adhere strictly to the dimension of the metering current transformer enclosure shown in Appendix 30. The current transformers must be installed with at least 13mm apart regardless of mounting arrangement. Customer shall make arrangement to rectify the enclosure should the dimension fails to meet the requirement.

6.9.3 The enclosure must be segregated from other equipment such as measuring instruments and control devices.

6.9.4 All screws, bolts and nut to be of brass. The enclosure shall be properly welded on the Switchboard Main Structural Framework.

6.9.5 The enclosure shall be covered by a clear plastic/acrylic sheet with sealing provision.

6.9.6 The enclosure shall be located immediately after the incoming circuit breaker(s).

6.9.7 Mounting of metering current transformers must be as follows:

(a) Current transformers must be mounted on jumpers for easy installation.

(b) Bakelite clamps must be provided to secure the meter current transformers in position.

(c) Adequate insulation between the metering current transformers and the busbar must be provided.

(d) S2 of the secondary terminal of the current transformer must be grounded at a single point.

(e) Clear indication of P1 and P2 orientation as verified by the customer/installation LEW in the enclosure to ensure correct orientation of CT installation by customer/installation LEW.

6.10 High Tension/ Extra-High Tension Metering

6.10.1 The customer is required to provide, install and maintain, at his own expense, current transformers, voltage transformers, a pre-wired metering panel with test blocks, MCBs, pilot lamps and accessories, at his receiving HT/EHT switchboard. These must meet SPPA's requirements. Drawings of the pre-wired metering panel may be requested from Electrical Meters Section.

6.10.2 All metering current and voltage transformers must be used solely for SPPA's revenue metering equipment. No other apparatus of the customer is permitted to be connected to such metering current and voltage transformers. However, a voltmeter may be allowed to be connected via a 100 mA fuse (sealable) subject to approval by Electrical Meters Section.

6.10.3 The customer must also provide a metering kiosk to be located close to where the metering current and voltage transformers are installed, such that the route length of the cables from the current and voltage transformers to the metering kiosk does not

exceed 20m. If the length exceeds 20m, LEW shall propose to Electrical Meters Section the suitable cable type and size for the distance, taking into consideration of the burden of metering current and voltage transformers.

6.10.4 The requirements for the kiosk are given in Appendices 31 and 32. The access to the metering kiosk must be from outside the HT switchroom and fitted with any one of SPPA's approved master lock series as specified in Section 6.1.15 at all times. If discovered otherwise, customer will be informed to rectify with reference to Section 6.1.17.

6.10.5 The customer must provide an appropriate metering panel of a size given in Appendix 33 and install a 50mm x 50mm trunking of metal or other approved material between the customer's HT switchboard and the metering panel together with the required type and size of cables.

6.10.6 Facilities for sealing connections of all metering wire termination at the customer's HT switchboard must be provided.

6.10.7 A schematic and wiring diagram of the customer's switchboard must be supplied to facilitate installation of the meters.

6.10.8 Current transformers installed in the switchgear must be easily accessible to ensure inspection, installation and future maintenance work can be conducted in a safe manner.

6.11 Specifications for High Tension Metering Current Transformers

6.11.1 The customer will provide two metering current transformers of 30VA burden for 66kV connection or 15VA burden for connection at 22kV and below. These must be of accuracy class 0.5 complying with IEC 61869-2.

6.11.2 The current transformers are to be installed on the L1 and L3 phases at the cable end for each of his receiving switchboard. The LEW shall propose suitable metering CTs with ratios to cater for the contracted capacity and the ultimate load subject to approval by Electrical Meters Section. For connection at 230kV, the LEW will liaise with Electrical Meters Section on metering requirements.

6.11.3 The rated short-time current rating must not be less than 63kA 1 second, 40kA 3 seconds, 25kA 3 seconds and 20kA 3 seconds for connection at 230kV, 66kV, 22kV and 6.6kV respectively.

6.12 Specifications for High Tension Metering Voltage Transformers

6.12.1 For each of the customer's receiving switchboard, one of the following voltage transformers must be provided:

(a) One unit 3-phase 66kV/110V, 22kV/110V or 6.6kV/110V voltage transformer of 100VA burden per phase, connected star-star with the L2 phase (yellow phase) terminal of the secondary winding earthed, or

(b) Three units single phase,

$$\frac{66kV}{\sqrt{3}} \Big/ \frac{110V}{\sqrt{3}} \quad \text{or} \quad \frac{22kV}{\sqrt{3}} \Big/ \frac{110V}{\sqrt{3}} \quad \text{or} \quad \frac{6.6kV}{\sqrt{3}} \Big/ \frac{110V}{\sqrt{3}}$$

Voltage transformers of 100VA burden per phase, connected star-star with the L2 phase (yellow phase) terminal of the secondary winding earthed.

6.12.2 Voltage transformers must be of accuracy class 1.0 complying with IEC 61869-3. The secondary wiring of the voltage transformer must terminate in a sealable MCB incorporated in the switchgear panel. The MCB must be rated at 6A, 110V, 50Hz with breaking capacity not less than 10kA and the terminals of the MCB must be able to accept cables of cross section up to 6mm^2.

6.12.3 The voltage transformers must be fused and adequate stock of spare high-voltage fuses must be kept by the customer.

6.13 Testing of Metering CTs and VTs

6.13.1 All metering current transformers together with their manufacturers' test certificates must be submitted for testing and approval by Electrical Meters Section at the Meter Test Laboratory at least 2 weeks before connection. Lead time required for CT testing is 2 weeks.

6.13.2 Original manufacturer test reports of all voltage transformers must be submitted to Electrical Meters Section for approval before the voltage transformers are installed at site. Date of test report should not be more than 1 year from intended date of installation. The test reports must be endorsed by an accredited testing laboratory under the SAC-SINGLAS or SAC MUTUAL RECOGNITION ARRANGEMENTS (MRA) partners program. Voltage transformer supplier must produce a declaration letter signed by a Licensed Electrical Worker (LEW) declaring that the voltage transformers have been tested for compliance with IEC 61869-3.

6.13.3 All test certificates and reports mentioned in Section 6.13.1 and 6.13.2 for the metering current transformers and voltage transformers must be submitted through SP Group eBusiness portal.

6.13.4 The metering voltage transformers, after re-installation onto customer's switchgear, have to be tested and phase out, and a voltage ratio, sequence and phase angle test report (Appendix 34) has to be submitted to Electrical Meters Section before installation of meters.

6.14 Miscellaneous Metering Requirements

6.14.1 Low Tension Customer

(a) Single Customer – Approved load more than 69kVA

- The customer will provide three metering current transformers (CTs) of 5VA burden and accuracy class 0.5 complying with IEC 61869-2 and the pre-wired metering panels on the customer's intake switchboard. The pre-wired metering panel must be fitted with SPPA approved type test block, 4-pole MCB and connected with metering cables to the CTs and busbars. The CTs together with their manufacturer's test certificates must be submitted for testing and approval at least 2 weeks before connection is required.

- A request for appointment for meter installation shall be made only after the LEW has arranged with SPSL for a date to energise the service connection.

- Electrical Meters Section will arrange to install the meters upon production of the energisation appointment letter issued by SPSL and requires at least 4 business days before the date of energisation of service connection.

6.14.2 Multi-Metered Buildings

(a) Submission of floor plans of building showing the locations of metering kiosks, meter room, meter compartments / riser ducts.

(b) Submission of dimensioned metering layout showing the plan, front and side elevations of the meter boards / rooms / compartments / riser ducts, etc. The metering drawings have to be endorsed by the LEW in-charge of the project.

(c) Arrangements for sample units of each approved type of meter compartment / riser duct and meter board to be inspected and approved by Electrical Meters Section before meters are installed.

(d) Bulk meter fixing request of new HDB and private developments shall be submitted at least 2 weeks in advance. Arrangements shall be made with Electrical Meters Section to install the meters.

6.14.3 Landed Housing Development

(a) Submission of site plans of building showing the locations of meter compartment at gate post / pillar.

(b) Submission of dimensioned metering layout showing the plan, front and side elevations of the meter compartment in the gate post / pillar. The metering drawings have to be endorsed by the LEW in-charge of the project.

(c) Arrangements for sample units of each approved type of meter compartment and meter board to be inspected and approved by Electrical Meters Section before meters are installed.

6.14.4 High Tension / Extra-High Tension Customer

(a) The revenue metering equipment will be installed at the customers' end of the service connection. The customer shall provide a suitable metering kiosk at his intake station, and metering CTs and VTs for each of his receiving switchboard as shown in Appendix 31-33.

(b) The LEW shall propose suitable metering CTs with ratios to cater for the contracted capacity and the ultimate load subject to approval by Electrical Meters Section. The table below is provided as a guide for installation with 2 service intakes:

Customer Connection	Contracted Capacity (MW)	CT Ratio (A)
22kV Service Connection	0.0 - 0.8	50/25/5
	0.81 - 1.7	100/50/5
	1.71 - 2.5	150/75/5
	2.51 - 3.2	200/100/5
	3.21 - 5.0	300/150/5
	5.01 - 6.6	400/200/5
	6.61 - 10.0	500/300/5
66kV Service Connection	0.0 - 5.0	100/50/5
	5.01 - 10.0	200/100/5
	10.01 - 20.0	400/200/5
	20.01 - 30.0	500/300/5
	30.01 - 40.0	800/400/5
	40.01 - 80.0	1000/500/5

* For 230kV and 400kV service connections, please consult Electrical Meters Section directly.

(c) For installations that use metering VT with two or more separate windings, LEW may request the Letter of Undertaking from Electrical Meters Section. The Letter of Undertaking shall be submitted through SP Group eBusiness portal.

(d) The LEW/Customer shall note the estimated lead time for HT meter installation is 4 weeks upon submission of CT/VT documents in the e-Business portal. Lead time is subjected to changes.

6.15 Contestable Customers

6.15.1 Eligibility

(a) The eligibility of contestable customers is determined by EMA.

6.15.2 Additional Requirements for Contestable Customers on AMI Meters

(a) A contestable customer using Advanced Metering Infrastructure (AMI) meters based on RF shall, in the event that RF signal is weak at the metering point, facilitate and get approval from the building owner for SPPG to install additional Radio Frequency (RF) infrastructure from the meter to the RF antenna. The scope of work shall be advised by SPPG after site assessment.

RF infrastructure shall include but not limited to the following items:

i. RF High Gain Antenna
ii. Coaxial cable
iii. Termination box
iv. Other associated materials

If the contestable customer is a tenant, they must obtain prior approval from their landlord for such works to be carried out.

(b) If the RF infrastructure is not feasible, the contestable customer shall facilitate, together with the building owner - the installation of Telco infrastructure to ensure the availability of mobile telecommunication coverage where the

metering point is located. Customer shall co-ordinate with SPPG for such scenarios.

6.15.3 Additional Requirements for Contestable Customers on MV90 Meters

(a) Existing contestable customers on MV90 meters are strongly encouraged to replace the MV90 meters to AMI meters which uses RF network for remote meter reading.

(b) The customer or their LEW representative can contact Electrical Meters Section to arrange for MV90 meter replacement to AMI meter.

6.16 Maintenance Procedure

6.16.1 High Tension and Low Tension Supply with Capacity above 69kVA

(a) All customers or their LEW representative shall write in to Electrical Meters Section to seek approval for any works that will require them to break SPPG metering seals for maintenance or any other purposes. Customers are to state in details the scope of works and are not allowed to break the seals prior to approval from Electrical Meters Section.

(b) Upon approval from Electrical Meters Section to break seal, customer or their LEW representative shall take photographs of the SPPG metering seals before and after breaking with the serial number of the seals clearly visible and submit to Electrical Meters Section.

(c) Upon completion of the maintenance work, the customer or the customer's LEW representative shall contact Electrical Meters Section and facilitate access for its officers to carry out the necessary resealing.

6.16.2 Supply Capacity up to 69kVA

(a) For any work that requires breaking of metering seals e.g. estate rewiring work, bulk meter shifting, upgrading of electrical wirings / replacement of meter boards etc., the LEW shall submit application to SP Services Ltd.

(b) In the event of emergency maintenance, LEWs can break the seal to carry out the necessary works and inform Electrical Meters Section immediately for resealing arrangement. LEWs are reminded to provide photographs of the affected meter installation and metering seals before and after breaking with the serial number of the seals clearly visible for audit purposes.

(c) Upon completion of the maintenance work, the customer or the customer's LEW representative shall contact Electrical Meters Section and facilitate access for its officers to carry out the necessary resealing.

6.16.3 Periodic Meter Replacement and Audit on Metered Installations

(a) Where SPPG is appointed as the Meter Equipment Service Provider (MESP), Electrical Meters Section shall conduct periodic meter replacements and audits at the prescribed intervals applicable to each meter type or facility under its responsibility, in accordance with the Metering Code.

(b) The customer or the metered entity shall be notified in advance of any periodic meter replacement and/or audit to be carried out at the metered installations.

(c) The customer or metered entity associated with the meter installation shall ensure that Electrical Meters Section, in its capacity as the Meter Equipment Service Provider (MESP), is granted unrestricted access to the meter installation for the purpose of carrying out periodic meter replacements and audits.

7 Appendices

LETTER OF CONSENT FOR SUBMISSION OF APPLICATION FOR ELECTRICITY SUPPLY

Note:

1] Submission of the letter of consent as part of the supporting documents is compulsory during CS 1 and CS 5 online application submission.

2] The owner of the premise has to indicate that prior consent has been given to the Licensed Electrical Worker to submit applications on his/her behalf.

3] Similarly, the Licensed Electrical Worker has to acknowledge that he has been granted consent to submit the application on behalf of the owner.

4] A copy of the letter of consent is available on SP Services webpage for download under the Licensed Electrical Worker tab. A sample copy is attached.

Letter of Consent for Submission of Application for Electricity Supply Date: _____

I / We, (Name) _____ of UEN No.: _____ or NRIC/FIN No: ☐☐☐☐

Note : Please state the last 4 characters (i.e. last three digits and alphabet) of NRIC / FIN / passport or other personal identification number.

of (Address) _____ Tel: _____

(A) Hereby declare: -

☐ That I have at least one (1) small and embedded generating unit (e.g. solar photovoltaic) at the Premises and I am **NOT** GST registered. I attach herewith a copy of non - GST registration from IRAS:

☐ That I have at least one (1) small and embedded generating unit (e.g. solar photovoltaic) at the Premises and I am GST registered. My GST registration number and date are as follows and I attach herewith a copy of the GST registration letter from IRAS:
GST registration number: _____ GST registration date: _____
I agree that I will not issue any tax invoice for electricity sold to SP Services Ltd but hereby authorize SP Services Ltd to issue tax invoices on my behalf. I will notify SP Services Ltd immediately if my GST registration is cancelled or if I am issued with a new GST registration number.

(B) Hereby give full consent to the below-named Licensed Electrical Worker: -

☐ To submit an application for electricity supply to the premises at ("Premises"): _____

(C) Hereby declare: -

- That I am / we are the legal owner / authorized occupier of the Premises;
- That I am / we are agreeable for any correspondence on the above application to be sent via email at the following email address : _____

I (Name) _____ of License No: _____
(Name of Licensed Electrical Worker)

of (Address) _____ Tel: _____

Hereby declare that the legal owner / authorized occupier of the Premises has given permission for my submission of the application for electricity supply.

Signature of Customer (Date) Signature of LEW (Date)

_____ _____

**Rubber stamp imprint required for corporate customers

FORM CS/3
Letter of Consent from the Landlord/Management Corporation

To: SP Group
2 Kallang Sector
Singapore 349277
Attn: SP Services

Email: Install@spgroup.com.sg

ELECTRICITY SUPPLY TO _____
(Full Address of the Customer)

FOR _____
(Name of Customer)

TOTAL LOAD ALLOWED FOR: _____ AT _____VOLTS

PART I

1. I have checked the loading of the electrical installation of the abovementioned building/complex and hereby confirm that the abovementioned load requirement can be catered for from the rising/horizontal mains system/main switchboard of the building/complex, and the total approved load to the entire building/complex will not be exceeded.

2. I have no objection for the abovementioned load to be connected to the rising/horizontal mains system/main switchboard of the building/complex.

3. The Electrical Installation Licence No. of the building/complex is _____.

4. The electrical installation of the building/complex from which this load is to be connected is

   ☐ Unmetered (i.e. without Master Account)

   ☐ Metered under Master Account No. _____.

5. I will check to ensure that the abovementioned installation is compatible with the electrical installation of the building/complex.

_____ Date: _____
Signature of Licensed Electrical Worker

Licence No: _____ /_____ Tel No: _____

Name: _____

Address: _____

_____S[_____]

PART II

I hereby give consent for the abovementioned customer to tap electricity supply of a capacity indicated above from the rising/horizontal mains system/main switchboard of the building/complex.

_____ Date: _____
Signature of Authorised Person

_____ _____
Name Designation

Official Stamp of the
Landlord/Developer/Management Corporation

13/10/11

FORM CS/3H
Letter of Consent from Housing & Development Board

To: SP Group
2 Kallang Sector
Singapore 349277
Attn: SP Services

Email: Install@spgroup.com.sg

ELECTRICITY SUPPLY TO _____
(Full Address of the Customer)

FOR _____
(Name of Customer)

TOTAL LOAD ALLOWED FOR: _____ AT _____VOLTS

PART I

1. I have checked the loading of the electrical installation of the above-mentioned building/complex and hereby confirm that the above-mentioned load requirement can be catered for from the rising/horizontal mains system/main switchboard of the building/complex, and the total approved load to the entire building/complex will not be exceeded.

2. I have no objection for the above-mentioned load to be connected to the rising/horizontal mains system/main switchboard of the building/complex.

3. The Electrical Installation Licence No. of the building/complex is _____.

4. The electrical installation of the building/complex from which this load is to be connected is:

   ☐ Unmetered (i.e. without Master Account)

   ☐ Metered under Master Account No. _____.

5. I will check to ensure that the above-mentioned installation is compatible with the electrical installation of the building/complex.

_____ Date: _____
Signature of Licensed Electrical Worker

Licence No.: _____ /_____ Tel No.: _____

Name: _____

Address: _____

_____S(_____)

PART II

I hereby give consent for the above-mentioned customer to tap electricity supply of a capacity indicated above from the rising/horizontal mains system/main switchboard of the building/complex.

_____ Date: _____
Signature of Authorised Person
For and on behalf of Housing & Development Board

_____ _____
Name Designation

Official Stamp of the
Landlord/Developer/Management Corporation

19/10/11

REQUEST TO HANDOVER SUBSTATION

Date:

To: SP Group
2 Kallang Sector
Singapore 349277
Attn: SP PowerGrid
(CPW / CPE / DNI / DNII / DNIII / DNIV / DNV / DNVI)

Dear Sir

PROJECT: ELECTRICITY SUPPLY TO _____

1. In connection with the electrification scheme (SPSL Appln No: _____), I wish to advise that the proposed SPPA substation has been completed in accordance with plans and specifications approved by your Company and the Competent Authority.

2. I confirm that the structural Professional Engineer in-charge has certified that the substation structure is constructed according to the approved plan to withstand the load specified by your Company.

1. I also certify that the electrical installation at the substation has been inspected and tested in accordance with the requirements of your Company as follows:

   a Earth value of electrode system is _____ ohms.
   b The continuity of each circuit protective conductor is satisfactory.
   c All metal conduits have been bonded to earth.
   d Polarity throughout the installation is correct.
   e All single pole control devices are in live conductors only.
   f The insulation resistance of the fixed wiring installation is _____ Megaohm.
   g All flexible cords, switches, fuses, plugs and socket outlets are in good serviceable condition.
   h The installation includes _____ Nos lighting points and _____ Nos socket outlets.

4. I shall be obliged if you could send your representative for a joint site inspection on _____, and thereafter to take over the said substation.

Yours faithfully

_____
Signature of Licensed Electrical Worker

Name: _____

Address: _____

Tel No: _____

NB: This form must be submitted one week prior to the date for joint site inspection.

TYPES AND LAYOUT OF SUBSTATION

The type of substation required will depend on the customer's load requirement. SPSL shall endeavor to provide the requirement of the substation within 10 business days following the receipt of application form.

Example of typical layout plans and details for substations of the independent building type are given in Appendices 11 to 15.

As a guide, the types of substations applicable for the various load requirements are as follows: -

Load Requirement	Primary Distribution Voltage	Room Size (M) L x W x H	Drawing References
Up to 1,000 kVA at 400/230V	22kV	Switchroom: 6.0 x 5.7 x 5.6 Transformer: 4.0 x 4.5 x 3.6	
Up to 2,000 kVA at 400/230V	22kV	Switchroom: 7.0 x 6.7 x 5.6 Transformer: 6.7 x 4.5 x 3.6	Appendices 11
Up to 4,250 kW at 22kV	22kV	Switchroom: 6.0 x 6.2 x 5.6	
Up to 12,750 kW at 22kV	22kV	Switchroom: 9.3 x 6.2 x 5.6	

The functional and safety requirements inclusive of the Workplace Safety and Health (Work at Height) Regulations 2013 & Amendment Regulations 2014 for the substation must be complied with. For example, the minimum clear height of paved vehicular access shall be 4.5m (1-storey), and 5.5m (1½-storey) for the delivery area directly in front of the substation.

Subject to the layout and access being suitable, the customer may incorporate the substation as part of his main building. The typical layout plans shown in this handbook depict only the functional requirements.

SUBMISSION OF SUBSTATION SITE AND LAYOUT PLANS

Before construction of the substation, the LEW shall submit to SPPG plans showing all relevant information for vetting. These include (a) site / location of the proposed substation in relation to the rest of the development, (b) detailed plans layout, (c) sections and elevations, (d) electrical layout c/w single-line drawing, and (e) all relevant miscellaneous details. Upon approval, one set of endorsed plans shall be returned to LEW.

All plans/drawings are to be submitted in A1 page size pdf. All pages are to be signed by the LEW who is responsible for the planning and design of the proposed substation. To facilitate processing, LEW covering letter should include MWP references, Project title and name / contact number of his engineer-in-charge. "Checklist for Submission of Substation Plans (Appendix 14) should also form part of the plans submission.

In the case of plans re-submission, all amendments (addition/deletion/revision) must be highlighted in the new set of drawings and listed out in the covering letter.

All plans are to be drawn to scale (1:50 for main layout, 1:100 for sections, elevations, etc) with total dimensions and breakdown dimensions/all spacing shown clearly.

Electronic e-submission: Submission shall be made in digital format. Comments and replies shall be offered digitally via e-mail. The e-mail addresses dedicated for the respective zone for submission are listed as follows:-

i) abbasmohdsupiah@spgroup.com.sg (East Zone)
ii) liqing@spgroup.com.sg (West Zone)

Substation Site Plans

These plans should show the location of the proposed substation(s) in relation to the surrounding area and should include the following:

1 The proposed substation(s) – to be highlighted
2 Customer's intake switchroom(s) ("CSR") and service cable route/set-up to substation;
3 SPPA's main incoming cable entry with sectional details inclusive of roadside drain top/invert level on layout plan
4 SPPA's main incoming cable entry with sectional details inclusive of roadside drain top/invert level on layout plan
5 Access driveway width, finish & headroom, where applicable including highlighting it up to development's entrance to public road
6 North-East Gridlines or 2 NE survey coordinates.
7 Endorsement Block : complete with MWP Reference No., Applied load at specific voltage level, CSR location (level), onus on party to provide/ install/ maintain service cables, Target date of energization.
8 Development Title and address

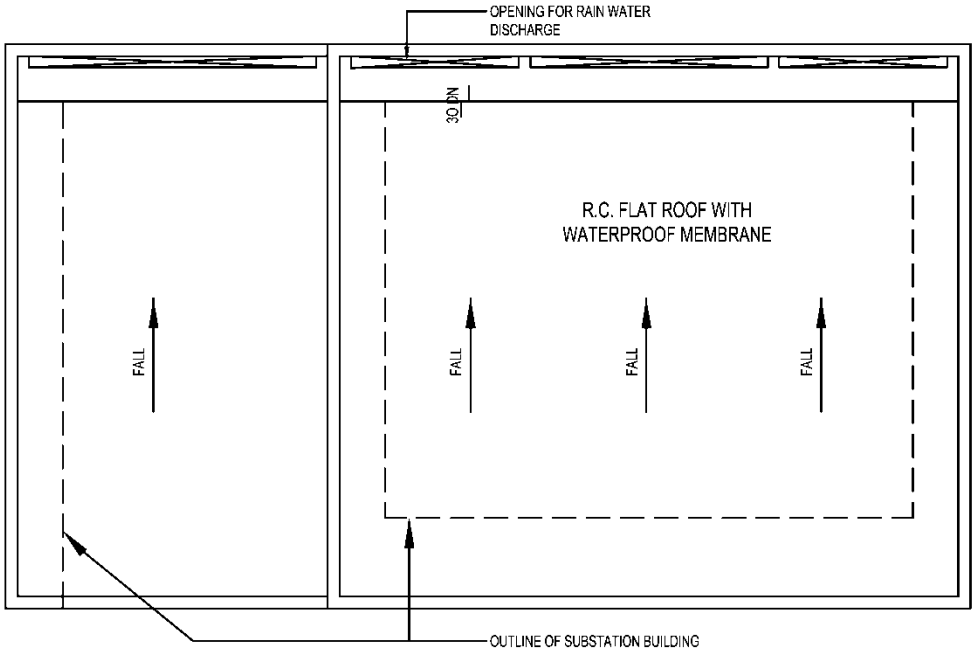
Substation Design/Layout Plans

It is mandatory that the submission shall include the following:

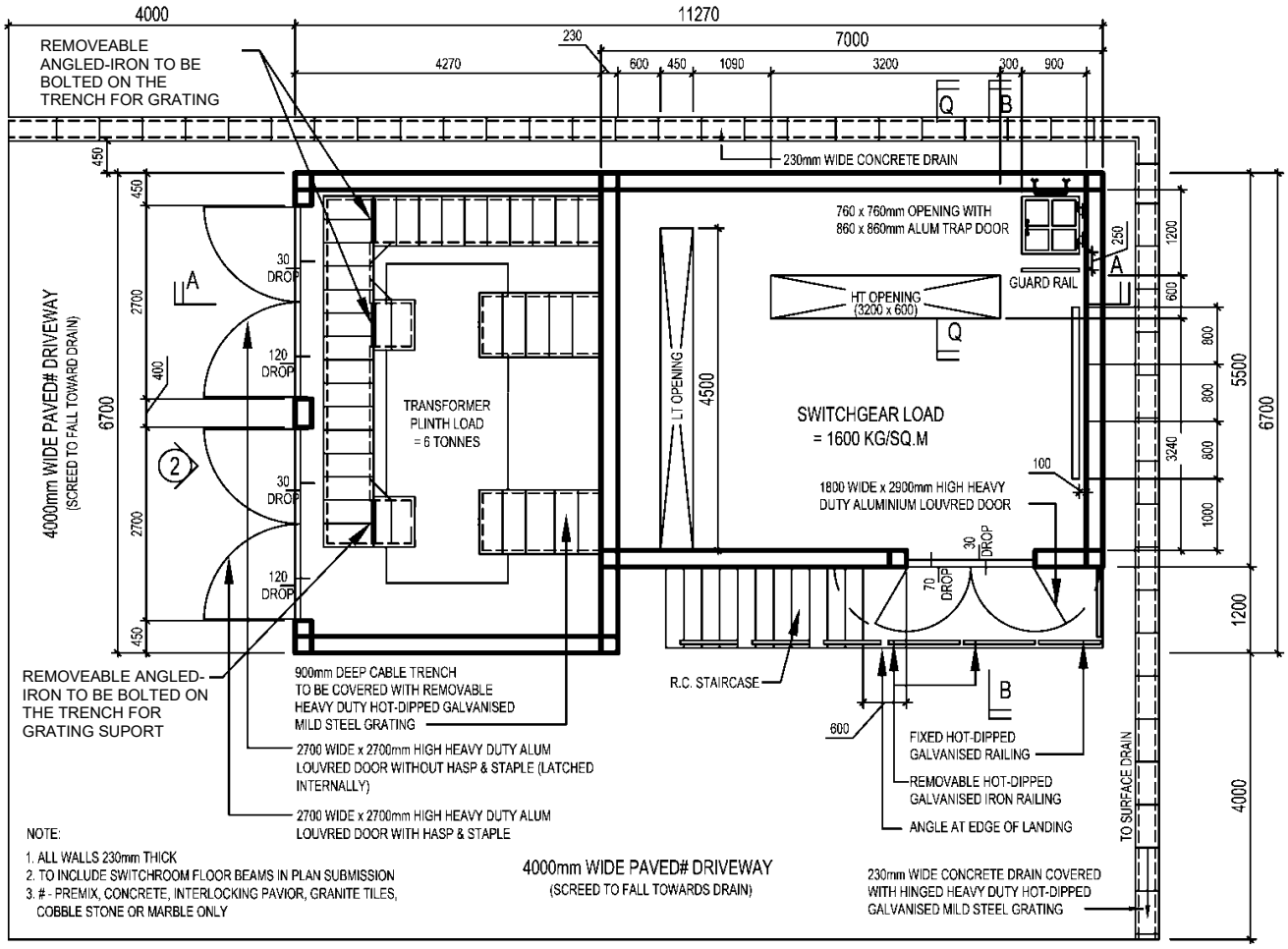
1 Salient requirements for the design of the substation are as listed in Appendix 15. Unless explicit waiver is granted, these requirements are to be incorporated in the architectural, and structural plans.
2 Plan, front, rear and side elevations with at least 3 cross sections showing the surrounding roads, cable chamber, switch room beams and clear height, switch room floor openings, transformer plinths, trenches and other pertinent details;
3 Space usage of adjoining upper floor, basement as well as adjacent spaces surrounding the substation shall be stated if substation forms part of the owner's building.
4 An AutoCAD softcopy of the endorsed substation site/location shown within the overall development as shown on the site/location plans to be emailed to our Mapping and Earthworks Administration section to mwp@spgroup.com.sg to facilitate our digitization in our mapping system.

Important Note: It is the onus of the LEW in charge to liaise with the project architects and structural engineers to ensure that all requirements as endorsed on the drawings are incorporated in the architectural and structural plans prior to the commencement of the substation construction.

22kV / LV SUBSTATION



ROOF PLAN



LAYOUT PLAN

22kV / LV SUBSTATION

LEGEND OF ELECTRICAL INSTALLATION

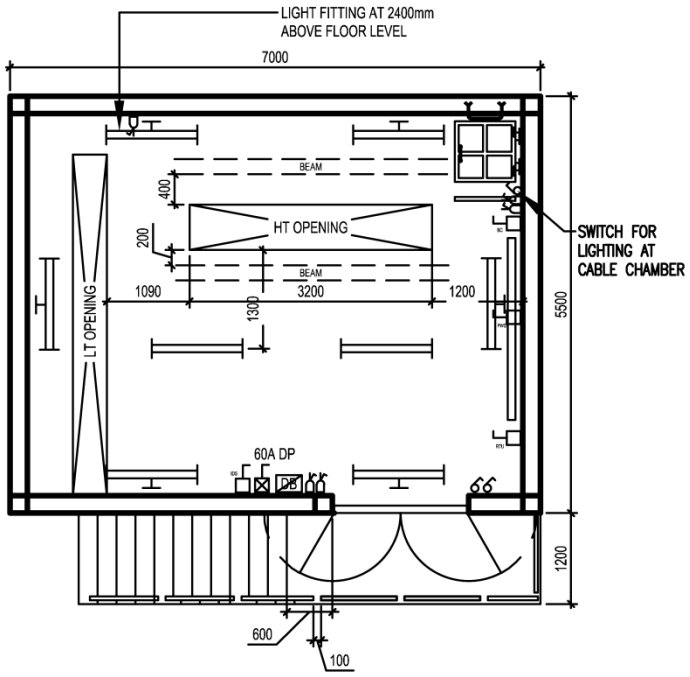
- 2 x 28W T5 FLUORESCENT LAMP FIXED TO WALL OR UNDER CEILING
- DB — 60A DISTRIBUTION SWITCHBOARD (MCB AND RCCB (63A/30mA IT) CONTROLLED)
- 13A METAL CLAD SWITCHED SOCKET OUTLET
- METAL CLAD SWITCH
- 2 x 28W T5 FLUORESCENT LAMP FIXED TO WALL WITH WIRE MESH GUARD
- 20A DP ISOLATOR (RCCB BY-PASSED)
- 60A DP ISOLATOR

NOTES:

1) GENERAL REQUIREMENTS FOR ELECTRIC SUBSTATION LAYOUT AS SHOWN IN APPENDIX 15 OF THE HANDBOOK ON HOW TO APPLY FOR ELECTRICITY CONNECTION, TO BE INCORPORATED INTO THE ARCHITECTURAL PLAN(S) [THE WHOLE OF THESE NOTES ARE TO BE REPRODUCED ON THE LAYOUT PLAN OF THE SUBSTATION SUBMITTED FOR APPROVAL AND ENDORSEMENT]

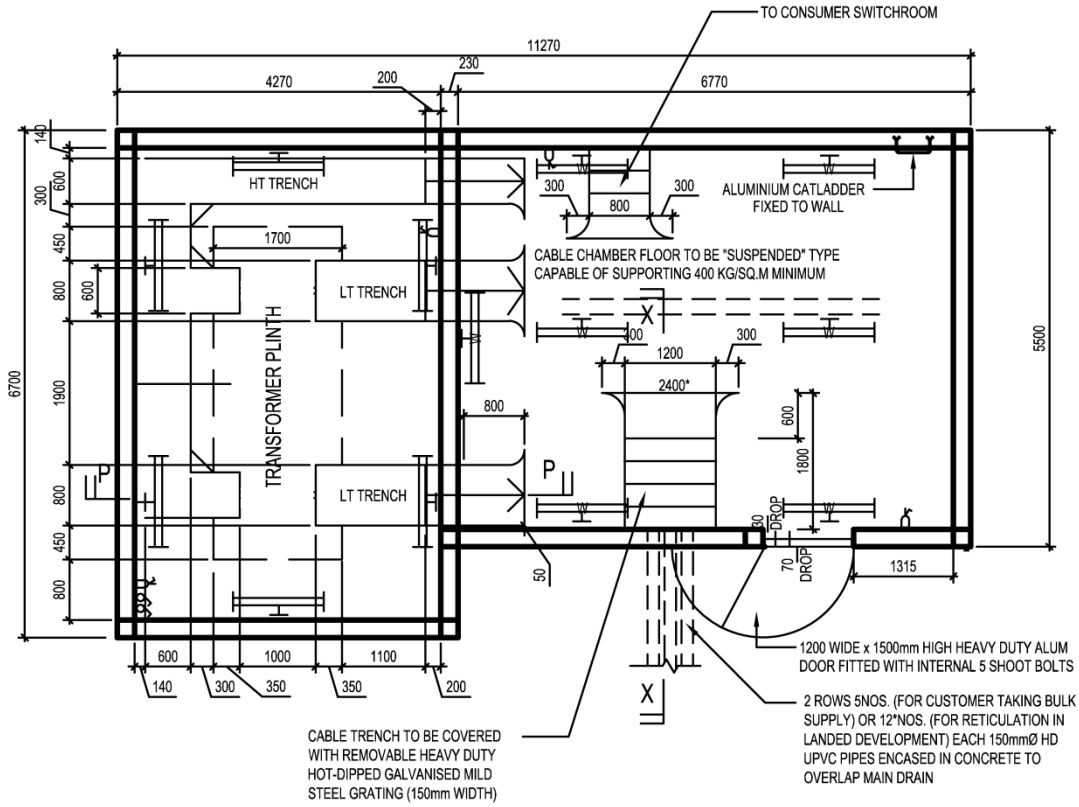
2) THIS DRAWING SERVES AS A GENERAL GUIDELINE ONLY AND IS SUBJECT TO MODIFICATIONS AS AND WHEN REQUIRED WITHOUT PRIOR NOTICE.

3) ALL DIMENSIONS ARE IN MILLIMETRES.



DETAILED PLAN OF SWITCHROOM

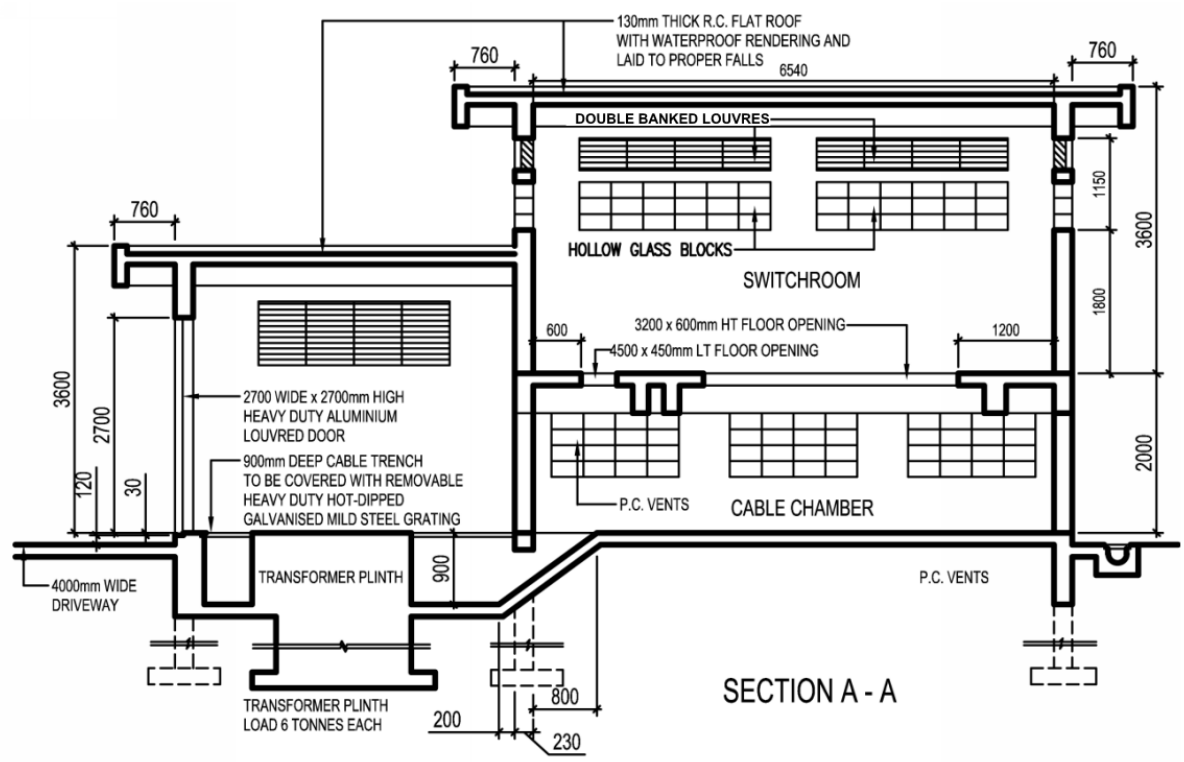
INCLUDING ELECTRICAL LAYOUT

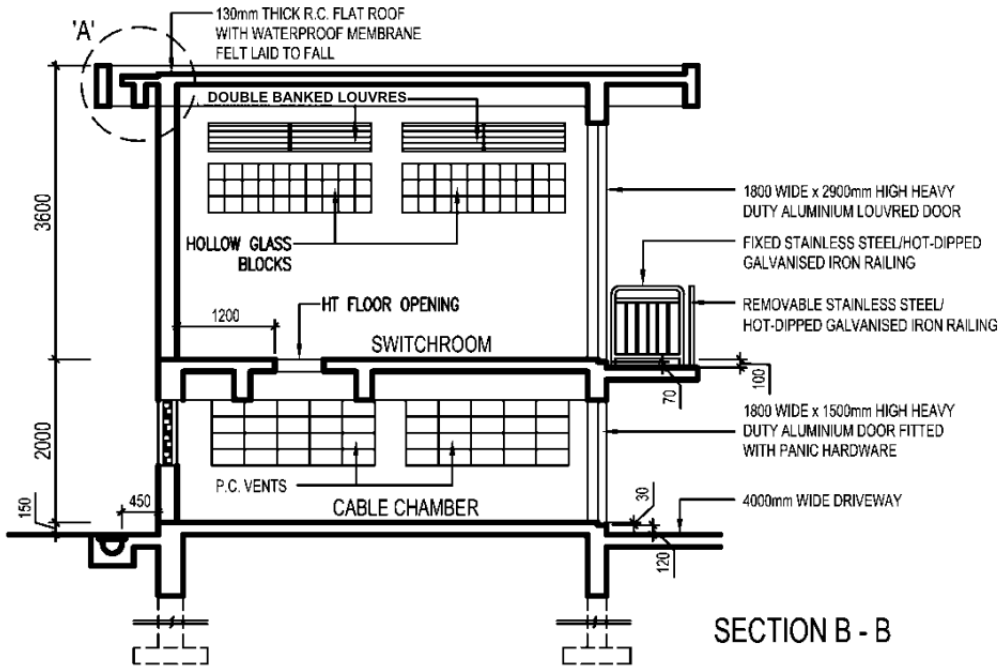


DETAILED CABLE CHAMBER PLAN

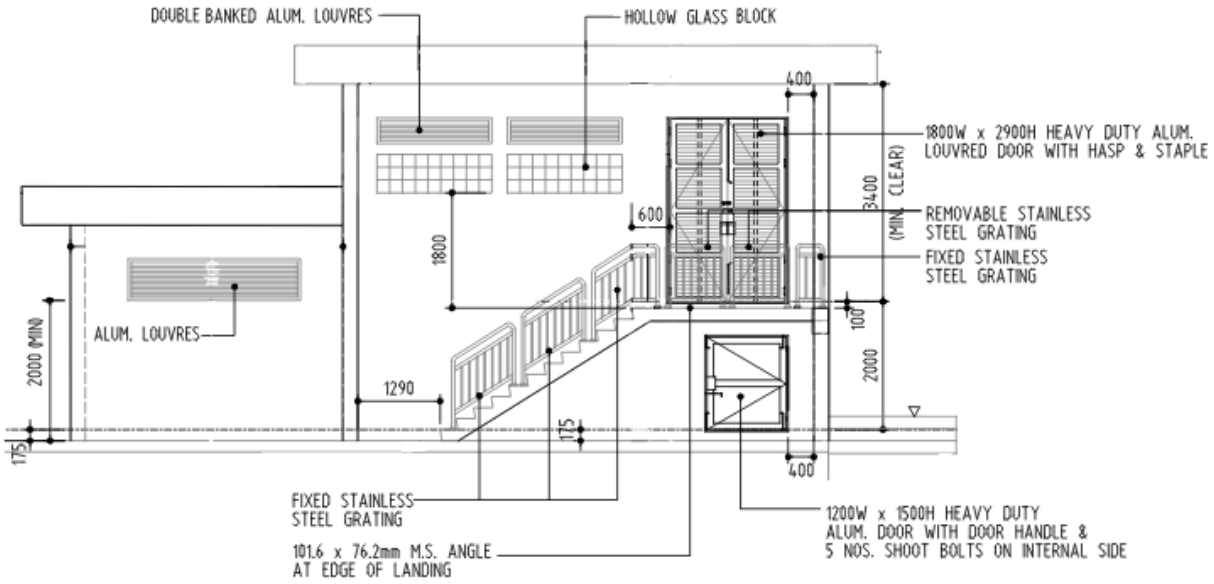
INCLUDING ELECTRICAL LAYOUT

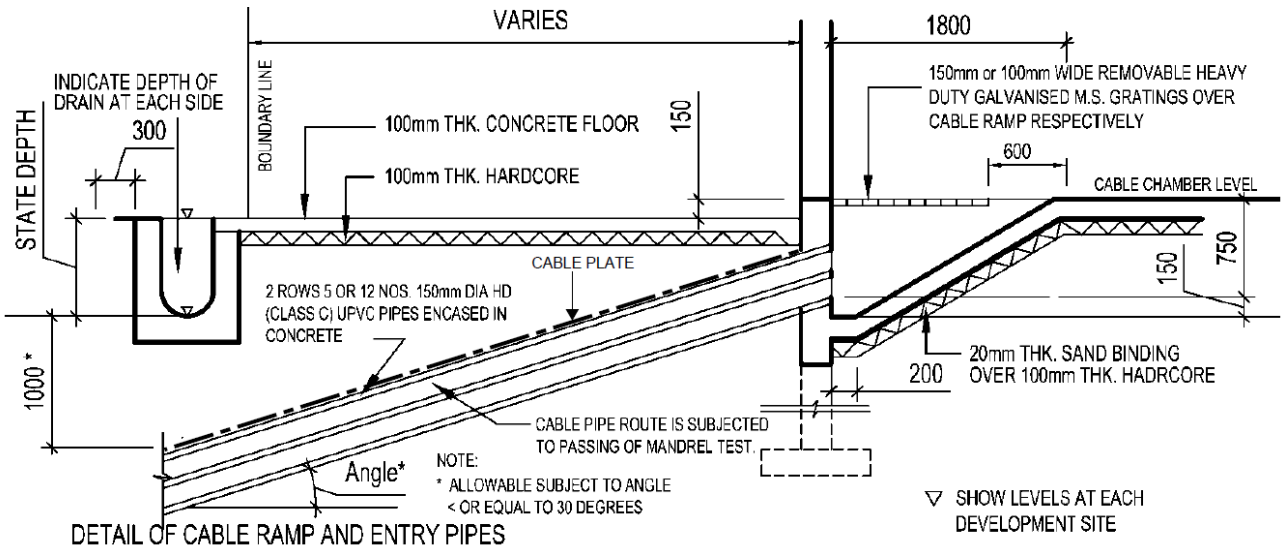
22kV / LV SUBSTATION





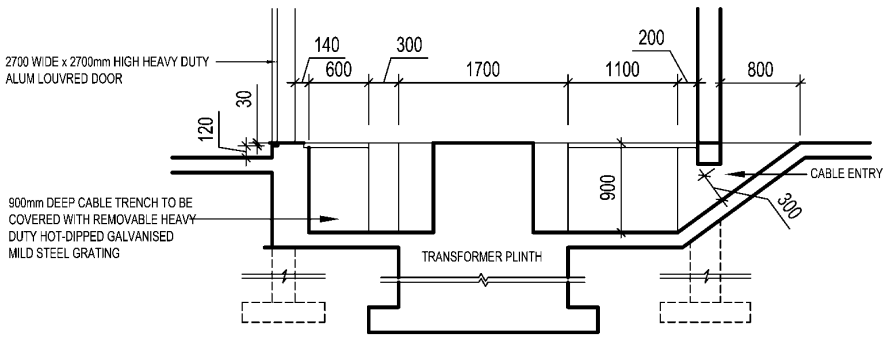
22kV / LV SUBSTATION





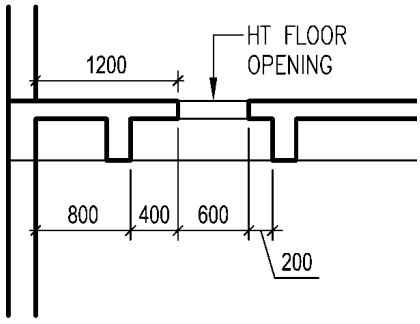
DETAIL OF CABLE RAMP AND ENTRY PIPES

SECTION X - X



SECTION P-P

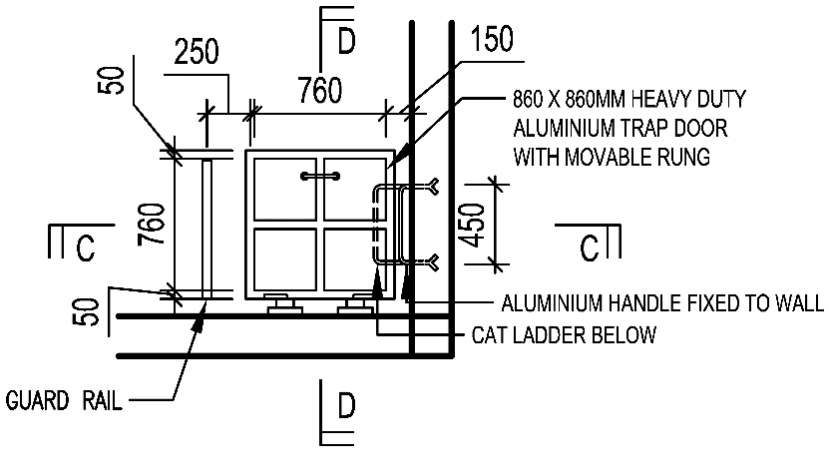
Scale 1:50



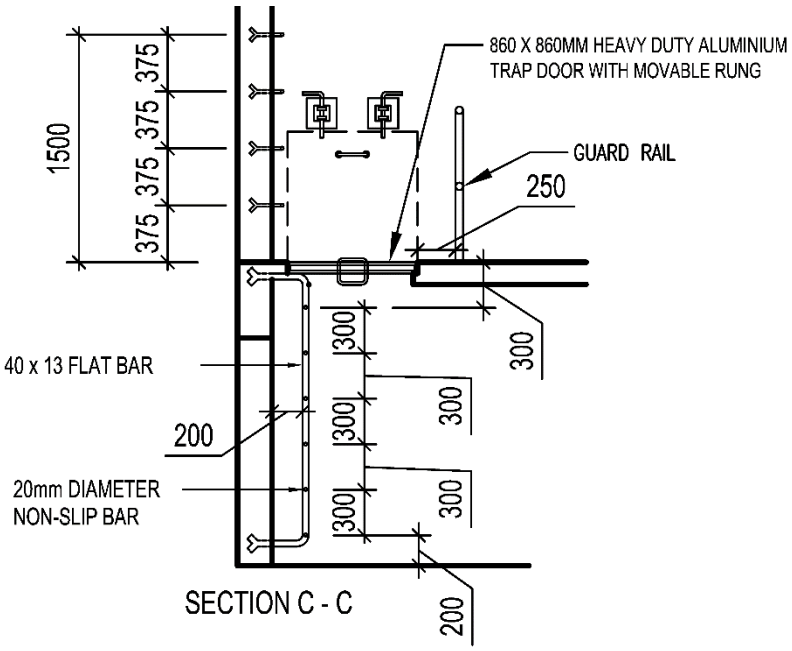
SECTION Q-Q

Scale 1:50

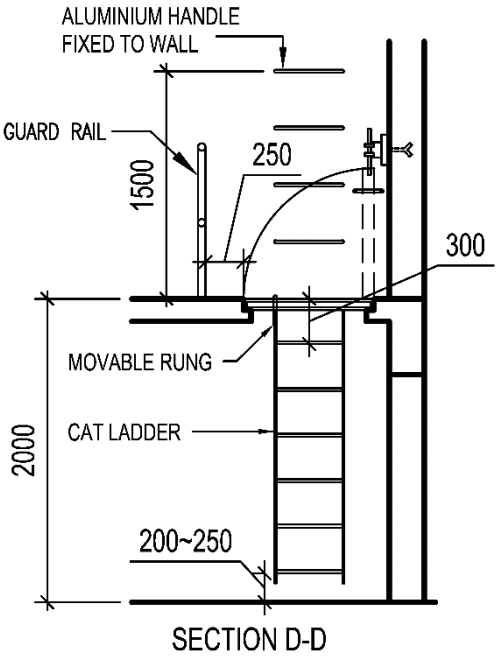
22kV / LV SUBSTATION



PLAN OF ALUMINIUM TRAP DOOR AND CATLADDER



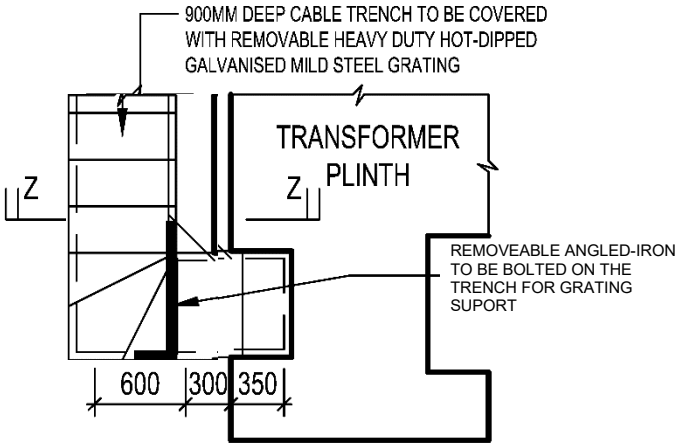
SECTION C - C

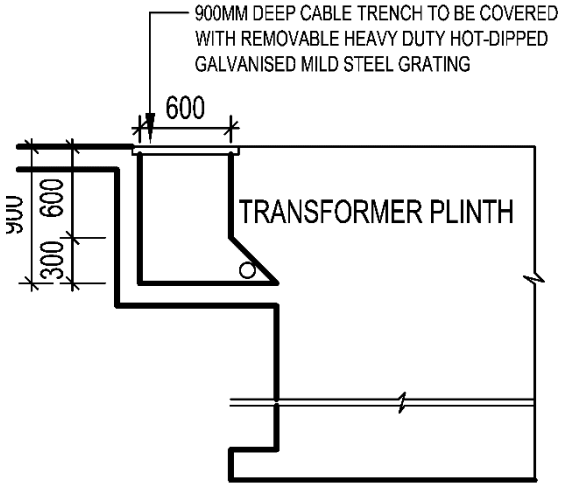


SECTION D-D

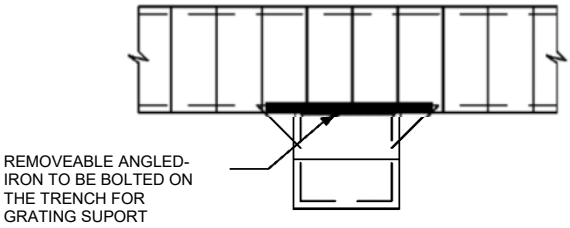
22kV / LV SUBSTATION

DETAIL AT HT CABLE TRENCH CORNER





SECTION Z - Z



DETAIL AT T- TRENCH

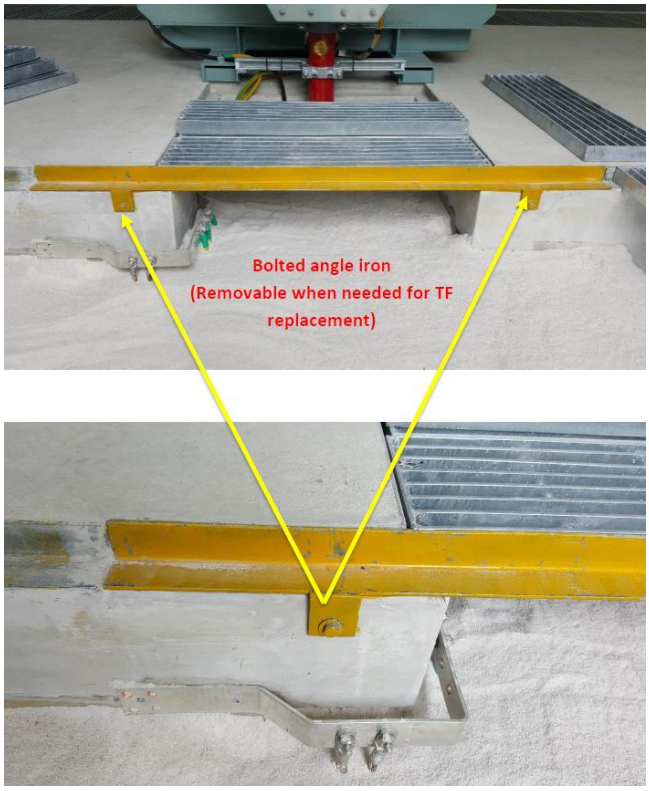
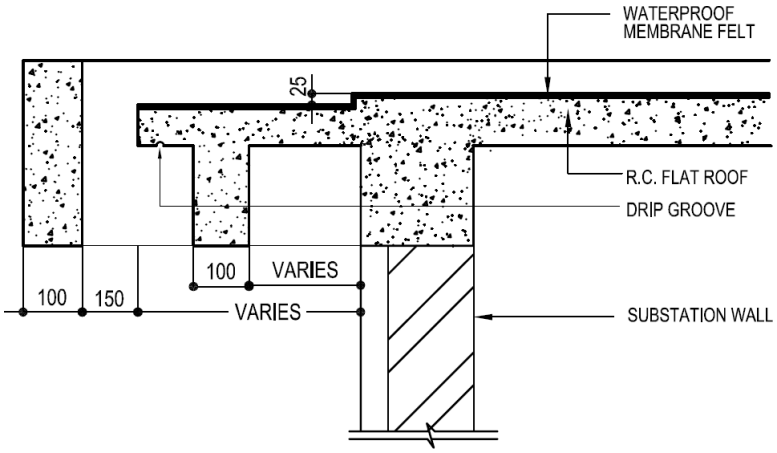


PHOTO OF REMOVABLE ANGLED-IRON

22kV / LV SUBSTATION

ROOF EAVE AND GLASS BLOCK

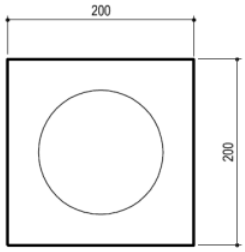


NOTE:

PC VENT BLOCK AND GLASS BLOCK TO BE FLUSHED EXTERNALLY

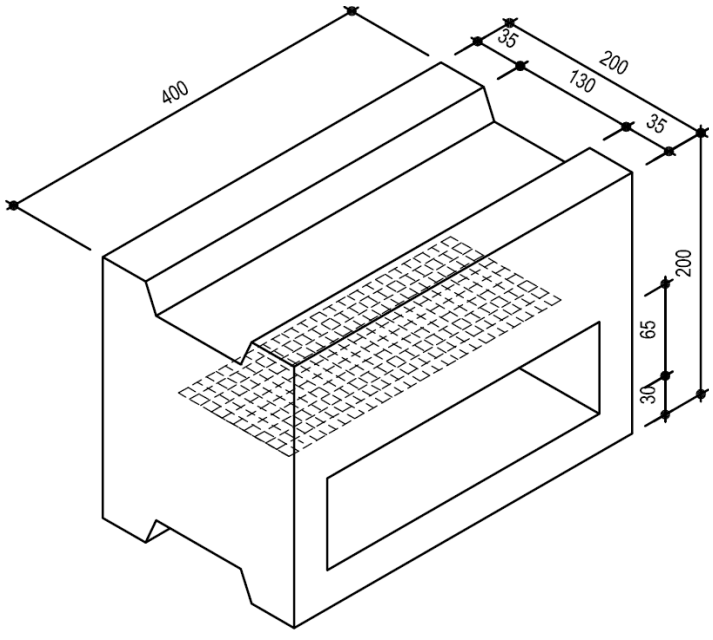
DETAIL `AA'

SCALE : N.T.S.



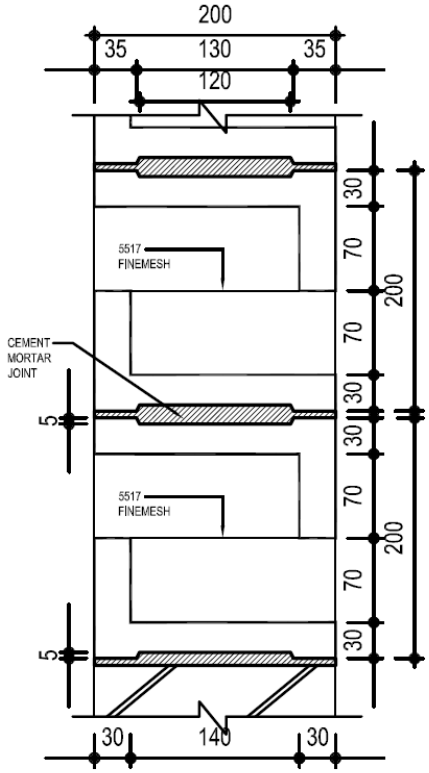
DETAIL OF HOLLOW GLASS BLOCK

PC VENT BLOCK DETAIL



ISOMETRIC VIEW

[Scale: NTS]

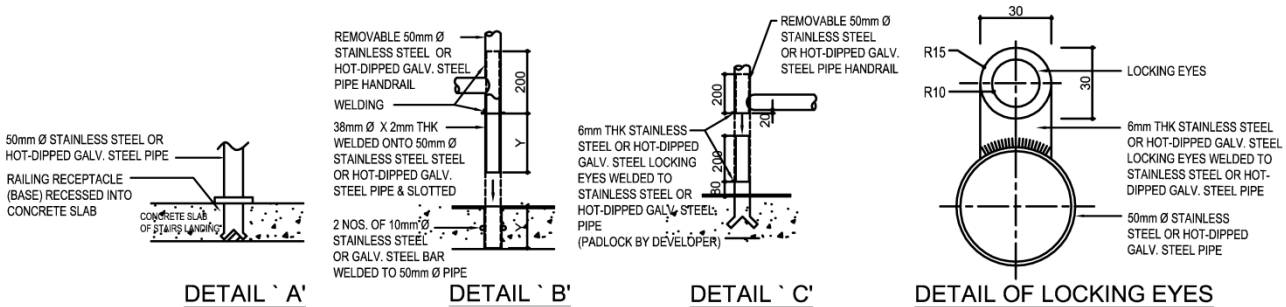


VENT PANEL

[Scale: NTS]

22kV / LV SUBSTATION

DETAILS OF RAILINGS (FIXED / REMOVABLE)

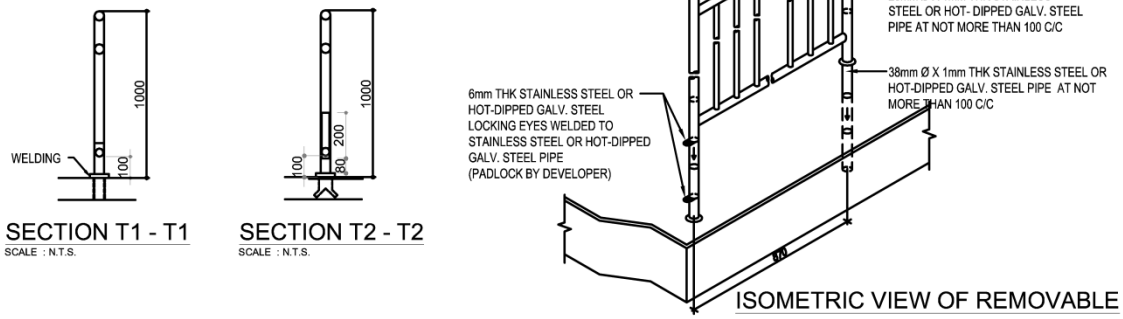


DETAIL ` A'
SCALE : N.T.S.

DETAIL ` B'
SCALE : N.T.S.

DETAIL ` C'
SCALE : N.T.S.

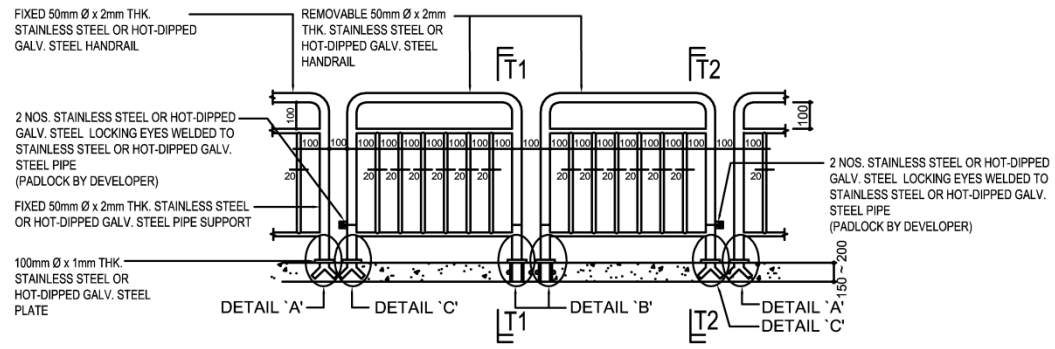
DETAIL OF LOCKING EYES
SCALE : N.T.S.

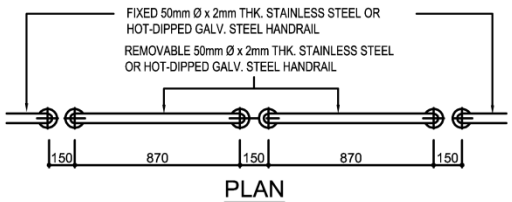


SECTION T1 - T1
SCALE : N.T.S.

SECTION T2 - T2
SCALE : N.T.S.

ISOMETRIC VIEW OF REMOVABLE RAILING
SCALE : N.T.S.



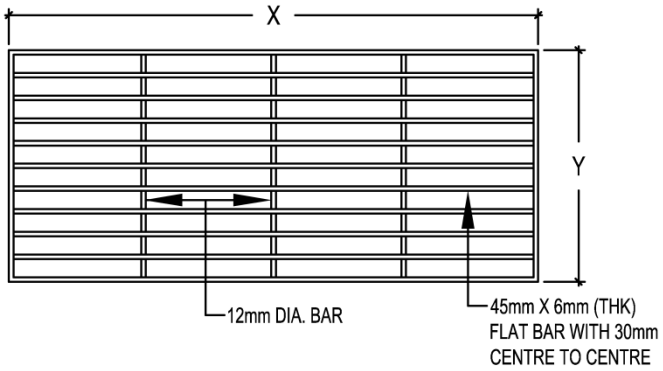


PLAN
SCALE : N.T.S.

22kV / LV SUBSTATION

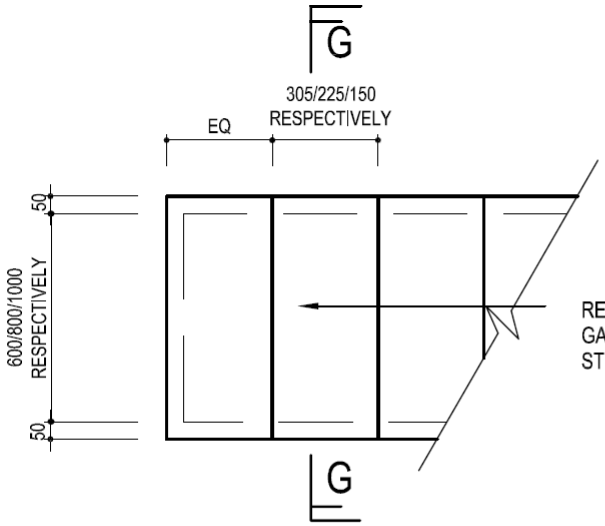
TRENCH AND GRATINGS

TRENCH WIDTH (D)	X (L)	Y (W)
600/700	700/800	300
800/850	900/950	250
900	1000	200
1000/1200	1100/1300	150
1600	1700	100

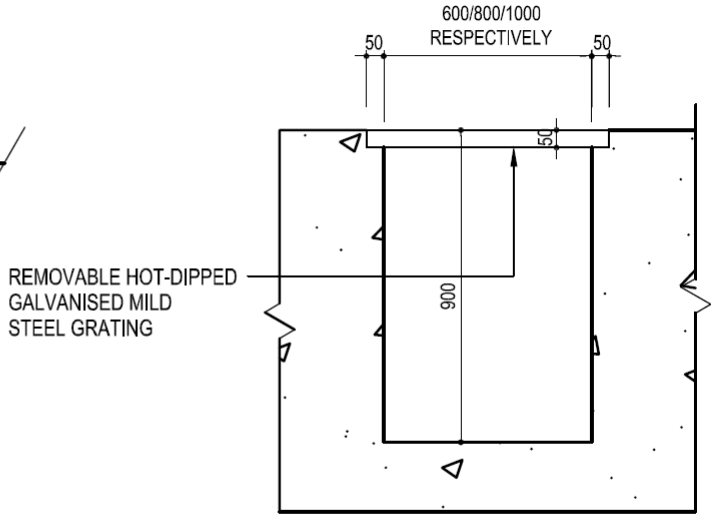


TYPICAL HEAVY DUTY HOT-DIPPED
GALVANISED MILD STEEL GRATING DETAIL

Scale : NOT TO SCALE



CABLE TRENCH OPENING
SCALE: N.T.S



SECTION G-G
SCALE: N.T.S

TRANSFORMER ROOM LOUVRED DOOR WITH HASP & STAPLE

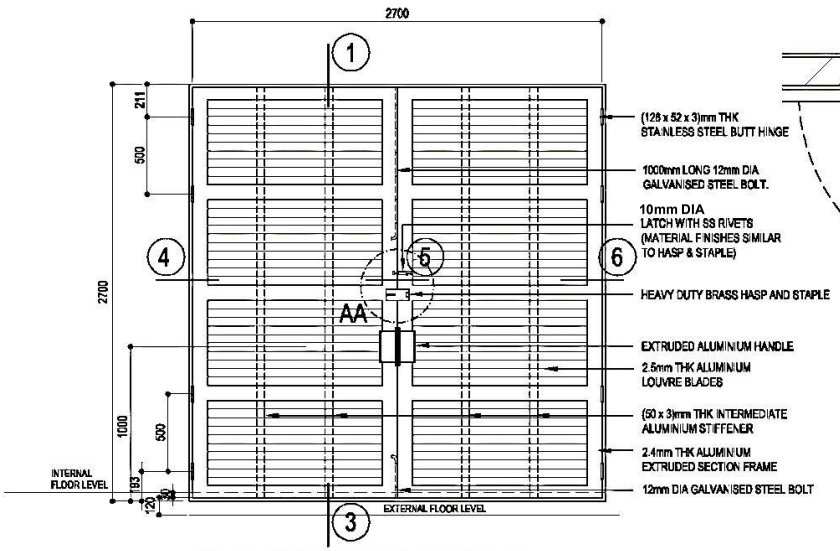
GENERAL NOTES:

1a. All aluminium shall be anodized in bronze colour (18 microns);

1b. Alternatively, the door finish maybe powder coated. Such finish being a polyester thermosetting powder electrostatically applied and oven baked to cure. This door coating maybe selected for its resistance to weather and its overall durability.

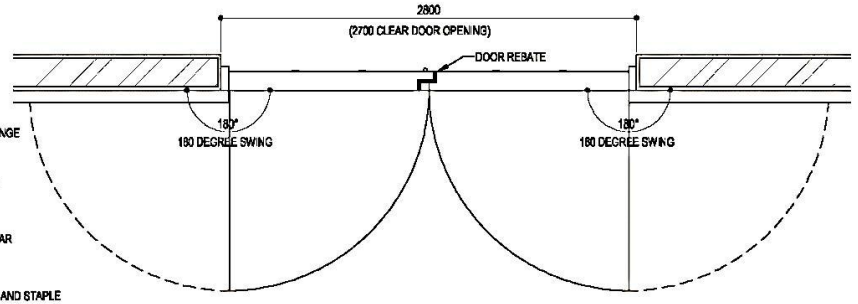
2. Door to be fitted with good quality door hook or magnetic door catch.

3. All rivets used in door fabrication are to be of Stainless Steel type including that of the butt hinge mounting.



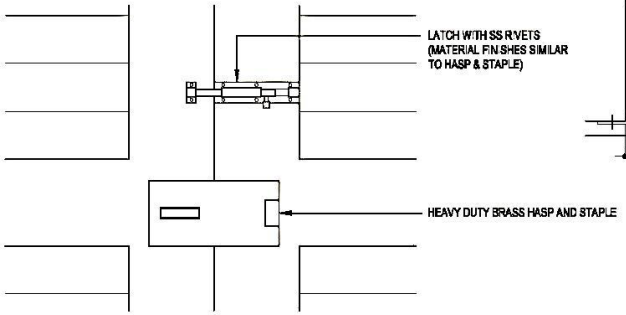
ELEVATION OF HEAVY DUTY ALUMINIUM LOUVRED DOORS FOR TRANSFORMER ROOM (DOOR C/W HASP & STAPLE)

SCALE: N.T.S.



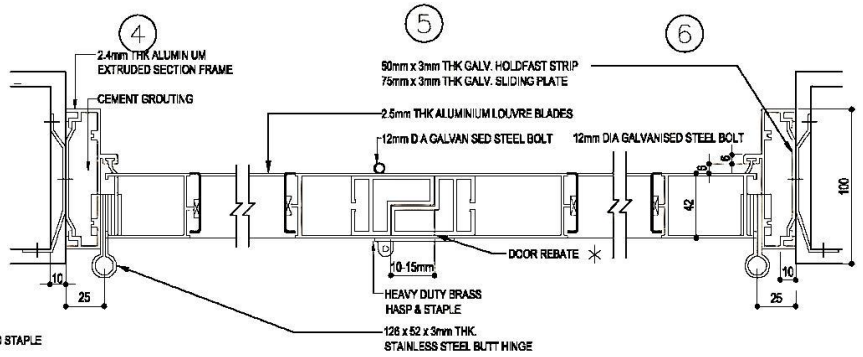
PLAN OF ALUMINIUM LOUVRED DOOR FOR TRANSFORMER ROOM

SCALE: N.T.S.



DETAIL AT AA

SCALE: N.T.S.



TYPICAL PLAN- FOR ONE DOOR

SCALE: N.T.S.

TRANSFORMER ROOM LOUVRED DOOR LATCHED INTERNALLY

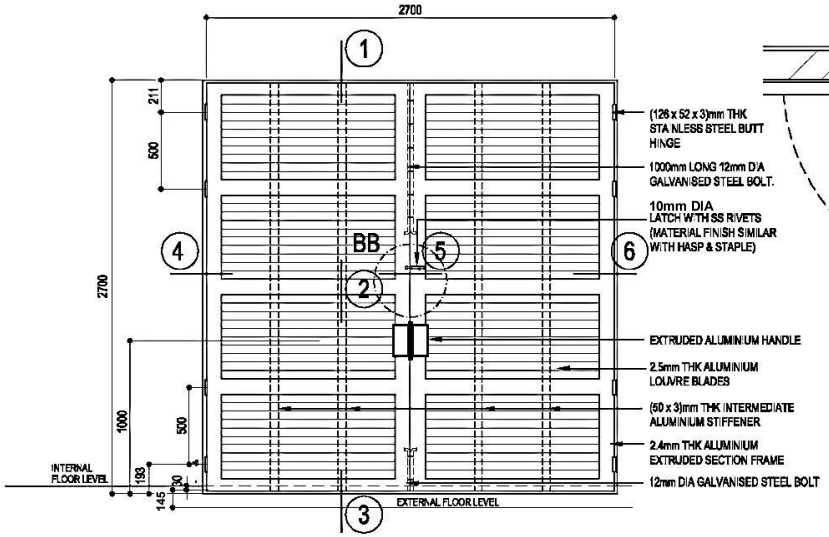
GENERAL NOTES:

1a. All aluminium shall be anodized in bronze colour (18 microns);

1b. Alternatively, the door finish maybe powder coated. Such finish being a polyester thermosetting powder electrostatically applied and oven baked to cure. This door coating maybe selected for its resistance to weather and its overall durability.

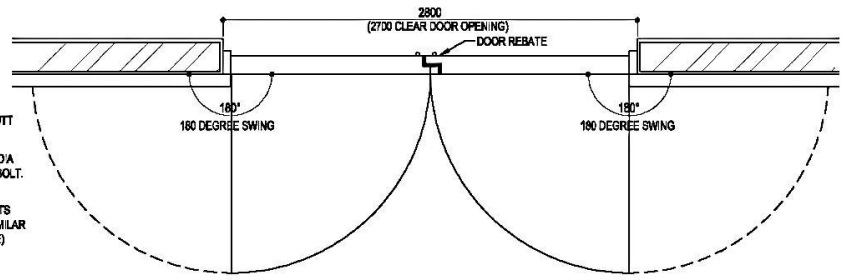
2. Door to be fitted with good quality door hook or magnetic door catch.

3. All rivets used in door fabrication are to be of Stainless Steel type including that of the butt hinge mounting.



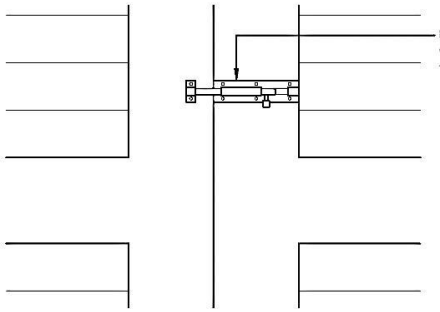
ELEVATION OF HEAVY DUTY ALUMINIUM LOUVRED DOORS FOR TRANSFORMER ROOM (DOOR WITHOUT HASP & STAPLE)

SCALE: N.T.S.



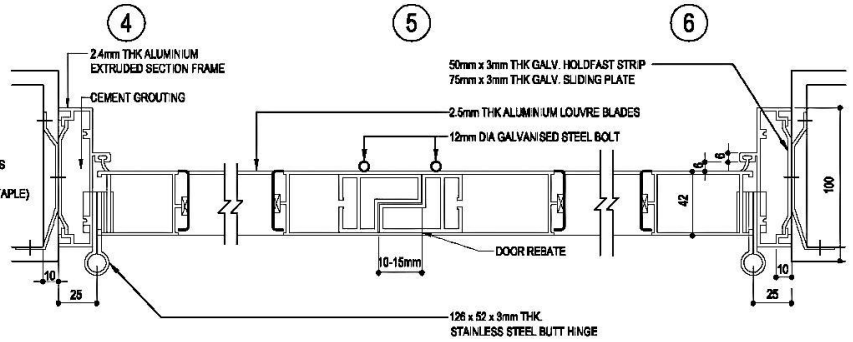
PLAN OF ALUMINIUM LOUVRED DOOR FOR TRANSFORMER ROOM

SCALE: N.T.S.



DETAIL AT BB

SCALE: N.T.S.



TYPICAL PLAN - FOR OTHER DOORS

SCALE: N.T.S.

SWITCHGEAR LOUVRED DOOR

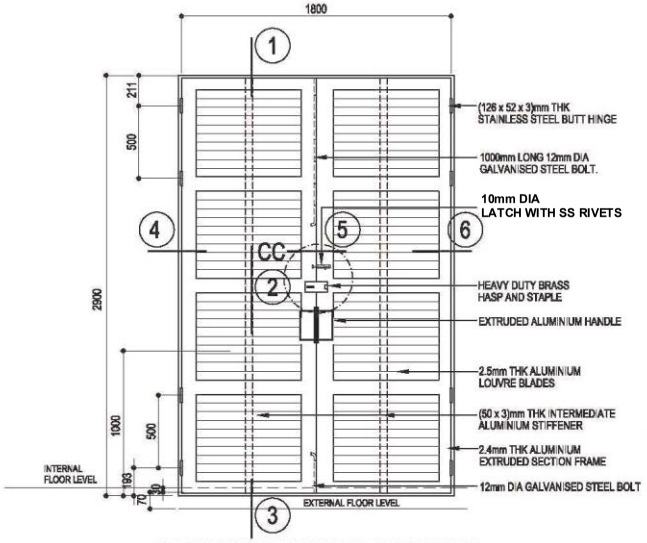
GENERAL NOTES:

1a. All aluminium shall be anodized in bronze colour (18 microns);

1b. Alternatively, the door finish maybe powder coated. Such finish being a polyester thermosetting powder electrostatically applied and oven baked to cure. This door coating maybe selected for its resistance to weather and its overall durability.

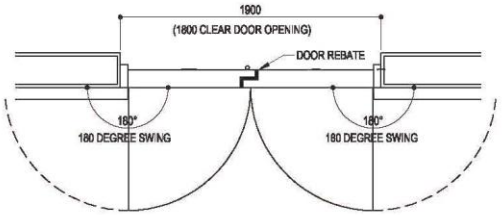
2. Door to be fitted with good quality door hook or magnetic door catch.

3. All rivets used in door fabrication are to be of Stainless Steel type including that of the butt hinge mounting.



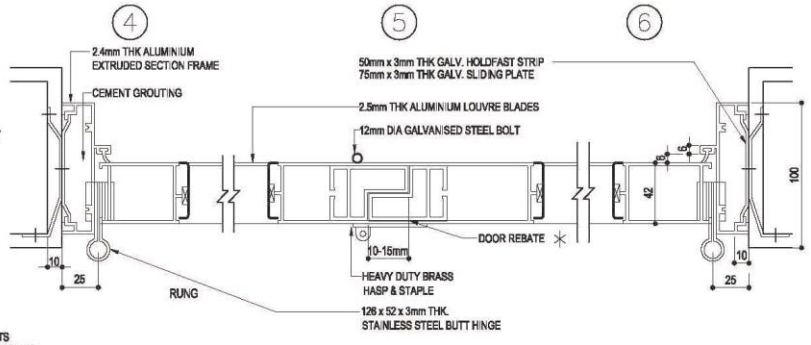
ELEVATION OF HEAVY DUTY ALUMINIUM LOUVRED DOORS FOR 22kV SWITCHGEAR ROOM (DOOR C/W HASP & STAPLE)

SCALE: N.T.S.



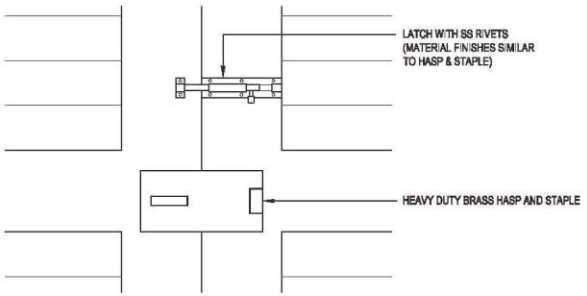
PLAN OF ALUMINIUM LOUVRED DOOR FOR 22kV SWITCHGEAR ROOM

SCALE: N.T.S.



TYPICAL PLAN- FOR 22kV SWITCHGEAR ROOM

SCALE: N.T.S.



DETAIL AT CC

SCALE: N.T.S.

SWITCHGEAR AND CABLE CHAMBER EXIT DOOR

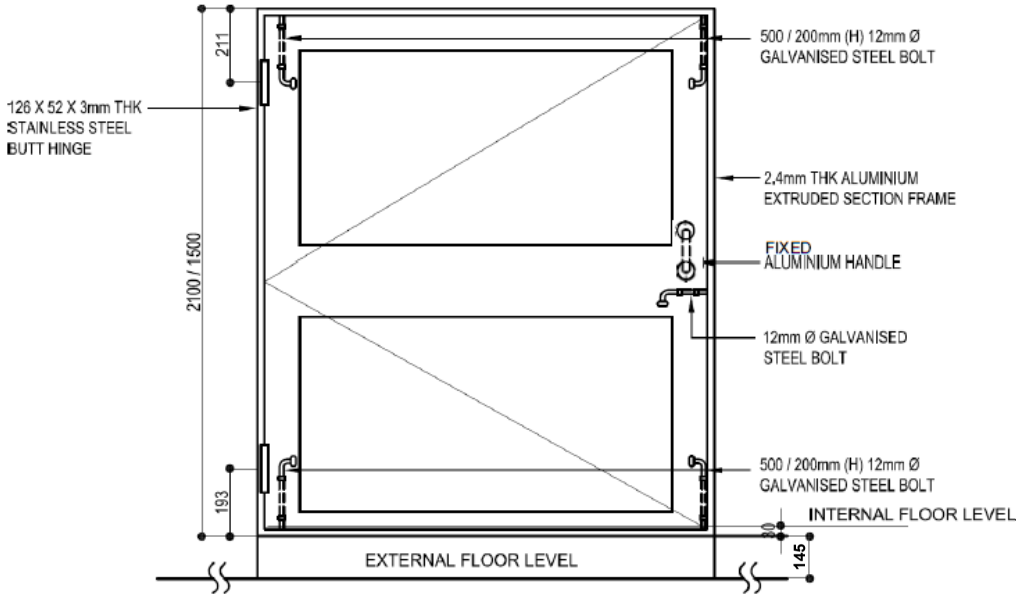
GENERAL NOTES:

1a. All aluminium shall be anodized in bronze colour (18 microns);

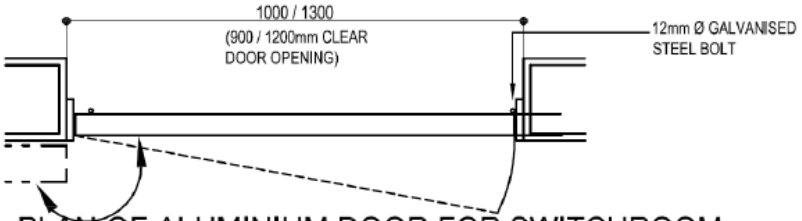
1b. Alternatively, the door finish maybe powder coated. Such finish being a polyester thermosetting powder electrostatically applied and oven baked to cure. This door coating maybe selected for its resistance to weather and its overall durability.

2. Door to be fitted with good quality door hook or magnetic door catch.

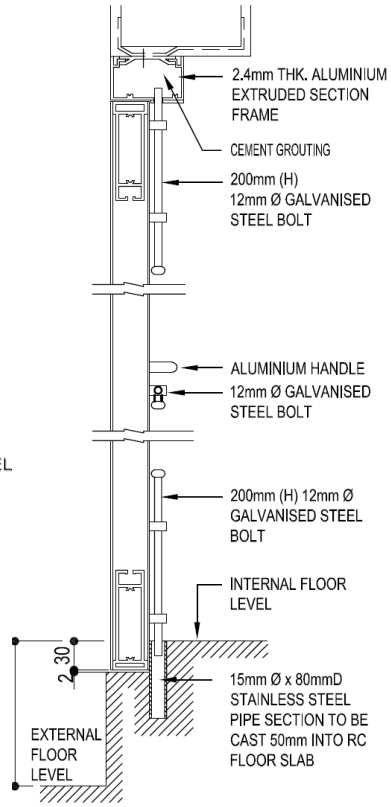
3. All rivets used in door fabrication are to be of Stainless Steel type including that of the butt hinge mounting.



ELEVATION
SCALE N.T.S.



PLAN OF ALUMINIUM DOOR FOR SWITCHROOM & CABLE CHAMBER EXIT
SCALE: N.T.S.



TYPICAL SECTION THROUGH ALUM FLUSHED DOOR
SCALE: N.T.S.

GENERAL NOTES:

1a. ALL LUMINIUM DOOR SHALL BE ANODISED IN BRONZE COLOUR (18 MICRONS) PROCESS COMPLYING WITH B.S. 1615:1972 OR

1b. ALL ALUMINIUM DOORS MAY BE POWDER COATED. THE FINISHES BEING A POLYESTER THERMOSETTING POWDER ELECTROSTATICALLY APPLIED AND OVEN BAKE TO CURE. THE COATING BEING SPECIFICALLY SELECTED FOR ITS RESISTANCE TO WEATHER AND OVERALL DURABILITY.

2. ARCHITECTS/ DEVELOPER MAY OPT FOR LOUVRED DOOR PROVIDED THE LOUVRES ARE BLANK-OFF WITH ALUMINIUM SHEET BEHIND DOOR WITH BEADING.

3. 1500mm HIGH CABLE CHAMBER & 2100mm HIGH FOR SWITCHROOM.

HASP AND STAPLE

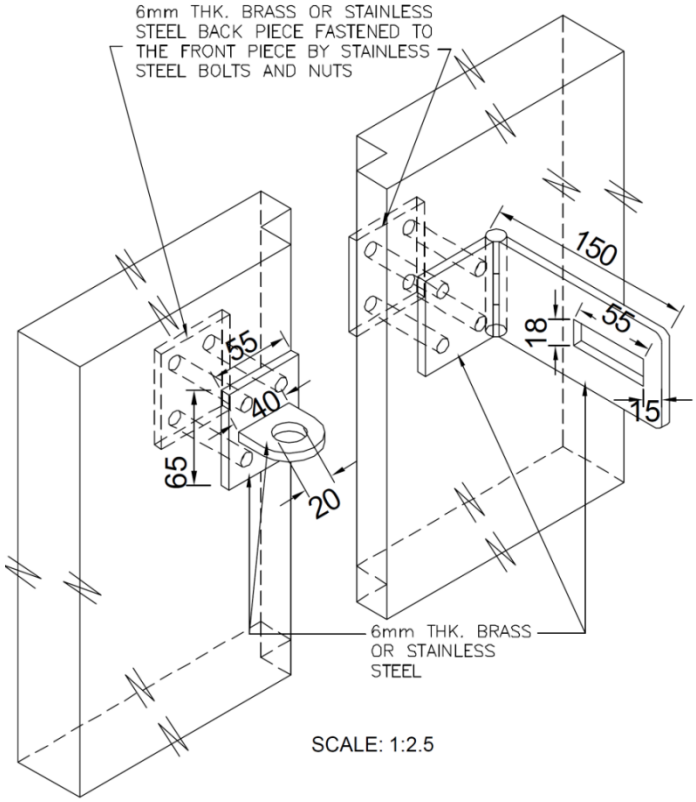
GENERAL NOTES:

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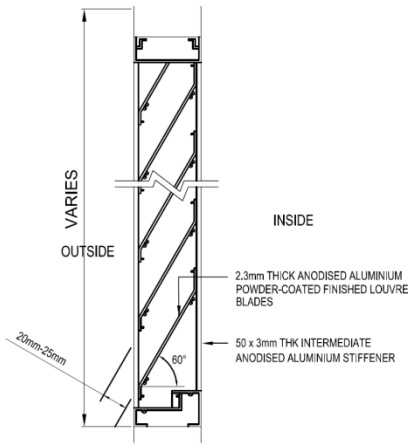
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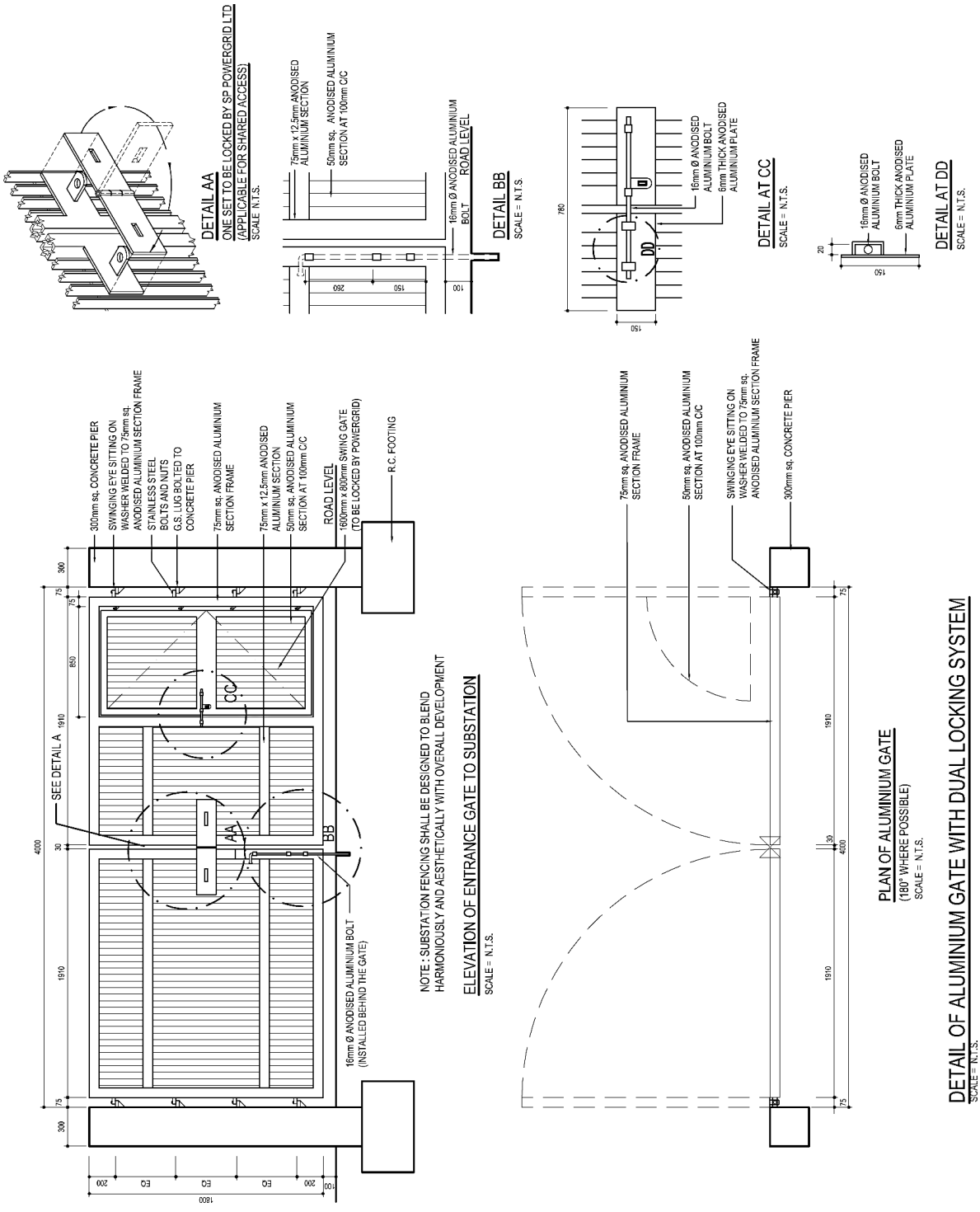


ALUMINIUM VENT



DETAIL OF ALUMINIUM LOUVRE BLADES

GATE DETAILS



CHECKLIST FOR SUBSTATION BUILDING PLAN SUBMISSION

Proposed : _____

Name of Licensed Electrical Worker (LEW) / Qualified Person (QP) : _____

BP No (if any): _____

	ITEMS	YES	NO
1	Drawings in A1 or A2 series.	☐	☐
2	Plan, front, rear and side elevations included.	☐	☐
3	Cross-sections in relation to roads and immediate surroundings included.	☐	☐
4	Detailed layout scales in 1:50 for all plans and 1:100 for all sections and elevations.	☐	☐
5	Substation requirements stated in Handbook on How to Apply for Electricity Connection including latest updating are complied with.	☐	☐
6	Plans duly signed by the Licensed Electrical Worker / QP.	☐	☐
7	Proper vehicular access to the substation from main road coloured.	☐	☐
8	I have advised the structural PE that substation structure is to be designed to withstand the loading specified in the Handbook and all structural requirements have been reflected in this submission.	☐	☐
9	All trenches/floor openings not affected by any beam.	☐	☐
10	Required clear (from underside of any beam) of all equipment rooms and cable chamber complied with.	☐	☐
11	No column within substation.	☐	☐
12	No wet area above substation.	☐	☐
13	Location of Customer's Switch room and proposed service cable route shown. SPPG/ owner (delete as appropriate) to provide service cables.	☐	☐
14	This installation is required to or would like to receive interim supply via mobile generator.	☐	☐
15	Location of Customer's LT Switch room / remote connection point for the connection of mobile generator shown.	☐	☐
16	I undertake to advise the architect and structural PE to ensure that all the requirements as endorsed, are incorporated into the architectural and structural plans prior to substation construction.	☐	☐
17	Previous drawings with SPPG's comments attached (for resubmission case).	☐	☐
18	All additions / deletions / amendments coloured.	☐	☐
19	Any encumbrances? If so, please highlight.	☐	☐
20	Latest edition of Appendix 15 (Notes on Substation Salient Layout Requirements) appended.	☐	☐
21	Any use of flood protection measures, as approved under the PUB CoP.	☐	☐

_____ _____ _____

Signature & Stamp of Licensed Electrical Worker | Licence No | Date

Note: Please tick in appropriate box for all items.

This checklist is to be submitted for every submission / re-submission.

SUBSTATION SALIENT LAYOUT REQUIREMENTS TO BE INCORPORATED IN THE ARCHITECTURAL PLANS

ITEM	REQUIREMENT
Location	Proposed substation to be located on flood-free area and above the Minimum Platform Level (MPL) as specified by PUB. (LEW to furnish relevant letter from PUB)
Security Access	24/7 unrestricted/unimpeded security access to be provided. Types: 24-hour manned guard house preferred. Dedicated access: c/w 1.8m high, 4m wide heavy duty aluminium hollow block gate to standard details. (see Appendix 13 for gate details). Shared access: to provide gate with dual-locking facility. Unmanned gate: to provide call panel / intercom facility / CCTV linked to remote 24-hour manned control room. 24-hour free (unmanned) access: to state, if relevant.
Driveway/Access Road	Width & Finishes: to be of minimum 4.0m wide on "flat" ground. A gradient greater than 1:15 is not acceptable at equipment delivery area in front of the switch room. Surface to be paved with premix/tarmac, concrete, interlocking paviours, granite tiles, cobble stone or marble only. Grasscell or grasscrete as material for driveway finishes is not acceptable. Loading: To withstand heavy vehicles with laden load of 40 tonnes for all 22kV & 6.6KV substations. Headroom: 4.5m minimum clear to be maintained throughout the entire route for vehicular passage. Headroom requirement at equipment delivery area (in front of switch room) is 5.5m minimum for 1 ½ - storey type of substation. 4.5m headroom is sufficient for 1-storey substation. No parking lots are to be drawn in such a way that car parked over them would obstruct vehicular access to the substation.
Cable Entry Ducts	Type: Heavy duty (Class C) UPVC pipes of 150mm diameter in concrete jacket to be provided. Pipe Termination: To be terminated 300mm beyond boundary line or the roadside drain abutting public road at a depth of not exceeding 2.0m from the finished road level. Maximum 2-layer configuration is allowed and is to be laid at an angle not greater than 30 degrees tilting towards the external. All installed pipes to pass through Mandrel Tests prior to inspection by SPPG. (see Appendix 15.1) Pipe Clearance: To clear 2.5m minimum from any N-Park tree, fire hydrant, manhole, OG Box, lamp post etc. All street furniture are to be clearly shown. The LEW must ensure that the lead-in pipe connection point for SPPG is clear from underground services, road furniture and practical for excavation work to be carried out. Termination of pipes at rigid pavement is not permitted. Pipe Encasement: All entry pipes within owner's premises to be encased in concrete jacket, including those installed at high level of basement level. Adequate cable plate of appropriate voltage level covering the width of the encasement installed and laid along the entire route of the connecting pipes shall be provided. Lead-in pipes on suspended tray/ladder are not permitted. Pipe Sealant: All entry pipes c/w pulling ropes to be sealed with removable water-tight and gas-tight material at both ends immediately upon cable installation. Approved compound types are : (i) Viscotaq @ Visco Sealant, (ii) Sealtaq @ Aquablock, (iii) 4416 Duct Sealant Kit 3M, (iv) Densoseal 16A. Sectional View: Full and detailed sectional view, including draw pit(s) if any, reflecting boundary line, depth of pipes, ground services to be shown. HDB Precinct Projects: For new substations, the entire cable entry pipe routing to be provided by developer/HDB. For upgrading projects, the entire pipe provision to be provided by HDB. Final resurfacing on Tarmac road is under SPPG's purview, while the rest is under HDB for areas including concrete surface, interlocking tiles, slabbed carpark lots, turfs, planters, building apron, linkway, special landscaping area, covered walkway, EPS gantry, footpath tiles and drain undercrossing structure, etc Non-HDB Projects within HDB Precinct: For Non-HDB projects, e.g. schools and institutions, religious buildings, commercial malls, private condominium, developer is obligated to provide lead-in pipes not just beyond the site boundary, but to the nearest public road if there is no suitable network cables within the precinct from which supply could be tapped.
Letter of Undertaking (LOU)	For lead-in pipe structure overcrossing ENV drain: Written consent from PUB (Catchment & Waterways Dept (C&WD)) and design approval by SPPG both to be obtained prior to construction. Upon approval, a back-to-back LOU to be issued by the developer to SPPG Project Engineer / Officer at time of substation inspection, or earlier.

Cable Entry Ramp	(a)	Avoid being in the way of escape door, areas below switchgear and LT board, if possible.
	(b)	For service cable connection via cable ramp to CSR, the height clearance shall be capped at 250mm max.
	(c)	Walls and floors to be plastered, rendered waterproof.
	(d)	To be sand-filled with washed dry sand and covered with removable heavy duty hot-dipped galvanized mild steel gratings after cable installation.
Cable Trenches	(a)	Depth: normal trenches within substation for LT board and T/F tails are of depth 900mm. However, for 1-storey type set-up, the "double trench" shall be of depth 1500mm. Cat ladder to be provided within to facilitate access to base of trench.
	(b)	For service cable connection via cable trench, the height clearance at separation wall shall be capped at 250mm max.
	(c)	To be sand-filled with washed dry sand and covered by removable heavy duty hot-dipped galvanized mild steel gratings immediately after cable installation.
	(d)	Grating support: At L– or T–junctions of trench, angle-iron bar (or flat bar) to be solidly provided for grating support. (See details of "grating support"). Grating laid must be able to withstand a minimum load of 100kg.
	(e)	No beams shall be allowed within / across the trenches.
Draw Pit	(a)	Sunken type: applicable to area / surface of premix (tarmac) finishes only ; pit to be 800mm below road surface.
	(b)	Surface or flushed type: easy access to flushed removable covers dispenses the need for excavation; applicable to driveway of paved finishes such concrete, marble, granite tiles, cobbled stone, interlocking paviors and grass. For practical reason, in the case of grass, no part over the exposed pit is allowed for flowering plants or shrubs to be planted. SPPG shall not be held liable for any damage to vegetation rendered by owner over the draw pit in any activities involving pit access.
	(c)	Weight of pit cover: to be of manageable weight less than 55kg/piece.
	(d)	Depth: cat ladder to be provided for access to base for all cases when the depth of the pit proper is in excess of 1.5m.
Cable Chamber "Basement"	(a)	Type/Loading: To be of 'suspended' type and of floor loading 400kg/m^2 minimum.
	(b)	Floor level drop: 150mm above the external apron / driveway level and be above MPL as specified by PUB.
	(c)	Headroom clearance: floor-to-floor (switch room to chamber) height difference is to be at least 2m. A minimum headroom of 1.5m from bottom of beam support to finished floor level (FFL) be maintained.
	(d)	Door: Single-leaf, heavy-duty aluminium solid door of dimension (1.2mW x 1.5mH), complete with door handle and 5 nos. of shoot bolts on internal side (See door details) and restraining door hooks externally.
	(e)	Warning sign plates: To affix the following:
	(i)	"No Smoking" sign plate prominently affixed on external side of door.
	(ii)	"Hard Hat Area" sign plate prominently affixed on chamber wall near cat ladder area.
	(f)	Warning strip: To paint a 50mm (H) warning strip on the front and back of all beams with red luminous paint.
	(g)	Ventilation: Adequate natural ventilation to be provided with PC vent block panels only, installed at height 200mm min from FFL. Aluminium louvres are not permitted on this level.
	(h)	Wall and floor to be efficiently waterproofed. Adequate drainage to be provided, where necessary.
Switch room	(a)	Height: Clear Headroom of minimum 3.1m is to be complied with. No free column is allowed within the switch room.
	(b)	Floor rendering: Floor to have a 50mm thick cement rendering including a 20mm granolithic smooth finish of cement, granite chips and sand in the ratio of 1:1:1 plus 9kg ironite or equivalent approved hardener to each 45 kg of cement. Final rendering of switch room floor to be done before installation of switchgear floor frame. Area around switchgear floor frame is to be cement-screeded immediately after floor frame installation.
	(c)	Floor loading: Switch room floor to withstand a loading of 1,600kg/m^2. Clearances allowed for front and rear beam supports from HT opening are 200mm and 400mm respectively. HT and LT openings are to be beam-free. All floor beam supports to be shown dotted.
	(d)	Any excess opening to be covered with removable heavy duty hot-dipped galvanized mild steel grating to withstand 100kg loading, immediately after floor frame installation.

	(e)	Access to cable chamber: the provision comprises of a trap door with hinged heavy duty aluminium chequered cover complete with fastening shoot-latch, floor opening of (760mm x 760mm), guard rail, and a cat ladder with 6 non-slip rungs. (see "Trap Door" details)
	(f)	Door: Louvered type, of heavy duty aluminium with dimension (2.9mH X 1.8mW) complete with dust cover for floor shoot-hole, Hasp and staple (150mm x 65mm x 6mm) and mini shoot-latch. (See details for both "Door" and "Hasp & Staple"). Door hinges to be of brass or stainless steel material. Sturdy restraining door hooks must also be provided at waist height.
	(g)	Ceiling/ Double slab: Ceiling to be of smooth finishes and emulsion-painted. All beams to be plastered or encased in concrete. If usage of place above switch room is deemed to be of wet area, provision of double-slab ceiling/roof is mandatory.
Transformer Room	(a)	Height: Clear headroom of 3.1m minimum to be maintained. The room should be free from any column.
	(b)	Door: Louvered type, of heavy duty aluminium door of dimension (2.7mH x 2.7mW) complete with mini-latch & Hasp and staple (150mm x 65mm x 6mm) for each transformer. (See details for both "Door" and "Hasp & Staple"). Door hinges to be of brass or stainless steel material. Sturdy restraining door hooks must also be provided at waist height.
	(c)	Plinth loading: Each plinth to be designed to withstand a dead load of 6 tonnes. Width of HT and LT plinth recess to be 600mm and 800mm respectively. Distance between plinth recesses to be less than 1.0m.
	(d)	Trench width / depth: Width of HT and LT trench to be 600mm and 800mm respectively be provided for (1 x 1.5 MVA) or (2 x 1 MVA) transformers. Depth for both HT and LT T/F tails shall be 900mm.
	(e)	Ventilation / Fire-rated roller shutter: Adequate natural cross air ventilation must be provided with PC vent block or aluminium ventilation panels at high level. Mechanical ventilation is not permitted. Where fire-compartmentation involves the installation of fire-rated roller shutter (FRRS) over the door, it is to be installed within the transformer room. An escape door must be provided at the rear or side of the room where the abutting area outside it does not fall within the fire protection zone. LEW/Architect must furnish consultation reply from SCDF to substantiate such mandatory FRRS installation requirement.
	(f)	Noise level: Noise level of 60 dB emitted from each transformer to be considered in the choice of location of transformer room/yard. Architect/ QP to ensure compliance on requirement especially when its proposed location is in close proximity to residential units.
	Note:	For below grade transformer room, transformers provided by SP PowerGrid will be in accordance with the prevailing and applicable fire safety requirements at the time of installation. Developers and Qualified Persons (QP) shall ensure that the siting, design, construction and all other provisions of the below grade transformer room comply with the prevailing Fire Code and all other applicable requirements of the relevant authorities.
Wall/Column finishes	(a)	All concrete surfaces shall be properly prepared and 20mm cement plastering work carried out such that there should be no cracks, blisters and other defects.
	(b)	The emulsion painting system used for external walls shall be suitable for outdoor application. There shall be a five (5) years warranty of the textured coating on all walls against all defects arising from colour–fastness, faulty workmanship and/or materials, etc.
	(c)	All substation walls, both external and separation wall shall be of concrete, 230mm overall thickness including the 20mm plastering. Precast walls approved by BCA are acceptable provided the overall specified thickness of 230mm minimum is met. However, plain brick wall or honeycomb wall design shall not be considered.
Electrical Installation	(a)	Schematic layout and single-line diagram (SLD) to be shown. All switches, sockets and isolators, etc that are grouped under the respective sub-circuits are to be labelled precisely in the SLD. Copy of SLD to be pasted on the back cover of distribution board (DB). Alternatively, it may be framed up and permanently displayed on the wall next to the DB.
	(b)	Type T5 (28W) fittings: Substation to be adequately lit. Light fittings (T5 only) are to be installed at 3m height (suspension type) and 2.4m height (wall-mounting type) measuring from floor level. Wire-mesh casing type is to be used for light fittings installed in cable chamber.
	(c)	All wirings are to be in surface conduits. Circuits to be controlled by miniature circuit breakers (MCB). The DB is to be complete with an RCCB.
	(d)	20A isolators: Supply via 20A DP isolators for battery charger, RTU, PWS & IDS to be wired by-passing RCCB. All isolators to be installed at a height greater than 1.6m from floor level.
	(e)	Fire-rated roller shutter: 20A isolator is also applicable for fire-rated roller shutters. In this instance, supply to be tapped from developers' emergency source DB.
	(f)	Hoist: Where a 3-tonne 4 directional lifting hoist has been installed, a 32A TPN isolator is to be provided. Supply of 32A TPN isolator is to be taken from SPPG's DB.

Roof	(a)	Finishes / fall: To be of flat reinforced concrete (RC) efficiently waterproofed and laid to fall at 1:80 minimum.
	(b)	Roof eaves opening: Roof eaves with multiple 150mm wide long slot openings to be provided for rain water discharge to free-fall direct into apron drain. Rain water down pipe arrangement for water discharge is not permitted.
	(c)	Green planters or façade treatment on roof top are not encouraged. Request may be considered on case-to-case basis and double-slab requirement may be imposed.
RC Staircase	(a)	Railings/ Material: Fixed / removable railing to be provided at stairs and loading platform in front of switch room door. Hot-dipped galvanized mild steel or stainless steel for railings complying with Appendix 11 to be used. Staircase is to be of reinforced concrete (RC). Metallic Staircase is not permitted.
Metering Kiosks	(a)	To be provided for SPPA (see Appendices 31 to 33) when customer is taking HT-Intake supply. They are to be located close to the customer HT intake switchroom.
Fencing	(a)	Where required, chain-link fencing to be provided after the 600mm wide concrete apron.
Drainage	(a)	Where necessary, efficient cut-off drainage system, complete with hinged heavy duty hot-dipped galvanised mild steel gratings around the substation to be provided. Apron drain in front of substation must be covered with hinged HD hot-dipped galvanized m.s. gratings.
Bollard & Chain	(a)	Where applicable, to be provided to deter illegal parking by vehicles. Maintenance is under owner's/developer's purview.
Miscellaneous Details	(a)	All relevant details must be included in the plans submission to avoid any probable dispute arising from deviations. Details should include items like hasp & staple, standard (dedicated) gate, dual-locking facility, HD grating, glass block, HD Al louvre, Mandrel block, both switch room and Transformer doors, 1-leaf chamber door, just to name a few.
Non-Standard Substation	(a)	Multi-tier Substation: Upon request by applicant and subject to agreement by SPPG, multi-storey type may be offered due to footprint constraint. Provision of 3-tonne hoist is mandatory.
	(b)	Single-storey Substation: May be considered upon request by applicant and subject to agreement by SPPG. Three (3) criteria are to be complied with.
	(i)	Must be **integrated with the main development / building;
	(ii)	Furnish letter from PUB declaring that the substation is located on flood-free area and above the Minimum Platform Level (MPL) as specified by PUB;
	(iii)	Ultimate applied load capped at 1MVA max.
		** The proposed substation is only reckoned to be "integrated" when it is essentially "tucked in" within the main building proper and is constraint by height limitation. Its roof is not to be open to sky, hence it cannot exist as an independent building.
Substation Maintenance	As spelt out in the Connection Agreement (CA), maintenance of substation external structures including walls, roof, gate, fencing, compound and driveway, is under the purview of the owner / developer. SPPA shall be responsible for maintenance of internal structures within the substation proper.	

NOTE:

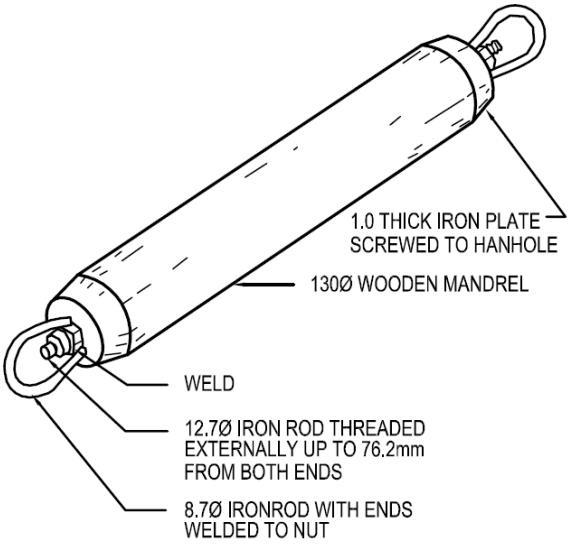
(a) Appointed project LEW / QP is to liaise closely with Architect and Structural Engineer to obtain all their respective requirements for incorporation into final layout plans submitted for SPPG's endorsement. LEW / QP is advised to arrange to conduct stringent site study / survey to avert encumbrances for a smooth layout design. Trial holes / cable detection works are some relevant and useful activities for consideration.

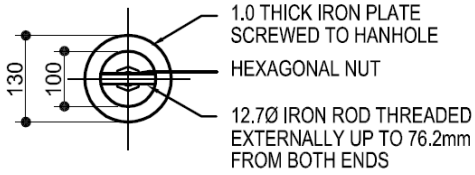
(b) All dimensions and figures are to be checked by the Architect / structural engineer / appointed project LEW prior to substation construction.

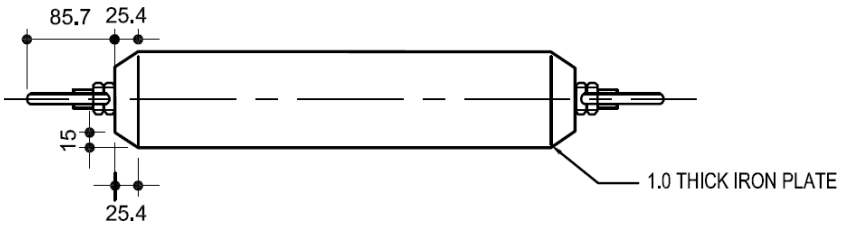
(c) If the Management Committee (MCST) / building owner / occupier were to subsequently replace the security personnel with other means e.g. electronic security system etc; SP PowerGrid Ltd shall be consulted on the alternative unrestricted / unimpeded access arrangement to the substation.

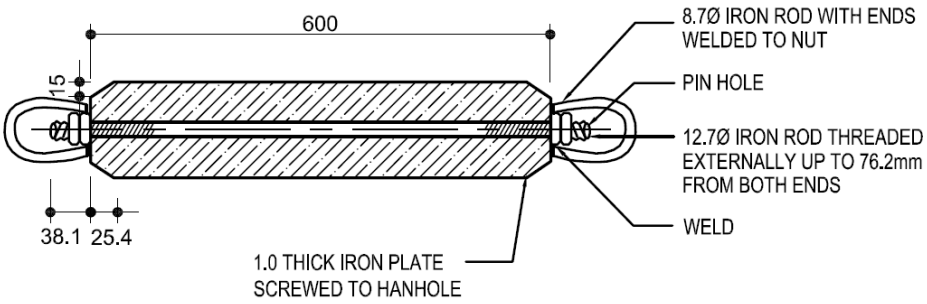
(d) LEW / M&E consultants are to ensure that the proposed substation is constructed to SPPG approved plans. Deviations in construction may render the entire substation layout being not functional. Costs for abortive or remedial works can be substantial and the time incurred may seriously result in undesirable delay in the timely provision of electricity connection.

WOODEN MANDREL









MANDREL TEST DETAIL

SCALE : N.T.S.

ALUMINIUM LOUVRE (DOUBLE BANKED) FOR SWITCH ROOM

All ventilation louvres shall be designed to comply with the following specifications:

a) The appointed supplier should be registered as a company supplying weatherproof ventilation louvre (i.e. performance louvre) with not less than 15 years of proven track records/project references as a registered company and **NOT** as an individual.

b) The inner layer of blades shall be mounted into individual modules, comprising also of frames, support mullions, internal drainage channels, tie rods, wedges, etc with mullion set at 12500mm centre maximum, to maintain rigidity.

c) The front louvre shall be snapped onto the above-described mullions to form a continuous, unbroken line appearance. The louvre should not be drilled or riveted to fix the blade to the mullion. This is to prevent distortion, twisting or shearing of the louvre or support due to thermal expansion and contraction. The mullions shall be fixed with stainless steel bolts / nuts at top and bottom end with suitably sized steel sections to meet wind loading.

d) The louvre shall be finished in either polyester powder coating finish with 10-year warranty on paintwork.

e) All components of the louvre system should not be made of nylon or polymeric materials due to their combustibility as we as their lack of structural integrity at elevated temperatures.

f) An independent fire test report on the louvre at elevated temperatures (250^{O}C for 1 hour) shall be provided.

g) The louvre shall be tested in compliance to the latest code of practice or equivalent accepted by the international recognized standard. Rin defence and airflow efficiency tests on louvres carried out in accordance to the 4th Edition of HEVAC Technical Specification shall be subjected to the Company approval and the said tests shall be conducted by BSRIA and/or AMCA.

h) The entire assembly of the louvre system shall have an **airflow coefficient of Class 2 and rain defence of Class A** under a wind condition of 13.0m/s and rainfall of 75mm/hour. The louvre system shall achieve a **HEVAC class of A2** for an airflow velocity up to 1.0m/s.

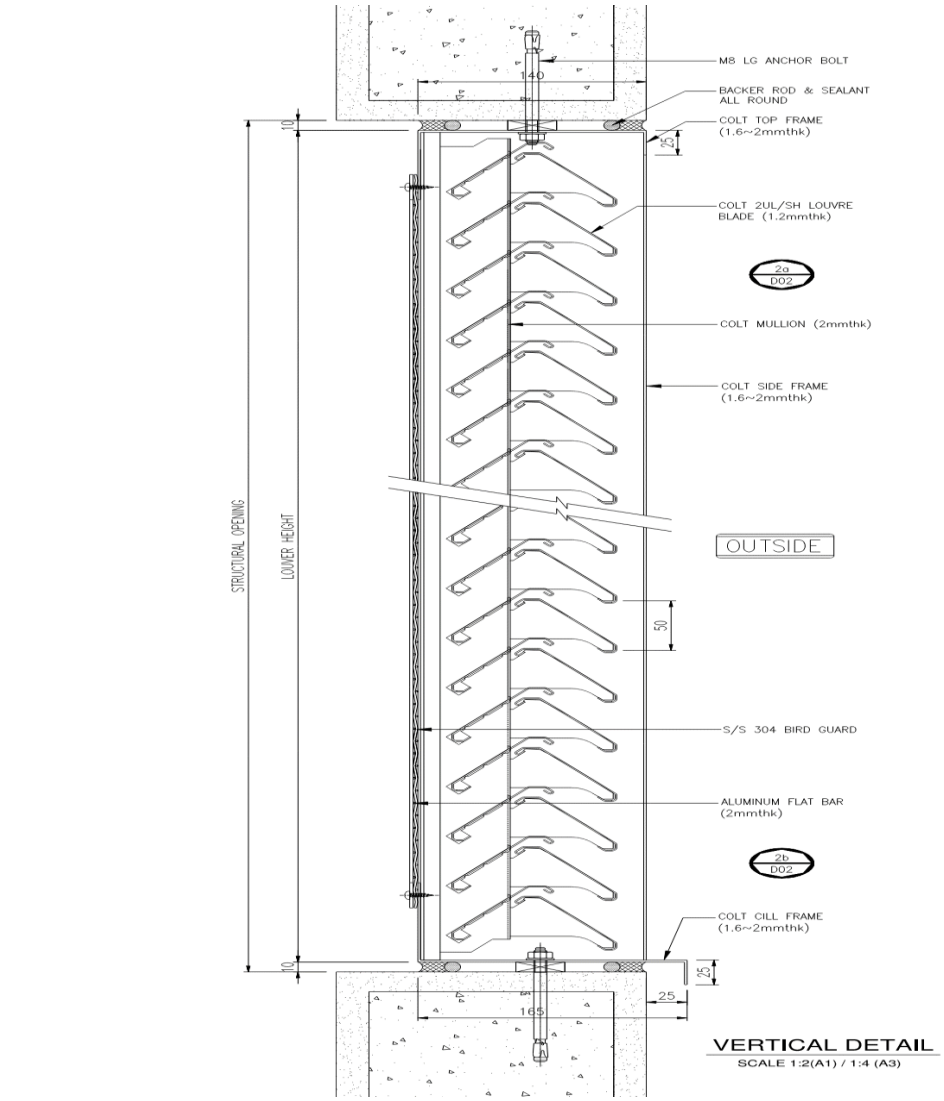
i) The entire assembly shall be design and manufactured by a firm registered to BS 6750 Part 1 – BSI ISO 9001 for Quality Assurance of the louvre system.

   i. The Design & Manufacture of Air Ventilation Equipment, Louvre and Moving Air Equipment including appendices stating the scope of registration under Standard Industrial Codes (SIC) SIC 3284, SIC 8370 and SIC 5030

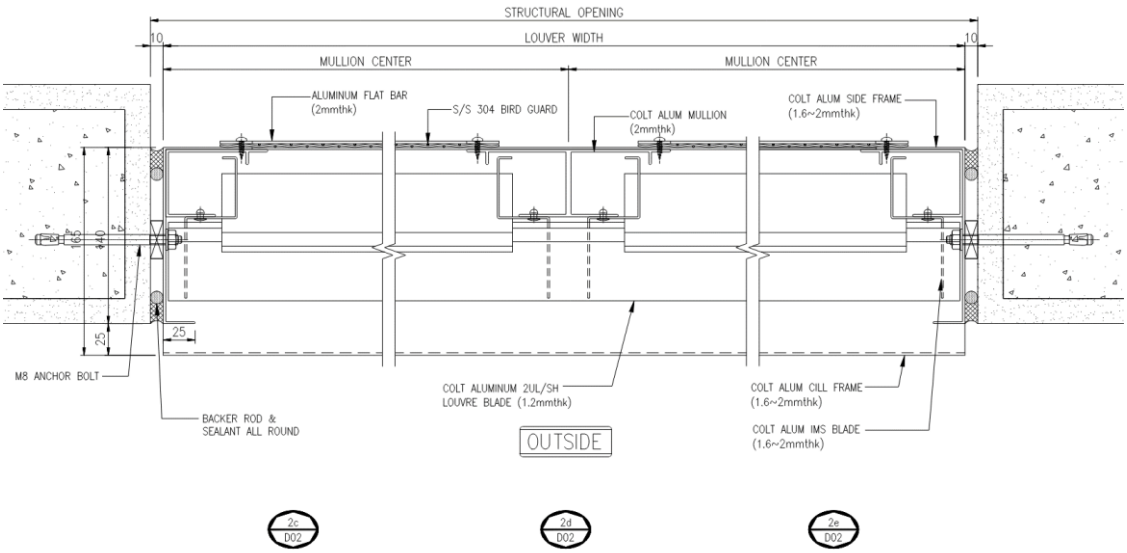
   ii. The Design of Air Ventilation Equipment, Louvre and Air Moving Equipment including appendices stating the scope of registration under Standard Industrial Codes (SIC) SIC 32834, SIC 8370 and SIC 5030

   iii. The Design, Installation and Commissioning of Natural Ventilation Systems and Louvre System including appendices stating the scope of registration under Standard Industrial Codes (SIC) SIC 3284, SIC 8370 and SIC 5030

ALUMINIUM LOUVRE (DOUBLE BANKED) DETAILS



VERTICAL DETAIL
SCALE 1:2(A1) / 1:4 (A3)



HORIZONTAL DETAIL
SCALE 1:2(A1) / 1:4 (A3)

GENERAL REQUIREMENTS FOR DEVELOPING A STAND-ALONE ABOVE-GROUND TRANSMISSION SUBSTATION (66kV ONLY)

1. The proposed site within the substation perimeter fence shall be intended solely for substation development.

2. An adequate site (approx. 4500m2) should be provided for the development of substation to fulfil the latest substation equipment and functional requirements. All planning parameters and consideration shall comply with the requirements from the URA and any other relevant authority.

3. Suitable and proper cable access shall be provided on at least two sides of the site for all cables entering and leaving the proposed site.

    a) If there is any roadside drain fronting/surrounding the substation site, the Developer is required to install cable ducts under-crossing the drain. If the depth of the drain is more than 2.0 metres from the proposed substation ground level, the cable ducts shall be installed to over-cross or under-cross the drains with approval from relevant authorities. However, SPPG will not issue any letter of undertaking to divert cables laid to over-cross or under-cross any drains or other services.

    b) The Developer is required to inform SPPG of any existing or planned rigid pavements on the roads adjacent to the proposed substation site because such rigid pavements would affect cable installation. Suitable locations for cable entry pipe blocks should be discussed and confirmed before the proposed site could be considered feasible.

4. There shall be no danger from flooding and fire hazards.

5. Unrestricted human and vehicular access to the substation shall be available at all times.

6. Proper vehicular access to substation shall be provided for transportation of substation equipment (estimated 150 tonnes) by normal means, i.e. truck and trailer.

    a) Vehicular access and driveways within the substation site shall be able to cater to the required turning radius of heavy equipment trailer / truck.

    b) Gradient of the access road to the site shall not be steeper than 1:20.

7. The substation site shall be totally free of any existing/proposed underground and/or aboveground services.

8. Effect of noise disturbance to neighbouring development shall be considered.

9. The substation building design shall incorporate all conditions/requirements as stated in the latest *Guidelines/Requirements for Transmission Substation Buildings*. A softcopy of the Guidelines will be sent to the Developer upon confirmation of the substation project.

10. A 66kV transmission substation could be classified as a Critical Physical Infrastructure (CPI) by EMA / MHA. The classification process would take time.

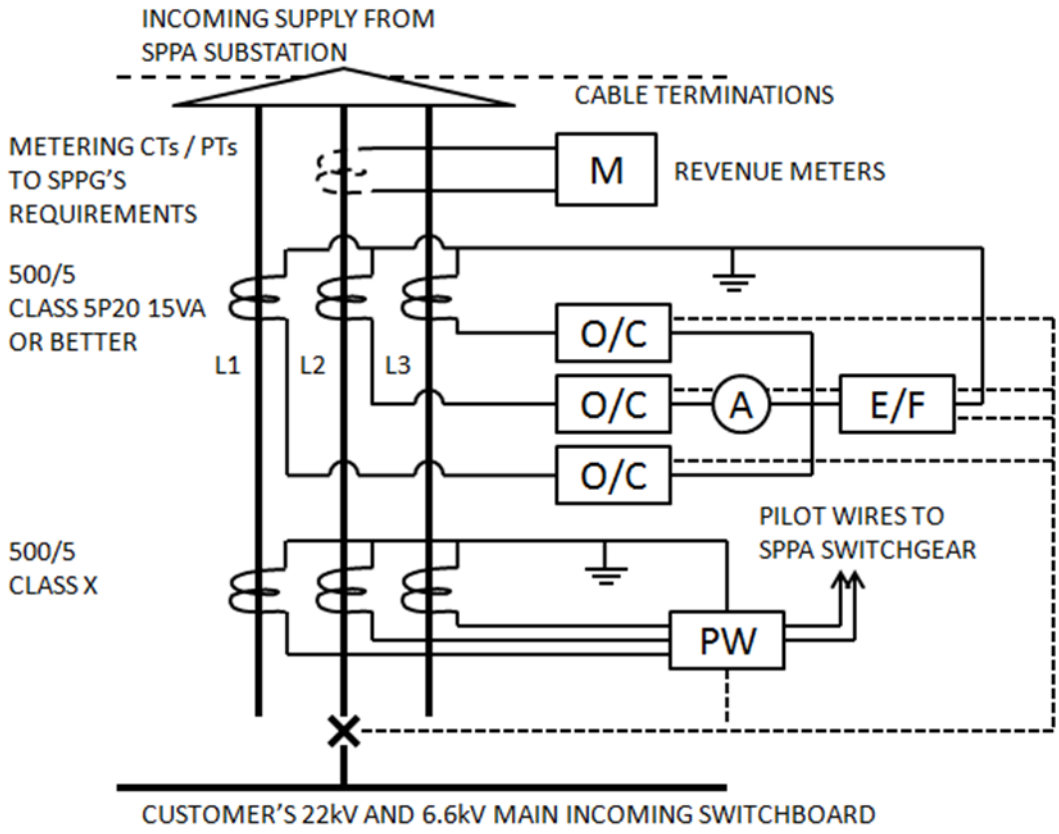
    a) As advised by EMA, the Developer should, before the CPI classification is confirmed, make budgetary provisions for:
        i) Engaging a Security Consultant
        ii) Security features that may be required in the proposed substation building design.

    b) Implementation of Security-by-Design (SBD) scheme should proceed once the substation is confirmed as a CPI.

11. Approval from SPPG as well as all relevant government Agencies including EMA on the substation design including security requirements shall be obtained before tender for construction.

12. The Developer is required to sign the Substation Building Agreement before the endorsement of substation building plans by SPPG.

ENGINEERING REQUIREMENTS FOR CUSTOMER'S 22kV and 6.6 kV MAIN INCOMING SWITCHGEAR



O/C	–	Overcurrent relay type IDMTL with 3/10 characteristics. Plug Setting =100%, Time Multiplier=0.1.
E/F	–	Earth fault relay type IDMTL with 3/10 characteristics. Plug Setting =20%, Time Multiplier=0.1.
PW	–	PW main protection relay shall match with the SPPG's end. The PW relays are typically Solkor R / RF, HOR4, MHOR unit protection relay (For 22kV connection)
A	–	Ammeter
CB	–	Circuit breaker
- - - →		To circuit breaker trip circuit

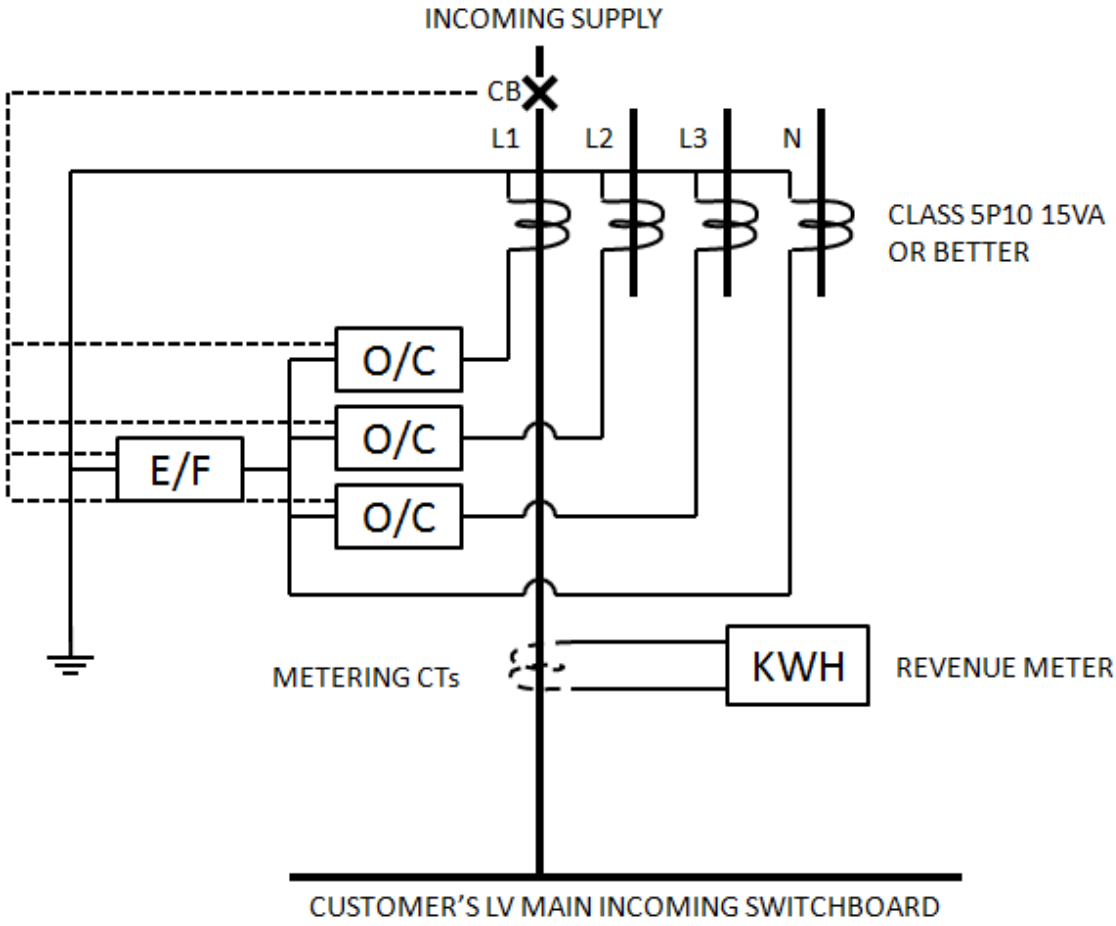
Notes (Important):

1. Where there is more than one incoming service, a bus-section breaker shall be provided and be electrically and mechanically interlocked against parallel operation of the incoming services.
2. There should not be any earthing facilities in the customer switchboard at the main incoming panel.

Notes (Protection):

1. Pilot wire protection CTs shall comply with the following requirements:
   a. Rated knee point voltage at maximum secondary turns not less than 80V.
   b. Exciting current at the rated knee point voltage not more than 150mA.
   c. Resistance of the secondary winding, corrected to 75°C not more than 0.15 ohm.
2. No other auxiliary device shall be connected to the pilot wire protection CTs. Pilot wire protection CT star-point shall be towards protected line.

ENGINEERING REQUIREMENTS FOR CUSTOMER'S LV MAIN INCOMING SWITCHGEAR

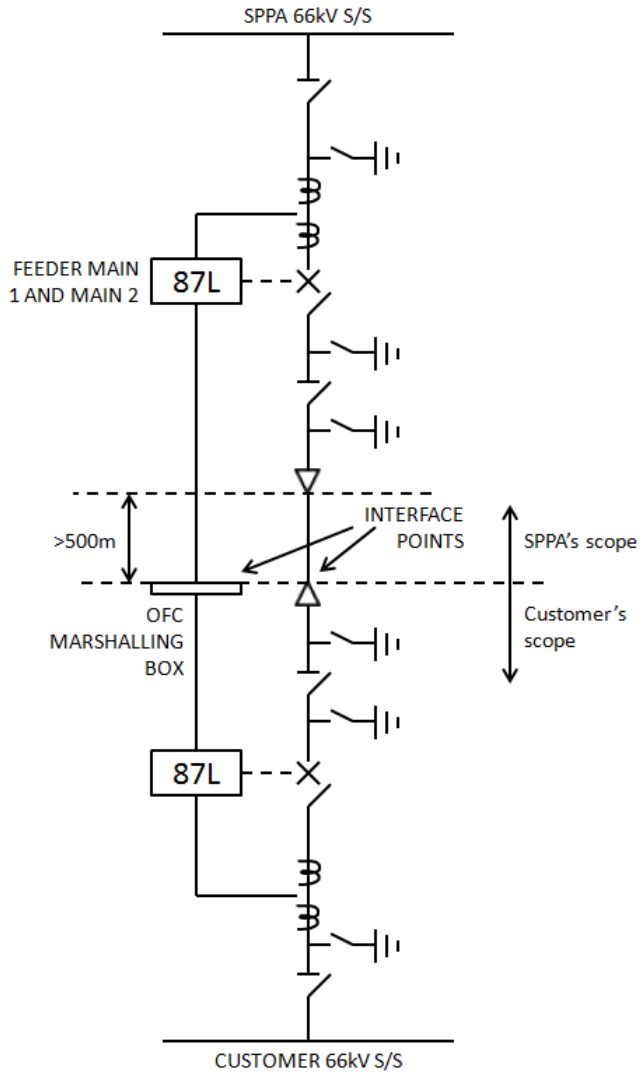


O/C	–	Overcurrent relay type IDMTL with 3/10 characteristics or DTL relay. For DTL relay, the setting shall be 100% of approved load with a time lag of not more than 0.5 sec. For IDMTL relay, the plug setting shall be 100% of approved load with a time multiplier of 0.1 (or 0.2 for approved load more than 1.5kA and up to 2.2kA and with source from SPPA's 22kV substation).
E/F	–	Earth fault relay (DTL) operating at primary fault current of 20% of approved load subject to a maximum of 120 Amp with time lag of not more than 0.5 sec.
CT	–	Current transformer Class 5P10, 15VA or better.
CB	–	Circuit breaker with adequate breaking capacity and circuit breaker using shunt trip shall be provided with series trip (Direct acting trip) device that operates with no time delay under short-circuit condition, or with HRC fuses in series.
- - - →		To circuit breaker trip circuit.

Notes:

Where there is more than one incoming service, a 4-pole bus-section breaker shall be provided and be electrically and mechanically interlocked against parallel operation of the incoming services.

ENGINEERING REQUIREMENTS (TYPE 1)
CUSTOMER 66kV FEEDER CONNECTION (see note i)



	Numerical Relay System (OFC) (see note iv)
Feeder Main 1	Current Differential 1 (OFC)
Feeder Main 2	Current Differential 2 (OFC)
Inter-tripping 1	Current Differential 1 (OFC)
Inter-tripping 2	Current Differential 2 (OFC)
Interlocking (For CB control/safety)	Current Differential 1 (OFC) (see note v)
Remote End Interlock (on ES & DS)	Mechanical (see note v)

Notes:

i) For designated customer and subjected to approval by SPPG for 66kV feeder connection exceeding 500m from SPPA substation.

ii) Engineering and Protection details including interlocking and intertripping shall be discussed on application.

iii) For reasons of obsolescence or availability, the type of relays and protection schemes shall subject to review and confirmation during the consultation period.

iv) End to end intertrip and interlock schemes where applicable, shall be implemented via the current differential system.

v) Interlock Scheme is for the operation, control / safety / signalisation of the isolator and/or circuit breakers at both ends. Details of the scheme requirement shall be discussed during consultation period.

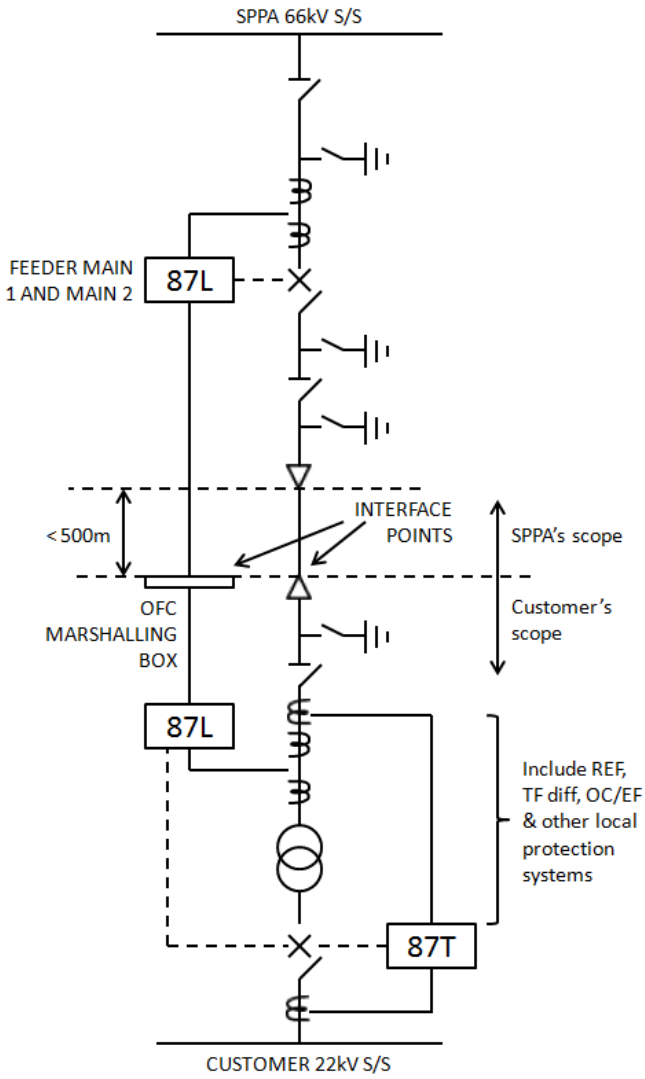
vi) Customer to supply and install OFC marshalling board of approved design to accommodate the optic fibre cables.

vii) Customer shall be responsible for all power / auxiliary cable termination works at their equipment.

viii) The designated Main 1 and Main 2 protection system shall be fully independent duplicated system.

ix) Appropriate test facility such as test switches for trip isolation is to be provided for the unit protection system.

ENGINEERING REQUIREMENTS (TYPE 2)
CUSTOMER 66kV FEEDER – TRANSFORMER CONNECTION
(WITH 66kV ISOLATOR / CIRCUIT BREAKER)
(see note i and viii)



Numerical Relay System (OFC/PW) (see note iv)	
Feeder Main 1	Current Differential 1
Feeder Main 2	Current Differential 2
Inter-tripping 1	Current Differential 1
Inter-tripping 2	Current Differential 2
Interlocking (For CB control / safety)	Current Differential 1 (see note v)
Remote End Interlock (on ES & DS & neutral)	Mechanical (see note v)

Notes:

i) For designated customer and subjected to approval by SPPG for 66kV feeder-transformer connection <500m from SPPA substation.

ii) Engineering and Protection details including interlocking and intertripping shall be discussed on application.

iii) For reasons of obsolescence or availability, the type of relays, signalling equipment and protection schemes shall subject to review and confirmation during the consultation period.

iv) Intertrip and interlock schemes where applicable, shall be implemented via the current differential system.

v) Interlock scheme is for the operation, control / safety / signalisation of the isolator and/or circuit breakers at both ends. Details of the scheme requirement shall be discussed during consultation period.

vi) Customer to supply and install OFC marshalling board of approved design to accommodate the optic fibre cables.

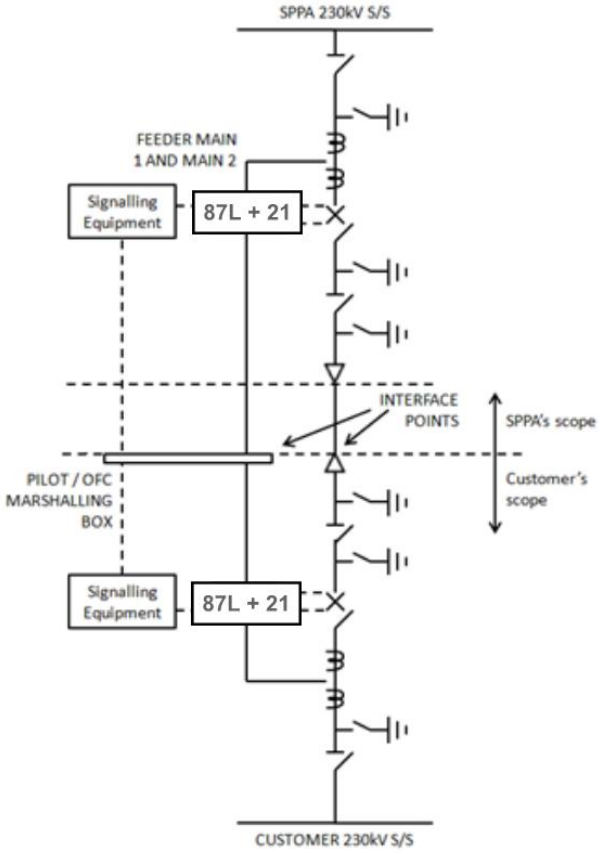
vii) Customer shall be responsible for all power / auxiliary cable termination works at their equipment.

viii) Customer intake may be a circuit breaker or an isolator depending on the length of the HV cable decided at the planning stage.

ix) The designated Main 1 and Main 2 protection system shall be fully independent duplicated system.

x) Appropriate test facility such as test switches for trip isolation is to be provided for the unit protection system.

ENGINEERING REQUIREMENTS (TYPE 3)
CUSTOMER 230kV FEEDER CONNECTION (see note i)



Supply from SPPA 230kV Source Station Numerical Relay System (OFC) (see note iii)	
Feeder Main 1	Current Differential with Distance Protection
Feeder Main 2	Current Differential with Distance Protection
Teleprotection	Signalling equipment
Inter-tripping	Signalling equipment
Remote End Interlock (on ES & DS & CB)	Mechanical & Electrical (via signalling equipment) (see note vi)
Switching sequencing	Via signalling equipment (see note vi)

Notes:

i) For designated customer and subjected to approval by SPPG for 230kV feeder connection.

ii) Engineering and Protection details including interlocking and intertripping shall be discussed on application.

iii) For reasons of obsolescence or availability, the type of relays, signalling equipment and protection schemes shall subject to review and confirmation during the consultation period.

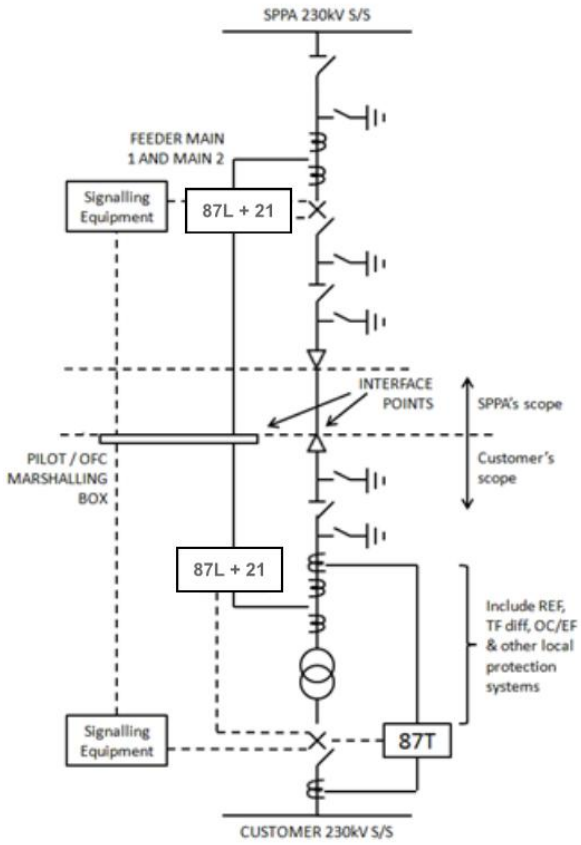
iv) Customer to supply and install OFC/Pilot marshalling board of approved design to accommodate the optic fibre cables and other auxiliary cables.

v) Customer shall be responsible for all power / auxiliary cable termination works at their equipment.

vi) Interlock scheme is for the operation, control / safety / signalisation of the isolator and/or circuit breakers at both ends. Details of the scheme requirement shall be discussed during consultation period.

vii) Appropriate test facility such as test switches for trip isolation is to be provided for the unit protection system.

ENGINEERING REQUIREMENTS (TYPE 4)
CUSTOMER 230kV FEEDER – TRANSFORMER CONNECTION
(see note i)



Supply from SPPA 230kV Source Station Numerical Relay System (OFC) (see note iii)	
Feeder Main 1	Current Differential with Distance Protection
Feeder Main 2	Current Differential with Distance Protection
Teleprotection	Signalling equipment
Inter-tripping	Signalling equipment
Remote End Interlock (on ES & DS & CB)	Mechanical & Electrical (via signalling equipment) (see note vi)
Switching sequencing	Via signalling equipment (see note vi)

Notes:

i) For designated customer and subjected to approval by SPPG for 230kV feeder connection.

ii) Engineering and Protection details including interlocking and intertripping shall be discussed on application.

iii) For reasons of obsolescence or availability, the type of relays, signalling equipment and protection schemes shall subject to review and confirmation during the consultation period.

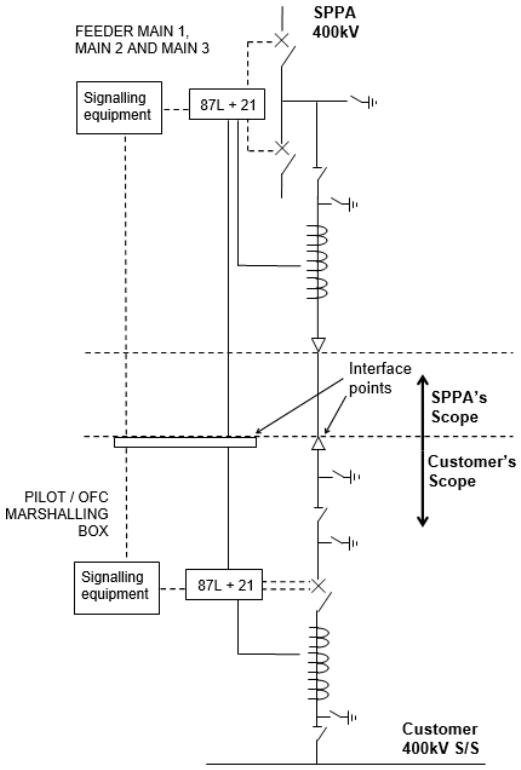
iv) Customer to supply and install OFC/Pilot marshalling board of approved design to accommodate the optic fibre cables and other auxiliary cables.

v) Customer shall be responsible for all power / auxiliary cable termination works at their equipment.

vi) Interlock scheme is for the operation, control / safety / signalisation of the isolator and/or circuit breakers at both ends. Details of the scheme requirement shall be discussed during consultation period.

vii) Appropriate test facility such as test switches for trip isolation is to be provided for the unit protection system.

ENGINEERING REQUIREMENTS (TYPE 5)
CUSTOMER 400kV FEEDER – TRANSFORMER CONNECTION
(see note i)



Supply from SPPA 400kV Source Station Numerical Relay System (OFC) (see note iii)	
Feeder Main 1	Current Differential
Feeder Main 2	Distance Protection
Feeder Main 3	Current Differential with Distance Protection
Teleprotection	Signalling equipment
Inter-tripping	Signalling equipment
Remote End Interlock (on ES & DS & CB)	Mechanical & Electrical (via signalling equipment)
Switching sequencing	Via signalling equipment

Notes:

i) For designated customer and subjected to approval by SPPG for 400kV feeder connection.

ii) Engineering and Protection details including interlocking and intertripping shall be discussed on application.

iii) For reasons of obsolescence or availability, the type of relays, signalling equipment and protection schemes shall subject to review and confirmation during the consultation period.

iv) Customer to supply and install OFC/Pilot marshalling board of approved design to accommodate the optic fibre cables and other auxiliary cables.

v) Customer shall be responsible for all power / auxiliary cable termination works at their equipment.

vi) Interlock scheme is for the operation, control / safety / signalisation of the isolator and/or circuit breakers at both ends. Details of the scheme requirement shall be discussed during consultation period.

vii) Appropriate test facility such as test switches for trip isolation is to be provided for the unit protection system.

viii) Switchgear configuration in this diagram at Customer 400kV side is indicative only.

STATEMENT FOR DE-ENERGISATION AND RE-ENERGISATION (SDRE)

SP POWERGRID LTD

STATEMENT FOR DE-ENERGISATION AND RE-ENERGISATION (SDRE)
Part 1 & 2 concern the de-energisation and re-energisation of the service cable specified below. Each statement is valid only when it is signed by both the LEW of the installation and the SP POWERGRID officer-in-charge of the de-energisation or re-energisation.

Name of Installation : _____ MSS A/C No : _____

Address of Installation: _____ (S) _____

Service Cable No:1 / 2 / 3 / 4 ** Meter ID(s): _____

Isolated From (Substation Name, OG Box, Etc) : _____

This de-energisation is *

- ☐ Due to tripping
- ☐ Requested by SP PowerGrid
- ☐ Requested by LEW
- ☐ Routine Servicing
- ☐ Account closure** temporary / permanent (decommission and/or demolish)
  (For account closure, please omit Part 2 & 3 and send to SP Services Ltd)
- ☐ Others: _____

* Please tick whichever is applicable
** Please delete whichever not applicable

PART 1A: DE-ENERGISATION STATEMENT - TO BE COMPLETED BY LEW BEFORE DE-ENERGISATION OF SERVICE CABLE(S)
This statement is required only when work is to be done on the service cable(s) by either the LEW or the SP PowerGrid officer, or both. **If MSS A/C No starts with 930 and supply is switched off for more than 2 business days, please complete Part 1 and email it to SP Services Ltd (Email: meterconfig@spgroup.com.sg) immediately upon turn off.**

DECLARATION BY LEW: I, the undersigned LEW, hereby declare that the circuit breakers for the above service cable(s) has/have been turned off and safely isolated from the customer's intake switchboard. SP PowerGrid can proceed to de-energise the above service cable(s).

Date of turn off: _____ Time of turn off: _____

Signature : _____ Name : _____ Licence No : _____

PART 1B: DE-ENERGISATION STATEMENT - TO BE COMPLETED BY SP POWERGRID AFTER DE-ENERGISATION

DECLARATION BY SP POWERGRID OFFICER: I, the undersigned SP POWERGRID officer, hereby declare that the above service cable(s) has/have been de-energised and safely isolated from the SP PowerAssets' network.

Date of turn off: _____ Time of turn off: _____

Signature : _____ Name : _____ Section : _____
SP PowerGrid Limited
as agent for and on behalf of SP PowerAssets Limited

PART 2: RE-ENERGISATION STATEMENT - TO BE COMPLETED BEFORE RE-ENERGISATION)

Date : _____ Time : _____

DECLARATION BY LEW: I, the undersigned LEW, hereby declare that the customer's switchgear, to which the abovementioned service cable(s) is/are connected, is cleared of all earthing leads, labour and tools, and that the switchgear is fit for re-energisation from SP POWERASSETS' end with effect from the time specified above. I undertake to ensure that no work by any person will be carried out on the service cable(s) at the customer's end until a new shutdown statement is signed by both parties.

Signature : _____ Name : _____ Licence No : _____

ACKNOWLEDGEMENT BY SP POWERGRID OFFICER

Signature : _____ Name : _____Section : _____
SP PowerGrid Limited
as agent for and on behalf of SP PowerAssets Limited

PART 3: DECLARATION BY LEW ON THE TIME OF TURN ON OF INCOMING SUPPLY AT CUSTOMER'S INTAKE SWITCHBOARD (FOR CONTESTABLE CUSTOMERS ONLY)

To: SP Services Ltd, Remote Meter Reading Section
(Email: meterconfig@spgroup.com.sg)

DECLARATION BY LEW: I, the undersigned LEW, hereby declare that I had turned on the incoming supply at customer's intake switchboard at the following date/time:

Date of Turn-On: _____ Time of Turn-On : _____

Signature: _____ Name: _____ Licence No : _____

CERTIFICATE OF READINESS FOR THE ENERGIZATION OF SERVICE CONNECTION (COR)

Name of Customer Installation: _____
Address: _____
Customer Installation Licence No/Expiry Date: _____
Connection Voltage: _____
Approved Load: _____
Name of Connection Cable(s): _____
Owned by Connection Applicant (Yes / No) _____
MSS Account No: _____
Name of Retailer: _____

Certification By LEW

I, _____(name) the undersigned LEW, hereby certify that the service connection*, the equipment and works at the above installation (Licence No: _____) are now ready and fit for energisation with effect from the date and time specified below.

Date:
Time:

I certify that:

a. Protection details are as follows:

CT Ratio: _____ /1A or 5A*
Short-Time Withstand Current Ratings of Main Supply Incoming Switchgear _____ KA for 1 sec or 3 sec

Main 1 Type: _____
Main 2 Type*: _____ Direct Acting Tripping Setting: _____
O/C Type: _____ Setting: _____
E/F Type: _____ Setting: _____

b. The switching equipment/transformer/service connection* and all associated apparatus related to the service connection have been tested and checked by me and they have passed the pre-commissioning checks and tests in compliance with the Market Rules, Transmission Code, Handbook on How to Apply for Electricity Connection, Connection Agreement, all other applicable standards, and the associated protection systems have all been proven effective.

c. The main protection schemes for the connection have been commissioned by load simulation method on date: _____**

d. For multi-metered installation with the exception of HDB residential installation, the metering scheme has been designed as master/sub-metering scheme.

e. All necessary meters have been installed.

* Delete where not applicable
** To indicate NA where protection scheme is not applicable

f. The safety coordination requirements of the Transmission code have been fully complied with.

g. All workmen have been withdrawn and warned that it is no longer safe to continue to work on the equipment without a 'Permit-to-work (PTW)', and that all tools, scaffolding, ladders, construction materials including any temporary local earthing connections have been removed from the equipment, and all protective screens or guards, if any, have been securely fixed and the appropriate warning signs displayed and that all keys, if any, necessary for the isolation and operation of the equipment have been handed to me.

h. All circuit earth on equipment to be energised are removed.

i. Equipment to be energized in this request (the diagram must clearly indicate the portion of the equipment to be energized. If the space is insufficient, please provide diagram as attachment) is shown below:

Name & Signature of LEW requesting for energization of supply line	Licence No.	Date

FORM CS/6
Request from Contestable Customer for Installation of Electricity kWh Meter

For Official Use
Serial No. : _____ EBS Installation No. : _____

PART I : Customer Details – To be completed by LEW
To: Meters Section, SP PowerGrid through SP Services (Email: install@spgroup.com.sg)

Name of Customer (Mr/Mdm) /Company (Messrs): _____

UEN No.: _____ or NRIC No.: ☐☐☐☐

Note : Please state the last 4 characters (i.e. last three digits and alphabet) of NRIC / FIN / passport or other personal identification number.

Telephone No.: _____ Handphone No.: _____ Name of Contact Person for Company: _____

Existing MSS Account No. (if any): _____ Master Account No. (if any): _____

Application No.: _____ Type Of Business: _____

Site Address as given by IRAS: _____
(You are required to enclose a copy of the IRAS letter.)

Supply Capacity : _____ kVA/kW at _____ Volts
[Form CS/3 or CS/3H (if supply is from landlord) and COC shall be submitted together with this form]

Metering Scheme : _____ Turn On Date : _____

Source of Supply : ☐ SP PowerAssets ☐ Landlord

Type of Connection : ☐ New Connection ☐ Upgrading ☐ Downgrading

I hereby confirm that the electrical wirings at the meter installation have been checked and certified correct.

Name of LEW : _____ LEW Licence No. : _____

Telephone No. : _____ Handphone No. : _____

Signature : _____ Date : _____

*Note: For new supply, customer may apply for contestability status & MSS account no. after meters have been installed. LEW shall apply for license under this MSS account no. to operate electrical installation before proceeding to Installation Section to book for turn on appointment date.

PART II – To be completed by SP Services
To: Meters Section, SP PowerGrid – Application is in order. Please arrange to install the revenue meters.

Name : _____ Signature: _____ Date: _____

PART III – To be completed by Meters Section, SP PowerGrid
To: Supply Application, SP Services – Meters had been installed on _____. Details in EBS.

Name : _____ Signature: _____ Date: _____

PART IV (For official use)
To: Meter Data Management Branch, SP Services

Data Entered by : _____ Signature: _____ Date: _____
(Full Name)

PART V (For official use)
To: Client Relations Branch (MSSL Section), SP Services

Create MSS Account no. : _____ ☐ Consumer has been notified MSS account no.

Account Opened by : _____ Signature: _____ Date: _____
(Full Name)

Form CS/7
Request for Installation of Electricity kWh Meter (for Load Exceeding 45kVA)

For Official Use
Serial No. : _____ EBS Installation No. : _____

PART I : Customer Details – To be completed by LEW
To: Meters Section, SP PowerGrid through SP Services (Email: install@spgroup.com.sg)

Name of Customer (Mr/Mdm) /Company (Messrs): _____

Forwarding Address: _____

UEN No.: _____ or NRIC No.: ☐☐☐☐
Note : Please state the last 4 characters (i.e. last three digits and alphabet) of NRIC / FIN / passport or other personal identification number.

Handphone No.: _____ Name of Contact Person for Company: _____

Site Address for Installation of Meter: _____

Detail Location of Supply Intake Point: _____

Account No.: _____ Master Account No.: _____

Source of Supply: ☐ SP PowerAssets ☐ Landlord ☐ HDB

Type of Connection: ☐ New Connection ☐ Upgrading ☐ Downgrading ☐ Others : _____

Supply Capacity: _____ kW at _____ Volts Type of Business: _____
(Form CS/3 or CS3/H, COC and LEI shall be submitted together with this form)

Details of Landlord/MCST

Name of Landlord/MCST: _____ Landlord's Account No.: _____

Forwarding Address : _____ Postal Code: _____

Name of LEW in charge of Landlord's Electrical Installation: _____

Contact No. of Landlord's LEW: _____

I hereby confirm that the electrical wirings at the meter installation have been checked and certified correct.

Name of LEW: _____ LEW Licence No.: _____

Forwarding Address: _____ Postal Code: _____
(as registered with EMA)

Telephone No.: _____ Handphone No.: _____

Signature : _____ Date: _____

PART II – To be completed by SP Services
To: Meters Section, SP PowerGrid – Application is in order. Please arrange to install the revenue meters.

Name : _____ Signature: _____ Date: _____

PART III –To be completed by Meters Section, SP PowerGrid
To: Supply Application, SP Services – Meters had been installed on _____. (Details in EBS)

Name : _____ Signature: _____ Date: _____

PART IV – [For official use]

☐ Check and perform Master-sub Tagging

☐ Sent to CRO for account move in on _____

☐ Move in/ Turn-On Date is on _____

APPLICATION FOR APPOINTMENT FOR ENERGISATION OF SERVICE CONNECTION

To:	HOS, Elect Installation	From [Name of Design LEW]:
Company:	SP Services Ltd	Company:
Email Address:	largeinstall@spgroup.com.sg	Contact No.:
Date:		Email Address [Design LEW]:
Application No.:		Email Address [Applicant/Owner:
MSS A/C No.:		Distributed Generation Capacity [MWac] [if applicable]:
Approved Load:		

I would like to make an appointment for energisation of service connection to _____

_____.

[site address]

The following documents are attached together with this application.

Documents	Tick if applicable
1] Opening of Account with SP Services Ltd	
2] Opening of Account with Electricity Retailer [for contestable consumer]	
3] Confirmation of meters already fixed [for HT and contestable consumer]	
4] Electrical Installation Licence issued by EMA	
5] Certificate of Compliance [original to be submitted to SPPG's project officer]	
6] Letter from IRAS confirming official address	
7] HT Meter installation letter from SPPG Electrical Meters Section	
8] Meter Declaration Report [For installation with existing meter]	
9] Letter from SPPG confirming Application for De-Energisation/Re-Energisation [ADRE] for existing supply	
10] HDB Residential Block Common Services meter: [KVA]	
11] Commissioning of PV system [with Application for Net Export Rebate form etc]	
12] Generation Licence [Required for Generation Capacity more than 1 MWac]	
13] Others [Please specify]	

The preferred appointment dates [at least 4 business days] are as follows:

1st choice: Date: _____ Time: Morning / Afternoon [Please select]

2nd choice: Date: _____ Time: Morning / Afternoon [Please select]

3rd choice: Date: _____ Time: Morning / Afternoon [Please select]

**Express Appointment Date: _____ Time: Morning / Afternoon [Please select]
[less than 4 business days] [Express Meter Installation Fee applies^]

Terms and Conditions

1. I will submit the Certificate of Readiness on site, failing which service connection shall not be energised and SPPG & SPPA shall not be liable for any loss arising therefrom.
2. I understand that the date of appointment is subject to confirmation by SP Services Ltd and the appointment date shall not be earlier than 4 business days from this submission date.
   a. If turn-on appointment is less than 4 business days, payment for express meter installation would apply, subject to availability of resources. Applicant is to check with Electrical Meters Section.
   b. Please note that applications submitted after 11am may only be processed on the next business day.
   c. For meter installation queries, please call Electrical Meters Section at 6916 8555.
3. For cancellation of domestic appointments less than 4 business days, retest charges may be imposed.
4. After confirmation of appointment, any request for changes in scheduled date shall only be made by the design/installer LEW via official letter/email to both SP PowerGrid and SP Services.

Name & Signature of Design LEW	Licence No.	Date

^ Refer to Section H of Transmission Service Rate Schedule found at SP Group website > Resources > Electricity Works

Dec 2019

TECHNICAL REQUIREMENTS FOR SERVICE CABLE AND METER COMPARTMENT FOR LANDED HOUSES

1 The service cable termination and meter compartment shall be located at the front-gate pillar/perimeter wall such that it is accessible to SPSL's and SPPG's officer without the need to enter the customer's premises.

2 It shall be constructed of concrete, brick or high impact fibre glass and shall be completely weatherproof. Provision shall be made to prevent any stagnation of water within the compartment.

3 The main dimensions of the compartment are shown in the layout drawing (see Appendix 24.1). The depth of the compartment measured from the meter board surface to the compartment door shall be between 200 mm and 300 mm.

4 A meter board of 20 mm thick and constructed of teak wood or any hardwood chemically treated against termite attack shall be provided. Plywood board is not acceptable. A minimum space of 450 mm (W) x 800 mm (H) shall be allowed for the termination of the service cable and the installation of service MCBs and meters. Customer's MCBs or connectors shall be mounted on a separate board in a separate compartment.

5 A hinged door with a clear glass viewing window shall be provided. The viewing window with a 200 mm (W) x 300 mm (H) x 6 mm (thickness) clear cover shall be positioned to be directly in front of the meter location. To avoid high humidity and condensation within the compartment, sufficient ventilation shall be provided. The access door shall not have less than 450 mm clear access opening.

6 The door shall be constructed of stainless steel, anodised aluminium or high impact type fibre glass reinforced material. Where a metal door is provided, a means of earthing shall be provided.

7 One 100mm diameter UPVC lead-in pipe shall be provided for SPPA service cable below 120mm^2 and one 150mm diameter UPVC lead-in pipe shall be provided for SPPA service cable 120mm^2 and above. The pipe shall be laid up to 100 mm from the floor slab of the electric meter compartment and shall undercross any drain in front of the compartment. All installed pipes to pass through Mandrel Tests prior to inspection by SPPG. (see Appendix 15.1)

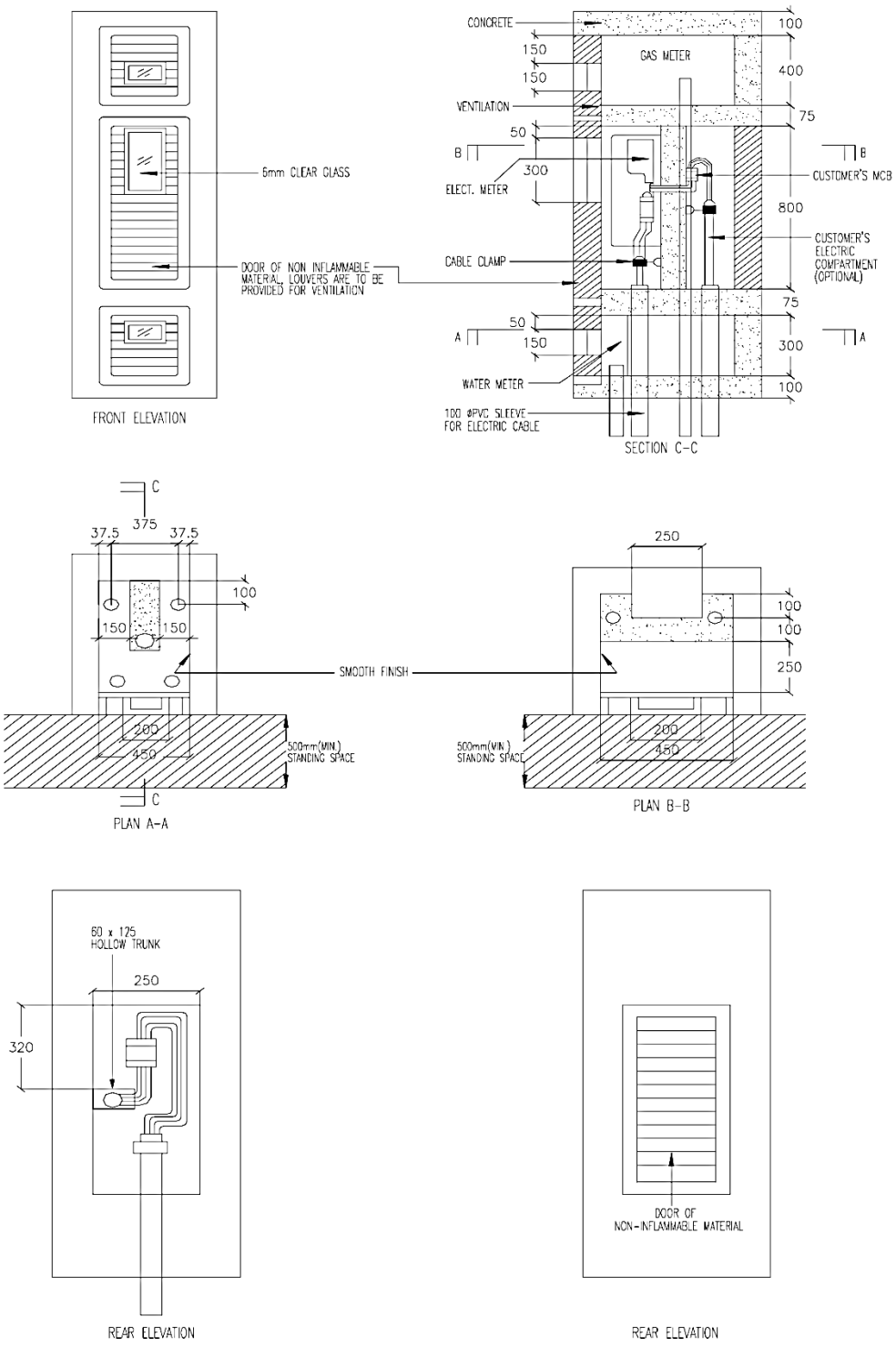
8 Draw pit(s) shall be provided strategically including each turn of the service cable to facilitate the installation of the service cable.

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

10 The compartment shall be exclusively used for service cable and electricity meter. No water meter, gas meter or other facilities shall be placed within the same compartment.

11 Should the meter-box structure exceeds stipulated dimensions, please obtain clearance from the URA's Development Control Division. You may refer to URA's website for more details: Development Control (ura.gov.sg)

STANDARD METER COMPARTMENTS AT GATE PILLAR

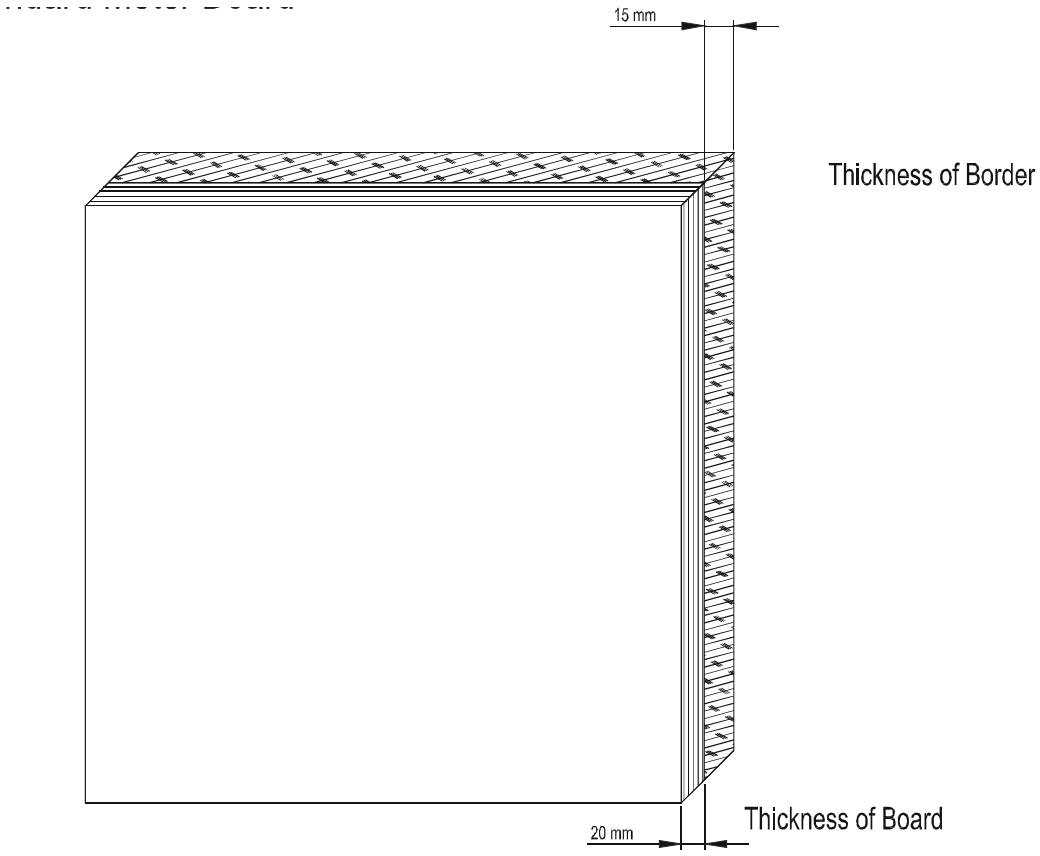


IF THE METER COMPARTMENT IS LOCKED, THE LOCK MUST COMPLY WITH THE REQUIREMENETS IN SECTION 6.1.5.

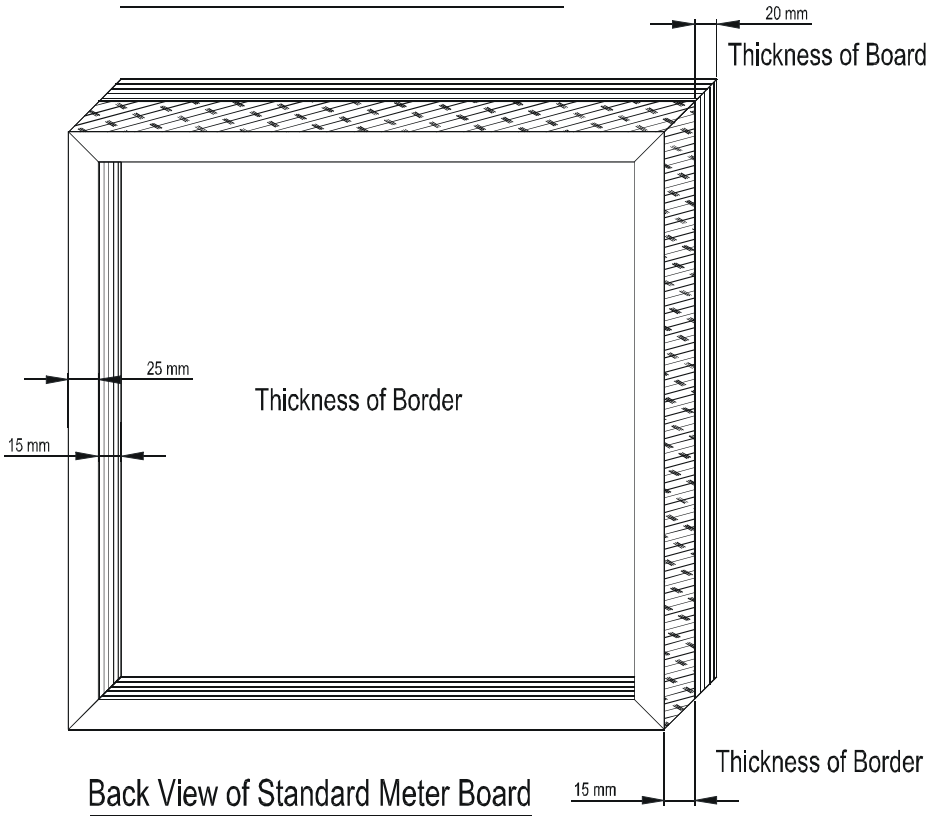
ALL DIMENSIONS ARE IN mm.

SCALE: NOT TO SCALE

STANDARD METER BOARD



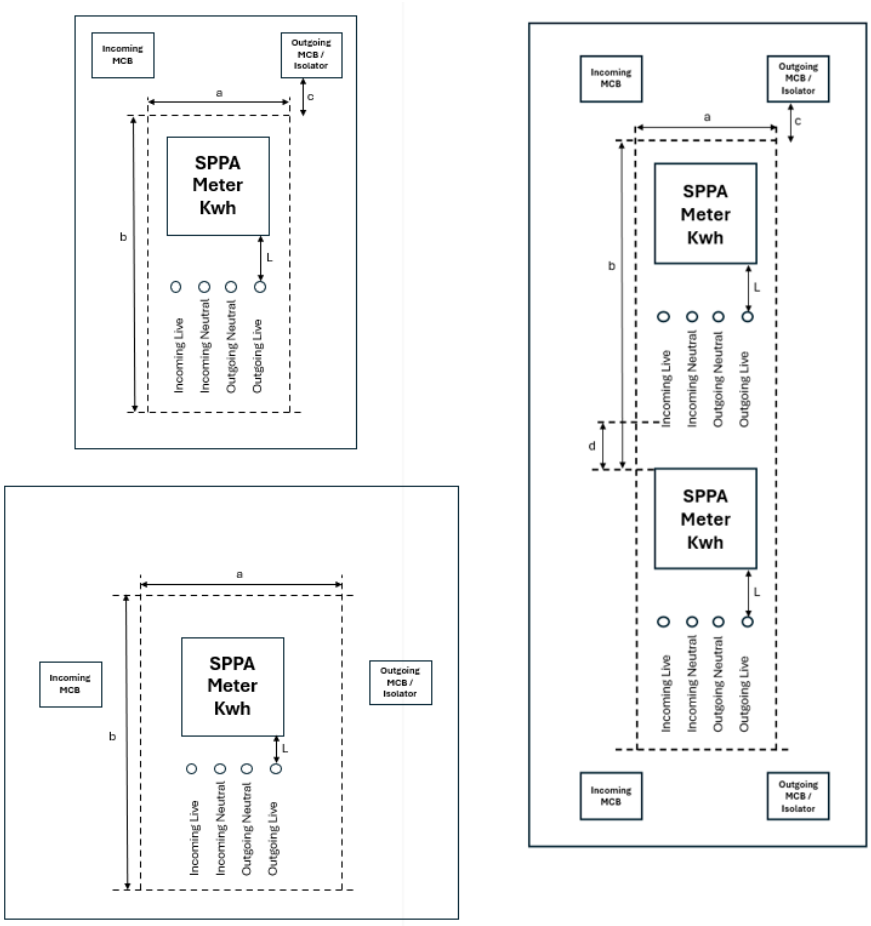
Front View of Standard Meter Board



Back View of Standard Meter Board

Note: Drawing not to scale. All dimensions in mm.

STANDARD SIZE FOR SINGLE-PHASE METER BOARD



1 Minimum space for single-phase meter position (enclosed within broken lines)
(i) **a:** 230mm x **b:** 280mm for 35 sq. mm cable and below
(ii) Depth from surface of meter board to the surface of the meter enclosure door must be at least 200mm or greater.

2 A customer's earthing terminal shall be provided on the meter board for termination of the earthing lead and earth continuity conductor

3 Not more than one wire should be connected to each terminal of the meter terminal block

4 All wires on the meter board from MCB / Cut-out to the meter and meter to main switch should preferably be run on the surface

5 The size of cables to be used for connection to meters should not exceed 35 sq. mm

6 The length of wire "**L**" protruding from the meter board to the meter terminal shall be at least 300mm

7 There shall be at least **c**: 40mm of minimum spacing allowance starting from the top of the meter free from any equipment or accessories

8 For meters grouped in a centralised meter room etc, an additional minimum spacing of **d:** 70mm (Fig B) is necessary between each row of meters for ease of installation / change

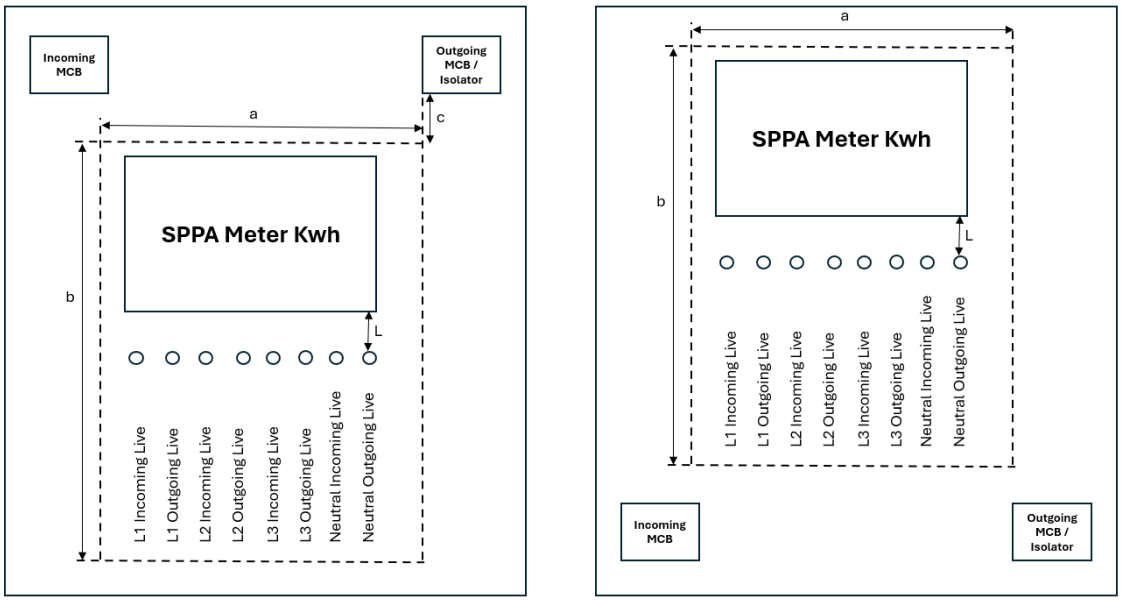
9 The meter cables should follow the new cable colour code stated in SS 638

10 There shall be an outgoing isolator/MCB installed after the meter

11 Some typical layouts are shown in figures A, B and C

Note: drawings not to scale. All dimensions in mm.

STANDARD SIZE FOR THREE-PHASE METER BOARD



1 Minimum space for three-phase meter position (enclosed within broken lines)
(i) **a:** 400mm x **b:** 400mm
(ii) Depth from surface of meter board to the surface of the meter enclosure door must be at least 200mm or greater.

2 A customer's earthing terminal shall be provided on the meter board for termination of the earthing lead and earth continuity conductor

3 Not more than one wire should be connected to each terminal of the meter terminal block

4 All wires on the meter board from MCB / Cut-out to the meter and meter to main switch should preferably be run on the surface

5 The size of cables to be used for connection to meters should not exceed 35 sq. mm

6 The length of wire "**L**" protruding from the meter board to the meter terminal shall be at least 300mm

7 There shall be at least **c**: 40mm of minimum spacing allowance starting from the top of the meter free from any equipment or accessories

8 The meter cables should be colour-coded respective to their phases or shrouded with coloured sleeving

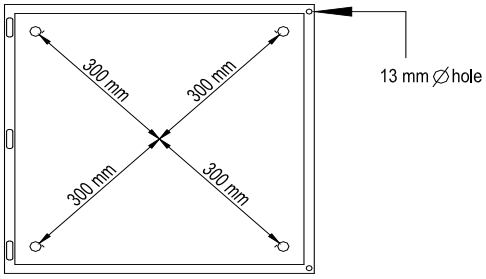
9 The meter cables should follow the new cable colour code stated in SS 638

10 There shall be an outgoing isolator/MCB installed after the meter

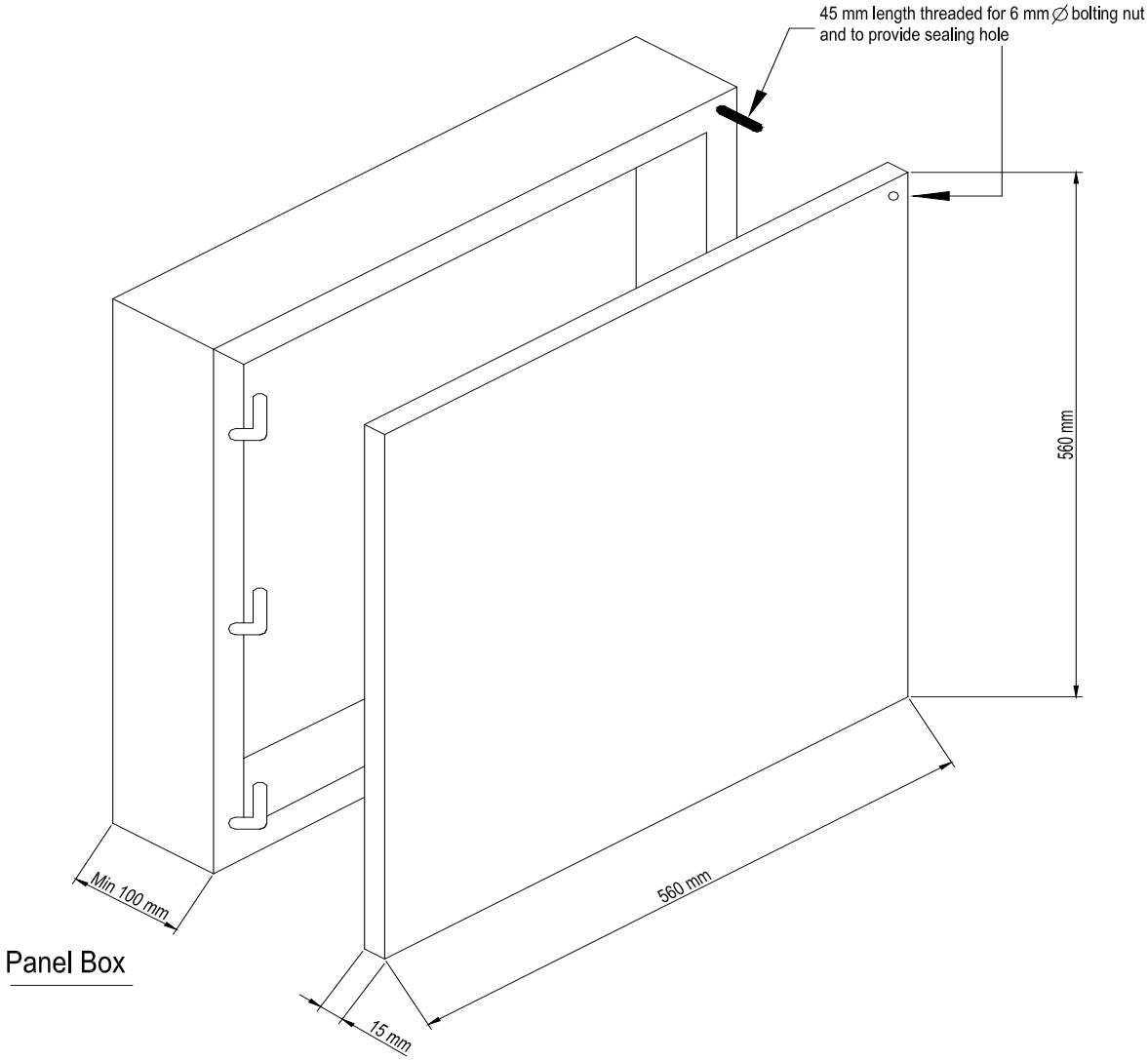
11 Some typical layouts are shown in Fig A and B

Note: drawings not to scale. All dimensions in mm.

CT METER PANEL FOR LOW VOLTAGE SUPPLY



Front Elev. (Panel Box)

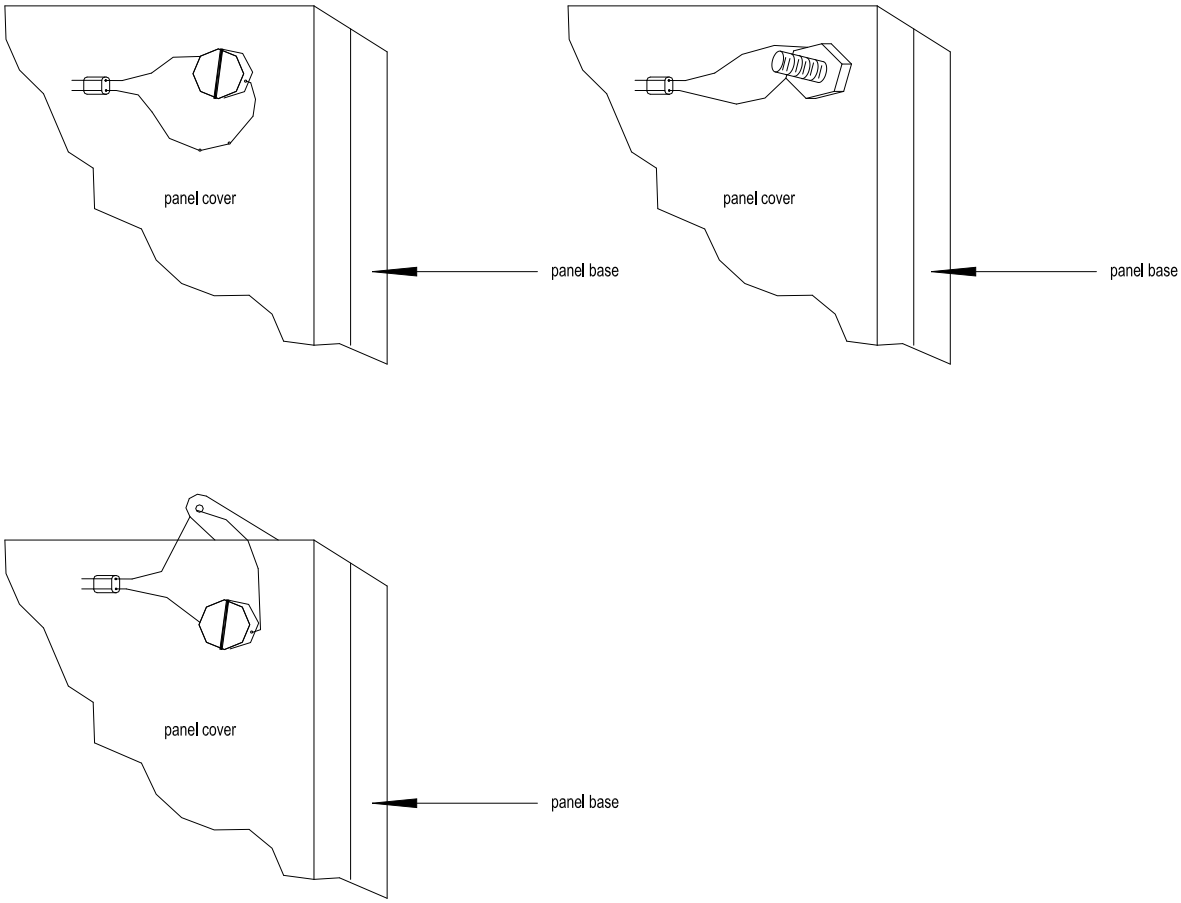


Panel Box

Meter Mounting Panel

Note: Drawing not to scale. All dimensions in mm.

METHODS FOR SEALING METERING PANELS

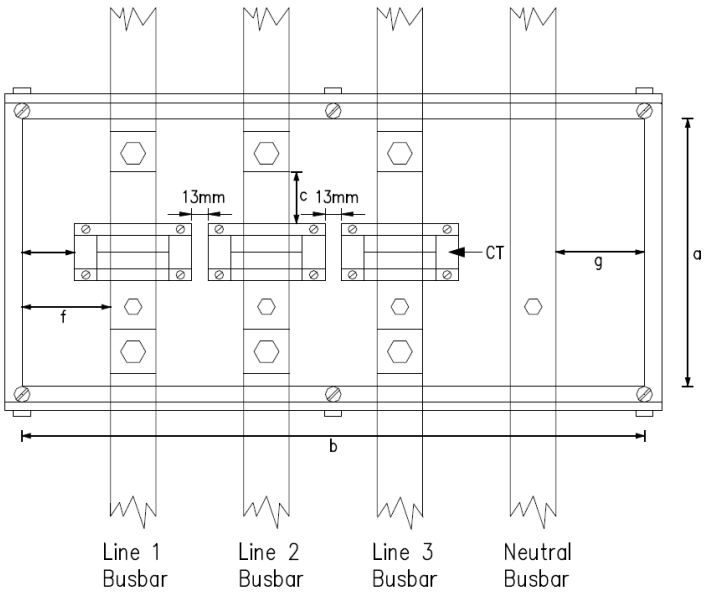


All holes for threading seal wires should be 2mm size

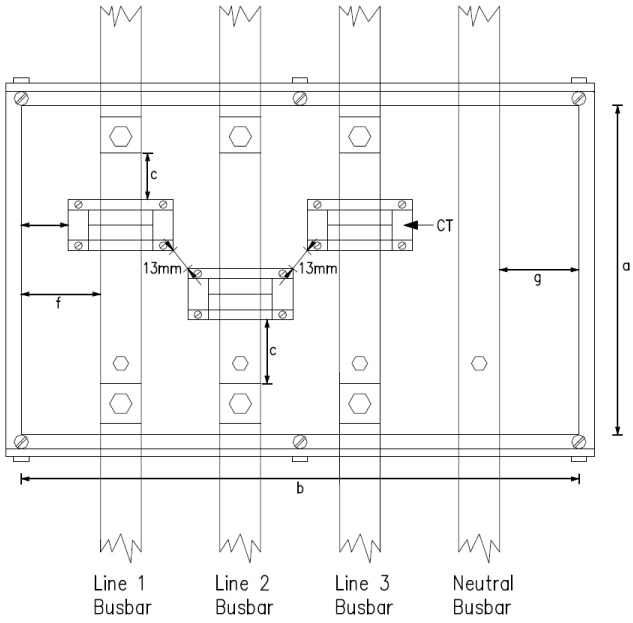
Drawing not to scale. All dimensions in mm.

ENCLOSURE FOR LOW VOLTAGE METERING CURRENT TRANSFORMERS

In–Line



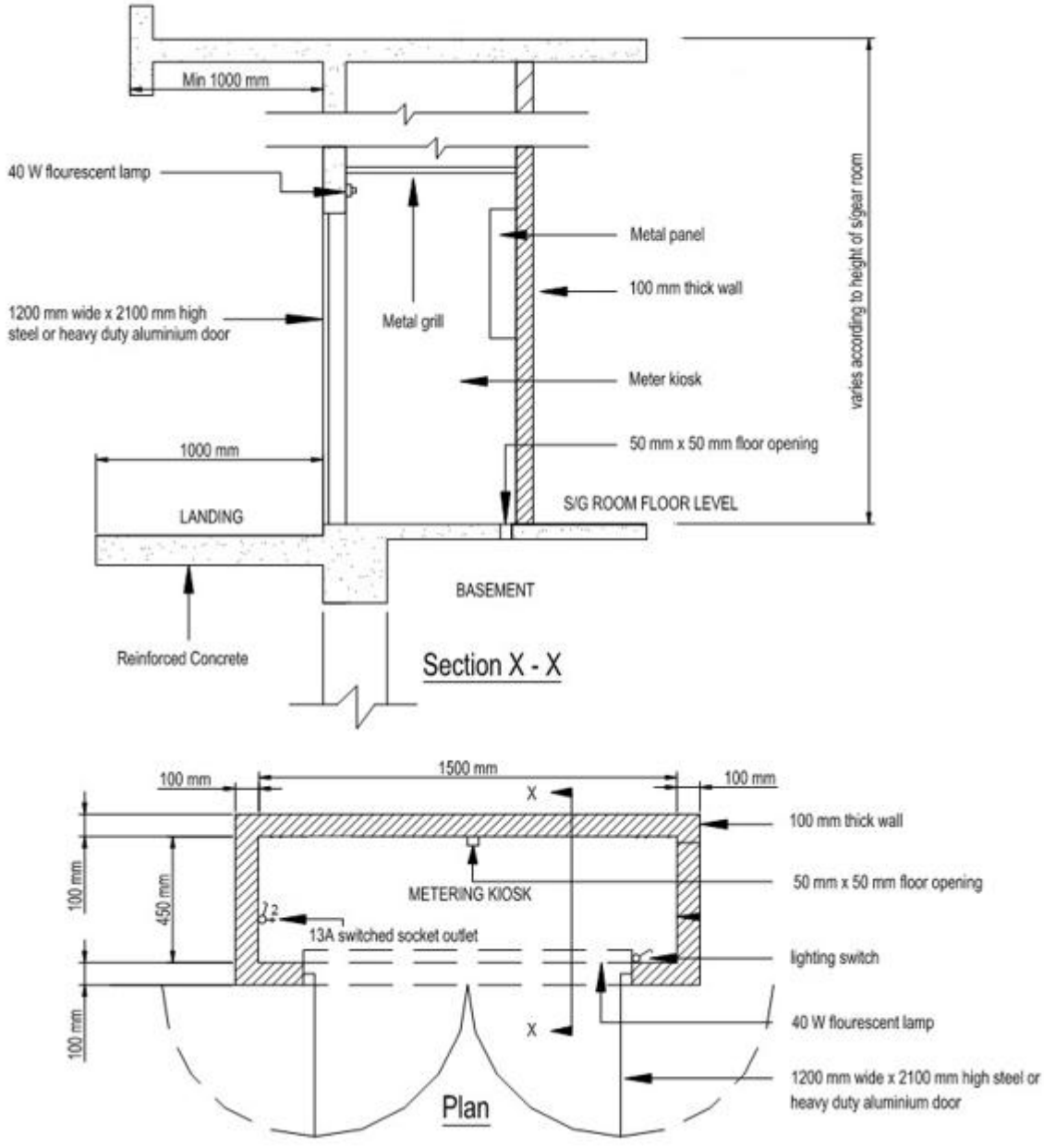
Staggered



Drawing not to scale.

	In-line mounting		Staggered mounting
	Small (< 207kVA)	Normal (> 207kVA)	
a	300mm	300mm	Minimally 325mm
b	450mm	650mm	Minimally 450mm
c	70mm	70mm	70mm
d	13mm between CT		
e	250mm	300mm	300mm
f	100mm	Minimally 100mm	
g	50mm	50mmmm	50mm

HV METERING KIOSK REQUIREMENTS
(FOR 1 OR 2 FEEDERS)



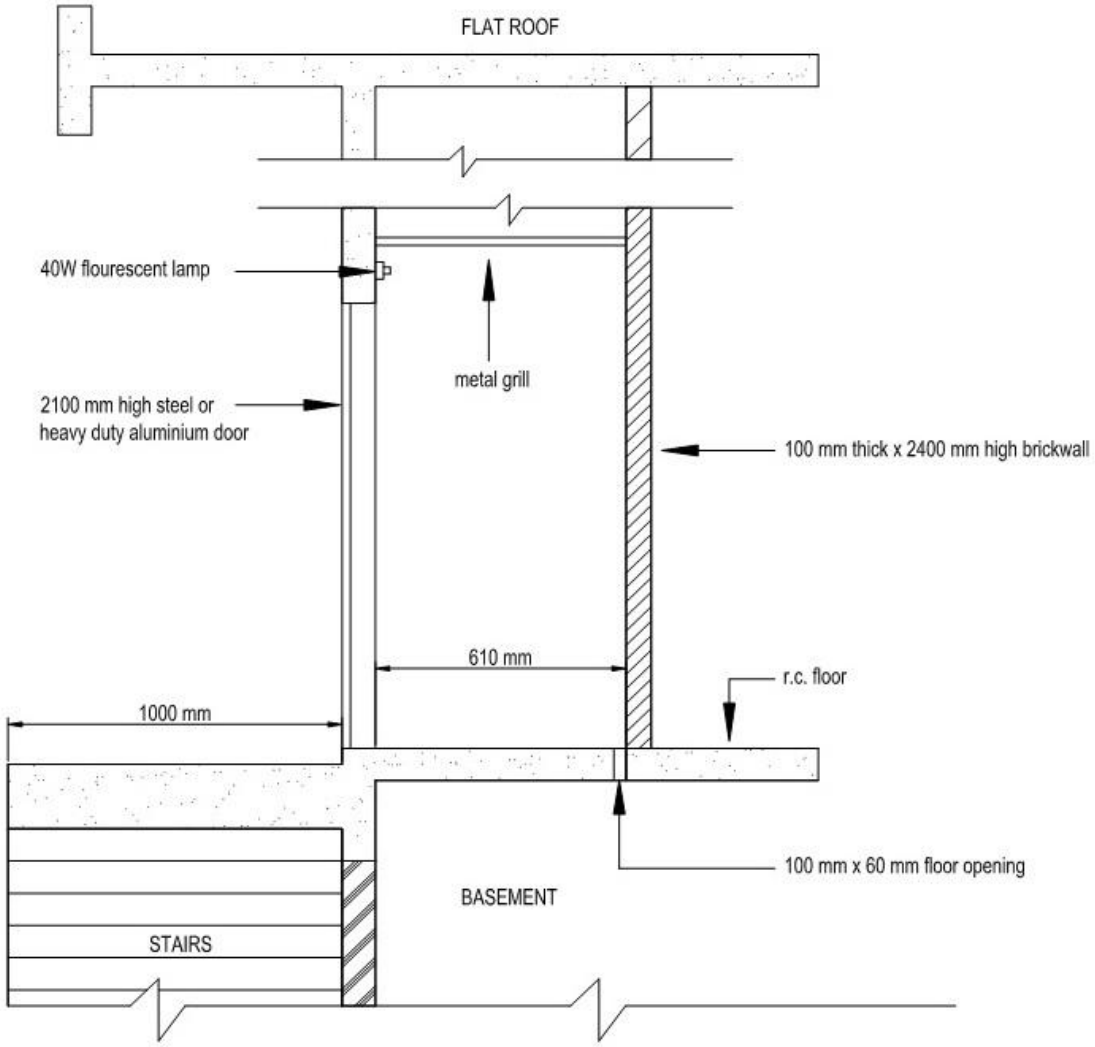
Note: Drawing not to scale. All dimensions in mm

Side Elevation of Metering Kiosk for 1 or 2 feeder panel

The following are required:

a) Metering kiosk: 650mm by 1700mm by minimum height 2400mm of solid brick as shown.
b) Floor opening 50mm by 50mm as shown.
c) Staircase and 1000mm landing where required.
d) Steel or heavy duty aluminium door of 1200mm wide by 2100mm height to be fitted with one of the SPPA approved master series locksets as given in section 6.1.5.
e) One 2 gang 13A switched socket outlet and two 40W lighting points.
f) If landing is above ground level, safety railings must be provided.
g) No louvers to be provided for metering kiosk, including the doors.

HV METERING KIOSK REQUIREMENTS
(FOR 3 OR 4 FEEDERS)



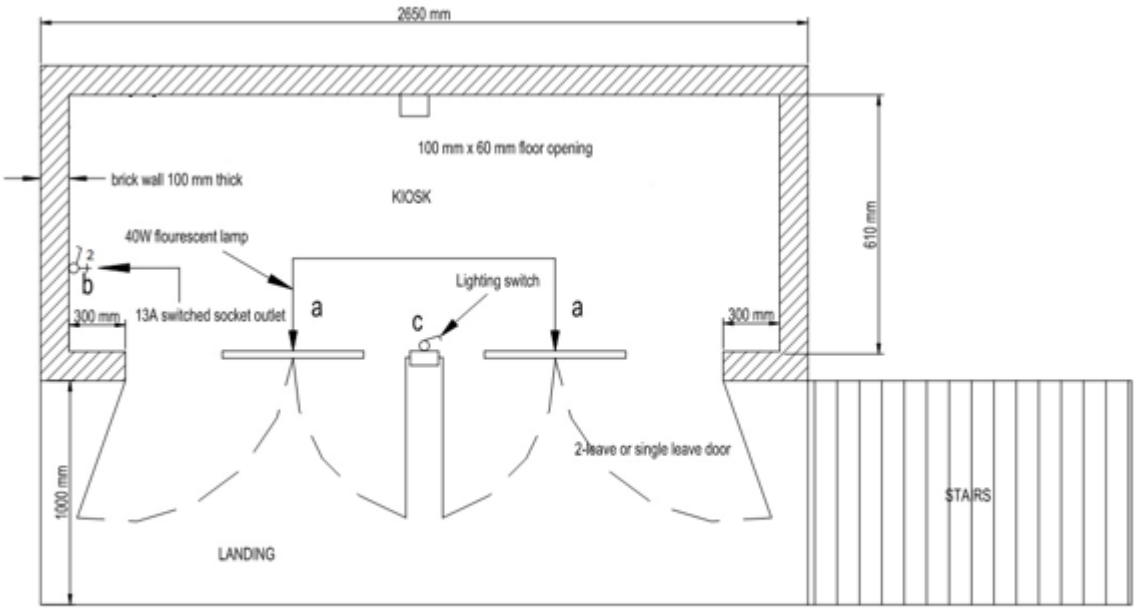
Note: Drawing not to scale. All dimensions in mm

Side Elevation of Metering Kiosk for 3 or 4 feeder panel

The following are required:

a) Metering kiosk: 810mm by 2650mm by minimum height 2400mm of solid brick as shown.
b) Floor opening 100mm by 60mm as shown.
c) Staircase and 1000mm landing where required.
d) Steel or heavy duty aluminium door of 800mm wide by 2100mm height to be fitted with one of the SPPA approved master series locksets as given in section 6.1.5.
e) One 2 gang 13A switched socket outlet and two 40W lighting points.
f) If landing is above ground level, safety railings must be provided.
g) No louvers to be provided for metering kiosk, including the doors.

HV METERING KIOSK REQUIREMENTS (FOR 3 OR 4 FEEDERS)



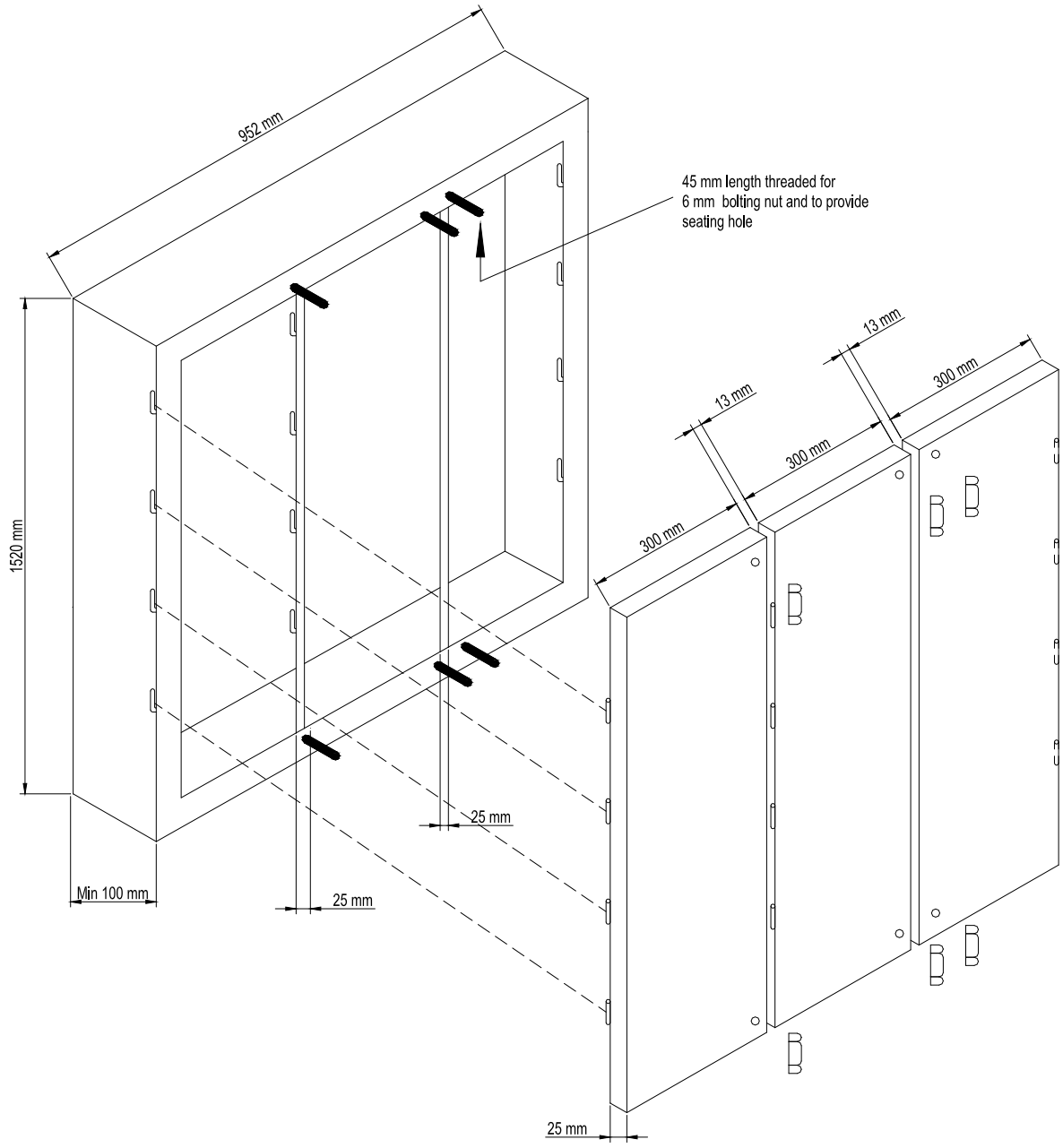
Floor Plan of Metering Kiosk

a = 40W fluorescent lamps

b = 2 gang 13A switched socket outlet

c = 10A switch for fluorescent lamps

HV METERING PANEL REQUIREMENTS
(FOR 1 OR 2 FEEDERS)



Thickness of plate – Min 1.6mm
Hinge – Min 4 nos

NOTE:

1 For 3 or 4 feeders, customer to provide 2 nos of the above metering panel

2 Drawing not to scale. All dimensions in mm.

3 Meter panel shall be provided with CT/VT test terminal blocks with facilities for shorting out and earthing the CT/VT terminals.

METERING VTs
VOLTAGE RATIO, SEQUENCE & PHASE ANGLE TESTS REPORT

Customer: _____ A/C No.: _____

Project Address: _____

PT No.: _____ Voltage Ratio : _____

For Feeder No.: _____

I, _____, EMA Licensed No. _____ had carried out the above test and results are given below.

I hereby certified that the VTs are correctly connected up for tariff metering.

Stamp & Signature of LEW _____ Date: _____

Primary (V) Across	Secondary		Frequency	Phase Angle	
	Sequence Across	Volt		Lead	Lag
L1 L2	L1 E / L1 L2				
	L2 L1				
	L2 E / L2 L3				
	L3 E / L3 L1				
L2 L3	L2 E / L2 L3				
	L3 L2				
	L3 E / L3 L1				
	L1 E / L1 L2				
L3 L1	L3 E / L3 L1				
	L1 L3				
	L1 E / L1 L2				
	L2 E / L2 L3				

BASIS FOR THE SERVICE CONNECTION CHARGE

1 Service Connection Charges for Low Tension (LT) Connection

All LT consumers are required to pay a one-time upfront service connection charge. These charges which vary for different load requirements are categorised depending on the provision of a substation.

For consumers with substations, their supply intake point is usually adjacent to the substation, which requires a service cable of approximately 15m in most instances. Therefore, the standard connection charge is computed based on a cost of service cable length of 15m. Consumers shall pay the additional cost for service cable exceeding 15m. In addition, consumers shall also pay for those dedicated assets, such as switchgear and transformers, which are serving them and do not benefit others.

For individual consumers without substations, the cost of LT service cable for the same capacity may vary widely depending on their locations with respect to the nearest LT mains. These consumers are not the sole beneficiaries of the extension of the LT network. To achieve a greater degree of equity in terms of cost for these general consumers, a standard cost approach is adopted by grouping consumers with similar supply requirements. The average global cost per kVA is determined based on past statistics. For example, this category of consumers which comprises mainly landed residential owners, applying for the same applied load will pay the same standard connection charge regardless of the location of their premises from the existing LT network.

Standard charges are only applicable to consumers who are connected to the shared network. The rates, which are approved by EMA, are available in the Transmission Services Rate Schedule. Standard charges are not applicable to consumers where the network created is unlikely to be shared by others. Some of these include supply to HDB premises, premises involving installation of bigger capacity cable in order to overcome the excessive voltage drop, temporary work sites, public installations and offshore island premises. These consumers would have to pay for the full connection network cost, based on user-pay principle, as they are the main beneficiaries.

2 Service Connection Charges for HT, EHT and UHT Connection

Consumers receiving HT, EHT and UHT connection shall pay the cost of the service connections to their intake equipment including cables, associated equipment and facilities to effect the connection of consumer's equipment to SPPA's substation/network. The service connection shall cater for single contingency.

Consumers requesting additional level of contingency above single contingency are required to pay for the full cost of such provision.

3 Dedicated Distribution Substation

The developer or consumer shall pay the full cost of all associated equipment and facilities under a dedicated network/substation scheme for which the network capacity is intended to serve the developer's development or consumer's premise(s) exclusively.

A substation comprises land, building, electrical equipment and associated cables. A substation which serves a development or premise has to be provided and paid for by the developer or consumer. As the capacity of electrical equipment is lumpy, the substation may have excess capacity. The developer or consumer will carry the cost of this excess capacity which cannot be avoided. As this substation is required to serve mainly the development's or consumer's load, it is considered a dedicated substation.

To reduce cost, a developer or consumer can choose to let SPPA bear the cost of the electrical equipment and associated cables, thus making the network/substation a non-dedicated one. In return, SPPA must be allowed to allocate the excess capacity to other consumers. Even after the excess capacity is allocated, SPPA shall return the capacity to the developer or consumer if his demand grows later provided existing allocated capacity to other consumers can be diverted. The latter provision shall also apply to the decommissioning of the substation. At present, most substations provided by developers or consumers are non-dedicated substations.

STANDARD SERVICE CONNECTION CABLES

The type of service connection cables for terminating into a customer's intake point for the applied load connected at the LV and 22kV level and the typical connection schemes are illustrated as follows:

Voltage Level	Applied Load(kVA)	Size of Cables		Type of cables
LV	Up to 15	35mm^2	2Core	Cu/XLPE/SWA/PVC
	16 – 23	35mm^2	2Core	Cu/XLPE/SWA/PVC
	16 – 45	35mm^2	4Core	Cu/XLPE/SWA/PVC
	46 – 75	35mm^2	4Core	Cu/XLPE/SWA/PVC
	76 – 140	120mm^2	4Core	Al/XLPE/SWA/PVC
	141 – 180	185mm^2	4Core	Al/XLPE/SWA/PVC
	181 – 230	300mm^2	4Core	Al/XLPE/SWA/PVC
	231 – 280	300mm^2	4Core	Cu/XLPE/SWA/PVC
	281 – 460	2x300mm^2	4Core	Al/XLPE/SWA/PVC
	461 – 560	2x300mm^2	4Core	Cu/XLPE/SWA/PVC
	561 – 1000	7x500mm^2	1Core	Cu/XLPE/PVC
	1001 – 1500*	7x1000mm^2	1Core	Cu/XLPE/PVC
	1001 – 2000^	2 sets of 7x500mm^2	1Core	Cu/XLPE/PVC
	2001 – 3000^	3 sets of 7x500mm^2	1Core	Cu/XLPE/PVC
22kV+	Up to 12750kW^	2 X 300mm^2	3Core	Cu/XLPE/DSTA/PVC
	12751 – 25500kW^	4 X 300mm^2	3Core	Cu/XLPE/DSTA/PVC
	Pilot cables	1.5 mm^2	5 pair	Cu/PE/DSTA/PVC

For development whereby the service connection cables are to be supplied and installed by the customer (i.e. via cable tray, top entry termination or the customer's switchroom is not at the same level as SPPA's switchroom), the LEW shall, in the event of a non-standard cable installation, seek approval from SPPG prior to installation.

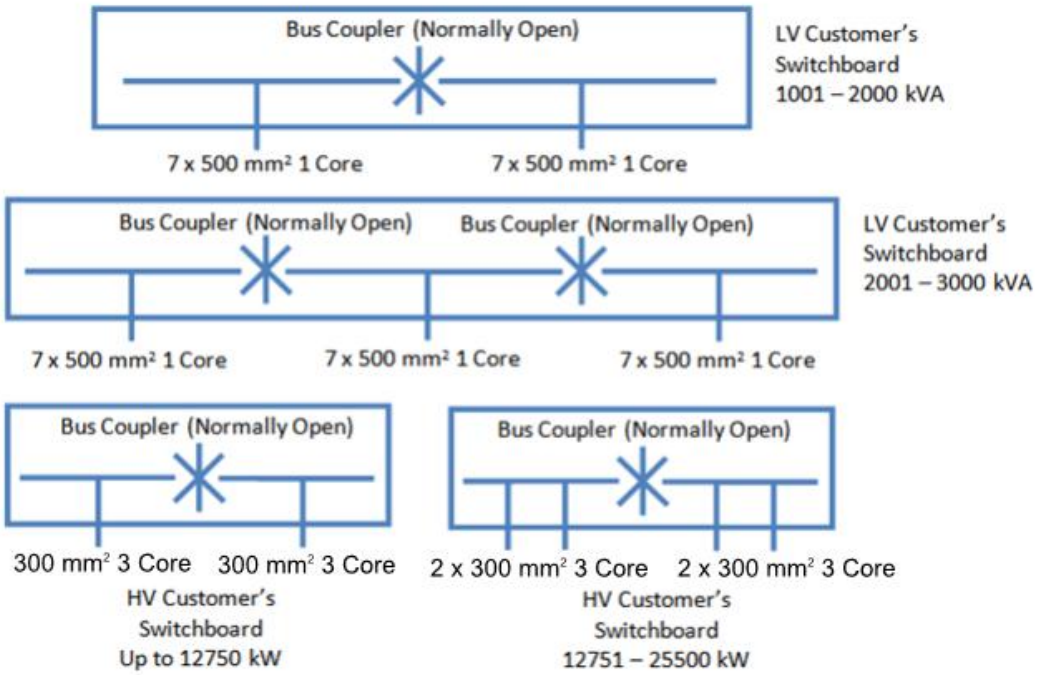
For development with provision of a substation, the service connection cables are to be supplied, installed and maintained by the customer if the customer's switchroom is not abutting to SPPA's switchroom.

* Applies to upgrading of applied load only

\+ Under normal operating condition, the customer shall ensure that his load is balanced on all service connection cables at all times. The customer is required to reduce or maintain his load to within the rated capacity of the remaining service connection circuit(s) in the event of a busbar failure or outage for maintenance. The 22kV cable should be able to withstand single-phase to earth fault current of up to 4kA.

^ Each set of service connection cables shall be located inside the same customer's switchroom.

^ Each set of service connection cables shall not be operated in parallel at all times, including its downstream connections. There must be an electrical and mechanical interlocking bus coupler / section breaker between each set of cables terminating into the customer's switchboard as shown below to prevent any possible parallel operation:



FORM
CERTIFICATE OF COMPLIANCE

Particulars of Electrical Installation

Name of Consumer: _____

Address of Installation: _____

_____

Electrical Installation Licence No.: _____ MSS Account No.: _____

Approved load & Supply Voltage: _____ kW _____ Volts

Generator(s) Installed: ☐ Operated in parallel with PowerGrid's network

No. of Generator(s): _____ Rating: _____kVA

☐ Standby Generator

No. of Generator(s): _____ Rating: _____kVA

☐ Not Applicable

Electrical Installation Design Certification

I certify that the design of the above-mentioned electrical installation complies with the requirements of the Electricity (Electrical Installations) Regulations 2002 and the relevant Singapore Standard Code of Practice. With the certification of compliance by the LEW responsible for the installation work as shown below, I hereby request for the energisation of the supply line to the said electrical installation on _____ (date).

_____ _____ _____

Name & Signature of LEW responsible for design of electrical installation* **Licence No.** **Date**

Electrical Installation Inspection Certification

I have supervised the work of the above-mentioned electrical installation and hereby certify that the electrical installation complies with the requirements of the Electricity (Electrical Installations) Regulations 2002 and the relevant Singapore Standard Code of Practice. I further certify that the technical requirements as stipulated by the person responsible for turning on the switchgear which controls the supply of electricity to the said electrical installation have been complied with.

_____ _____ _____

Name & Signature of LEW responsible for electrical installation work* **Licence No.** **Date**

*The same LEW may perform both design and installation work for the electrical installation.

Copy to:
Market Support Services Licensee

REF: E[EI]Reg5[2]

STATEMENT OF TURN–ON OF ELECTRICITY

ELECTRICITY SUPPLY TO _____
(Name of Applicant)

AT _____
(Address of Installation)

_____

ELECTRICAL INSTALLATION LICENCE NO* : _____

APPLICATION NUMBER: _____

I agree that the above-mentioned electrical installation is suitable for connection to the electrical system. I certify that the supply line to the installation has been energized on

_____ at _____ .
(Date) (time)

Name & Signature of PowerGrid's Officer	NRIC No.	Date

I acknowledge that the supply line has been energized on the date and time indicated above.

Name & Signature of LEW requesting for energization of supply line	Licence No.	Date

I acknowledge that the supply line has been energized on the date and time indicated above and confirm that I will be responsible for the operation of this electrical installation hereafter.

Name & Signature of LEW responsible for the operation of the electrical installation*	Licence No.	Date

I acknowledge that the supply line has been energized on the date and time indicated above.

Name & Signature of Applicant or His Representative	NRIC / Passport No.	Date

* Not Applicable for an electrical installation that is exempted from licensing.

Original Copy - PowerGrid Ltd
Pink Copy - LEW (Requesting)
Yellow Copy - LEW (Operation)
Green Copy - Applicant
Email Copy - MSSL
Digital Copy - File

REF: E(EI) REG R5(4)

Note: This form can be downloaded from http://elise.ema.gov.sg.

REQUIREMENTS FOR EMBEDDED GENERATION FACILITY / INTERMITTENT GENERATION SOURCES (IGS)

The consumer applying to connect an embedded generation facility / IGS is required to obtain SPPA's approval and shall comply with the technical, safety & operational and commercial & legal requirements below:

High Tension and above (6.6kV & above) consumers with embedded generation / IGS, will need to choose one of the 3 backup schemes (full or partial) required: (1) Summation Scheme; (2) Capped Capacity Scheme; or (3) Extended Capped Capacity Scheme. The consumer will need to sign a Supplemental Agreement with the Transmission Licensee to reflect their choice of backup scheme for the service connection.

Consumers adopting Summation Scheme and not on Solar Generation Profiling option shall provide metering transformer(s), both voltage and current for HT and above connections, and current only for LT connections, and a suitable facility (including all necessary pre-wiring) to house the summation meter(s), which will be provided and installed by SPPA, for measuring output of all the generators / IGS, which is summed with import from grid in the same time intervals to determine the Maximum Demand. If the embedded generation / IGS in the premises is 1MWac or above, generation meters need to be installed, which the consumer can request to double up as summation meters (SPPA will need to remove any existing summation meters). Capped Capacity and Extended Capped Capacity Scheme requirements are in Appendix 39.1 and 39.2 respectively. For more information on PV requirements, please refer to the SP Group website at www.spgroup.com.sg.

1 Technical Requirements

a) Real and reactive power/voltage output and voltage and frequency response times must be within agreed limits

b) To comply with the voltage imbalance, voltage fluctuation and harmonic content requirements as specified in the Transmission Code

c) Ensure that there is no interference to SPPA's equipment or any other directly or indirectly connected consumers

d) Ensure adequate partitioning of the embedded generation facility equipment from SPPA's equipment

e) Where required by SPPA, to install harmonic device to ensure compliance with the harmonics standard at PCC as specified in the Transmission Code

f) LEW is required to submit fault level reports to SPPG's Planning Section. The embedded generation system shall limit their fault level contribution to the grid to a level acceptable to SPPG.

2 Safety & Operational Requirements

a) Provide an interlocking and inter-tripping facility for the service connection that meets SPPA's requirement

b) Fit embedded generation facility with reverse power relays to prevent export of power to the transmission system. However, this requirement will not apply in the event that EMA / EMC had given approval for the export of power to the transmission system

c) Not operate the embedded generation facility in islanding mode, i.e. the embedded generator must isolate itself from the distribution network when there is a fault/tripping on the latter or the consumer's installation (non-islanding protection)

d) Provide a synchronizing facility at the incoming switchboard of its service connection and ensure that any output is always synchronized with the distribution network

1 Commercial & Legal Requirements

The consumer with an embedded generation facility / IGS shall:

a) Pay use of system charges in accordance with the Transmission Services Rate Schedule

b) Indemnify SPPA

i) for all losses and liabilities arising from any loss of synchronisation caused by any tripping or re-closing of any breakers in the transmission system and the embedded generation facility / IGS connected in parallel to the transmission system ; and

ii) Against losses to third parties caused by impedance, disruption degradation interference or failure of transmission services to third parties caused by the system or works carried out on the transmission system.

c) Certify to SPPG that the embedded generation facility meets all conditions of the relevant legislation, regulation (including installation, fire and safety, noise and environment)

d) Conduct regular site tests and notify SPPG of the results

e) Allow SPPG to conduct inspection of, disconnect and enforce conditions in respect of the service connection if the embedded generation facility / IGS fails to meet any of the above requirements

f) Resolve, at its own expense, all third party complaints concerning the embedded generation facility / IGS (e.g. complaints due to noise, or aesthetic reasons); and

g) Subject to SPPG approval, use the service connection at its own risk to operate in parallel with its embedded generation facility / IGS.

TERMS AND CONDITIONS FOR CAPPED CAPACITY SCHEME (CCS)

1 The Consumer shall at its own expense, install and maintain, in accordance with such requirements that the Transmission Licensee may from time to time stipulate:

1.1 at the Consumer's incoming switchboard (or at such other point that Transmission Licensee may specify), a Load Limiting Device ("**LLD**"), which will automatically disconnect the Service Connection from the Transmission System in the event ("**Event**") that the Consumer's intake from the Transmission System exceeds one hundred and twenty percent (120%) of the Contracted Capacity ("**CC**") for more than ten (10) seconds continuously.

1.2 at the HT metering kiosk (or at such other point that Transmission Licensee may specify), a Load Monitoring Device ("**LMD**") including device licence, all control cables for the LMD as well as metering accessories for the Transmission Licensee to monitor the Consumer's intake from the Transmission System.

2 Upon installation, all title, rights and interest in the LMD shall vest immediately in the Transmission Licensee. However, the Consumer shall ensure that:

2.1 The LMD shall at all times be set and adjusted to the satisfaction of the Transmission Licensee;

2.2 No modification, reset or adjustment to the LMD is carried out without first obtaining the Transmission Licensee's approval;

2.3 The initial testing, commissioning and subsequent annual testing of the LMD as well as any modification, reset or adjustment to the LMD approved by the Transmission Licensee is to be carried out by a Licensed Electrical Worker and in the presence of a representative from the Transmission Licensee;

2.4 The LMD is re-tested and re-commissioned as and when required at the discretion and direction of the Transmission Licensee;

2.5 All test results are submitted to the Transmission Licensee at such address as notified by the Transmission Licensee within two (2) weeks from the date of the testing;

2.6 The representatives of the Transmission Licensee are granted unrestricted access to substation premises for on-site inspection and retrieval of data from the LMD;

2.7 The LMD is covered under a valid maintenance contract providing for relevant technical support and replacement parts to keep the LMD in good operational condition at all times; and

2.8 If any defect in the LMD is detected, the Consumer is required to rectify these defects, and replace the LMD if necessary within two (2) weeks from the date of detecting these defects.

3 The Transmission Licensee shall be entitled to witness all testings of the LMD (as set out in clause 2 above) at its own expense. All other expenses in connection with the testing of the LMD shall be borne by the Consumer.

4 The conversion to CCS shall be effective upon the following (the "**CCS Effective Date**"):

4.1 the Consumer's compliance with Item 1 above; and

4.2 the successful commissioning of the LLD and LMD.

5 In the event that the LLD fails to cap the power demand (kW) drawn from the network in the circumstances as described in Item 1.1, the Uncontracted Standby Capacity Charge ("**USCC**") shall apply and be payable.

6 The USCC is a monthly charge payable in any month for the Uncontracted Standby Capacity utilised. The Uncontracted Standby Capacity is the peak power demand in kW drawn from the network exceeding 120% of CC, recorded from the time the power drawn exceeds 120% of CC to the time the power drawn falls below 120% of CC. This peak power demand is recorded by the LMD at single second intervals.

7 The rate of USCC shall be the prevailing rate stated in the Transmission Service Rate Schedule. SPPA reserves the right to review the USCC rate applicable to the Consumer from time to time, such review to be subject to EMA's approval. The current rate for USCC is 5 times of the CC Charge for demand drawn exceeding 120% of CC.

8 For each Event, as defined in Item 1.1 above, the Consumer is required to submit, within two weeks of the occurrence of the Event, a report to the Transmission Licensee detailing each Event. The details shall include but not be limited to:
(a) Time (accurate to seconds) and date of the Event(s), supported by system event log listings;
(b) Detailed description of the Event, in particular the cause(s) of Event; and
(c) Remedial actions to prevent future Events.

9 The Consumer shall ensure that multiple sources of Transmission System are not connected in parallel at any time, and that any switching between circuits is undertaken on "black changeover" or "break before make" basis.

10 The Transmission Licensee reserves the right to withdraw the CCS from the Consumer if the Consumer fails to comply with the terms and conditions applicable to the scheme, and to offer only the Summation Scheme (as outlined in Clause 12.14(a) of the CCA) to such Consumer.

11 The Consumer acknowledges and accepts that in the event of a change in scheme for whatever reason, the Service Connection may be disconnected temporarily to facilitate the installation of energy meters and other equipment for the purposes of the implementation of the Summation Scheme.

TERMS AND CONDITIONS FOR EXTENDED CAPPED CAPACITY SCHEME (ECCS)

1 The Consumer shall at its own expense, install and maintain, in accordance with such requirements that the Transmission Licensee may from time to time stipulate:

1.1 at the Consumer's incoming switchboard (or at such other point that the Transmission Licensee may specify), a Load Limiting Device ("**LLD**"), which will automatically disconnect the Service Connection from the Transmission System on the happening of any one of the following events ("**Event**"):

(a) when the Consumer's intake from the Transmission System exceeds one hundred and twenty percent (120%) of the Contracted Capacity ("**CC**") for more than one hundred (100) seconds continuously; or

(b) when the Consumer's intake exceeds two hundred percent (200%) of the CC for more than ten (10) seconds continuously.

1.2 at the HT metering kiosk (or at such other point that Transmission Licensee may specify), a Load Monitoring Device ("**LMD**") including device licence, all control cables for the LMD as well as metering accessories for the Transmission Licensee to monitor the Consumer's intake from the Transmission System.

2 Upon installation, all title, rights and interest in the LMD shall vest immediately in the Transmission Licensee. However, the Consumer shall ensure that:

2.1 The LMD shall at all times be set and adjusted to the satisfaction of the Transmission Licensee;

2.2 No modification, reset or adjustment to the LMD is carried out without first obtaining the Transmission Licensee's approval;

2.3 The initial testing, commissioning and subsequent annual testing of the LMD as well as any modification, reset or adjustment to the LMD approved by the Transmission Licensee is to be carried out by a Licensed Electrical Worker and in the presence of a representative from the Transmission Licensee;

2.4 The LMD is re-tested and re-commissioned as and when required at the discretion and direction of the Transmission Licensee;

2.5 All test results are submitted to the Transmission Licensee at such address as notified by the Transmission Licensee within two (2) weeks from the date of the testing;

2.6 The representatives of the Transmission Licensee are granted unrestricted access to substation premises for on-site inspection and retrieval of data from the LMD;

2.7 The LMD is covered under a valid maintenance contract providing for relevant technical support and replacement parts to keep the LMD in good operational condition at all times; and

2.8 If any defect in the LMD is detected, the Consumer is required to rectify these defects, and replace the LMD if necessary within two (2) weeks from the date of detecting these defects.

3 The Transmission Licensee shall be entitled to witness all testing of the LMD (as set out in clause 2 above) at its own expense. All other expenses in connection with the testing of the LMD shall be borne by the Consumer.

4 The conversion to ECCS shall be effective upon the following (the "**ECCS Effective Date**"):

4.1 the Consumer's compliance with Item 1 above; and
4.2 the successful commissioning of the LLD and LMD.

5 In the event that the LLD fails to cap the power demand (kW) drawn from the network in the circumstances as described in Item 1.1, the Uncontracted Standby Capacity Charge ("**USCC**") shall apply and be payable. The USCC is a monthly charge payable in any month for the Uncontracted Standby Capacity utilised.

6 For the purposes of this ECCS, the term "Uncontracted Standby Capacity" shall mean the capacity by which the demand in kW drawn from the network:

6.1 exceeds 120% up to a level of 200% of the CC at the metered intake supply point for a duration of more than 100 seconds continuously; or
6.2 exceeds 200% of the CC at the metered intake supply point for a duration of more than 10 seconds continuously.

7 The rate of USCC shall be the prevailing rate stated in the Transmission Service Rate Schedule. SPPA reserves the right to review the USCC rate applicable to the Consumer from time to time, such review to be subject to EMA's approval. The current rate for USCC is:

7.1 5 times of the CC Charge for demand drawn exceeding 120% up to 200% of CC; and
7.2 12 times of the CC Charge for demand drawn exceeding 200% of CC.

8 For each Event, as defined in Item 1.1 above, the Consumer is required to submit, within two weeks of the occurrence of the Event, a report to the Transmission Licensee detailing each Event. The details shall include but not be limited to:
(a) Time (accurate to seconds) and date of the Event(s), supported by system event log listing;
(b) Detailed description of the Event, in particular the cause(s) of Event; and
(c) Remedial actions to prevent future Events.

9 The Consumer shall ensure that multiple sources of Transmission System are not connected in parallel at any time, and that any switching between circuits is undertaken on "black changeover" or "break before make" basis.

10 The Transmission Licensee reserves the right to withdraw the ECCS from the Consumer if the Consumer fails to comply with the terms and conditions applicable to the scheme, and to offer only the Summation Scheme (as outlined in Clause 12.14(a) of the CCA) to such Consumer.

11 The Consumer acknowledges and accepts that in the event of a change in scheme for whatever reason, the Service Connection may be disconnected temporarily to facilitate the installation of energy meters and other equipment for the purposes of the implementation of the Summation Scheme.

FORM CS/12
Application for Electrical Installation Test (up to 45 kVA)

To: SP Group
2 Kallang Sector
Singapore 349277
Attn: SP Services

Email: install@spgroup.com.sg

I/We hereby request an appointment to test the electrical installation at the premise with SP Services **Utility Account No**: ☐

(Please tick or fill in the appropriate boxes)

☐ An application for electricity supply service has been submitted earlier and approved.
SP Services **Application Reference No** is: ☐

OR

☐ This is a new application. Duly completed CS/5 form is transmitted herewith.
(CS/3 form shall be transmitted for supply connection from landlord's electrical installation)

Type of Meter Required:	☐ Single-Phase	☐ Three Phase	☐ No New Meter Required
Removal of Old Meter(s):		☐ Yes	☐ No

*Preferred Dates : (in order of preference)	1 _____	☐ Morning	☐ Afternoon
	2 _____	☐ Morning	☐ Afternoon
	3 _____	☐ Morning	☐ Afternoon

Remarks: _____

(*Your preferred dates shall be from the 3rd working day onwards. If you do not give us your preferred date(s), we shall give you the earliest possible available appointment date & time.)

Signature:

Licensed Electrical Worker:
Telephone/ Handphone No .: Fax No.:

Notes:

1. This application form is only to be used for electrical installations with supply capacity up to 45 KVA.
2. A reply will normally be given by the next working day. It is important that you give us your telephone/ handphone numbers to contact you to give an alternative test appointment date if your preferred dates are not available.
3. The granting of an appointment on preferred date is at SP Services' discretion and subject to availability of testers.
4. Applications received after 3pm will be processed the next working day.
5. For urgent inspection with meter, you are required to:
   i) contact Installation Branch at 69169386 for appointment, and
   ii) contact Meters Section at 1800 278 2778 for meter fixing (a fee is chargeable); before submitting the application to Supply Application Section for processing.

13/10/11

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APPLICATION FOR CONTESTABILITY STATUS & MARKET SUPPORT SERVICES ("MSS") ACCOUNT & TRANSMISSION SERVICES FOR LOW TENSION ("LT") CONSUMERS

(FOR COMMERICAL AND INDUSTRIAL CONSUMERS ONLY)

Part A: Consumer & Premises Details

Name of Consumer:		Unique Entity No. (UEN/NRIC):	
Contact Person:		Mobile No.:	
Email:		Tel No.:	
Premise address(es): ("the Premises")			
		S	
Mailing Address (if different from premises)			
		S	

Part B: Application for Contestability

1. I/We wish to apply to be a contestable consumer and open an MSS account for the Premises.
2. I/We intend to purchase electricity from:

☐ A Licensed Electricity Retailer
Name of Retailer: _____

☐ The Wholesale Electricity Market through SP Services Limited (SPS)

☐ The Wholesale Electricity Market through the Energy Market Company (EMC)

3. Request Date of Contestability*: _____ Existing Electricity Account No. (if applicable): _____

** Notwithstanding your request date of contestability, you shall only be classified as a contestable consumer after (i) the required meter(s) have been installed and commissioned at the Premises, and (ii) you have been notified by SPS that your application is successful.*

4i. I/We intend to move-in/take-over the Premises currently under:

☐ Low tension supply (Move-in)

☐ Low tension supply (Take-over)

☐ High tension supply, with Contracted Capacity: _____

ii. Where applicable, I/we agree that my/our move-in/take-over of the Premises is subject to the corresponding move-out of the existing consumer of the Premises and I/we agree that SPS shall not be liable for any inconvenience, loss, expense and damage that may be incurred or suffered as a result of a delay, postponement or cancellation of such move-out by the existing consumer.

iii. I/We agree that I/we will be billed from 00:00hr on the date of move-in/take-over and up to 23:59hr on the date I/we move out of the Premises.

iv. I/we understand that electricity supply will not be turned on if SPS' technician finds that the meter is not connected to the electrical installation or the electrical installation has been rewired at the Premises.

5. I/we confirm that the Premises is lawfully used or occupied by me/us for commercial and industrial purposes. I/We would like to apply to become contestable under the following scheme and acknowledge that I/we, where applicable, satisfy the prescribed requirements:

☐ <u>Under the normal contestability scheme (*for non-master-metered accounts*)</u>

or

☐ <u>Under the *Demand Aggregation Scheme (*for master-metered accounts*):</u>
I/We am/are the holder of the master-metered account of the Premises and am/are applying for the Demand Aggregation Scheme. I/We hereby confirm that I/we have complied with and undertake to continue to adhere to the prevailing "Conditions for Master-Metered Account Holders to be Classified as Contestable Consumers under the Demand Aggregation Scheme" (as may be updated from time to time) issued by the EMA. Refer to the Open Electricity Market website (www.openelectricitymarket.sg) for the document.

or

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☐ **Under the *En-bloc Contestability Scheme (*for master-metered accounts*):**

I/We am/are the holder of the master-metered account of the Premises and am/are applying for the En-bloc Contestability Scheme. I/We hereby confirm that I/we have complied with and undertake to continue to adhere to the prevailing "Conditions for Master-Metered Account Holders to be Classified as Contestable Consumers under the En-Bloc Contestability Scheme" (as may be updated from time to time) issued by the EMA. Refer to the Open Electricity Market website (www.openelectricitymarket.sg) for the document.

**Note: Registered master account holders are required to provide Annexes A and B to terminate the sub-metered accounts.*

or

☐ **Under the Enhanced Central Intermediary Scheme (ECIS) (*for non-master-metered accounts with Embedded Intermittent Generation Sources ("IGS")*):**

i) The embedded IGS installed at my/our Premises is:
- ☐ 10 MWac and above. I/We will register my/our embedded IGS with EMC for payment.
- ☐ Less than 10 MWac. I/We will register my/our embedded IGS SPS for payment under the ECIS.

The total generation capacity at my/our Premises (including all blocks) is: _____ MWac. I/We will inform SPS on any changes to the total generation capacity.

Please complete Annex C and provide your GST details below if you are registering your embedded IGS with SPS for payment under the ECIS

I/We acknowledge that SPS will pass on the rebates and charges in my/our next billing cycle after SPS receives payment from EMC.

i. I/We am/are GST-registered. My/Our GST registration number and date are as follow and I/we attach herewith a copy of the GST registration letter from IRAS:
GST registration number: _____ GST registration date: _____

ii. I/We agree that I/we will not issue any tax invoice for electricity sold to SPS but hereby authorize SPS to issue tax invoices on my/our behalf. I agree that SP Services Limited can charge GST at the prevailing rates based on the date my taxable supplies are provided. I/We will notify SPS immediately if my/our GST registration is cancelled or if I/we am/are issued with a new GST registration number.

ii) For the installation of Generation Meters:
- ☐ I/We wish to engage SP PowerGrid Limited to install the main generation meter(s) *with/without check meter(s) *(please delete where not applicable). Please note that the installation of check meter(s) is compulsory for embedded IGS with a capacity of 1MWac and above. Refer to Application for Net Export Rebate form for the applicable charges;
- ☐ I/We will provide my/our own generation meter(s).

iii) I agree to submit the completed Application for Net Export Rebate form to SPS to process my application. Please refer to SP Group website for the application form (www.spgroup.com.sg)

6. **I/We agree that my/our contestability status cannot be revoked once I/we am/are classified as a contestable consumer from such date as may be notified by SPS unless the cessation of my/our classification as a contestable consumer is allowed under the Contestability (Contestable Consumers) Regulations 2019.**

7. I/We understand that my/our existing electricity meter(s) may be changed for the purpose of remote meter reading.

8. I/We agree to pay a Security Deposit (applicable if I/we am/are purchasing electricity from the Wholesale Electricity Market through SPS) for an amount informed by SPS within the time period stipulated by SPS or before the supply at the Premises has been turned on, whichever is earlier.

9. I/We agree to be bound by the Conditions of Service which shall take effect when this application is approved, and an MSS account has been opened for me/us. Please refer to the Conditions of Service on the Open Electricity Market website (www.openelectricitymarket.sg).

10. I/We agree that my/our application for contestability is subject to my/our compliance with all of the above and that SPS shall not be liable for any inconvenience, loss, expense and damage that may be incurred or suffered as a result of a delay or postponement of my/our compliance or non-compliance of all the above.

11. I/We agree that SPS may collect, use and disclose to any person or organisation, any and all particulars relating to the my/our personal data (including information relating to my/our MSS account) for the purposes of (i) SPS' provision of requested services; (ii) billing and account management including any debt collection or recovery;(iii) conducting surveys or obtaining feedback; (iv) informing me/us of products, services and benefits offered from time to time by SPS, its related corporations and business affiliates (unless I/we duly inform SPS otherwise); and (v) complying with all laws, regulations, and business requirements applicable to SPS, its related corporations and business affiliates from time to time.

12. Until and unless I/we duly inform SPS in writing otherwise, I/we hereby authorise SPS to provide my/our MSSL Account Number to the Electricity Retailer named in Part B No.3 above. I/We hereby irrevocably and unconditionally confirm, agree and undertake as follows:

i) to be liable for and fully indemnify SPS/SP Group**/any directors, employees, agents, successors (collectively the "**Representatives**") and assigns of SPS/SP Group/the Representatives from and against all actions, claims, liabilities, losses, damages, penalties, expenses,

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and costs whatsoever which SPS/SP Group/the Representatives may suffer, incur, sustain or be subject to (whether directly or indirectly) arising out of, in connection with or in relation to the provision of my/our MSSL Account Number to the Electricity Retailer; and

*** Note: "SP Group" includes Singapore Power Limited and any company that is fully or partially owned by Singapore Power Limited, whether beneficially or otherwise or under its management or control, including all its subsidiaries, affiliates and related companies*

ii) SPS/SP Group/the Representatives shall not be liable for any inconvenience, loss, expense and damage that may be incurred or suffered by me/us as a result of a delay or postponement in such provision of the MSSL Account Number to the Electricity Retailer.

Part C: Conditions for Transmission Services at Low Tension Supply*

1. I/We request SP PowerAssets Limited ("SPPA"), the Transmission Licensee, to provide or continue to provide, as the case may be, Transmission Services at Low Tension supply to the Premises (as set out in Part A above).
2. I/We confirm that I/we have read and accept the "Standard Terms and Conditions for Transmission Services for LT Consumers" (the "Terms and Conditions") available on the Open Electricity Market website (www.openelectricitymarket.sg).
3. If I/we am/are not required to provide a Substation for the proposed Connection, Clause 2 of the Terms and Conditions shall not apply to me/us.
4. If I/we am/are an indirectly connected LT Consumer(s) (i.e. consumer who does not receive supply directly from grid. e.g. sub-metered account) the Service Connection to the Premises shall be supplied, installed and maintained by me/us.
5. If I/we am/are not on retailer consolidated billing arrangement where I/we, instead of my/our retailer, assumes the obligation to pay the Transmission Licensee for transmission charges owed by the me/us respectively, I/we agree to pay a Security Deposit for an amount informed by the Transmission Licensee within the time period stipulated by the Transmission Licensee or before the supply at the Premises has been turned on, whichever is earlier.
6. I/We agree that by completing and submitting this application form, this application form (Parts A and C) and the prevailing Terms and Conditions (as at the date of submission of this application form) shall have the effect of a binding agreement ("Consumer Connection Agreement") between the Transmission Licensee and me/us from the Effective Date. Prior to the Effective Date, the Transmission Licensee reserves the right to reject the application submitted by me/us. Where I/we have an existing supply agreement, it will be superseded and deemed terminated by this Consumer Connection Agreement on the Effective Date. Where there are more than one Premises as indicated in the 'Address where supply is required' field in Part A, a separate and distinct Consumer Connection Agreement shall be deemed constituted between SPPA and me/us with the terms and conditions set out in Parts A and C and the prevailing Terms and Conditions applying to each such Premises.
7. **I/We shall complete Annex D and agree to the terms and conditions thereof, and Annex D shall form part of this agreement.**

*Consumers requesting SPPA to provide or continue to provide, as the case may be, Transmission Services at High Tension or above shall accept the "Standard Terms and Conditions for Transmission Services for Extra High Tension and High Tension Consumers "under the Consumer Connection Agreement with SPPA. Please contact SPPA at regmgt@spgroup.com.sg for more information.

Signature: _____ Company Stamp: _____

Name: _____ Designation: _____

Date: _____

For Official Use

MSSL A/C No: _____ Date of Application Received: _____

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ANNEX A - For Applications under the *En-bloc Contestability Scheme/Demand Aggregation Scheme (Master-metered Accounts Only)

<This is to be filled in by the LANDLORD>

Date: _____

SP Services Limited
2 Kallang Sector
Singapore 349277
Attention: SP Services Ltd, Customer Applications (MSSL Ops)

Dear Sir/Madam,

NOTICE OF TENANT'S (SUB METERS) TERMINATION OF ELECTRICITY SUPPLY SERVICES ACCOUNTS

Name of Consumer (Company/Individual): _____

Existing Electricity Account No.: _____

Address of Supplied Premises: _____

Telephone No.: _____ Fax No.: _____

Contact Person: _____

We have obtained full consent from all our tenants to terminate their electricity supply services accounts. Attached are the termination notices from all our tenants.

2. Please arrange to have the final meter readings for these tenants to be taken on _____ (date).

3. We will commence our new electricity supply agreement with our new electricity Retailer on _____ (date).

Signature: _____ Company Stamp: _____

Name: _____ Designation: _____

Contact Tel: _____

** Please ensure that ALL your tenants with an existing electricity supply account complete Annex B to avoid delay in processing*

** Please also ensure that the details on Annex B matches the records in our records. One way is to reference their existing utilities bills when completing Annex B*

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ANNEX B - For Applications under the *En-bloc Contestability Scheme/ Demand Aggregation Scheme (Master-metered Accounts Only)

<This is to be filled in by the TENANTS>

Date: _____

SPS
2 Kallang Sector
Singapore 349277
Attention: SPServices Ltd, Customer Applications (MSSL Ops)

Dear Sir/Madam,

NOTICE OF TERMINATION OF ELECTRICITY SUPPLY SERVICES - SUB METER ACCOUNT

1. Please be informed that I/we, _____(*sub meter account holder*),

of _____(*sub meter account's premises address*),

have agreed for our landlord to purchase electricity supply en-bloc on my/our behalf.

2. Hence, I/we wish to terminate my/our Electricity Supply Account (*EBS / MSS Account No.*) _____ with SPS.

3. Please forward the final bill and balance (if any) to

_____

_____ (*correspondence address*).

Signature: _____ Company Stamp: _____

Name: _____ Designation: _____

Contact Tel: _____

** Please also ensure that the details on Annex B matches the records in our records. One way is to reference your existing utilities bills when completing Annex B*

** You are required to give at least 7 business days' notice to terminate a MSS account.*

** Your existing electricity supply account will be terminated when we arrange to create your landlord's contestable account.*

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ANNEX C

Power System Operator (PSO)
Data Form For
Intermittent Generation Facility Registration[1]

INTERMITTENT GENERATION FACILITY (PV) STANDING CAPABILITY DATA			
To be completed by the IGF owner (with initial & company stamp on each page) for each IGF with an installed capacity of 100KWac and above per site			
Description of Data Submission (New / Revised / Removed):			
Name of Generation Facility:			
Maximum Generation Capacity*:			kW
Voltage Level of Connection Point to Grid:			66000 / 22000 / 6600 / 400 / 230 V
Facility's site address:		Postal Code:	
Total Internal Load Capacity:			kW
PV module			
Type of PV module:	(Monocrystalline / Polycrystalline / Amorphous / Others, please specify)		
Module Tilt Angle			degrees
Module Azimuth Angle			degrees

Drawing Submission	***Reference No***
1. Detailed single line drawing of the IGF showing connection arrangement of relevant PVs, numbers of inverters and switches.	
2. Schematic drawing of PV modules and inverters setup indicating total PV modules and total inverters capacity.	
(For IGF with an installed capacity of 1MWac and above per site) 3. Licensed Electrical Worker certified testing, commissioning reports and commissioning schedules.	

Key Dates of Generation Facility	
Date Generating Facility is expected to synchronise to the transmission system.	
Date Generating Facility is expected to end the commissioning test	
Date Generating Facility is expected to commence commercial operation.	

(For IGF with an installed capacity of 1MWac and above per site)			
To be completed by EMC-MO			
Name: B1-B2-B3			
To be completed by PSO			
Name of 66/22kV substation connected to IGF:			
SCADA B1–B2–B3 (PV):			
Default Bus:			
Alternate Default Bus:			
Default Branch:			
SU Type:	*Dependent / Independent*		
Mapping Protocol:	*Include / Replace*		
Additional Information:			

*Maximum Generation Capacity (total installed capacity within the site) for Photovoltaic (PV) refers to the aggregated inverter capacity (AC) of each point of connection to the grid.

[1]For any enquiries on the PSO data form, please email ema_pso_ssp@ema.gov.sg.

SPgroup
Empowering the Future of Energy

Annex D – Terms and conditions for use of mobile generator

1. On a goodwill basis, in order to assist you (the "Customer"), during localised electricity network supply interruption, subject to Customer's agreement and compliance with the terms and conditions of paragraph 5.1.4 of the guide on "How To Apply For Electricity Connection" (as may be amended from time to time) (the "Handbook"), SPPA/SPPG, at its option, offers to use commercially reasonable efforts to provide a mobile generator(s) rated up to 1 MVA at 400V to supply electricity to Customer's Premises during the interim while the electricity network supply is being restored. "Localized electricity network supply interruption" means an outage due to a fault in the equipment and cables in the substation or Overground Box (OG Box) serving the Customer's Premises or installation.

   A maximum of two mobile generators to a single site may be provided, subject to the availability of mobile generators and operational availability. In the event that the Customer chooses to comply with paragraph 5.1.4 of the Handbook, SPS, SPPA and/or SPPG (as the case may be) shall not be liable for any direct or indirect losses or damages, including loss of profits or business, in relation to, as the case may be:

   i. the provision of the mobile generator(s); or

   ii. a delay in providing the mobile generator(s); or

   iii. if the circumstances are such that the mobile generator(s) or interim electricity supply is not provided.

2. Please note that compliance with paragraph 5.1.4 of the Handbook is mandatory for new Customers in the Central Business District ("CBD") area receiving electricity supply from SPPG's electric distribution substation via customer's electrical in-take substation and operating consumer's Low Tension ("LT") electrical switch-room, or buildings housing critical infrastructures (physical and/or info-comm).

3. You, as the Customer, is required to choose the following:

   ☐ Yes:

   (i) this Premises or installation is required to; or
   (ii) I/We, as the Customer, would like to,

   receive interim electricity supply via a mobile generator, and I/We, the Customer, agrees to and shall comply with the specified requirements in paragraph 5.1.4 of the Handbook and shall ensure it is able to receive interim electricity supply via a mobile generator during a localized electricity network supply interruption.

   I/We, the Customer, agree to clause 1 in this Annex D.

   ☐ No, this premises or installation is not required to, and I/We, the Customer, would not like to, receive interim electricity supply via a mobile generator during a localized electricity network supply interruption.

I/We agree to the above terms and conditions and indicate my/our acceptance.

Signature: _____ Company Stamp: _____

Name: _____ Designation: _____

Date: _____

FORM
Completion Certificate for Modification of Electrical Installation

To: SP Group
2 Kallang Sector
Singapore 349277
Attn: SP Services

MODIFICATION TO ELECTRICAL INSTALLATION AT _____

_____
(Address of installation)

MSSL Account No.: _____

in the name of : _____

I, _____ certify that the modification to the above-mentioned electrical installation has been inspected and tested by me in accordance with Singapore Standard CP5: Code of Practice for Electrical Installations, and that to the best of my knowledge and belief the modification summarized below complies with the said Singapore Standard CP5 and the relevant Regulations.

Description	Quantity
Lighting points	_____
13 Amp socket outlets	_____
15 Amp socket outlets	_____
Heater	_____
Isolator	_____
Others (please specify)	_____

The said modification has been connected to the supply of electricity on _____. The existing supply line is adequate for the after diversity maximum demand of the above-mentioned electrical installation.

2. I append below the result of my inspection and test:

Incoming supply	:	PowerGrid Network / Third party electrical installation
MCB / Cutout size	:	_____ Amp
Revenue meter no	:	_____
RCCB rating	:	_____ Amp/30mA sensitivity
Phase to Phase insulation	:	_____ Mohm
Phase to Earth insulation	:	_____ Mohm
Neutral to Earth insulation	:	_____ Mohm
RCCB test satisfactory	:	Yes/No
Polarity check satisfactory	:	Yes/No
Earth fault loop impedance	:	_____ ohm
Date of inspection/ test	:	_____

_____ _____ _____
Name & Signature of Licensed Electrical Worker **Licence No.** **Date**

cc Consumer

REF: E(EI)Reg7(1)
2104008

FORM E
Certificate of Fitness of Residential Unit

Application No.: _____

To: SP Group
2 Kallang Sector
Singapore 349277
Attn: Manager, Installation Branch, SP Services

PROJECT: _____

_____

AT APARTMENT BLOCK NO.: _____ STREET NAME: _____

DATE OF INSPECTION: _____ POSTAL DISTRICT: _____

Type/Total No. of Units		/ [units]	/ [units]
Others	MCB Rating		
	MCB Type (Before & after Revenue Meter)		
	Service Cable Size		
	RCCB Rating / Sensitivity		
Details of Electrical Installation	Cooker / Oven Point		
	Water Heater Point		
	15A Socket Outlet		
	13A Socket Outlet		
	Fan Point		
	Lamp Point		
	20A isolator SPN		
	20A isolator TPN		
	30A isolator SPN		
	30A isolator TPN		
	Others		
Unit Nos.			

I hereby declare that I have supervised the installation, inspected and tested the electrical installation of the residential unit[s] in accordance with the relevant Regulations and Code of Practice.

_____
Signature/Name/Licence No. of LEW responsible for electrical installation work*

I hereby certify that the electrical installation of the residential unit[s] has been designed in accordance with the relevant Regulations and Code of Practice.

_____
Signature/Name/Licence No. of LEW responsible for design of electrical installation*

* The same LEW may perform both design and installation work for the electrical installation.

FORM
CHANGE IN DESIGN LICENSED ELECTRICAL WORKER

To: SP Group
2 Kallang Sector
Singapore 349277
Attn: SP Services
Email: install@spgroup.com.sg

Application No.: _____

Site Address: _____

_____

PART I [APPLICANT'S DETAILS]

To: Senior Manager (Supply Application), SP Services Ltd

We have changed our Design Licensed Electrical Worker for the above project to

_____of Licence No: _____.

My/Company's Name : _____

UEN No. : _____
or
NRIC No.. : | | | | |

Note : Please state the last 4 characters (i.e. last three digits and alphabet) of NRIC / FIN / passport or other personal identification number.

Name of Authorised Person for Company *(if applicable)* : _____

Contact No. : _____

_____ _____
Signature of Applicant/Company Stamp (if applicable) **Date**

==========

PART II [CURRENT DESIGN LICENSED ELECTRICAL WORKER]

I, _____ of Licence No: _____ would like to transfer my responsibilities as Licensed Electrical Worker for the above project to _____ of License No: _____.

_____ _____ _____
Name & Signature of LEW / Date **Licence No.** **Tel No.**

==========

PART III [NEW DESIGN LICENSED ELECTRICAL WORKER]

I accept to take over the responsibilities as Licensed Electrical Worker for the above mentioned project.

_____ _____ _____
Name & Signature of LEW / Date **Licence No.** **Tel No.**

Forwarding Address: _____

_____

TECHNICAL REQUIREMENTS OF DISTRIBUTED GENERATION AND NEW EXTRA / ULTRA HIGH TENSION CONNECTION

The technical requirements at the electricity supply network Point of Common Coupling (PCC)/Connection Point (CP) are highlighted below. Some of these requirements are covered in the Transmission Code issued by Energy Market Authority (EMA). PCC/CP is the point where a *connected person's* (refer to Transmission Code for definition) installation connects to the transmission system. For the purposes of this handbook, the terms Connection Point (CP) and Point of Common Coupling (PCC) shall be considered equivalent unless otherwise specified.

Distributed Generation (DG) refers to electricity generation (not limited to embedded systems) of varying scale using conventional or alternative energy technology, e.g. Gas / Steam Turbine Generator, Solar Photovoltaic (PV), Battery Energy Storage System (BESS), Fuel Cells, Biomass, etc.

1 Technical Requirements

1.1 Power Quality (PQ) Requirements

1.1.1 Harmonics

The generation of harmonics by the DG or new EHT/UHT connection shall not cause the maximum voltage total harmonic distortion, individual odd voltage harmonic, and individual even voltage harmonic at PCC to exceed the limits specified in Appendix F2.2 of the Transmission Code. These limits are indicated in Table 1 below and include the existing levels of harmonic distortion at PCC.

Table 1 – Maximum Permissible THDv % limit for various Voltage level at PCC

Maximum Permissible Limit (%)				
Parameter	Voltage at PCC (kV)			
	0.23 / 0.4	6.6/22	66	230 / 400
Voltage Total Harmonic Distortion, V_{THD}	5	4	3	1.5
Individual Odd Voltage Harmonic	4	3	2	1
Individual Even Voltage Harmonic	2	2	1	0.5

For harmonic current emission limits resulting from the operation of the plants, Connected Persons shall comply to the IEEE519 Recommended Limits as outlined in Tables 2, 3 and 4 below and implement the necessary harmonic mitigating solutions for any non-compliance.

Table 2 – Current distortion limits for systems at PCC rated up to 22kV

Maximum harmonic current distortion in percent of I_L						
Individual harmonic order[b]						
I_{SC}/I_L	$2 \le h < 11$[a]	$11 \le h < 17$	$17 \le h < 23$	$23 \le h < 35$	$35 \le h \le 50$	TDD
< 20[c]	4.0	2.0	1.5	0.6	0.3	5.0
20 < 50	7.0	3.5	2.5	1.0	0.5	8.0
50 < 100	10.0	4.5	4.0	1.5	0.7	12.0
100 < 1000	12.0	5.5	5.0	2.0	1.0	15.0
> 1000	15.0	7.0	6.0	2.5	1.4	20.0

[a] For $h \le 6$, even harmonics are limited to 50% of the harmonic limits shown in the table.

[b] Current distortions that result in a dc offset, e.g., half-wave converters, are not allowed.

[c] Power generation facilities are limited to these values of current distortion, regardless of actual I_{SC}/I_L unless covered by other standards with applicable scope.

Where

I_{SC} = Maximum short-circuit current available at the PCC under normal system configuration.

I_L = Maximum Demand load current

Note: The maximum demand load current (IL) shall be determined based on continuous current measurements at the PCC over a minimum period of seven consecutive days. IL shall be defined as the RMS current corresponding to the highest 15-minute or 30-minute apparent power demand recorded during the monitoring period. The resulting IL value shall be used for the calculation of the ISC/IL ratio.

Table 3 – Current distortion limits for systems at PCC rated at 66kV

Maximum harmonic current distortion in percent of I_L						
Individual harmonic order[b]						
I_{sc}/I_L	$2 \le h < 11$[a]	$11 \le h < 17$	$17 \le h < 23$	$23 \le h < 35$	$35 \le h \le 50$	TDD
< 20[c]	2.0	1.0	0.75	0.3	0.15	2.5
20 < 50	3.5	1.75	1.25	0.5	0.25	4.0
50 < 100	5.0	2.25	2.0	0.75	0.35	6.0
100 < 1000	6.0	2.75	2.5	1.0	0.5	7.5
> 1000	7.5	3.5	3.0	1.25	0.7	10.0

[a] For $h \le 6$, even harmonics are limited to 50% of the harmonic limits shown in the table.

[b] Current distortions that result in a dc offset, e.g., half-wave converters, are not allowed.

[c] Power generation facilities are limited to these values of current distortion, regardless of actual I_{sc}/I_L unless covered by other standards with applicable scope.

Where

I_{sc} = Maximum short-circuit current available at the PCC under normal system configuration.
I_L = Maximum Demand load current

Note: The maximum demand load current (IL) shall be determined based on continuous current measurements at the PCC over a minimum period of seven consecutive days. IL shall be defined as the RMS current corresponding to the highest 15-minute or 30-minute apparent power demand recorded during the monitoring period. The resulting IL value shall be used for the calculation of the ISC/IL ratio.

Table 4 – Current distortion limits for systems at PCC rated 230kV and above

Maximum harmonic current distortion in percent of I_L						
Individual harmonic order[b]						
I_{sc}/I_L	$2 \le h < 11$[a]	$11 \le h < 17$	$17 \le h < 23$	$23 \le h < 35$	$35 \le h \le 50$	TDD
< 25[c]	1.0	0.5	0.38	0.15	0.1	1.5
25 < 50	2.0	1.0	0.75	0.3	0.15	2.5
≥ 50	3.0	1.5	1.15	0.45	0.22	3.75

[a] For $h \le 6$, even harmonics are limited to 50% of the harmonic limits shown in the table.

[b] Current distortions that result in a dc offset, e.g., half-wave converters, are not allowed.

[c] Power generation facilities are limited to these values of current distortion, regardless of actual I_{sc}/I_L unless covered by other standards with applicable scope.

Where

I_{sc} = Maximum short-circuit current available at the PCC under normal system configuration.
I_L = Maximum Demand load current

Note: The maximum demand load current (IL) shall be determined based on continuous current measurements at the PCC over a minimum period of seven consecutive days. IL shall be defined as the RMS current corresponding to the highest 15-minute or 30-minute apparent power demand recorded during the monitoring period. The resulting IL value shall be used for the calculation of the ISC/IL ratio.

1.1.2 Voltage Fluctuation including Flicker

The DG or new EHT/UHT connection shall not cause voltage fluctuation at PCC to exceed 3% of the nominal voltage for step changes in their operations, as specified in Appendix F2.1 of the Transmission Code. The DG or new EHT/UHT connection shall also comply with Engineering Recommendation P28 – it shall not cause the short-term flicker severity value P_{ST} and the long-term flicker severity value P_{LT} at PCC to exceed 1.0 and 0.8 respectively.

1.1.3 Voltage Unbalance

The DG or new EHT/UHT connection shall not cause the maximum negative phase sequence component of phase voltage at PCC to exceed 1%, as specified in Appendix F2.3 of the Transmission Code.

1.1.4 DC Injection

DC injection into the transmission system is deprecated. DC injection into the low voltage network at PCC shall not exceed 0.5% of the inverter rated output current.

If the DC injection at PCC of an inverter based DG system deviates from this requirement, the Licensed Electrical Worker (LEW) shall submit technical justification (including effect on the transmission system) to SP PowerGrid (SPPG) for consideration. If applicable, the LEW shall also submit the specifications of mains isolation transformer or trip setting of DC injection detection device.

1.1.5 Voltage Disturbance

The design operation of the DG or new EHT/UHT connection shall take into consideration voltage disturbance phenomenon, such as voltage dip, in the transmission system. If their operations cannot tolerate any voltage fluctuations or distortions in supply, the Connected Persons shall at their own cost provide power quality devices, as specified in Section 6.7.4 of the Transmission Code.

1.2 Voltage and Frequency Operating Range

This clause is only applicable for DG connections.

The DG shall disconnect from the transmission system:

i. for faults on the service connection between the DG to PCC;
ii. prior to re-closure of the transmission system circuit breaker to the service connection;
iii. if any phase of the transmission system is under or over voltage as detected at PCC or at the DG terminal. The range of abnormal operating voltages and the corresponding maximum disconnection time (i.e. operating time) are listed in Table 5 as follows:

Table 5 – Range of abnormal operating voltages and its maximum disconnection time

Voltage Range (% of base voltage)	Minimum Holding Time (second)	Maximum Trip Time (second)
V < 50	0.6	1.6
50 ⩽ V < 88	2.0	3.0
110 < V < 120	1.0	2.0

The DG shall be capable of sustained operation and remain connected to the transmission system if the frequency of the transmission system is within the range listed in Table 6 as specified in Appendix F6.2 of the Transmission Code.

Table 6 – Range of Frequency and its operating requirement

Frequency Range (Hz)	Requirement
52 – 47.5	Continuous operation
47.5 – 47	Remain in operation for at least 20s each time frequency falls below 47.5Hz

2 Submission of Compliance

The LEW shall confirm compliance with regard to the technical requirements specified in Clause 1. This shall include but is not limited to the following:

- Reports (Simulation or Measurement) confirming technical compliance to all the PQ requirements as specified in Clause 1.1.
- Supporting data on technical compliance (e.g. report of simulation study / type test / PQ measurement, specifications and settings of generator / inverter, short circuit current contribution, etc.).
- Single Line Diagram (SLD) of the DG or new EHT/UHT connection up to the PCC level.
- PQ Simulation report shall include but not limited to the plant design details (e.g. SLD, AC equipment specifications, Inverters/converters type test report), study methodology (methodology used for various study cases, any references to relevant standards) and assumptions made (e.g. Short explanation of the short-circuit MVA and X/R ratio values assumed at the PCC, worst case scenarios used).
- Type test reports for three-phase six-pulse converters, three-phase active-front-end converters, three-phase twelve-pulse converters, single-phase rectifiers and all inverters to be provided.
- Any other technical documentation deemed necessary by SPPG officer in the course of clarification.

The submission lead time for the above simulation and PQ measurement reports are stipulated in clause 2.1. Technical justification shall be submitted to SPPG for consideration for deviation or non-compliance, if any.

2.1 PQ Simulation and Measurement Report for DG and EHT/UHT Connection

2.1.1 For DG Connection on new/existing installations

The technical requirements below are only applicable for the following:

- For Distribution connection, the DG aggregated capacity at PCC is more than 1MWac.
- For Transmission connection, the DG aggregated capacity at PCC is more than 10MWac.

For the new standalone DG connection, connected persons shall:

- Before SPPG supply turn-on, conduct PQ simulation[3] as stipulated in Clause 2 at 100% of declared DG capacity.
- After SPPG supply turn-on, conduct 7 days PQ measurement at PCC or next possible point nearer to the DG connection before DG energization and another 7 days PQ measurement[4] at the same point after DG energization at 100% of declared DG capacity.

For the DG connection on **existing installations**, connected persons shall:

- Before new/additional DG energization, conduct 7 days PQ measurement at PCC or next possible point nearer to the DG connection.
- After new/additional DG energization, conduct 7 days PQ measurement[4] at same point after DG energization at 100% of declared DG capacity. The final measurement report shall include the 7 days PQ measurement before the new/additional DG was energized.

The submission lead time of the reports are as follows:

- The PQ simulation report shall be submitted at least 6 months before SPPG supply turn-on date or before new/additional DG turn-on date.
- For the DG connection on existing installations, the 7 days PQ measurement report shall be submitted at least 6 months before new/additional DG energized. The final PQ measurement report after the DG turn-on date, which also include the comparison with the 7 days before new/additional DG energized, shall be submitted to SPPG within 2 months after the DG turn-on date. BESS final PQ measurement report shall be submitted within 6 months after energization base on availability of scenarios testing.

Additional Notes:

- Subsequently, Connected Persons may be required to submit the PQ measurement annually or at such intervals as may be specified by SPPG.
- In the event that the DG connection is causing any adverse impact to the transmission system or found to be in non-compliance with any of the technical requirements in accordance to Transmission Code, Connected Persons shall voluntarily disconnect the DG connection from the transmission system and it shall remain disconnected until it has been rectified to the satisfaction of SPPG.
- Should the simulation result is non-compliance with PQ requirements (in clause 1), Connected Persons shall consider in the report the implementation of any PQ mitigation solutions.

[3] For BESS standalone connection, the simulation shall be conducted at 100% of declared BESS capacity (include full charging and discharging cycle) and include other operational scenarios if any.

[4] For BESS standalone connection, the 7 days PQ measurement report after BESS energized shall include the scenarios of full charging and discharging cycle from min to max SOC and vice versa based on design requirements and also at maximum rate based on design operating requirements.

2.1.2 For EHT/UHT connection on new/existing installations

The technical requirements below are applicable for new and capacity upgrade connection:

For the EHT/UHT connection on **new installations**, connected persons shall:

- Before SPPG supply turn-on, conduct PQ simulation as stipulated in Clause 2 at 100% of declared EHT/UHT capacity and include contingency scenarios if any.
- After SPPG supply turn-on, conduct 7 days PQ measurement at PCC before energization of the new/additional loads and another 7 days PQ measurement at the same point after new/additional loads are energized.

For the EHT/UHT connection on **existing installations**, connected persons shall:

- Before new/additional loads energization, conduct 7 days PQ measurement at PCC. Also conduct PQ simulation as stipulated in Clause 2 for Transmission connected persons at 100% of declared EHT/UHT capacity and include contingency scenarios if any.
- After new/additional loads energization, conduct another 7 days PQ measurement at same point. The final measurement report shall include the comparison against the 7 days PQ measurement result before the new/additional loads was energized.

The submission lead time of the reports are as follows:

- For the EHT/UHT connection on new/existing installations, the PQ simulation report shall be submitted at least 6 months before SPPG supply turn-on date.
- For the EHT/UHT connection on existing installations, the 7 days PQ measurement report before the new/additional loads energized shall be submitted at least 6 months before SPPG turn-on date.
- For the EHT/UHT connection on new/existing installations, the final PQ measurement report after the new/additional loads energized, which also include the comparison with the 7 days before new/additional loads energized, shall be submitted to SPPG within 6 months after the SPPG turn-on date.

Additional Notes:

- Subsequently, Connected Persons may be required to submit the PQ measurement annually or at such intervals as may be specified by SPPG.
- In the event that the EHT/UHT connection is causing any adverse impact to the transmission system or found to be in non-compliance with any of the technical requirements in the Transmission Code, Connected Persons shall rectify the related issue including the implementation of mitigating solutions and provide updates upon request by SPPG until the issue has been fully resolved.
- Should the simulation result is non-compliance with PQ requirements (in clause 1), Connected Persons shall consider in the report the implementation of any PQ mitigation solutions.