Appendix 9D

Extract from CLP Power Hong Kong Limited Code of Practice No.101

3.2.3 The maximum number and type of plant to be accommodated.

3.2.4 Personnel access and equipment access (including power cables).

3.3 Approval of Drawings

3.3.1 Substation layout plans prepared by the building owner / customer's agent (e.g. architects or consultants) shall be submitted for the approval of the Senior Planning and Design Manager of the relevant Region of CLP Power. Regional boundary map in the Appendix A shows the geographical demarcation and contacts of the Regions in CLP Power supply area.

3.3.2 Standard (or typical) substation layout plans submitted by the Hong Kong Housing Authority shall be approved by the Senior Asset Development Manager of the Asset Management Department, CLP Power.

3.3.3 The submitted drawings shall be in both hardcopy and softcopy format. The softcopy shall be in .dwg format and compatible to AutoCAD® 2007 version or later version accepted by CLP.

4. ELECTRICAL EQUIPMENT IN DISTRIBUTION SUBSTATION

4.1 General Arrangement

Distribution substation consists of main high voltage equipment including high voltage gas insulated switchgear (GIS) or air insulated switchgear (AIS) and distribution transformer. Distribution substation can also be named as transformer room where transformer(s) are installed. High voltage switchgear room is for substation where only high voltage switchgear panels are installed.

Substations located on ground floor shall be equipped with silicone oil filled transformers or equivalent as a standard to avoid the need for a fixed fire fighting installation for the substation. Substations sited other than on ground floor such as basement and upper level of a building shall be equipped with non-flammable type transformers which have higher fire safety standard. Non-flammable transformers include SF_6 gas insulated, dry type and silicone fluid filled types.

CLP Power will determine the suitable type of non-flammable transformer to be used by considering the conditions of the substation site.

4.2 Types of Electrical Equipment

4.2.1 A substation shall normally accommodate the following equipment.

11kV switchgear	-	This normally consists of the total number of panels required for the particular project plus one spare panel for future purpose.
Distribution transformer	-	One to three transformers as required.
LV board	-	One to three boards per substation.
LV capacitor bank	-	One per transformer.
LV fuse cutout unit	-	One per LV capacitor.
30V battery and charger	-	One for 5 units or less 11kV switchgear panels. Two for more than 5 units.
Pilot marshalling boxes	-	Two per substation.
Fibre optic marshalling box	-	Two per substation.
Remote terminal units	-	Consisting of Customer Remote Terminal Unit (CRTU) and Low Voltage Remote Terminal Unit (LRTU). One to two for each type per substation.
Meter summation panel	-	One per substation.

4.2.2 The number of LV boards in a substation will normally be one to three units. The LV boards will be connected to other substations by LV cable interconnectors in order to improve the reliability of the LV supply to the customer. Senior Planning and Design Manager will determine the number of LV boards and LV cable interconnectors to be installed for the substation.

4.2.3 The battery/charger unit, pilot marshalling box, fibre optic marshalling box and remote terminal unit shall be wall-mounted.

4.3 Equipment Dimensions, Weights and Operation Space

Due to the variety and continuous improvement of equipment in feature and safety, the type of the equipment and hence its dimensions and weight may vary from time to time. The substation layout is subjected to the equipment being used.

In general, the minimum clearances and safe operating areas required around the electrical equipment shall be :

11kV switchgear	- 1000mm at the back of the panels. - 1500mm in front of 11kV circuit breakers. Where metering circuit breaker panels are installed, 2000mm for the operation of the VT lifting trolley may be required. - 750mm on the other two sides of the switchboard.
Distribution transformer	- 900mm around the LV terminals. - 750mm on the other sides.
LV board	- 1000mm in front of the board. - 750mm on the sides where cables turn in and out. - The cable trench edge shall be 120mm from wall.
LV capacitor bank	- 750mm in front and 200mm on two or rear sides.
LV fuse cutout unit for LV capacitor	- 1000mm in front of cutout.

4.4 Foundations

4.4.1 The transformer foundation/plinth shall be capable of supporting a minimum load of 9000kg. The minimum loading of the passage for delivery of the transformer from the unloading point to the transformer plinth shall be sufficient to support the transformer weight. Normally, the transformer is supported by two metallic frames in form of channels or inverted U-channels or four steel wheels which stand on the transformer foundation/plinth. The plinth strength shall be adequate to stand for the pressure imposed by transformer base channels or wheels.

4.4.2 The minimum dimensions of the transformer plinth should be 1.8m long x 1.3m wide and level with finished floor level. Actual plinth size is subjected to the transformer rating and type.

4.4.3 The 11kV switchgear foundation shall be capable of supporting a maximum static plus dynamic load of 17kN per panel. The minimum cover between the finished floor level and the reinforcement bar of the foundation shall be 80mm. The floor surface shall be flat and within a tolerance of 1mm in 1000mm.

4.5 Earthing Design for Electrical Equipment

Earthing design for the electrical equipment shall be in compliance with CLP Power earthing standard. The designer or builder of the distribution substation should coordinate with Senior Planning and Design Manager of CLP Power for the provisions of the earthing installation.

For the connection of CLP earthing network outside the distribution substation, the earthing bars which are provided and installed by the building owner for the distribution substation shall be extended to the location(s) where CLP supply cables enter the site owned by the building owner.

4.6 Equipment for Metering at High Voltage Supply

When metering of high voltage supply is used, additional space and building provisions shall be required in the substation for accommodating the HV metering equipment. The building owner shall agree with CLP Power to provide enough space and provisions in the substation.

5. ARCHITECTURAL/CIVIL DESIGN

5.1 General Requirements

5.1.1 All substations shall comply with the Hong Kong Electricity Ordinance (Cap. 406), the Hong Kong Buildings Ordinance (Cap. 123) and the "Fire Services Requirements for Consumer Substations using Oil Filled Transformers and Switchgear in Buildings" (latest version of NP 101), Part X of FSD Circular Letter no. 4/96, Part X.2 of FSD Circular Letter no. 5/98 and the related Codes of Practice on Fire Services.

5.1.2 Substations shall be situated at the periphery of the building and be accessible at all times. For the substations on ground level, the access route should be directly from open air (non-covered area). Such area should be vertically uncovered and unobstructed. In case the periphery is covered by the canopy of the building, the direct distance from the entry of the substation to the non-covered area should not exceed 2.5m. The permanent access to the substation shall be of adequate height, width and of sufficient strength to accommodate the size and weight of both the transformer and the conveying vehicle. The minimum width for plant delivery shall not be less than 3 meters taking into consideration the size of the major electrical plant such as transformers and switchgear being used.

5.1.3 For substation location exposing to the risk of flooding such as near an inclined road, slope and sea front, or locating at low principal datum (PD) level, less than 4.4mPD at Victoria Harbour or 5.5mPD at Tolo Harbour, the following anti-flooding measures shall be considered to prevent flooding of the substation:-

- Change the location of the substation from ground floor to upper floor, or;
- Raise the substation floor level to minimum 4.4mPD at Victoria Harbour or 5.5mPD at Tolo Harbour, or;
- Install flood prevention facilities such as sump pump and flood gate. Flood gate should be installed in substation to prevent water ingress from door or low level louvre.

5.1.4 The layout shall be designed to be adequate for the lifetime of the substation and the ultimate quantities of electrical equipment to be installed such that any civil work in the substation can be avoided or will be minimal when additional electrical equipment is necessary to install.

5.1.5 The substation minimum clear headroom shall be:

- 3.3m above ground for substation without transformer.
- 3.6m above ground for substation with transformer and 630mm diameter exhaust fan.
- 3.8m above ground for substation with transformer and 800mm diameter exhaust fan.

The recommended maximum ceiling height is 4m but subjected to the required clearance of lifting hoist on the ceiling if provided.

5.1.6 The substation ceiling and customer main switchroom ceiling shall be of suitable waterproof construction to prevent water leakage. No water pipe, drainage pipe or customer's installation shall be located in the substation or located in and passing through any part of and inside the ceiling slab of the substation. Decorative structure / add-on material applied on the ceiling surface of the substation will not be allowed.

5.1.7 To avoid water seepage / leakage into the substation from the floors above the substation, double slab ceiling with waterproofing construction and drainage system or equivalent design shall be constructed by the building owner / customer of the substation. The double slab ceiling or equivalent design shall first be agreed with CLP Power and shall be approved by the Authorized Person (AP) (as defined under the Buildings Ordinance) of the developer and/or the building owner of the substation.

The developer and / or the building owner of the substation is recommended to follow the standard requirement of double slab, which headroom of 1000mm under slab and 600mm underneath beam. However, in case the developer has encountered specific site difficulties and with substantiation provided such as:

1) site constraint;
2) height restriction;
3) tight construction programme.

The following alternative solutions will also be accepted by CLP:-

i) Transfer slab with minimum thickness of 1000mm;
ii) minimum 600mm under slab

There shall be no left in timber formwork inside the void after casting the concrete to avoid breeding of organisms.

Other alternative arrangements proposed such as light weight ceiling / non-structural double slab with water proofing are required to be substantiated by the developer with life time performance not worse than double slab design for CLP consideration.

5.1.8 No civil expansion joint shall be located in any part of the substation.

5.1.9 Not more than 3 transformers shall be accommodated within any one transformer room.

5.1.10 Ground level substations should be at least 150mm higher than the outside (pavement) level to reduce the risk of flooding.

5.1.11 Substation walls shall be made of reinforced concrete or concrete block of BS 6073 Part A with a compressive strength of not less than $20N/mm^2$ and tiled up to a height of 1500mm above floor level with 150mm x 150mm white ceramic tiles. Above the tiles, the wall and the ceiling should be cement and sand plastered and finished with one coat of liquid prepolymer sealing and two finishing coats of white acrylic resin based coating in glossy finish.

5.1.12 The substation floor should be cement and sand rendered with trowelled smooth finish and painted with one coat of polyurethane sealer and two coats of grey epoxy dustproof coating.

5.1.13 When single core cables are used for the connection between the 11kV/LV transformer LV terminals and the customer's switchgear, the customer main switchroom should be immediately adjacent to, above or below the substation. Cable sealing to 2-hour fire resistance rating (FRR) by 'Multi-Cable Transit' (MCT) system shall be used.

5.1.14 The openings for cable inlet shall be properly sealed by CLP Power so as to prevent water ingress into the substation and be of 2-hour FRR construction. The method of sealing shall be referred to CLP Power's duct sealing standard.

5.1.15 For laying of temporary supply cables from the substation, a 150mm x150mm through wall opening at high level on the perimeter wall of the substation shall be provided. The opening shall be sealed by removable stainless steel cover with waterproof gasket. The cover shall be fitted on both inside and outside of the substation.

5.1.16 All external steelwork shall be stainless steel of the low carbon type, Grade 316L (Japanese SUS 316L or US AISI 316L). This specification applies to all doors, door frames, louvres, rat guards, etc. The stainless steel substation door should not be painted to avoid maintenance due to aging of the painting.

5.1.17 Internal steelwork (air trunking hangers, chequer plate, etc.) should be hot dip galvanised and finished with one coat of calcium plumbate or zinc phosphate primer and two finishing coats of grey synthetic paint.

5.1.18 Adequate ventilation to open air by means of permanent installation which is completely segregated from ventilation system of the main building should be provided.

5.1.19 A recess for sump pump in the deepest cable trench shall be constructed for placing the sump pump to extract water in the cable trench when necessary.

5.1.20 No storage of transformer insulant or switchgear insulant is allowed in the distribution substation or customer main switchroom.

5.1.21 The typical distribution substation layouts in this Code of Practice should be used whenever possible.

5.1.22 Black/Yellow colour stripes shall be painted on the edge/step where floor level change.

5.1.23 When stair is built for accessing the substation, handrailing shall be installed along the stair and the stair nosing (the front edge of the stair step) should use durable yellow colour tile or shall be painted by durable yellow colour reflective paint.

5.1.24 Adequate exit signage and emergency lights in compliance with the relevant BD, FSD regulations shall be provided along the emergency exit route of distribution substation.

5.2 Additional Requirements for Basement Substations

5.2.1 Basement substations shall be directly accessible from the open air at ground level by a separate and independent staircase.

5.2.2 Multiple substations on the same floor and are in close proximity may share one separate and independent staircase(s) leading to ground level in lieu of one staircase for each substation.

5.2.3 When the staircase or access route from the exit of the basement substation to ground floor is longer than 10m of travel, adequate natural or mechanical ventilation installation shall be provided. (For details, refer to the Section on Ventilation Design in this COP)

5.2.4 Basement substations should not be located at the lowest basement level to reduce the risk of flooding. Under the substation, there should be at least one accessible basement floor where drainage system is installed to prevent flooding.

5.2.5 A protected lobby with self-closing doors fitted with panic bolt leading to the adjacent communal area of the building shall be provided.

5.2.6 A vehicular access leading from street level to the substation should be provided for equipment delivery.

5.2.7 Emergency exit route diagram shall be provided in the substation.

5.2.8 Subjected to the configuration of the 11kV supply network, provision of a 11kV switch room(s) on ground level will be required as a switching substation for the 11kV cables supplying the building.

5.2.9 A fan room should be provided at ground level for accommodating the ventilation fans for the substation. Access and adequate working space shall be provided.

5.2.10 A suitable damp-proof course shall be provided on the outside of all external walls which are below ground level to separate the substation from unexcavated ground.

5.2.11 A sump pit with sump pump of minimum pumping capacity of 3 litres per second and sufficient head and removable covers shall be provided. A high water level detector shall be fitted in the sump pit to raise an alarm inside the substation and shall activate the substation monitoring alarm system. A drainage pipe with valve shall be provided to drain water in the sump pit to the building drainage system.

A change-over switch shall be provided for the sump pump so as to operate from the customer's supply when necessary.

Flooding alarm light shall be provided at each access point of the basement substation.

An automatic and manual control for the sump pump start/stop shall be provided. A normally open voltage free contact for the flooding alarm is required for substation monitoring alarm system by Distribution Automation. This alarm contact shall be provided in a weatherproof enclosure to IP55 located in the substation.

5.3 Additional Requirements for Upper Floor Substations (maximum fifth floor or maximum 17m above ground level)

5.3.1 Upper floor substations should be located at the periphery of the building. Substations should be directly accessible by a separate and independent staircase.

5.3.2 The access and exit route of the upper floor substation shall always lead to the ground level of the building. Any lockable door, gate, barrier along the route shall be avoided.

5.3.3 A protected lobby with self-closing doors fitted with panic bolt leading to the adjacent communal area of the building shall be provided.

5.3.4 Clear, durable signage to indicate the location of the substation in the building shall be displayed at suitable places to guide personnel to access the substation. The layout of the signage shall be agreed by CLP Power. Emergency exit route diagram shall be provided in the substation.

5.3.5 Multiple substations on the same floor and are in close proximity may share one separate and independent staircase(s) leading to ground level in lieu of one staircase for each substation.

5.3.6 When the staircase or access route from the exit of the substation to ground level is longer than 10m of travel, adequate natural or mechanical ventilation installation shall be provided. (For details, refer to the Section on Ventilation Design in this COP)

5.3.7 Equipment access can be from a public area inside the building:
(i) through a slab opening, or
(ii) by a vehicular access

The loading and unloading area for the delivery of equipment in or out of the substation should be within the building area where it is owned or managed by the building owner. Using the public pavement or road outside the substation as loading and unloading area should be avoided. Access passage for equipment shall be at least 3m wide and 2.8m high.

In the case of equipment access through a floor opening, the opening shall be provided with removable R.C. covers of 2-hour FRR construction. Removable stainless steel railing shall be provided to securely fenced the floor opening to a height of 900-1150mm with mid-rail between 450-600mm. An I-beam together with an electrical hoist for lifting minimum 9000kg load (actual required loading is subjected to the equipment used) in the substation shall be provided

and maintained by the building owner. An emergency lowering device with handwheel shall also be provided. The clear height of the hoisting equipment to the substation floor shall be minimum 3700mm under the hook.

A change-over switch shall be provided for the electric hoist to operate from either the customer's essential supply or the substation local supply.

5.3.8 Subjected to the configuration of the 11kV supply network, provision of a 11kV switch room(s) on ground level will be required as a switching substation for the 11kV cables supplying the building.

5.3.9 Independent cable riser rooms shall be provided solely for CLP Power's cables, constructed to 2-hour FRR and have access from a public area within the building. More than one stack of cable riser rooms may be required that will be determined by the electric power demand of and cable riser location in the building.

Normally, the cable riser room height should not be greater than 4m. Otherwise, adequate space shall be reserved inside the cable riser room for the erection of working platform for working at high level inside the room.

Cable riser room access doors shall be 2-hour FRR. Inside the cable riser room, opening on the floor and ceiling slabs shall be provided for installation of cables. The opening shall be sealed up with 2-hour FRR material by the building owner after installation of the cables.

A lifting beam and trolley shall be provided at the highest or intermediate cable riser room to facilitate cable installation. The lifting load shall be 500kg minimum. Actual required loading is subjected to the cable length. Hooks for fastening of safety harness shall be provided at suitable locations when the access to the lifting beam/trolley is more than 2m above floor.

5.3.10 Hooks for fastening of independent lifeline should also be provided at the ceiling of the highest cable riser room. This hook shall be with similar installation method as those haulage lug and lifting eye as shown in drawing T-COP-10250-D-E33-0101-20. The safety loading of each hook is 2 tons.

5.4 Additional Requirements for High Level Substations (above fifth floor or 17m above ground level)

5.4.1 The substations shall be located on the mechanical services plant floor and at the periphery of the building.

5.4.2 When there is a refuge floor or another mechanical services plant floor is directly above or below the level where the substation is located, an independent staircase shall be provided in the substation to the refuge floor or another mechanical services plant floor as an additional route for emergency evacuation.

5.4.3 Multiple substations on the same floor and are in close proximity may share a separate and independent staircase(s) leading to the refuge floor or another mechanical services plant floor in lieu of one staircase for each substation.

5.4.4 Subjected to the configuration of the 11kV supply network, provision of a 11kV switch room(s) on ground level will be required as a switching substation for the 11kV cables supplying the building.

5.4.5 The access and exit routes of the high level substation shall always lead to the ground level of the building. Any lockable door, gate, barrier along the route shall be avoided.

5.4.6 The exit door(s) shall be opened to a protected lobby with self-closing doors fitted with panic bolt leading to the adjacent communal area of the building.

5.4.7 Clear, durable signage to indicate the location of the substation in the building shall be displayed at suitable places to guide personnel to access the substation. The layout of the signage shall be agreed by CLP Power. Emergency exit route diagram shall be provided in the substation.

5.4.8 Equipment access shall be by a lift in the public area inside the building. The lift in the building shall be capable to carry the heaviest equipment in the substation such as transformer. This lift shall be able to change-over to the essential supply of the building when its normal supply fails. The lift designer should coordinate with Senior Planning and Design Manager of CLP Power on the loading requirement of the lift.

Access passage for equipment shall be at least 3m wide and 2.8m high. Bigger access may be required in case of special applications.

5.4.9 Independent cable riser room shall be provided solely for CLP Power’s cables, constructed to 2-hour FRR and have access from a public area within the building. More than one stack of cable riser rooms may be required that will be determined by the electric power demand of and location in the building.

Normally, the cable riser room height should not be greater than 4m. Otherwise, permanent steel working platform with wire mesh floor of live load not less than 0.75kPa and proper access shall be provided for every 4m inside the cable riser room for cable laying work at high level.

Cable riser room access doors shall be 2-hour FRR. Inside the cable riser room, opening on the floor and ceiling slabs shall be provided for installation of cables. The opening shall be sealed up with 2-hour FRR material by the building owner after installation of the cables.

A lifting beam and trolley shall be provided at the highest level and when required the intermediate floor level of the cable riser room to facilitate cable installation. The lifting load shall be determined by the weight of the heaviest cable at its full length.

5.4.10 Hooks for fastening of independent lifeline should also be provided at the ceiling of the highest cable riser room. This hook shall be with similar installation method as those haulage lug and lifting eye as shown in drawing T-COP-10250-D-E33-0101-20. If the total height of cable riser is more than 30 metres, hooks shall be installed on the ceiling of riser room(s) in the intermediate levels provided the maximum distance between each 2 hooks is less than 30 metres. The safety loading of each hook is 2 tons.

5.4.11 Cable jointing room, 3m by 3m, constructed to 2-hour FRR on each mechanical plant floor from the ground to the substation shall be provided to allow future cable repair/replacement.

5.4.12 A cable unloading area next to the cable riser room on ground level shall be provided for uncoiling the cable from the cable drum and laying to the cable riser room. The space for this unloading area varies for different cases, and shall be determined by CLP Power Planning Engineer.

5.5 Cable Trenches, Cable Ducts and Draw Pits

The cross-sectional areas of cable trenches shall not be reduced by ground beams or other civil structures. Power cables of different voltages should be segregated in different cable trenches. The invert level of cable trenches at the boundary of a substation should be 1050mm (if trench depth is 1200mm) below pavement level. If ground beams are present at the boundary of a substation, the clearance under the beams shall be 500mm minimum. A recess inside the cable trench should be constructed for placing the sump pump at the lowest level of the trench.

The cable trench steel chequer plates shall be marked with numbers (left to right and clockwise convention) to avoid being misplaced. Proper supports such as a removable angle iron should be provided at the bends and tee-points.

5.5.1 HV Cable Trenches

HV cable trenches shall be generally 1200mm deep.

5.5.1.1 800mm wide for 11kV switchgear panels;

5.5.1.2 600mm wide for 11kV cables from 11kV switchgear to transformers; the final section which leads to the transformer HV terminal could be 300mm wide.

5.5.2 LV Cable Trenches

5.5.2.1 LV cable trenches should generally be 800mm wide x 1200mm deep.

5.5.2.2 Trench for LV single core cables from the transformers to customer main switchroom should be 1000mm wide x 1200mm deep for 4 MCT's. The maximum length of this section of trench is limited to 20m.

5.5.3 Pilot Cable Trench

A short trench 400mm wide x 1000mm deep should be extended to where the pilot cable marshalling boxes are installed.

5.5.4 Trenches, Cable Ducts and Draw Pits Construction

Except cable trenches inside the substation, all cable trenches, cable ducts and draw pits outside the substation are required to fully fill up with sand or sifted soil or sand bags at all time after cabling by CLP Power is completed.

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All trenches shall be covered with 6mm thick steel chequer plates. In the case of a suspended trench, the trench walls shall be constructed to 2-hour FRR. All junctions of trenches shall be chamfered to 150mm x 150mm.

Both sides of the cable trench under the 11kV switchgear shall be of dense concrete construction to a minimum width of 200mm for switchgear support.

Design of cable trough for inclined surface shall be in compliance with CLP standard. Details refer to CLP Drawing 'Typical Cable Trough in Slope T-GEN-25500-D-E33-0226-01' when required.

5.5.5 Trench Outlet

5.5.5.1 All trench outlets should have the same width as the trench and 150mm diameter G.I. sleeves shall be provided.

5.5.5.2 For basement and upper floor substations, adequate number of MCT holes should be provided for incoming power cables and pilot cables, taking into account the number of 11kV panels in the substation.

5.6 Doors

Substation doors shall be made of stainless steel. Substation which have doors open over a street, the doors shall be built such that when they are fully opened, which will not cause an obstruction to any person or vehicle using the street. For typical substation design, the door should be able to open outwards into an unobstructed space with a 180° swing.

The following notice plate shall be installed by CLP Power:

- 'DANGER'
- Wear safety helmet
- Substation nameplate
- SF_6 gas-filled equipment warning plate for substations with SF_6 equipment installed.

Fixed Fire Fighting Installation Notice plate shall be provided by the building owner / customer when required.

25mm diameter galvanised steel eye bolts should be installed on internal wall on both sides of all doors at 1m above the floor for hanging a temporary caution notice. A stainless steel box shall also be provided to store a 3m long plastic chain (Box dimension : 125mm length x 125mm wide x 125mm high).

5.6.1 Type of Door

5.6.1.1 Double leaf door shall be normally 2600mm wide and 2800mm high for transformer access. Actual door size is subjected to the transformer rating and type.

A 700mm wide x 2100mm high wicket door with handles shall be provided in one leaf for personnel access.

Drawings No. T-COP-10250-D-E33-0103-16 and T-COP-10250-D-E33-0103-17 show the details of this type of door.

5.6.1.2 Double leaf door 1500mm wide x 2500mm high shall be provided for 11kV switchgear and personnel access. Actual door size is subjected to the switchgear rating and type. Drawing No. T-COP-10250-D-E33-0103-20 shows this type of door.

5.6.1.3 Single door 930mm wide x 2100mm high with handles shall be provided for personnel access and exit. Drawing No. T-COP-10250-D-E33-0103-14 shows this type of door.

5.6.1.4 Single leaf door for personnel access opening to a staircase or exit route shall be self-closing.

For doors which required fire resistance period rating such as 2-hour fire resistance rating (FRR) such as 2-hour in terms of integrity (and insulation when necessary) shall comply with the relevant requirements of the Buildings and Fire Services Regulations such as the Code of Practice for Fire Safety in Building 2011 and latest corrigenda by Buildings Department and shall have relevant approval certificates / documents accepted by Building Department. The design shall be agreed by CLP Power. (Note: the drawings in this Code of Practice are only indicative in terms of door design, dimensions, wickets, etc.).

5.6.2 Lock

A substation shall have only one designated personnel access door and this door shall be fitted with an emergency exit deadlock set with panic bar and flush key hole.

A second, or emergency exit door should be provided for substations longer than 10m (possibly a wicket door in a double leaf door). Such an emergency exit will be provided with a panic bar which will operate top and bottom bolts of the door, without key.

In case of a double leaf switchgear access door an emergency exit deadlock set with panic bar will operate one leaf of the door if this is the only access.

Main double leaf transformer access doors will lock by top and bottom bolts inside the substation.

5.6.3 Controlled Access

The access need to be controlled to ensure that only authorized staff, contractors and visitors pass through by means of access control and intruder detection system. Metallic conduit system for access control should be provided from each access door to the pilot marshalling box. Detail refer to drawing T-COP-72000-D-E33-0103-23-A-A.

5.7 Substation Name

The following principles shall be followed when naming distribution substations :-

(i) Building name, or
(ii) Street and street number, or
(iii) Village name, or
(iv) The generally accepted location name.

The substation name shall not be more than 25 characters and the above shall be in both English and Chinese.

5.8 Vermin Proofing

Some distribution substations are located in buildings with a dusty, damp and vermin infested environment. Vermin are usually small animals such as rats, lizards and birds, etc. and insects are cockroaches and flies, etc. To avoid problems of hygiene, corrosion and risk of insulation breakdown inside the electrical equipment caused by the vermin, vermin proofing is normally achieved by a combination of means. The substation building itself will act as the first line of defense while the electrical equipment design will act as the second.

In case of indoor substations, the first line of defense shall be by means of :

- Substation walls
- Doors
- Rat guards at ventilation louvres and grills
- Sealing of cable trench openings.

Electrical equipment in substations is designed to different degrees of protection according to IEC 60529. Typical 11kV switchgear is designed to IP4X while the LV boards are to IP2X. Therefore, the substation design shall provide an effective vermin proofing means as the first line of defense to protect the equipment.

In case of outdoor substations, vermin proofing mainly depends on the electrical equipment itself.

5.9 Stainless Steel for Substation External Steelwork

5.9.1 Material used shall be Grade 316L stainless steel. This is a nickel-chromium steel containing molybdenum and a small amount of carbon. This steel is well suited to external applications particularly coastal areas.

5.9.2 The Japanese standard for this steel is SUS 316L. The American equivalent is AISI 316L.

5.9.3 The following notes relate to all external steelwork and in particular the doors :-

(i) The hinges of each door leaf must be designed and constructed to withstand the weight of the door plus 50kg and be not less than four in number per leaf.

(ii) Welding treatment must be suitable for Grade 316L stainless steel and must not create weak spots at the weld. After welding, the weld surface must be brushed clean to remove all welding flux and surface dirt. The surface shall then be solvent cleaned to remove all residual dirt and grease.

(iii) The doors and other external steelwork shall be covered with plastic sheets at the time of installation and such plastic sheets shall not be removed until the building construction work is completed.

5.10 Requirements of Substation External Decorative Louvre

5.10.1 Generally, no external decorative louver should be installed, affixed or attached outside the distribution substation. For special circumstances, the building owner should obtain prior agreement of CLP Power if they wish to add such decoration.

5.10.2 External decorative louvre should not be fixed directly or indirectly onto substation stainless steel doors and ventilation louvres.

5.10.3 The weight and the fixing method of the external decorative louvre shall be certified by the Authorized Person representing the building owner / customer to ensure that it will not impose hazard to our operation staff and the general public. The Authorized Person should also submit this design to the relevant authorities for approval according to the statutory regulation.

5.10.4 The decorative louvre shall not obstruct the access of operation and transport of equipment in and out of the substation. With the decorative louvre, all substation doors should be able to open outwards with 180 degree swing.

5.10.5 The external decorative louvre shall not affect the substation ventilation.

5.10.6 The decorative louvre shall provide fitting provisions for installing the substation nameplate, danger warning notice etc. and shall not affect the display of the substation nameplate and notice plates.

5.10.7 The building owner/management company / customer shall be the owner of the external decorative louvre and responsible for the maintenance of the decorative louvre. Annual inspection of the louver should be carried out by an competent person to confirm its safety.

5.11 Requirements for Vehicular Access

5.11.1 In general, the minimum requirements for vehicular access shall be :

Lorry dimension	10.5m (L) x 2.6m (W)
Turning radius of vehicular	9.8m
Headroom for loaded lorry movement	4.6m
Headroom for unloading area	5.5m
Weight for the loaded lorry	24000 kg
Weight for the 1.5 MVA transformer	9000 kg
Plant delivery access	3m (W) x 2.8m (H)

5.12 Plant Delivery

The maximum allowable gradient of ramp for plant delivery shall be in a ratio of 1:12. Level difference between floor inside substation and public pavement should not be greater than 400mm wherever practical.