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TOPIC 1: CHANGES AND HIGHLIGHTS IN ELECTRICITY ACT AND RELEVANT REGULATIONS

1 Changes in the Electricity Industry

1.1 Role of the Electricity Industry in Singapore

The electricity industry plays a significant role in the Singapore economy. With its history of rapid growth and expanding demand for domestic and commercial energy, Singapore is very reliant on an efficient and modern electricity system. The reliable supply of electricity, at a competitive price, influences the ability of Singapore industry to compete domestically and internationally, which in turn has a direct impact on the national economy.

1.2 Overview of Industry Reform Process

The electricity and piped gas industries in Singapore have traditionally been vertically integrated and Government-owned. The Public Utilities Board (PUB) was formed in May 1963 to undertake the supply of water, electricity and piped gas to the population of Singapore.

The first reform of the electricity industry was in 1995 when the Government corporatised the electricity undertakings of the PUB. The intention was to gradually introduce competition in electricity generation and retail so that Singapore would have an electricity market that allows market forces rather than central planning to drive investment, production and pricing decisions. Please see below for the milestone developments of the electricity industry.

1 October 1995

Corporatisation of electricity and piped gas operations of the Public Utilities Board to gradually introduce competition in the energy market.

1 April 1998

The Singapore Electricity Pool (SEP) was established to facilitate the trading of electricity between generation companies and the retail company in a competitive environment. The SEP was operated by PowerGrid Ltd as the Pool Administrator.

11 March 2000

In March 2000, the Government decided to continue with further deregulation of the industry to obtain the benefits of full competition. The key restructuring initiatives includes:

- The separation at the ownership level of the contestable and non-contestable parts of the electricity industry;
- The establishment of a system operator and market operator;
- The establishment of a real-time wholesale market; and
- The liberalization of the retail market.

1 April 2001

The Energy Market Authority (EMA) was formed to promote competition and regulate the electricity and gas industries.

The Energy Market Company (EMC) took over the role of Market Administrator.

As the first step towards separating ownership of the contestable parts of the industry from the natural monopolies, Singapore Power Ltd fully divested its generation companies, PowerSenoko Ltd and PowerSeraya Ltd, to Temasek Holdings.

1.3 The Key Players in the New Electricity Market (NEM)

- *The regulator:* The EMA is the Regulator of the electricity sector and has the ultimate responsibility for ensuring that the NEM meets the needs of Singapore.

- *The market operator:* The EMC is the company that will operate and administer the wholesale market.

- *The power system operator:* The PSO, which is a division of EMA, is responsible for ensuring reliable supply of electricity to consumers and the secure operation of the power system. The PSO controls the dispatch of facilities in the wholesale market, coordinates outage and emergency planning and directs the operation of the Singapore high-voltage transmission system under the terms of an "operating agreement" with SP PowerAssets, the transmission licensee.

- *The transmission licensee:* SP PowerAssets owns and is responsible for the operation and maintenance of the transmission and distribution networks. To ensure a reliable and efficient transmission and distribution system, SP PowerAssets appointed SP PowerGrid to manage its business including the management of the transmission network and the operation of the distribution network.

- *Generation licensees:* All dispatchable generators above 1MW must be licensed by the EMA and are required to be registered with the EMC as market participants. Mandatory participation ensures that all generators of any significant size are subject to the market rules.

- *Market support services licensees:* MSSLs provide market support services such as meter reading and meter data management. They also facilitate access to the wholesale market for contestable consumers and retailers, and are responsible for supplying electricity to all non-contestable consumers. At the start of the NEM, the incumbent supplier, SP Services Ltd, will be the only MSSL, although others may enter the market at a later date.

- *Retail electricity licensees:* Retailers are permitted to sell electricity to contestable consumers. They may be market participant retailers (MPRs) and obtain electricity for this purpose by purchasing directly from the wholesale market (provided that they are licensed by the EMA to trade in the wholesale market and are registered with the EMC as market participants) or non-market participant retailers (NMPRs) and obtain supply through the MSSL.

- *Consumers:* Consumers are categorized as contestable and non-contestable, depending on their annual electricity usage. Contestable consumers may purchase electricity from a retailer, an MSSL or directly from the wholesale market as direct market participants (provided in the latter case that they are licensed by the EMA to trade in the wholesale market and are registered with the EMC as market participants). Non-contestable consumers are supplied with electricity by a MSSL.

2 Changes in the Legislative Landscape

2.1 Period before 1 December 2002

Regulation Division, EMA, enforced the following Acts & regulations in respect of consumers' electrical installations:

(a) The Public Utilities Act (Cap. 261)

- The Public Utilities (Electricity) Regulations 1997
- The Public Utilities (Electricity Supply) Regulations 1997
- The Public Utilities (Licence to Use or Operate Electrical or Supply Installations) Regulations 1997

(b) The Electrical Workers & Contractors Licensing Act (Cap. 89)

- The Electrical Workers & Contractors Licensing Regulations 1997

2.2 Period between 1 December 2002 & 1 January 2003

The following Act and regulations were repealed on 1 Dec 2002.

- The Electrical Workers & Contractors Licensing Act (Cap. 89)
- The Electrical Workers & Contractors Licensing Regulations 1997

The relevant part of the Electricity Act (Cap. 89A) and the Electricity (Electrical Workers) Regulations came into operation with effect from 1 December 2002.

All licensed electrical workers were informed of the changes through Circular RD/E01/2002 dated 30 November 2002.

2.3 Period after 1 January 2003

The New Electricity Market opened on 1 January 2003 and the consumers' electrical installations are now being regulated under the following Acts and regulations:

- Electricity Act (Cap. 89A)
- Electricity (Electrical Installations) Regulations

The Electricity (Electrical Installations) Regulations replaced the following regulations made under the Public Utilities Act (Cap. 261):

- The Public Utilities (Electricity) Regulations 1997;
- The Public Utilities (Electricity Supply) Regulations 1997; and
- The Public Utilities (Licence to Use or Operate Electrical or Supply Installations) Regulations 1997.

All licensed electrical workers were informed of the changes through Circular RD/E02/2002 dated 30 December 2002.

3 Key Changes with the Enactment of the Electricity Act and Regulations

3.1 Certificate of Compliance & Statement of Turn On of Electricity Supply

The licensed electrical worker appointed by a consumer shall issue a Certificate of Compliance (Appendix 1) in respect of the consumer's electrical installation prior to the energisation of the supply

line to the electrical installation. At the time the supply line is energized, the person responsible for turning on the switchgear which controls the supply of electricity to the electrical installation shall issue a Statement of Turn On of Electricity (Appendix 2 & 3).

3.2 Compliance with Codes of Practices

In addition to compliance with the Singapore Standard CP5, Code of Practice for Electrical Installations, compliance with the following Singapore Standard Codes of Practice are made mandatory under the regulations:

- Singapore Standard CP 88, Code of Practice for Temporary Electrical Installations – Part 1: Construction and Building Sites;
- Singapore Standard CP 88, Code of Practice for Temporary Electrical Installations – Part 2: Festive lighting, trade fairs, mini-fairs and exhibition sites.

3.3 Licensing of Electrical or Supply Installations

Application for an electrical or supply installation licence shall now be made through a licensed electrical worker of the appropriate class employed or appointed by the applicant. Licensed electrical workers shall keep a proper record of their appointments by consumers and shall produce the record to the Authority if so required.

3.4 Completion Certificate for Modification of Electrical Installation

A licensed electrical worker shall, upon completion of any modification to an electrical installation that is exempted from licensing, inspect, test and submit the completion certificate (using the form given in Appendix 4) to the market support services licensee, i.e. SP Services Ltd.

3.5 Cable for concealed wiring in installation

Where concealed wiring is installed in an electrical installation at a depth of less than 50mm from the surface, no person shall use for such concealed wiring a non-metallic sheathed electricity cable or non-sheathed electricity cable without any metallic conduit or trunking for such a cable.

3.6 Permit To Work (PTW) & Notice against any interference

For work on high voltage apparatus, the permit-to-work to be issued by an authorized high voltage switching engineer shall be in the form as shown in Appendix 5, and the notice against any interference as shown in Appendix 6.

3.7 Statement of Disconnection and Reconnection of source of electricity for electrical installation taking high voltage supply from another electrical installation

Where work is to be carried out on a high voltage apparatus or any part thereof connected to a source of electricity supply which is not under the control of an authorized high voltage switching engineer, the authorized high voltage switching engineer shall arrange to obtain a certificate in the form shown in Appendix 7 from the person having control of such source of electricity supply.

4 Licensing Requirements

Objective of Licensing Electrical Installations

Ensure the owners of large electrical installations maintain their electrical installations properly and arrange for their installations to be inspected and certified safe annually.

Why annual inspections are necessary

Equipment in electrical installations degenerate with time. Manufacturers therefore recommend equipment such as transformers and switchgear to be checked annually. In addition, vital protection devices need also to be checked annually to ensure their operational integrity. Defects in the electrical installation, if not detected and remedied, will pose a danger to life, property and the integrity of the part of the national grid to which they are connected. Annual safety inspections by LEWs ensure that potential defects are detected and remedied before they become a safety risk.

EMA subjects electrical installations that are exposed to greater risks, e.g. construction work sites, temporary outdoor installations etc, to more frequent inspections.

LEW shall advise the owners of the relevant electrical installations about the requirements for renewing their installation licences and assist the owners to arrange for regular inspection and maintenance works to ensure electrical safety.

4.1 Temporary Electrical or Supply Installation at Work Sites

The licensed electrical worker who is taking charge of the temporary electrical or supply installation at work sites shall inspect the installation at monthly intervals and shall submit copy of the inspection report to EMA using standard Form EI(R2).

4.2 Trade Fairs, Festive Lightings, Mini-fairs etc.

The licensed electrical worker who is taking charge of these types of electrical installation shall inspect the installation daily. Licensed electrical workers shall keep the daily inspection reports and shall produce the reports to the Authority if so required.

4.3 Condominiums & Multi-Tenanted Buildings

The licensed electrical worker who is taking charge of condominiums or multi-tenanted buildings shall inspect the installation at six-monthly intervals and shall submit a copy of the inspection report to EMA using standard Form EI(R1).

4.4 Contestable Consumers

As the LEW appointed by the landlord of a multi-tenanted building who is classified as a contestable consumer, the landlord's LEW must update EMA a list of the tenant units, which holds a separate electrical installation licence, to be excluded from the building's electrical installation licence. All tenanted units with approved load exceeding 45kVA will by default covered under the landlord's electrical installation licence unless they hold a separate electrical installation licence.

4.5 After Approval of Electrical or Supply Installation Licence

Upon receiving the notification from the Authority that the application of electrical or supply installation licence is approved, the licensed electrical worker shall print the electrical or supply installation licence and deliver the licence to the applicant within 7 days from the receipt of the notification.

5 New Licence Condition for HT Installation

Every high voltage apparatus in the installation shall be maintained according to the manufacturer's recommendation. You shall keep record of all the maintenance work conducted and shall be able to submit the maintenance report to the Authority as and when required.

Requirement for Independent Audit

In the event that your electrical installation causes 3 or more voltage dips to SP PowerAssets' electricity network (the "**Network**") within a period of 24 months, the Energy Market Authority ("**EMA**") may require you to do the following work (the "**Work**"):-

(a) Engage an independent licensed electrical engineer ("**LEE**") to :-

- inspect, test and maintain the electrical installation; and

- conduct an independent audit (the "**Independent Audit**") and make recommendations in order to prevent further occurrences of voltage dips to the Network at your own expenses;

(b) submit to EMA, the results of the Independent Audit, in the form of a written report, at such intervals as EMA may determine, at your own expenses; and

(c) implement at your own expenses; all the recommendations of the independent LEE prepared in the Independent Audit, at your electrical installation.

The EMA will monitor your electrical installation for a further period of 12 months after the completion of the Work (the "**Period**").

In the event that a voltage dip occurs within the Period, the EMA may require you to re-conduct the Work.

6 Electrical Work

LEWs shall take note of their responsibility as stipulated in the legislation in regards to the performance of electrical work.

It is the responsibility of the licensing LEW to advise the owner of the electrical installation the type of work that should be carried out ONLY by the appointed LEW. Reference shall be made to Section 82(1) to (4) of the Electricity Act. The licensing LEW shall remind owner of electrical installation to be kept informed of any electrical work that is intended to be carried out.

For work to be carried out by a trained person, Section 82(5) of the Electricity Act states the responsibility of LEW and the employer of the trained person :

a. The trained person is recognised by his employer and the LEW in charge of the relevant electrical installation to have the necessary knowledge and experience to avoid danger; and

b. The trained person is capable of carrying out the work specified in the written instructions of the LEW.

Trained person must be a full-time employee.

Section 82(5) of the Electricity Act requires the trained person to carry out work in accordance with the written instructions of the LEW in charge of the relevant electrical installation.

LEW shall check that the trained persons are familiar with the written instructions and the relevant operation and maintenance manuals.

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: _____ Rating: _____ kVA
- ☐ Standby generator.
  No. of generator: _____ 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

STATEMENT OF TURN ON OF ELECTRICITY

ELECTRICITY SUPPLY TO _____
(Name of Applicant)

AT _____
(Address of Installation)

_____

I acknowledge that the above-mentioned electrical installation has been checked by the market support services licensee. I have energised the supply line to the installation on _____ *(date)* at _____ *(time)*.

Name & Signature of person responsible for energisation of supply line	**Licence No.**	**Date**

_____

I acknowledge that the supply line has been energised on the date and time indicated above.

Name & Signature of Applicant or his representative	**NRIC / Passport No.**	**Date**

This form is applicable to electrical installation exempted from licensing.

STATEMENT OF TURN ON OF ELECTRICITY

Appendix 3

ELECTRICITY SUPPLY TO _____
(Name of Applicant)

AT _____
(Address of Installation)

_____

ELECTRICAL INSTALLATION LICENCE NO: _____

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 energised on _____ at _____.
(date) *(time)*

Name & Signature of person responsible for energisation of supply line	**Licence No.**	**Date**

I acknowledge that the supply line has been energised on the date and time indicated above.

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

I acknowledge that the supply line has been energised 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 energised on the date and time indicated above.

Name & Signature of Applicant or his representative	**NRIC / Passport No.**	**Date**

This form is applicable to licensed electrical installation only.

REF: E(EI)Reg5(4)

COMPLETION CERTIFICATE FOR MODIFICATION OF ELECTRICAL INSTALLATION

To:
SP Services Ltd
Attn: Manager (Installation)

MODIFICATION TO ELECTRICAL INSTALLATION AT _____

_____

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 summarised 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 / 30 mA 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

*PTW. No: _____

PERMIT TO WORK
ON HIGH VOLTAGE CABLES & EQUIPMENT
IN CONSUMER'S ELECTRICAL INSTALLATION

1. ISSUE OF PERMIT-TO-WORK (PTW) :

This is to certify that the following cable between / equipment at _____

_____

(state the exact location and / or switchroom involved)

HAS BEEN ISOLATED at _____

AND EARTHED at _____

(state exact point or position of isolation and earthing)

AND IS NOW SAFE TO WORK ON. Details have been recorded in the Consumer Switchroom Record Book.

Time of issue of PTW : _____ Date of issue : _____

The Competent Person in charge of work has been instructed to commence work.

_____ _____

Name & Signature of Authorised High Voltage Switching Engineer Licence No.

2. INSTRUCTION TO WORK:

I have read and understood the instructions from the Authorised High Voltage Switching Engineer to commence work on the above cable / equipment.

Time : _____ Date : _____

_____ _____

Name & Signature of Competent Person Licence No.

3. COMPLETION OF WORK :

The work has been completed, all personnel and tools have been withdrawn, and the men in my charge have been warned that it is **no longer safe** to work on the above cable / equipment.

Time : _____ Date : _____

_____ _____

Name & Signature of Competent Person Licence No.

4. CANCELLATION OF PERMIT :

The above PTW No. _____ dated _____ is now cancelled and withdrawn. No further work is to be performed on the above cable / equipment without another PERMIT-TO-WORK.

Time of cancellation : _____

Date of cancellation : _____

_____ _____

Name & Signature of Authorised High Voltage Switching Engineer Licence No.

*Duplicate copy of this PTW shall be retained by the Authorised High Voltage Switching Engineer.

NOTICE AGAINST ANY INTERFERENCE WITH LIVE APPARATUS



DANGER

This cable between / equipment at

_____

_____

has been isolated and earthed and

SHOULD NOT BE INTERFERED WITH

without the consent of the authorised high voltage switching engineer (AHVSE) who has issued a PERMIT-TO-WORK

No: _____

on (DATE / TIME) _____

Signature of AHVSE: _____

Name: _____

Contact No: Tel _____ Pager _____

REF: E(EI)Reg24(1)(b)

(The symbol and text shall be black and background colour shall be yellow. This Notice shall be printed on self-adhesive A6-size paper)

Appendix 7

*Certificate No. (E.g. 9/12345/0001)

STATEMENT OF DISCONNECTION AND RECONNECTION OF SOURCE OF ELECTRICITY FOR ELECTRICAL INSTALLATION TAKING HIGH VOLTAGE SUPPLY FROM ANOTHER ELECTRICAL INSTALLATION

The following statements concern the disconnection and reconnection of the supply line specified below from the source of electricity. Each statement shall be valid only when it is signed by both the Authorised High Voltage Switching Engineer (AHVSE) and the person having control of the source of electricity.

The incoming supply line No:_____

of (name of installation) _____ (Licence No: _____)

is to be isolated from the source of electricity
at (name of installation) _____ (Licence No: _____).

This disconnection of the above-mentioned supply line
from the source of electricity is requested by : (Name) _____.

PART I : STATEMENT OF DISCONNECTION OF SOURCE OF ELECTRICITY

TIME:_____ DATE: _____

DECLARATION BY PERSON HAVING CONTROL OF THE SOURCE OF ELECTRICITY : I, the undersigned, declare that the above supply line has been safely isolated from the source of electricity and will not be reconnected without the prior written agreement of the AHVSE for the above first-named installation.

SIGNATURE:_____NAME:_____ LICENCE NO:_____

DECLARATION BY AHVSE: I, the undersigned, declare that the above supply line has been safely isolated from the above first-named installation.

SIGNATURE:_____NAME:_____ LICENCE NO:_____

PART II: WRITTEN AGREEMENT FOR RECONNECTION TO SOURCE OF ELECTRICITY

TIME: _____ DATE:_____

DECLARATION BY AHVSE: I, the undersigned, declare that the above first-named installation to which the above supply line is connected, is cleared of all earthing leads, labour and tools, and that the supply line is safe for reconnection to the source of electricity with effect from the time specified above. I undertake to ensure that no work by any person will be carried out on any apparatus that is connected to the above supply line until a new statement is signed by both parties.

SIGNATURE:_____NAME:_____LICENCE NO: _____

DECLARATION BY PERSON HAVING CONTROL OF THE SOURCE OF ELECTRICITY: I, the undersigned, acknowledge the above declaration by the AHVSE and agree to reconnect the source of electricity to the above supply line.

SIGNATURE:_____NAME:_____LICENCE NO: _____

TOPIC 2: PROCEDURES FOR APPLICATION & TURN-ON OF ELECTRICITY SUPPLY

1 Procedures for Application of Electricity Supply

1.1 Submission of Consultation Form

For direct connection to Grid, customer may seek consultation on the technical requirements at the conceptual/planning stage by submitting Consultation Form through the Licensed Electrical Worker (LEW) to SP PowerGrid.

SP PowerGrid requires information such as site & location plans, gross floor area, type of premises and business activity, supply requirement and expected date of energisation.

1.2 Submission of Application for Direct Connection Load ≤ 45 kVA

The LEW, on behalf of customer, shall submit an Application Form with 2 copies of site & location plans showing proposed intake connection point to SP Services to apply for new or modified connection to the Transmission System.

SP Services shall endeavour to send the quotation for electricity supply connection to the customer within 10 business days.

Customer pays Service Connection Charge within the validity period of the quotation.

Upon receipt of payment, SP PowerGrid will commence work and inform the customer and LEW on completion.

Customer shall open an utilities account and pay security deposit to SP Services.

The LEW shall submit Form CS/5 - Application for Inspection of Electrical Installation on behalf of the customer, and a copy of Certificate of Compliance (CoC) to request for an inspection and turn-on by SP Services.

(Note: First-time inspection is free-of-charge)

www.spservices.com.sg

1.3 Submission of Application for Indirect Connection Load ≤ 45 kVA

Customer shall open an utilities account and pay security deposit to SP Services.

The LEW shall submit Form CS/5 or CS/5H on behalf of the customer together with the landlord's consent on Form CS/3 – Letter of Consent from the Landlord/ Management Corporation or Form CS/3H – Letter of Consent from Housing & Development Board and a copy of CoC to request for an inspection and turn-on by SP Services.

(Note: First-time inspection is free-of-charge and Form CS/3 or Form CS/3H is not required for HDB residential premises)

1.4 Submission of Application for Direct Connection Load > 45kVA

The LEW shall submit an Application Form with 2 copies of site & location plans showing proposed intake connection point, on behalf of the customer.

SP Services shall advise the LEW & customer on the approval of the application & technical requirements within 10 business days for connections up to 22kV, within 60 business days for 66kV connections and within 100 business days for 230kV connections.

For Service without sub-station, the procedure is the same as for Direct Connection Load ≤ 45 kVA.

For Service with sub-station, LEW shall submit sub-station plan & metering requirements to SP PowerGrid for clearance.

SP Services shall send to customer the Quotation, Agreement, Deposit amount required for Opening of utilities account.

On receipt of payment for service connection charge & signed agreement, SP PowerGrid will commence work & inform LEW & customer on completion.

Customer shall proceed to open an utilities account with SP Services together with a security deposit and instruct his LEW to apply to Energy Market Authority (EMA) for Electrical Installation (EI) Licence.

The customer shall subscribe and activate 1 functional telephone line per metering point for remote meter reading purposes, if applicable.

LEW shall submit a copy of CoC, EI Licence and IRAS letter stating official address (if applicable) to Installation Section of SP Services @ SPTI (Braddell Road) to request for an appointment for energisation of service connection with SP PowerGrid.

1.5 Submission of Application for Indirect Connection Load > 45 kVA

Once the premises is ready for installation of meters, the customer shall proceed to open an utilities account with payment of security deposit to SP Services.

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

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

The LEW shall proceed to liaise with Meter Section of SP PowerGrid to install meters.

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

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.

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

1.6 Submission of Application for New EHT & HT Consumers Who wish to be Contestable at time of Turn-On

The procedure is similar to Direct & Indirect Connection Load > 45 kVA. In addition, the consumer must subscribe and install one dedicated telephone line per metering point (adjacent to meter panel) to be used for the purpose of remote metering.

The LEW shall submit a copy of the duly completed Form CS/6 – Request from Contestable Customer for Installation of Electricity kWh Meter with the active dedicated telephone line number clearly stated to SP Services for the installation of TOD Meter.

The LEW shall proceed to liaise directly with Meter Section of SP PowerGrid to have the TOD meter installed.

Upon completion of the installation of the TOD meter and telephone line, the consumer shall submit a copy of the duly completed Application for Contestability Status and Application to open a MSS Account to Client Relations Branch of SP Services at 111 Somerset Road, #06-05 or via fax:

6823-6800 at least 12 business days prior to the arrangement for the turn-on appointment.

If the customer chooses to purchase electricity from a Retailer with effect from the turn-on date, the Retailer must submit a transfer request to SP services at least 1 business day before the turn-on date.

Otherwise, SP Services 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 SP Services is required.

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

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 at Installation Section of SP Services @ SPTI (Braddell Road) (for HT Supply) or at Transmission Projects Section of SP PowerGrid @ Kallang Bahru District Office (for EHT Supply).

1.7 Submission of Application for Modification of Electrical Installation (Exempted From Licensing)

The LEW shall submit to SP Services the duly completed Form CS/5, together with Form CS/3 or Form CS/3H and the Completion Certificate for Modification of Electrical Installation 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)

SP Services conducts spot-checks for those system-selected applications.

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

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

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

2 Procedures for Turn-on of Electricity Supply

2.1 Types of Installations Required Checking by MSSL

- Small Electrical Installation
  (Supply capacity not exceeding 45 kVA)
- Large Domestic Electrical Installation
  (Supply capacity exceeding 45 kVA)
- Residential units in Condominium / Conventional Housing Development
- HDB Residential Units
- Bulk Replacement of Meterboards in multi-tenanted Building

2.2 Inspection of Small Electrical Installation (Supply Capacity ≤ 45kVA)

The customer shall open an account with SP Services. The LEW then submits Form CS/5 - Application for Inspection of Electrical Installation and Certificate of Compliance (CoC) to apply for an inspection appointment with Supply Application (SA) Section of SP Services. Upon confirmation, SA issues inspection appointment letter to the LEW.

Meter Section of SP PowerGrid will inspect and install the electricity meter one day before the inspection date.

For direct Grid connection, the LEW submits Certificate of Readiness (CoR) to SP Services on site.

SP Services then carries out the inspection in accordance with the requirements of EMA.

If the inspection result is 'Passed', SP Services or the LEW will turn-on the electricity supply. SP Services (on behalf of SP PowerGrid) or LEW then issues the "Statement of Turn-on of Electricity" to the LEW and applicant or his representative.

If the inspection result is 'Failed', the LEW shall rectify the defects and re-submit CoC to apply for re-inspection appointment. A re-inspection fee is payable.

A copy of the SP Services inspection report is given to the LEW and applicant or his representative on site. EMA will also receive a copy electronically.

2.3 Inspection of Large Domestic Electrical Installation (Supply Capacity > 45kVA)

The LEW submits an application for service connection if directly connected to Grid's network.

The LEW then installs the electrical installation in accordance with the single-line drawing (SLD).

Upon completion of the installation works, the LEW carries out inspection to ensure that the electrical installation complies with Singapore Standard CP5: Code of Practice for Electrical Installations and the relevant Electricity Regulations. He then certifies CoC and Form E - Certificate of Fitness of Residential Unit.

The customer shall open an account with SP Services. The LEW then submits the Inland Revenue Authority of Singapore (IRAS) letter stating the official address, CoC, Form E and the as-built SLD to Installation Section of SP Services to make inspection & turn-on appointment.

Installation Section checks the documents and issues turn-on appointment letter, if in order. The LEW will arrange with Meter Section of SP PowerGrid for fixing of meter. Meter Section will then install meters at least one day before the turn-on appointment date.

On the appointment day, the LEW must submit CoR to SP PowerGrid's project officer on site (for direct Grid connection). SP Services then carries out inspection of customer's electrical installation in accordance with the requirements of EMA.

If the inspection result is "Passed", SP PowerGrid or the LEW will energise the service connection and the LEW will then turn-on the electricity supply. SP PowerGrid or LEW will issue the "Statement of Turn-on of Electricity" to the LEW and applicant or his representative.

If the inspection result is "Failed", the LEW shall rectify the defects and re-submit CoC and Form E to apply for re-inspection & turn-on appointment. A re-inspection fee is payable.

A copy of the SP Services inspection report is given to the LEW and applicant or his representative on site. EMA will also receive a copy electronically.

2.4 Sample Unit Inspection of Electrical Installations in Private Residential Development

After main intake switchboard is energised, the landlord's LEW will turn-on the electricity supply to the outgoing circuits and downstream switchboards. The project LEW then carries out inspection & testing of all residential units and certifies Form E.

The LEW submits Form E, as-built SLD and IRAS letter stating the list of official addresses for the units to make appointment for sample unit inspection at Installation Section. Concurrently, Installation Section notifies Meter Section of SP PowerGrid to conduct separate inspection on the meterboards set-up.

SP Services conducts inspection of sample units selected in the presence of LEW. After verifying an adequate number of sample units to be in order and Meter Section has no objection to the meterboards set-up, SP Services notifies Meter Section to bulk fix meters.

Meter Section fixes the meters for all the residential units in the development. After meters installed, the LEW submits CoC to Installation Section to make appointment for inspection & pre-turn-on of supply to individual unit meterboard.

Upon successful inspection of each residential unit, the LEW turns-on the electricity supply up to meterboard. SP Services or the LEW will issue the "Statement of Turn-on of Electricity" to the developer.

If there are violations found which cannot be rectified on site, SP Services will issue a failure report for the LEW to rectify and make appointment for re-inspection of those units failed to pre-turn-on. A re-inspection fee is payable.

Turn-on of electricity supply to individual residential unit in the development will only be carried out after the owner has opened an account with SP Services.

2.5 Inspection and Pre-Turn-On of HDB Residential Units

The LEW carries out inspection & testing of all residential units in the block and certifies Form E. The LEW then submits CoC, Form E and as-built SLD of each premises type to HDB for certification.

After testing, HDB submits certification letter together with CoC, Form E and as-built SLD issued by the LEW to make appointment for inspection & pre-turn-on at Installation Section.

HDB also arranges with Meter Section of SP PowerGrid to bulk fix meters to all residential units in the block.

On the appointment date, SP Services selects a unit from each premises type for inspection. After inspection is passed for the selected units, pre-turn-on inspection will be carried out to all units in the block.

Upon successful pre-turn-on inspection of each unit, electricity supply is turn-on to the unit DB. The LEW then issues the "Statement of Turn-on of Electricity" to HDB.

SP Services will display a "caution" sticker at each unit DB with a guidance booklet for the owner to check the electrical installation before use.

If there are violations found which cannot be rectified on site, SP Services issues a failure report for the LEW to rectify defects and make appointment for re-inspection and pre-turn-on for those units fail to turn-on. A re-inspection fee is payable.

2.6 Inspection of Bulk Replacement of Meterboards

The LEW submits Form CS/5 to Electricity Supply Application Section of SP Services for bulk replacement of meterboards in multi-tenanted building.

The LEW submits meterboard layout plans to Meter Section of SP PowerGrid for approval.

Upon approval, the LEW then obtains permission from SP Services to break meter terminal seal and carries out bulk replacement of meterboards.

The LEW inspects and tests the meterboards and submain cables replaced. Upon completion, the LEW certifies Form F – Certification of Bulk Shifting/Replacement of Meterboards in Tenanted Buildings.

The LEW submits Form F and SP PowerGrid's approval letter of meterboard layout plans to Installation Section to make appointment for inspection of bulk replacement of meterboards. Inspection appointment is made if documents are in order.

On the appointment date, SP Services checks the following items in the presence of the LEW:

- Visual inspection of meterboard set-up;
- Correct meter number and unit address to tally with meter listing in SP Services' records;
- Correct meter rotation;
- Meters are not transposed with the neighbouring units;
- Polarity check of one SSO inside the unit (sample check for 10% of units).

SP Services re-seals all meter terminals after inspection.

SP Services will issue a completion inspection letter to the LEW and Landlord/MCST.

3 Related Information

For more information on Electricity Supply Application, you can refer to the Handbook "How to apply for Electricity Connection".

Alternatively, you can view the handbook from **http://www.sppowerassets.com.sg** or visit **http://www.spservices.com.sg** for more information on the New Electricity Market.

4 Important Contact Numbers

SP SERVICES LTD	**Tel No**	**Fax No**
General Enquiry on Application For Connection to Transmission System	68238287 / 68238340	68238289
Consumer Connection Agreement		
Contracts Section	68238282	68238289
Testing and Turn-on Appointment		
Supply Application Section	68238287	68238289
Installation Section	62777064	62777044
Opening of Utilities Accounts		
Enquiry	1800-2222333	68238229
SP POWERGRID LTD		
Endorsement of Substation Drawings		
• East zone	68238555	68238564
• West zone	68238556	68238564
Installation of Meters		
Deputy Director (Meter)	62777000	62777008
Enquiry	62777005	

SP SERVICES
A member of Singapore Power Group

APPLICATION FOR CONTESTABILITY STATUS

Name of Consumer (company): _____ ("the Consumer")

Existing Electricity Account No : _____ (if applicable)

Company Registration No: _____

Official Premises Address where supply is required: _____

_____ ("the Premises")

Mailing Address: (if different from the Premises) _____

_____ Fax No: _____

Contact Person: _____ Contact Tel: _____ E-mail: _____

* Requested Date of contestability: _____

1. I wish to apply to be a contestable consumer with respect to the premises stated above ("the Premises")
2. In accordance with the Electricity (Contestable Consumers) Regulations 2003 or such further amendments thereto, I confirm that "the Premises" is a non-residential premises.
3. The phone number of the phone line connected to my meters for the purpose of remote meter reading is _____.
4. I agree that my application for contestability is subject to my compliance with paragraph 3 above and that SP Services 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 compliance or non-compliance of paragraph 3 provided always that such delay, postponement or non-compliance is not caused by SP Services or is within its reasonable control.
5. If my application as a contestable consumer is approved, I agree to open an account with you for Market Support Services and to pay a Security Deposit for an amount declared and in the form approved by you within the time period stipulated by you.
6. I agree to be bound by the Conditions of Service (a copy which will be given to me), which shall take effect when I open an account with you for Market Support Services after being classified as a contestable consumer.

SIGNATURE: _____ COMPANY STAMP: _____

NAME: _____ DESIGNATION: _____

DATE: _____

* Note : (a) You shall be classified as a contestable consumer from such date as may be notified by SP Services Ltd and approved by the Authority.
(b) This form should reach SP Services Ltd at least 12 business days before the Requested Date of contestability

SP Services Ltd
111 Somerset Road #06-05 Singapore Power Building Singapore 238164
Tel : 1800- 2338000 Website: www.mssl.com.sg Email: aboutmssl@spower.com.sg Fax: 6820 6800

Updated 15 April 2005

SP SERVICES
A member of Singapore Power Group

APPLICATION TO OPEN A MARKET SUPPORT SERVICES ACCOUNT

MSSL A/C No.	

(For Official Use)

Name of Consumer (company): _____ ("the Consumer") Company Registration No: _____

Official Premises Address where supply is required : _____

_____ ("the Premises")

Mailing Address: (if different from the Premises) _____

_____ Fax No: _____

Contact Person: _____ Contact Tel: _____ E-mail: _____

* Requested Date of Account Activation: _____
(must be at least 12 business days from date of application)

☐ Tick where appropriate

1. I wish to apply to open an account for Market Support Services ("MSS") for the above premises ("the Premises").

2. I confirm that I am a contestable consumer and have been notified by Energy Market Authority/SP Services through the Contestability Notice dated _____. (Please attach the Contestability Notice).

3. ☐ I will make arrangement to turn on the supply of electricity to the electrical installation of my premises on _____ (date), and I will send a confirmation to notify you of any changes.

   ☐ I confirm that I intend to move-in/take-over a contestable premises currently taking high tension supply.

   Contract Capacity : _____

   Contract Expiry date : _____

   I agree that my move-in/take-over of the premises is subject to the corresponding move-out of the existing consumer of the premises and I agree that SP Services 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, provided always that such delay, postponement or cancellation is not caused by SP Services or is within its reasonable control.

   I agree that I will be billed from 00:00hrs on the date of move in/take over and up to 23:59hrs on the date I move out of the Premises.

4. I intend to purchase my electricity supply from :

   ☐ An Electricity Retailer
   Please specify Retailer Name : _____ Billing Option: * Split / Consolidated (delete appropriately)

   ☐ Indirectly from the wholesale electricity market through SP Services Ltd

   ☐ Directly from the wholesale electricity market

5. I agree to pay a Security Deposit for an amount declared and in the form approved by you within the time period stipulated by you or before the supply at the premises has been turned on, whichever is earlier.

6. I agree to be bound by the Conditions of Service (a copy of which has been given to me) which shall take effect when this application is approved.

SIGNATURE: _____ COMPANY STAMP: _____

NAME: _____ DESIGNATION: _____

DATE: _____

SP Services Ltd
111 Somerset Road #06-05 Singapore Power Building Singapore 238164
Tel : 1800- 2338000 Website: www.mssl.com.sg Email: aboutmssl@spower.com.sg Fax: 6820 6800

Updated 15 April 2005

FORM CS/5
APPLICATION FOR INSPECTION OF ELECTRICAL INSTALLATION

To: SP Services Ltd
111Somerset Road #06-05
Singapore Power Building
Singapore 238164

For official use

APPLICATION NO:

PART I

I/We,
#Mr/Mrs/Miss/Messrs _____
(# Delete as appropriate). (name of applicant/company)

Utility Account No :

_____

request you to provide an electrical installation inspection and install ☐ kWh meter.
(Please tick if meter is required)

Details of my/our application are as follows:

(Please fill in the appropriate box below)

An application for electricity supply service has been submitted earlier and approved.

SP Services Application Reference No is: _____

OR

This is a new application with details as given in Part II by my/our Licensed Electrical Worker undertaking the project.
(Form CS/3 or CS/3H shall be attached for supply connection from landlord's or HDB's electrical installation.)

My/Our particulars:

NRIC number/Company ROC number: _____

Name of Authorised Person for Company: _____
(if applicable)

Forwarding Address: _____

_____ Postal Code: _____

Tel: _____ Fax : _____ Mobile phone: _____ Pager: _____

Email: _____

_____ _____

Signature of Applicant Date

PART II **(INSTALLATION DETAILS - To be completed by Licensed Electrical Worker if there is no application submitted earlier)**

Project Description: _____

Site Address: _____ Postal Code: _____

Type of Application (Please tick the appropriate boxes)

☐ New Supply ☐ Temporary Supply ☐ Upgrading of Supply ☐ Downgrading of Supply

☐ Extension ☐ Rewiring ☐ Replacement of switchboard/switchgear

☐ Amalgamation ☐ Shifting of Meter

☐ Conversion to Master/Sub Metering Scheme

☐ Other Services (Please specify) .....

Supply Connection from: ☐ SP PowerAssets installation/mains ☐ Landlord's installation (Form CS/3 is to be submitted) ☐ HDB's installation (HDB's endorsement is required) ☐ Public Lighting Network (Form CS/3 PL is to be submitted)

Type of Development: ☐ Industrial ☐ Commercial ☐ Residential ☐ Others

Metering Scheme: *Master / Sub / Normal *(Delete as appropriate)

Type of Business (Brief Description): _____

Total supply capacity (including existing requirement, if any)

☐ 30/40A# 230V single-phase ☐ 60A/80A/100A# 230V single-phase ☐ 30A/60A# 400V three-phase ☐ .....kVA at 400V three-phase
(# Delete as appropriate)

PART III DETAILS OF PROPOSED INSTALLATION OR EXTENSION. For HDB residential unit, erasure/amendment to any of the "QTY" figure below is NOT acceptable.)

	QTY		QTY		QTY		QTY
5A socket outlets		20A SPN ISO		Cooker Point		Oven Point	
13A socket outlets		20A TPN ISO		Connection Unit		Shaver Unit	
15A socket outlets		30/32A SPN ISO		Fan Point		Urinal Sensor Point	
10A SPN/DP ISO		30/32A TPN ISO		Hair Dryer Point		Washing Machine	
10A TPN ISO		60A SPN/DP ISO		Hand Dryer Point		Water Heater Points	
15/16A SPN ISO		60A TPN ISO		Lamp points		Other Equipment	
15/16A TPN ISO		Cooker hob point		Neon Sign			

(A completed Certificate of Compliance is required to be submitted if a new meter is required.)

Name of LEW : _____ LEW Licence No. : _____

_____
Signature of Licensed Electrical Worker Date : _____

Forwarding address (as registered with EMA): _____ Fax No.: _____

_____ Contact No.: _____

Postal Code: _____

_____

PART IV Endorsement by HDB (applicable for HDB residential premises)

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 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.

_____
Name/designation/signature of authorised person
for and on behalf of Housing & Development Board Date: _____

APPLICATION FORM
FOR CONNECTION TO THE
TRANSMISSION SYSTEM

For official use only	
Application Number. :	
Date Received :	

To : SP Services Ltd
111 Somerset Road #06-01
Singapore Power Building
Singapore 238164

PART 1 APPLICANT'S DETAILS

Sub-metered consumers (tenants) are not eligible for this application. All tenants in multi-metered premises are required to obtain supply from their landlord/MCST or HDB for HDB premises.

I request you to provide/upgrade the load connection service to my premises as given in Part II by my Licensed Electrical Worker undertaking the project

Name of Company/Applicant *: _____ ROC/NRIC No: _____

Name of Authorised Person & Designation * : _____

Forwarding Address : _____ Postal Code : Singapore _____

Tel : _____ Fax : _____ Mobile Phone : _____ Pager _____

Email : _____ Signature of Applicant : _____ Date : _____

PART 2 INSTALLATION DETAILS – (To be completed by LEW)

Project Description : _____

Site Address : _____ Postal Code : Singapore _____

Utility Account No (existing) : _____ Existing Approved Load : _____ kVA/kW *

Any previous Consultation? Yes / No * If Yes, please provide Consultation No : _____

TYPE OF CONNECTION (Please tick appropriate boxes)

☐ New Connection ☐ Temporary Connection ☐ Replacement of switchboard (no load upgrading) [same / different switchroom *]

☐ Upgrading the existing connection point ☐ Change of intake connection point (involving new switchroom) ☐ Re-energise existing connection

☐ Others (please specify) : _____

TYPE OF DEVELOPMENT (Please tick appropriate boxes)

☐ Industrial ☐ Commercial ☐ Residential

☐ Others (Please specify) : _____

Type of Business Activity (Brief Description) : _____ Voltage Dip Sensitive? Yes / No *

LOAD REQUIREMENT (One intake connection point per premises)

Total load requirement (to include existing load, if any)

☐ 30A/60A/100A * 230V single-phase ☐ 30A/60A/100A * 400V three-phase ☐ _____ kVA at 400V three-phase

☐ 22kV (min 1,700kW for 2 HV services, min 12,751 kW for 4 HV services) ☐ 66kV/230kV * (min 25.5MW for 66kV,min 85MW for 230kV)

Contracted Capacity of _____ kW at _____ kV via _____ service cable(s).

Initial Contracted Capacity of _____kW (shall not be less than ¼ of the Contracted Capacity) for _____ months (not exceeding 12 months)

Total Load Requirement: _____ kW **(for multi-metered premises only)**

Landlord's Contracted Capacity (minimum 1700kW) : _____ kW (for multi-metered premises only)

Initial Landlord's Contracted Capacity : _____ kW (shall not be less than ¼ of the Landlord's Contracted Capacity)

For multi-tenanted installation with the exception of HDB residential installation, the metering scheme shall be designed as Master/Sub-metering scheme.

Target date of Energisation : _____/_____/_____ **Estimated ultimate load** _____ kVA/kW *
(Please refer to expected lead time in handbook)

TYPE OF PREMISES (Please tick appropriate box)

☐ Single user premises ☐ Multi-tenanted Master-sub premises ☐ Multi-tenanted premises

TYPE OF METERING SCHEME

Please specify the metering scheme : Master / Normal*

Any change in metering scheme? Yes / No*. If yes, please specify _____.

TO BE COMPLETED FOR INSTALLATION EXCEEDING 45kVA

Total Land Area : _____ m^2 Gross Floor Area : _____ m^2

PLANS AND DETAILS (Mandatory)

☐ 2 copies of Architect's site and location plan
☐ 2 copies of plan showing proposed customer's intake connection point and the existing intake point (if applicable)
☐ Details of the type, floor area & designed load of individual premises for multi-metered premises

PART 3 LEW DETAILS

I confirm that the above information is correct and agree to advise SP Services should there be subsequent changes.

Name of Authorised LEW : _____ Licence Number : _____

Registered Forwarding Address : _____

_____ Postal Code : Singapore _____

Tel : _____ Fax : _____ Mobile Phone : _____ Pager : _____

Email : _____

Signature of Authorised LEW _____ Date _____

* Delete where not applicable

■ **Appendix 21**

CERTIFICATE OF READINESS
FOR THE ENERGIZATION OF SERVICE CONNECTION

Name of Customer Installation: _____

Address: _____

Customer Installation License 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 (License No: _____) is 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 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 service 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.

* Delete where applicable

** To indicate NA where protection scheme is not applicable

e. all necessary meters have been installed.

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 energized are removed.

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

Name & Signature of LEW requesting for energisation of supply line	License No.	Date

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: _____ Rating: _____ kVA
☐ Standby generator.
No. of generator: _____ 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)

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

To: SP Services Ltd
111 Somerset Road #06-05
Singapore Power Building
Singapore 238164

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

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

To: SP Services Ltd
111 Somerset Road #06-05
Singapore Power Building
Singapore 238164

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 LEW

Licence No.: _____

Name: _____ Tel No.: _____

Address: _____

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

300403

FORM CS/6

REQUEST FROM CONTESTABLE CUSTOMER FOR INSTALLATION OF ELECTRICITY KWH METER

For Official Use
Serial No. : _____
CMS Installation no. : _____

PART I : Customer Details – To be completed by LEW

To Meter Section, SP PowerGrid Ltd through SP Services Ltd

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

NRIC/Company ROC:_____ Telephone No. : _____ Pager/Handphone No. : _____

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.)

Telephone No(s)/point(s) : _____
(For contestable customer, you are required to install telephone point(s) adjacent to the meter panel and provide the telephone no. before applying for the installation of the meters)

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

Name of LEW : _____ LEW License no. : _____

Telephone no. : _____ Handphone no. : _____ Facsimile 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 Ltd

To Meter Section, SP PowerGrid Ltd – Application is in order. Please arrange to install the revenue meters.

Name : _____ Signature: _____ Date : _____

PART III – To be completed by Meter Section SP PowerGrid Ltd

To Supply Application, SP Services Ltd – Meters had been installed on _____. Details in CMS.

Name : _____ Signature: _____ Date : _____

PART IV (For official use)

To Meter Data Management Branch, SP Services Ltd Facsimile no.:6737 2472

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

PART V (For official use)

To Client Relation Branch (MSSL Section), SP Services Ltd

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

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

Form CS/7

REQUEST FOR INSTALLATION OF ELECTRICITY KWH METER (FOR LOAD EXCEEDING 45KVA)

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

PART I Customer Details – To be completed by LEW

To Meter Section, SP PowerGrid Ltd through SP Services Ltd

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

NRIC/Company ROC: _____ Name of Contact Person for Company: _____

Telephone No. : _____ Pager/Handphone No. : _____

Site Address for Installation of Meter: _____

Detail location of supply intake point: _____

A/c no.: _____ Master A/c no.: _____

Source of supply : ☐ SP PowerAssets ☐ Landlord ☐ HDB

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

Supply Capacity : _____ kVA/kW at _____ Volts Type of Business: _____
(Form CS/3 or CS3/H and COC 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 : _____

Name of LEW : _____ LEW Licence no. : _____

I hereby confirm that the electrical installations and meter wiring were checked and certified correct.

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

Telephone no. : _____ Handphone no. : _____ Facsimile no. : _____

Signature : _____ Date : _____

PART II - To be completed by SP Services Ltd

To Meter Section, SP PowerGrid Ltd -- Application is in order. Please arrange to install the revenue meters.

Name : _____ Signature : _____ Date : _____

PART III -To be completed by Meter Section SP PowerGrid Ltd

To Supply Application, SP Services Ltd - Meters had been installed on _____. Details in CMS.

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 _____

CONSULTATION FORM
FOR CONNECTION TO POWERGRID
TRANSMISSION SYSTEM

For official use only	
Consultation Number. :	
Date Received :	

To : SP PowerAssets Ltd
111 Somerset Road #08-05
Singapore Power Building
Singapore 238164

CONSULTATION DETAILS

Sub-metered consumers (tenants) are not eligible for this application. All tenants in multi-metered premises are required to obtain supply from their landlord/MCST or HDB for HDB premises.

Reference to the consultation, I hereby enclose one copy of site & location plans including proposed customer's intake connection point Drawing No. _____ for your advice on connection requirements.

SITE DETAILS

Connection Applicant/Developer* : _____

Project Description : _____

Site Location – Lot & Mk No : _____

Street Name : _____ Blk/Unit No : _____

LOAD REQUIREMENT (One intake connection point per premises)

☐ New Connection ☐ Upgrading the existing service cable ☐ Temporary Connection

☐ Change of intake connection point ☐ Other Services (Please specify): _____

Type of Premises : Industrial/Commercial/Residential/Others* _____ Gross Floor Area(m^2): _____

Type of Business Activity (for non-residential premise only) : _____ Voltage Sensitive? Yes / No *

Existing Utility A/C No.(if any) : _____

Existing Approved Load (kVA) : _____ at 230V/400V/22kV/66kV/230kV*

Load Requirement (kVA) : _____ at 230V/400V/22kV/66kV/230kV*

Target date of Energisation : _____/_____/_____ **Previous consultation No. (if any) :** _____

Additional information : _____

_____

LEW DETAILS

I confirm that the above information is correct and agree to advise PowerGrid should there be subsequent changes.

Name of Authorised LEW : _____ Licence Number: _____

Company Forwarding Address : _____

_____ Postal Code : Singapore _____

Tel : _____ Fax : _____ Mobile Phone : _____ Pager : _____

Email : _____

Signature of Authorised LEW _____ Date _____

* Delete where not applicable

STATEMENT OF TURN ON OF ELECTRICITY
[Regulation 5(4) of the Electricity (Electrical Installations) Regulations 2002]

ELECTRICITY SUPPLY TO _____
(Name of Applicant)

AT _____
(Address of Installation)

_____

I acknowledge that the above-mentioned electrical installation has been checked by the market support services licensee. I have energised the supply line to the installation on _____ *(date)* at _____ *(time)*.

Name & Signature of person responsible for energisation of supply line	Licence No.	Date

I acknowledge that the supply line has been energised on the date and time indicated above.

Name & Signature of Applicant or his representatives	NRIC / Passport No.	Date

This form is applicable to electrical installation not exceeding 45 kVA, exempted from licensing and supplied from landlord's switchboard.

STATEMENT OF TURN ON OF ELECTRICITY
[Regulation 5(4) of the Electricity (Electrical Installations) Regulations 2002]

ELECTRICITY SUPPLY TO _____
(Name of Applicant)

AT _____
(Address of Installation)

_____

ELECTRICAL INSTALLATION LICENCE NO* : _____

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 energised on _____ *(date)* at _____ *(time)*.

Name & Signature of person responsible for energisation of supply line	Licence No.	Date

I acknowledge that the supply line has been energised on the date and time indicated above.

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

I acknowledge that the supply line has been energised 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 energised on the date and time indicated above.

Name & Signature of Applicant	NRIC / Passport No.	Date

*** Applicable to licensed electrical installation only.**

COMPLETION CERTIFICATE FOR MODIFICATION OF ELECTRICAL INSTALLATION

To: SP Services Ltd
111 Somerset Rd #06-05
Singapore Power Building
Singapore 238164

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

FORM E

CERTIFICATE OF FITNESS OF RESIDENTIAL UNIT

Application No. _____

To: Manager, Installation Branch
SP Services Ltd
111 Somerset Road #06-05
Singapore Power Building
Singapore 238164

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.

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 electrical installation work*

_____
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 F CERTIFICATION OF BULK SHIFTING/REPLACEMENT OF METERBOARDS IN MULTI-TENANTED BUILDINGS

To: Manager, Installation Branch
SP Services Ltd
111 Somerset Road #06-05
Singapore Power Building
Singapore 238164

Application No.: _____

Project Description: _____

_____

At Block No.: _____ Street Name: _____ Postal Code: _____

S/No.	Floor	Unit No	Meter No	Meter Reading After Meterboard Replacement	* Meter Rotation Checked	* Polarity Check	Date of Reading	Sample Checked (For Office Use)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

** tick as in order*

I hereby certify that I have supervised the work on the above electrical installation on bulk shifting / replacement of meterboards. I confirm that the electricity meter rotation, unit number labelling and meter wiring are in order. I also confirm that the supply polarity at the tenant's distribution board is in order.

_____ _____ _____

Name & Signature of Licensed Electrical Worker Licence No. Date

TOPIC 3: COMMON NON-COMPLIANCE IN ELECTRICAL INSTALLATIONS

1 Introduction

In NEM, EMA has re-categorized the common non-compliances into three groups

Category 1 – Serious
Category 2 – Minor and
Category 3 – Operational

EMA is monitoring the common non-compliances in category 1 & 2 only. A proper penalty will be given to these two categories. For category 3, no penalty is imposed by EMA. However, SP Services or SP PowerGrid may not allow the supply to be turned-on.

No electricity supply shall be taken from a supply line until every electrical installation connected to such supply line has been inspected and certified fit by a licensed electrical worker; and where the installation is exempted from licensing, it shall be checked by the Market Support Services Licensee.

If the inspection failed, LEW is to check the installation thoroughly, rectify all defects and apply for another appointment. A fee per account is chargeable for each subsequent inspection.

2 Non-Compliances of SS CP 5:1998 and other Relevant Regulations

The non-compliances are grouped into three separate categories depending upon the severity of the defect

2.1 Category 1

Non-compliances that pose immediate safety hazards or are of a serious nature

1001 No protection against direct contact for live conductors.
1002 Wrong polarity / phase sequence.
1003 Using single-pole circuit breaker for neutral conductor.
1004 Using unacceptable or deceptive method for earthing system / earthing system not provided.
1005 No provision of residual current circuit breaker (RCCB) of 30 mA sensitivity for domestic SSO / lighting circuits.
1006 No provision of residual current circuit breaker (RCCB) of 30 mA sensitivity for market / food stall, etc.

1007 No provision of residual current circuit breaker (RCCB) of 30 mA sensitivity for socket-outlet assembly used at construction site.
1008 No provision of residual current circuit breaker (RCCB) of 30 mA sensitivity for general-purpose SSO circuit outdoor.
1009 Neutral of generating set not effectively connected to Earth.

2.2 Category 2

Non-compliances that may pose safety hazards

General

2101 Insulation resistance value less than 0.5 MΩ for low voltage circuit.
2102 No documentation on tests carried out / incomplete test reports.
2103 Single-line drawing not provided / updated / endorsed by LEW.
2104 No provision of safety related equipment or signs such as rubber mat / fire extinguisher / danger sign / CPR chart at main intake switchboard.
2105 Improper installation of reduced voltage or SELV system.
2106 Improper installation that pose electrical safety hazards to the public. (to specify)
2107 Improper installation of generating sets.

Switchboard / DB / Control of Circuits

2201 Switchboard or distribution board not readily accessible.
2202 Circuit breaker before / after meter not of appropriate type.
2203 Circuit breaker of insufficient short circuit capacity.
2204 Improper interconnection of sources of supply.
2205 Failure to provide DP isolator / circuit breaker at meterboard or incoming of DB.
2206 Fittings or final circuits in defined area supplied from different sources of supply.
2207 Non-weatherproof distribution board located below water or drainage pipe joint or valve.
2208 Circuit breaker overrated for protection of a circuit.
2209 Additional point(s) sharing air-con or water heater final circuit.

Earthing

2301 Earthing system inadequately / improperly installed.
2302 Improper or no earth electrode inspection chamber.
2303 Earth fault loop impedance is high for TN-S system or the product of $R_a I_a$ exceeds 50 volts for TT system.

2304 Circuit protective conductor (CPC) not provided or sharing of CPC in final circuits.
2305 Earthing conductor / CPC / bonding conductor undersized.
2306 Using green & yellow colour combination wire as live conductor / wrong colour coding for protective conductor.
2307 Main equipotential bonding not provided for main water pipe, gas pipe or exposed metallic part of building structure.
2308 Exposed conductive parts not bonded to Earth.

Equipment / SSO

2401 Circuit breaker / isolator / RCCB / switch / ceiling rose / connection unit underrated.
2402 Switch or SSO in enclosed space susceptible to risk of fire or explosion.
2403 No provision of residual current circuit breaker (RCCB) for SSO in non-domestic electrical installation.
2404 Non weatherproof electrical device(s) exposed to weather or water splashing.
2405 Non weatherproof electrical equipment installed under tents in outdoor conditions.
2406 SSO installed at less than 150 mm above working surface or floor level.
2407 SSO installed on floor without mechanical protection or protection against ingress of water.
2408 Switch controlling SSO for general purpose not readily accessible.
2409 Using electrical accessory/fitting not complying standards stipulated in the code of practice CP 5 or CP 88.
2410 Socket-outlets (SSO) / switches installed inside bathroom.

Cable / Wiring

2501 Mains / sub-mains / busbar / final circuit undersized.
2502 Cables laid underground without armour or metallic sheath; non-sheathed cable installed in underground pipe.
2503 Cable installed not suitable for the environment or weather conditions.
2504 Single PVC-insulated cable installed without conduit or trunking.
2505 Wiring above false ceiling not properly installed or installed without mechanical protection.
2506 Cable in same conduit / trunking / ducting with other services.
2507 More than one final circuit in one circuit breaker way.
2508 Cable armour improperly bonded or not bonded to Earth.
2509 No provision of PVC or rubber grommet / bushing at metallic sharp edges to prevent damage of cable insulation.
2510 Electrical connections / joints not mechanically and / or electrically sound.

2511 Wiring encroached into other premises / another electrical installation.

2.3 Category 3

Non-technical issue

3001 Licensed electrical worker absent.
3002 Gate/door locked.
3003 Work incomplete.
3004 No incoming electricity supply.
3005 Meter board/meter compartment at gatepost not complying with requirements.
3006 Incorrect address.
3007 Premises not fully accessible for inspection of electrical wiring installation.
3008 Wrong type of application.
3009 No Statement of turn-on.

2.4 Abbreviations

CPC	Circuit Protective Conductor
mA	Milliampere
M-ohm	1,000,000 ohm
RCCB	Residual Current Circuit Breaker
DP	Double Poles
SSO	Switched Socket Outlet
PVC	Polyvinyl Chloride

3 Detailed Descriptions of Common Non-Compliances on Site

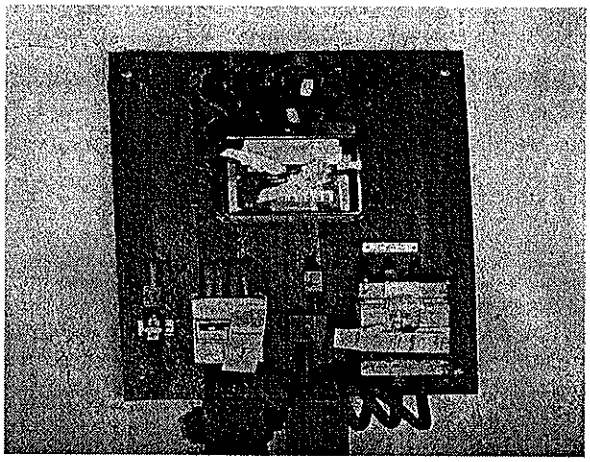
3.1 Low Insulation Resistance

Minimum value of insulation resistance

Circuit nominal voltage(V)	Test Voltage d.c.(V)	Minimum insulation Resistance (Mohm)
SELV and PELV	250	0.25
Up to including 500V with the exception of the above systems	500	0.5
Above 500	1000	1.0

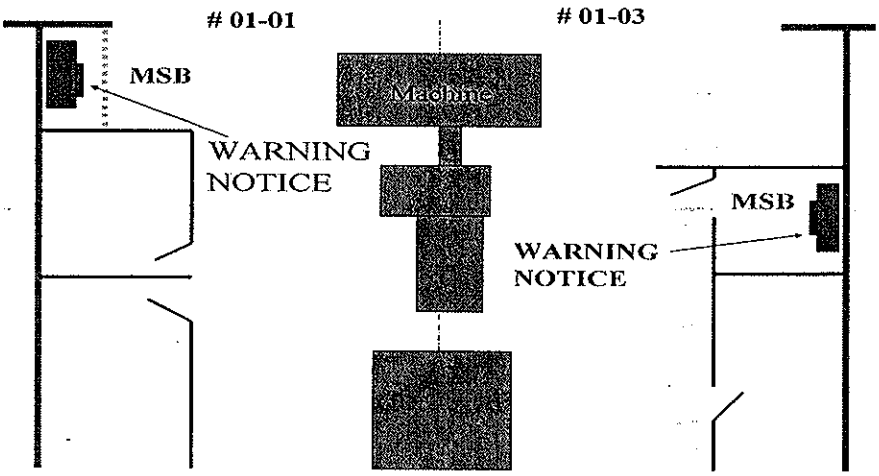
3.2 Identification of Protective Conductor without Using the Colour Combination of Green and Yellow or Using Single Colour Green

e.g. In a final Circuit, a black colour neutral cable is used as a circuit protective conductor. It is acceptable to use sleeve at both end of the cable; the sleeve shall have the combination colours of green and yellow.



3.3 Warning Notices Not Provided at the Main Linked Switches / Linked Circuit-Breaker for Installation Taking More than One Source of Supply

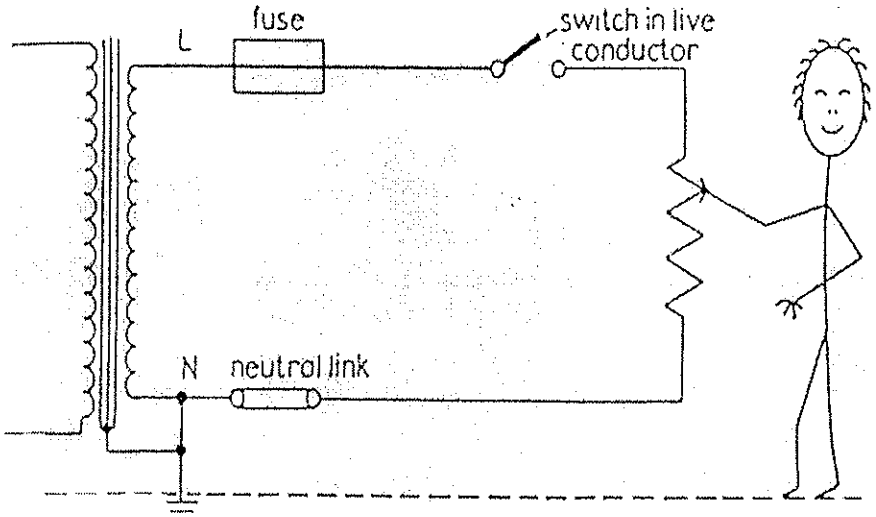
e.g. An installation has two separate main switchboards located at two different locations without the warning notices to warn any person the need to operate all the incoming circuit-breakers to achieve isolation of the installation.

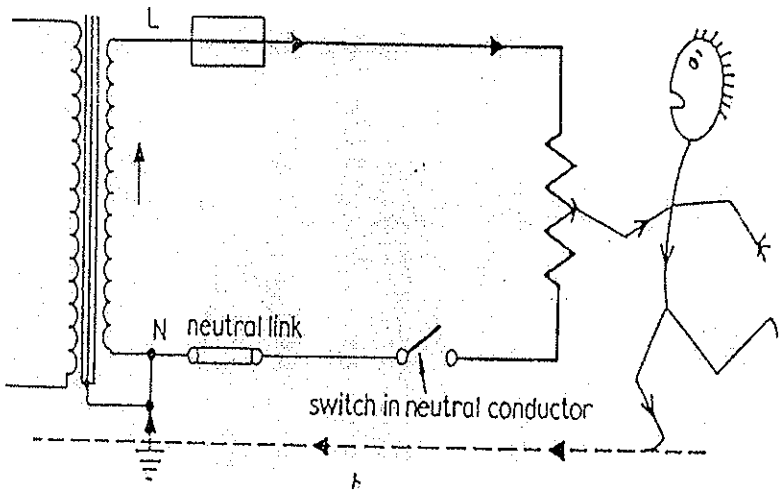


3.4 Wrong Polarity

e.g. Wrong polarity at the junction box which is used for the final connection to storage water-heater or instantaneous water-heater. The phase conductor is connected to the earth-terminal of the junction box.

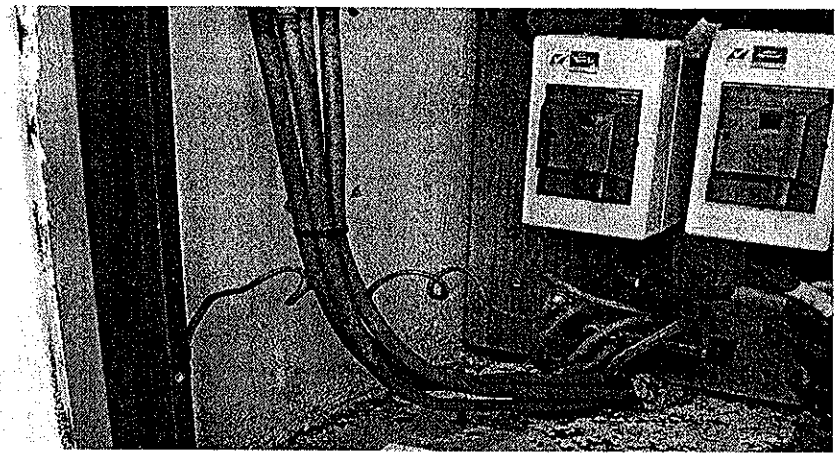
e.g. Wrong polarity at the socket-outlet such as transposition of the phase and neutral conductors or the phase conductor is connected to the earth-terminal.





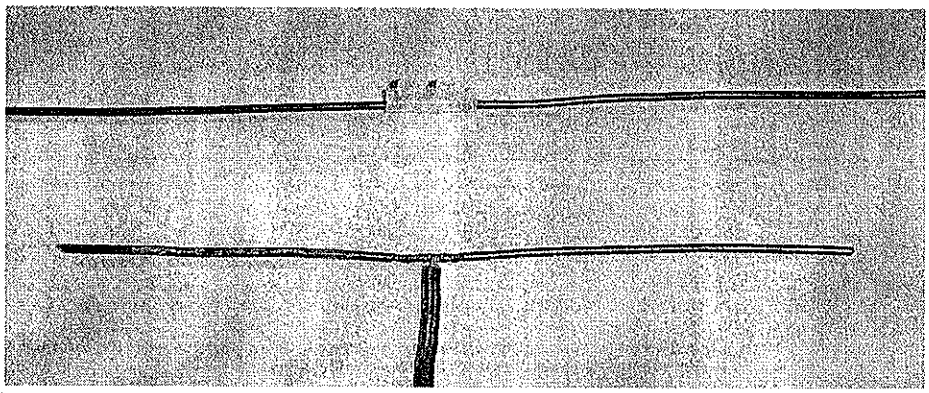
3.5 Exposed Conductive Parts Not Connected to Earth Effectively

These include the metallic enclosures of Class 1 current-using equipment, metallic cable sheaths, cable trays, trunkings and metallic conduits etc.



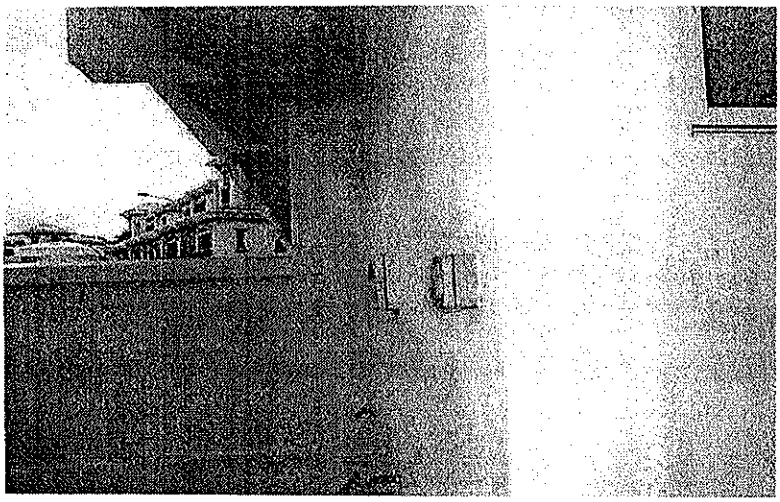
3.6 Electrical Connection / Joint Not Properly

e.g. PVC-cable is jointed to another PVC-cable by twisting the conductor together and covered the joint with PVC-tape.

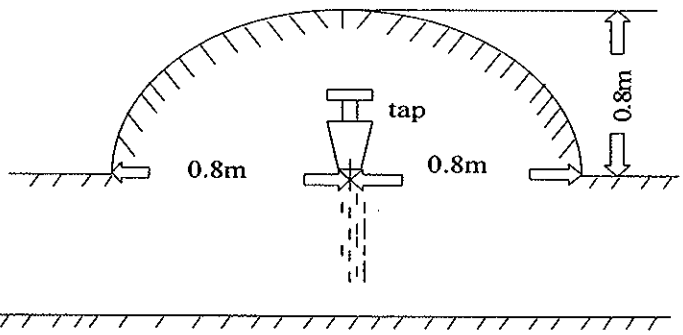


3.7 Non Weatherproof Electrical Device Exposed to Weather or Water Splashing

e.g. Wall mounted junction box or lighting fitting mounted on the wall above the bath tub. A person standing in the wet bath-tub can touch the exposed metallic part of the light fitting or junction-box. Also, water could be sprayed on these devices when using the shower.



Acceptable distance between switch/socket outlet from water tap.



Note:

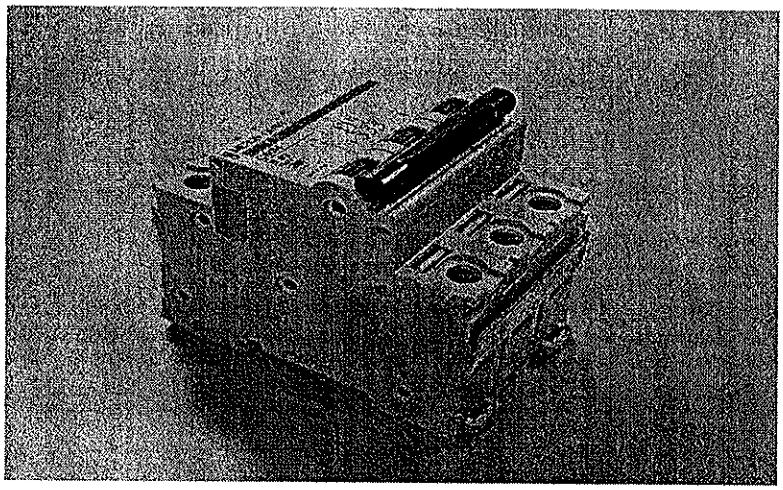
1. Switch/SSO shall be installed above the water tap source and outside the 0.8m zone to prevent water splashing.

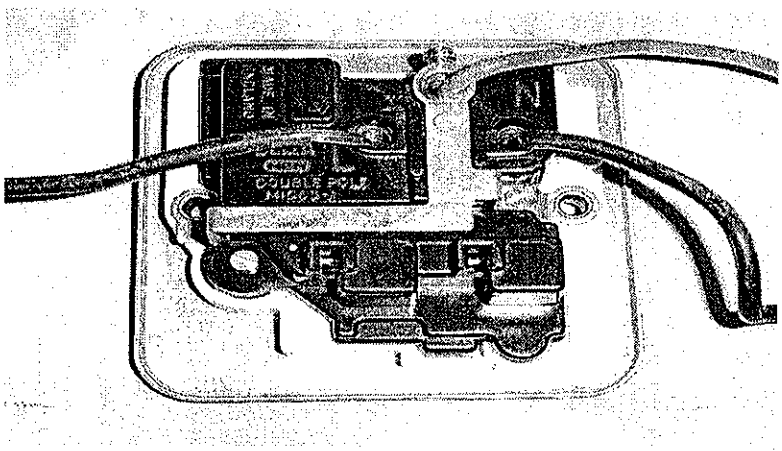
2. Switch/SSO installed above the water tap source but less than 0.8m away from it shall be provided with a splash-proof cover to protect against water splashing.

3. Switch/SSO installed below any water tap source must be of weather-proof type.

3.8 Exposed Live Parts

e.g. In high voltage discharge lighting installation, the joint of the high voltage conductor is exposed and not covered with suitable insulation. Furthermore, this joint can be touched by the person standing on the floor.

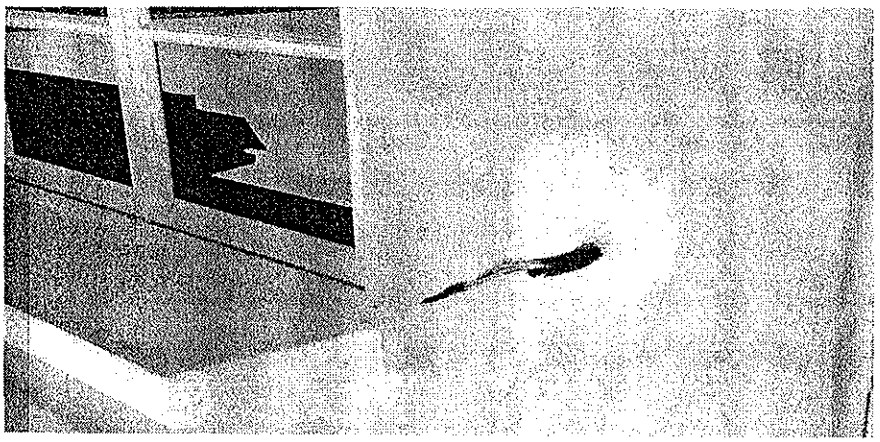




3.9 Accessory Not Provided for the Lighting Point

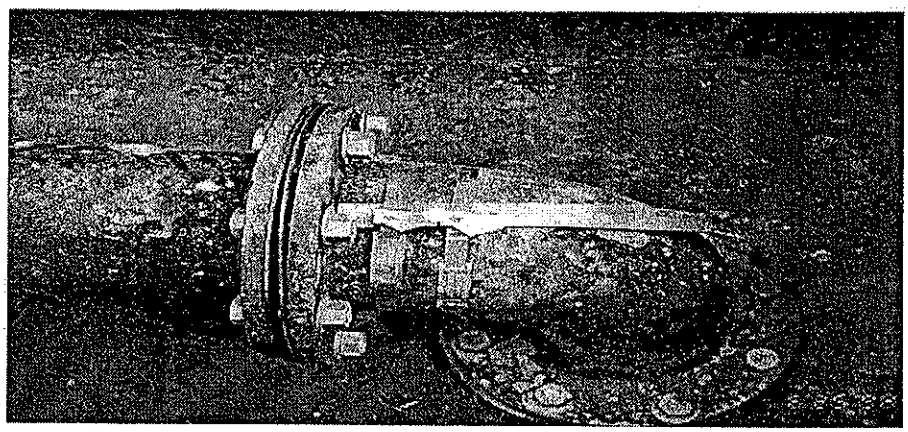
e.g. Using PVC insulated connector instead of the following accessories for the final connection of light fitting.

a) A ceiling rose to BS 67.
b) A luminaire supporting coupler to BS 6972 or BS 7001.
c) A batten lampholder to IEC 61184.
d) Screw lamp-caps and lamp-holders to SS471
e) A luminaire designed to be connected directly to the circuit wiring.
f) A suitable socket outlet.
g) A connection unit to SS 241 or BS 1363 Part 4.



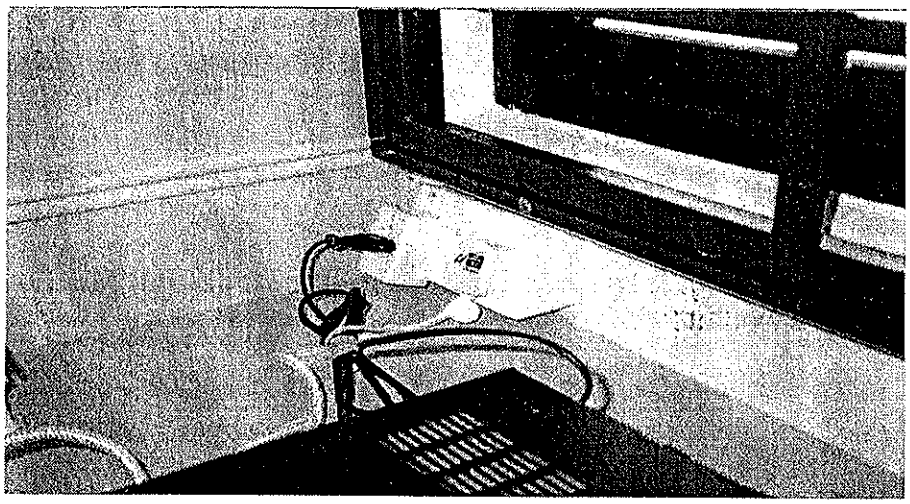
3.10 Main / Supplementary Equipotential Bonding Not Provided

Main equipotential bonding not provided for main water pipe, gas pipe or exposed metallic part of building structure.



3.11 SSO Installed at Less Than 150mm Above Floor Level or Working Surface

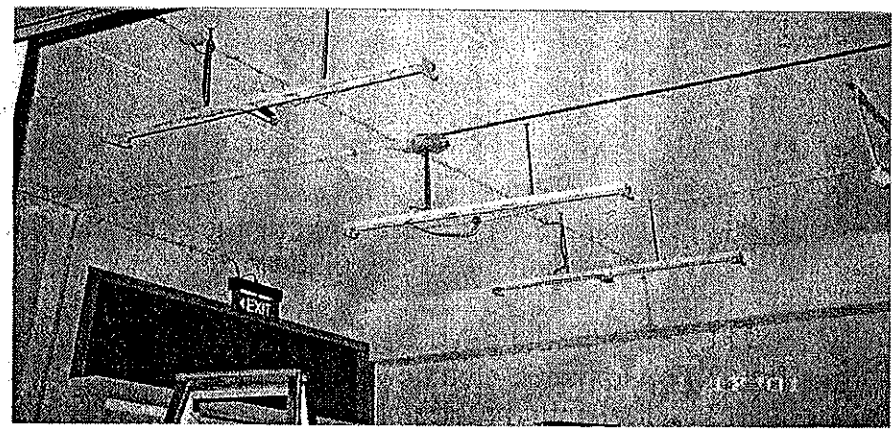
When a SSO is mounted on a wall, it is recommended that it should be mounted at a minimum height of 150mm from the floor level or 150mm above working surface. Also, when two SSO are installed side by side vertically, a distance of 150mm must be provided between the two SSO.

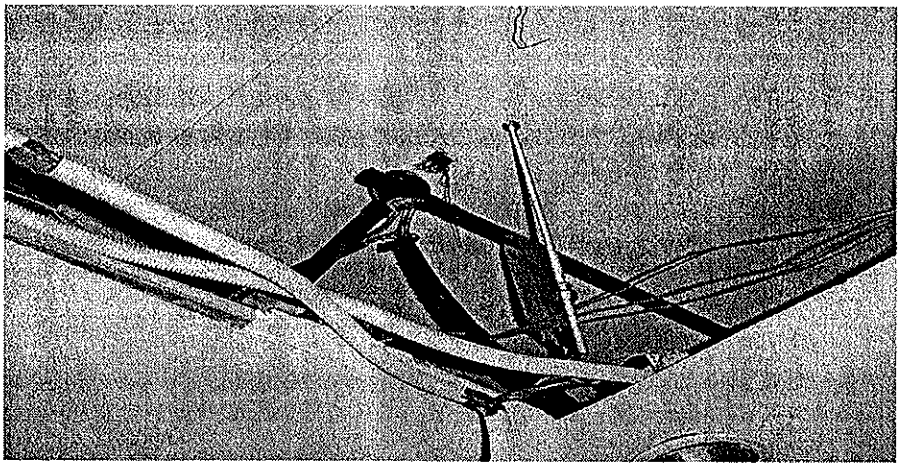


3.12 Wiring Above False Ceiling Not Properly Installed or Installed Without Mechanical Protection

e.g. Cable is laid on the false ceiling or,

e.g. Cable is laid in the conduit and hung in the air between two walls across the room.





3.13 Circuit Breaker Overrated - Does Not Afford Protection

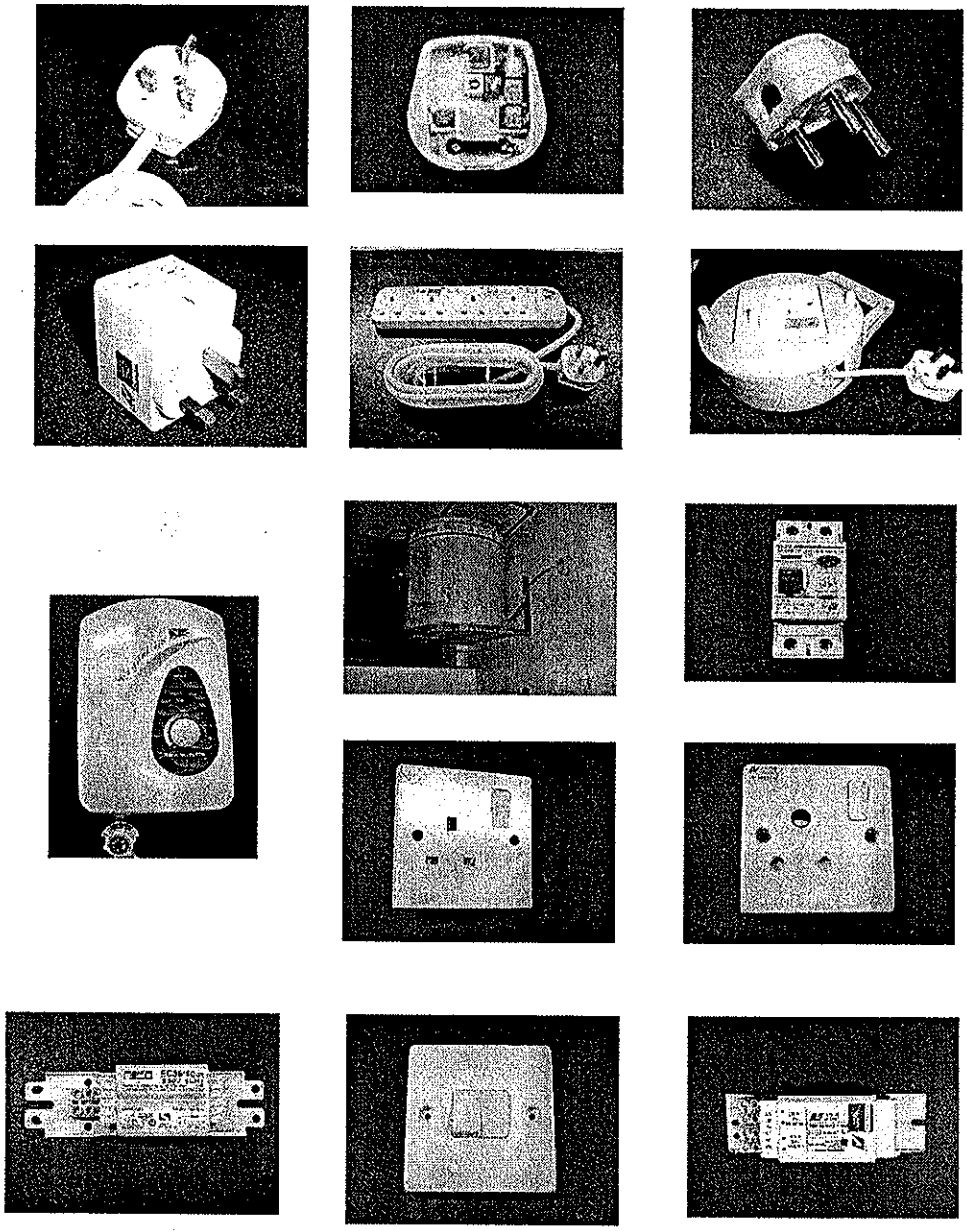
e.g. A lighting circuit is protected by a 15A MCB but the light holder is rated at 2A.

3.14 Accessory Used without the Registration/Approval from Spring Singapore, Consumer Product Safety Department

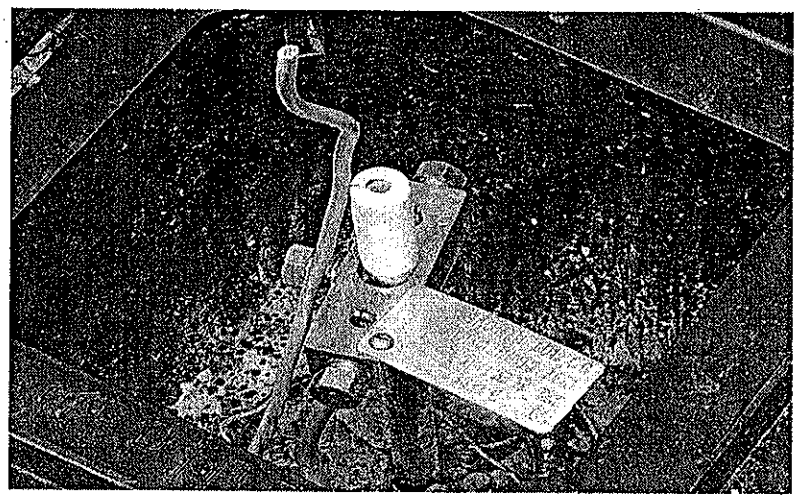
- 4-gang lighting switch modified to 1 dimmer control and 3 lighting switch.
- Transformer for downlight not approved from Spring Singapore, Consumer Product Safety Department.

Following 14 items are to be Registered/Approved from Spring Singapore, Consumer Product Safety Department before use.

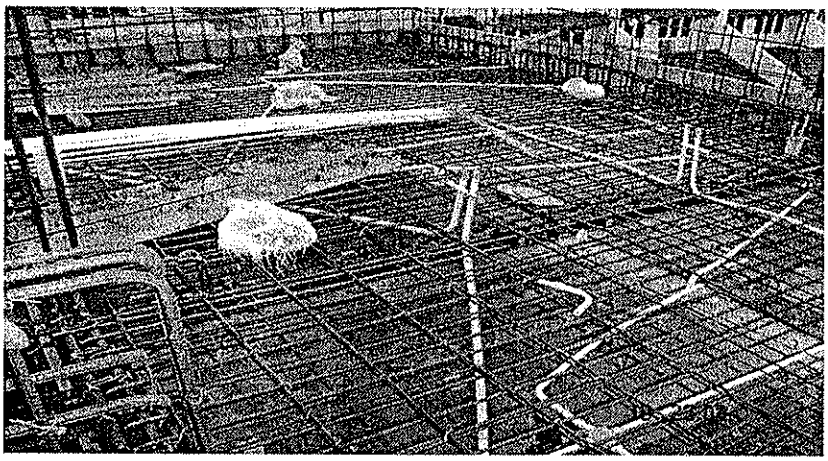
1. 3-pin rectangular type 13-Amp plugs
2. Fuses (less than or equal to 13-Amp) for use in plugs
3. 3-pin round type 15-Amp plugs
4. Multi-way adaptors
5. 3-pin portable socket-outlets
6. Portable cable reels
7. Instantaneous electric water heaters
8. Mains pressure electric storage water heaters
9. Residual current circuit breakers
10. 3-pin 13-amp socket outlets
11. 3-pin round type 15-Amp socket outlets
12. Domestic electric wall switches
13. Ballasts for tubular fluorescent lamps
14. Isolating transformers for downlight fittings



3.15 CPC, earthing conductor or bonding conductor undersized.



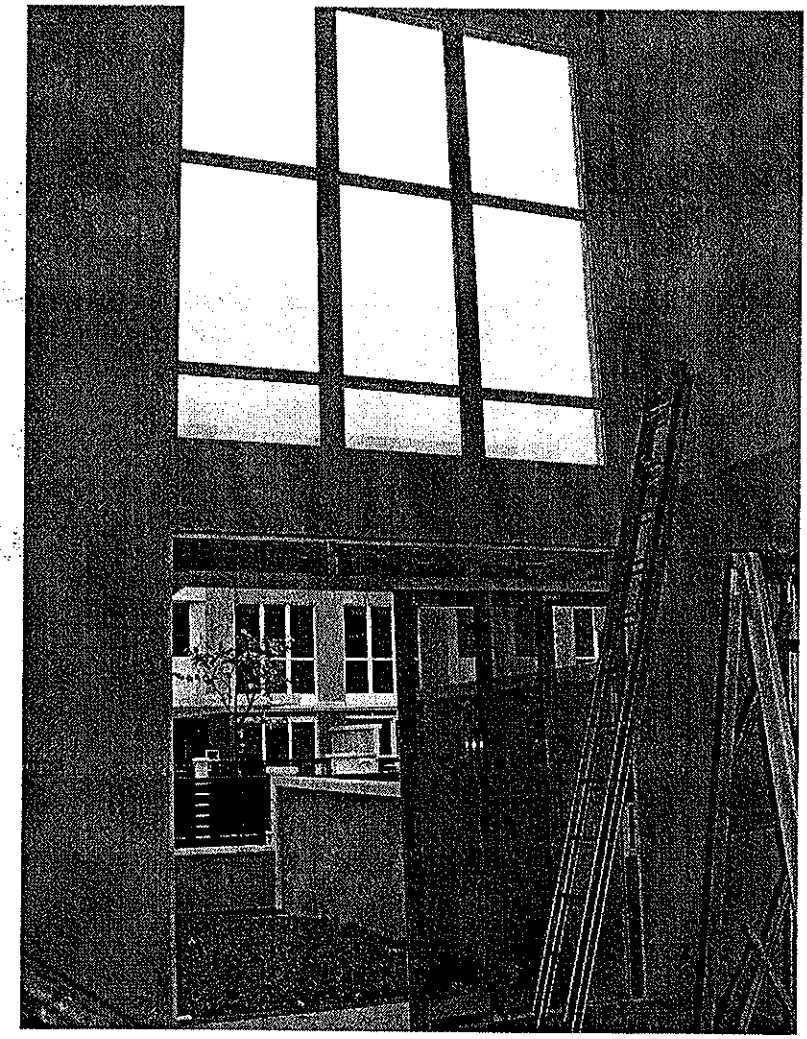
3.16 Cable laid underground without armour or metallic sheath; non-sheathed cable installed in underground pipe.



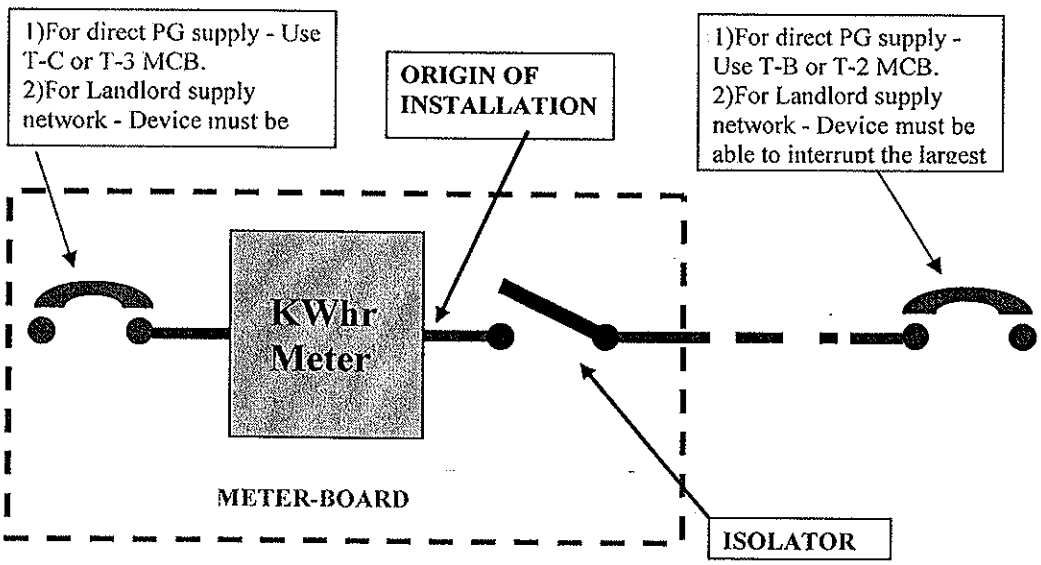
3.17 Single PVC insulated cable installed without conduit or trunking.



3.18 SSO for general purpose installed above 1.8m.



3.19 Wrong sequence of control at meter board

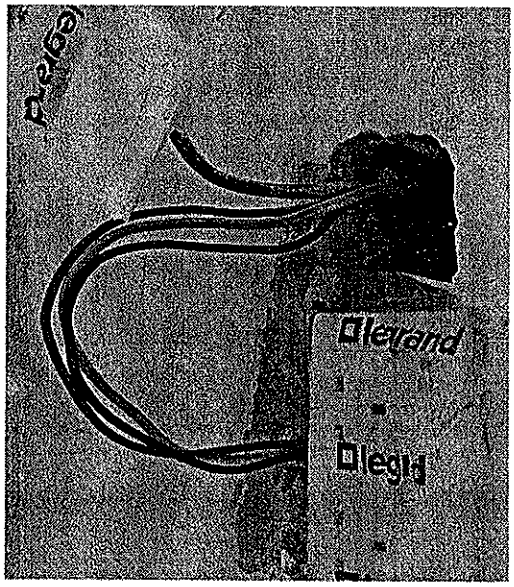


3.20 Meter board/meter compartment at gatepost not complying with requirements (SP PowerGrid Requirement)

Please refer to SP PowerGrid's "Application for Electricity Supply" handbook for detailed requirements

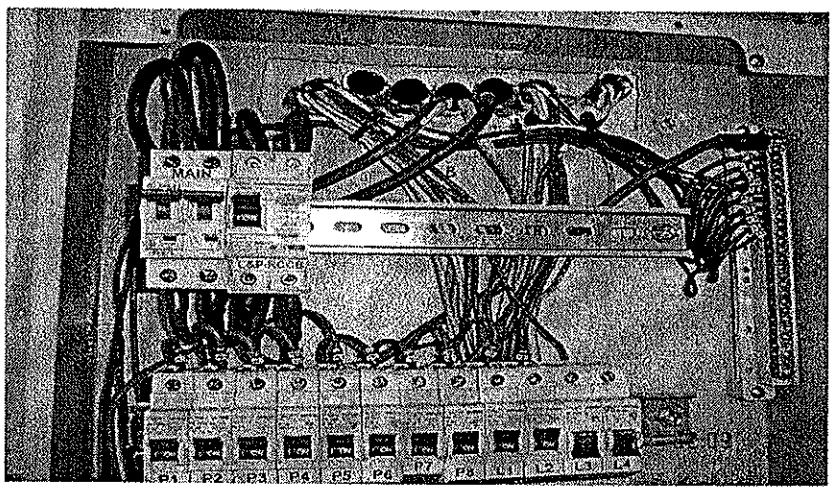
3.21 Cable in same conduit / trunking / duct with other services

Sharing of power cables with telephone and SCV cables in the same conduit.



3.22 Wiring encroaching into other premises/electrical installation

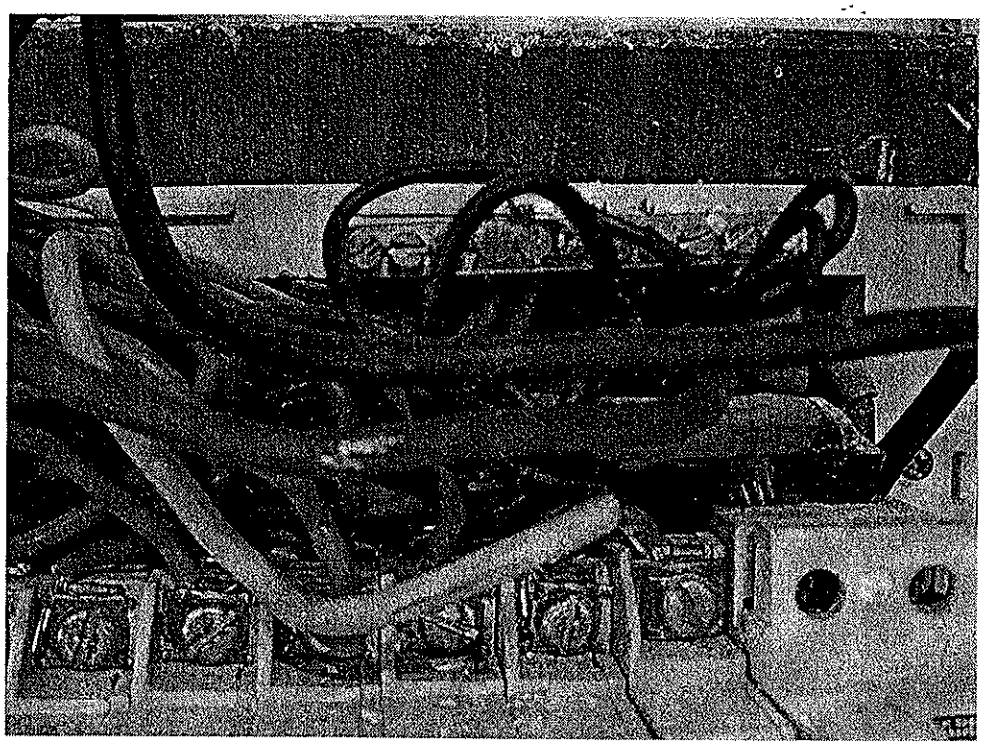
3.23 No provision of PVC or rubber grommet/bushing at metallic sharp edges to prevent damage of cable insulation



3.24 Cable armour improperly bonded or not bonded to earth



3.25 Improper Installations



TOPIC 4 : PROCEDURES FOR FIRST ENERGISATION TO NON-DOMESTIC CONSUMERS' ELECTRICAL INSTALLATIONS EXCEEDING 45KVA

1 Prior to Energisation

1.1 Contestable Consumers

- 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, and an Agreement offered after the substation's plans are endorsed.

1.2 Non-Contestable Consumers

- 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 and conditions with respect to the distribution service connection, is offered after the substation's plans are endorsed.

1.3 Obtain Licence for Electrical Installation (EI) from EMA

1.4 Open Account with Market Support Services Licensee (MSSL)

1.5 Pay Security Deposit

2 Roles of LEW

2.1 Supply Capacity > 45 kVA Up to 22 kV (Directly connected Consumers)

- To supervise and ensure that the electrical set up is in accordance with the relevant Codes of Practice (CP) and Regulations
- Ensure equipment tested (inclusive of Protection System) and Safety Inspection carried out
- Arrange for meter fixing and testing by Meters Section

- Submit CoC (*Form 4.1*) when requesting MSSL for an appointment of Energisation

2.1.1 <u>On the day of Energisation</u>

- Submit CoR (*Form 4.2*) to SP PowerGrid's (SPPG) Project Officer
- Perform Interlocking Tests on Incoming Circuit Breaker (CB)
- Perform Tripping Tests on Incoming CB

2.1.2 <u>Immediately after Energisation</u>

- Phasing of Incoming Supplies
- Acknowledge on the Statement of Turn-on of Electricity (*Form 4.3*)

2.2 <u>Supply Voltage at 66 kV and above</u>

- To supervise and ensure that the electrical set up is in accordance with the relevant CP and Regulations
- Ensure equipment tested and Safety Inspection carried out
- Joint preparation of Switching Procedures with SPPG for Power System Operator (PSO)'s approval
- Perform Pre-Commissioning Tests on Protection System
- Arrange for meter fixing and testing by Meters Section
- Submit CoC *(Form 4.1)* when requesting SPPG's Project Officer for an appointment of Energisation

2.2.1 <u>On the day of Energisation</u>

- Submit CoR (*Form 4.2*) to SPPG's Project Officer
- Perform PSO's approved Switching Procedures with SPPG

2.2.2 <u>Immediately after Energisation</u>

- Acknowledge on the Statement of Turn-on of Electricity (*Form 4.3*)

Form 4.1

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: _____ Rating: _____ kVA
- ☐ Standby generator.
  No. of generator: _____ 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)

Form 4.2

CERTIFICATE OF READINESS
FOR THE ENERGIZATION OF SERVICE CONNECTION

Name of Customer Installation: _____

Address: _____

Customer Installation License 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 (License No: _____) is 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 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 service 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.

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

Form 4.2

CERTIFICATE OF READINESS
FOR THE ENERGISATION OF SERVICE CONNECTION

e. all necessary meters have been installed.

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 energized are removed.

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

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

Form 4.3

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 energised on

_____ *(date)* at _____ *(time)*.

Name & Signature of SP PowerGrid officer SP PowerGrid Ltd as agent for and on behalf of SP PowerAssets Ltd	NRIC No.	Date

I acknowledge that the supply line has been energised on the date and time indicated above.

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

I acknowledge that the supply line has been energised 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 energised on the date and time as indicated above.

Name & Signature of Applicant or his representative	NRIC / Passport No.	Date

*** Not Applicable for an electrical installation that is exempted from licensing**

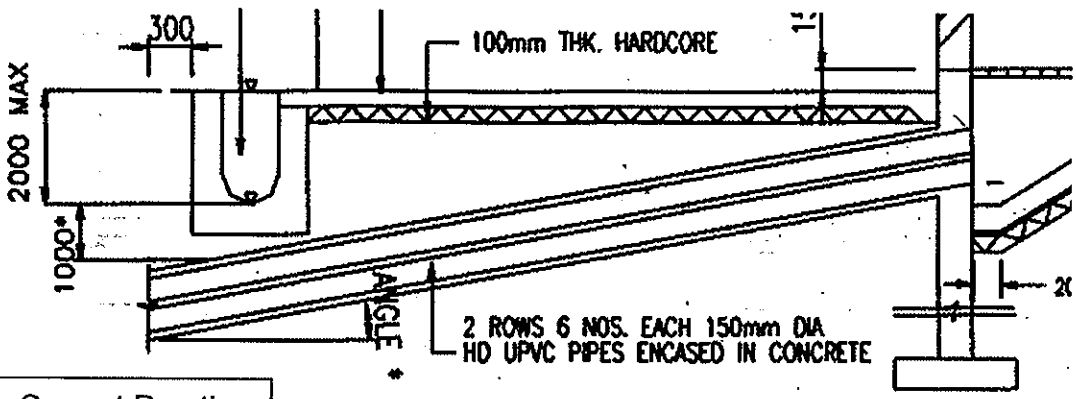
Original Copy – SP PowerGrid Ltd
Pink Copy – LEW (Requesting)
Yellow Copy – LEW (Operation)
Green Copy – Applicant
Blue Copy – MSSL
White (last) Copy – File

REF: E(EI) REG R5(4)

TOPIC 5: SITE REQUIREMENTS – COMMON DEVIATIONS

1 Substation Requirements – Deviations

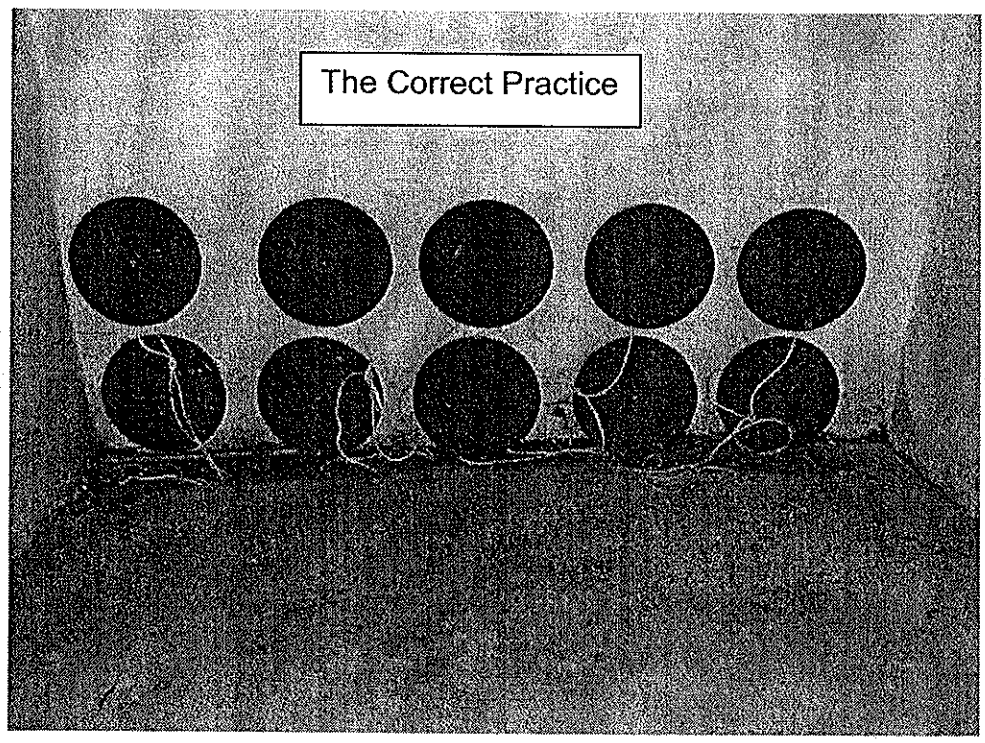
1.1 UPVC cable entry pipe not terminated beyond roadside drain.



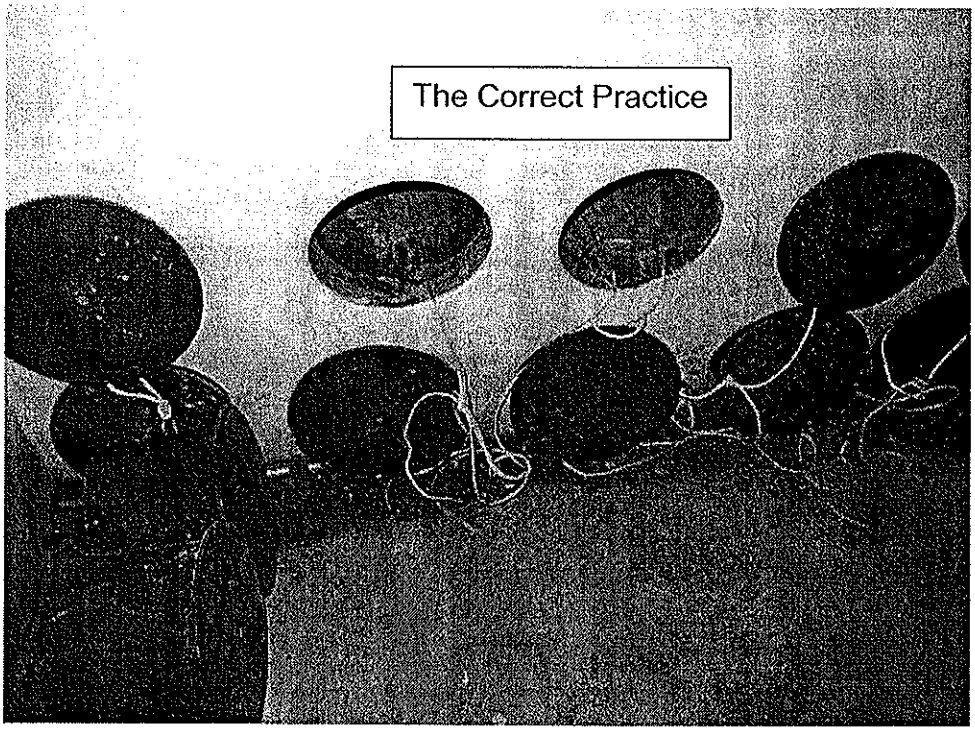
The Correct Practice

DETAIL OF CABLE RAMP AND ENTRY PIPES
SECTION X - X

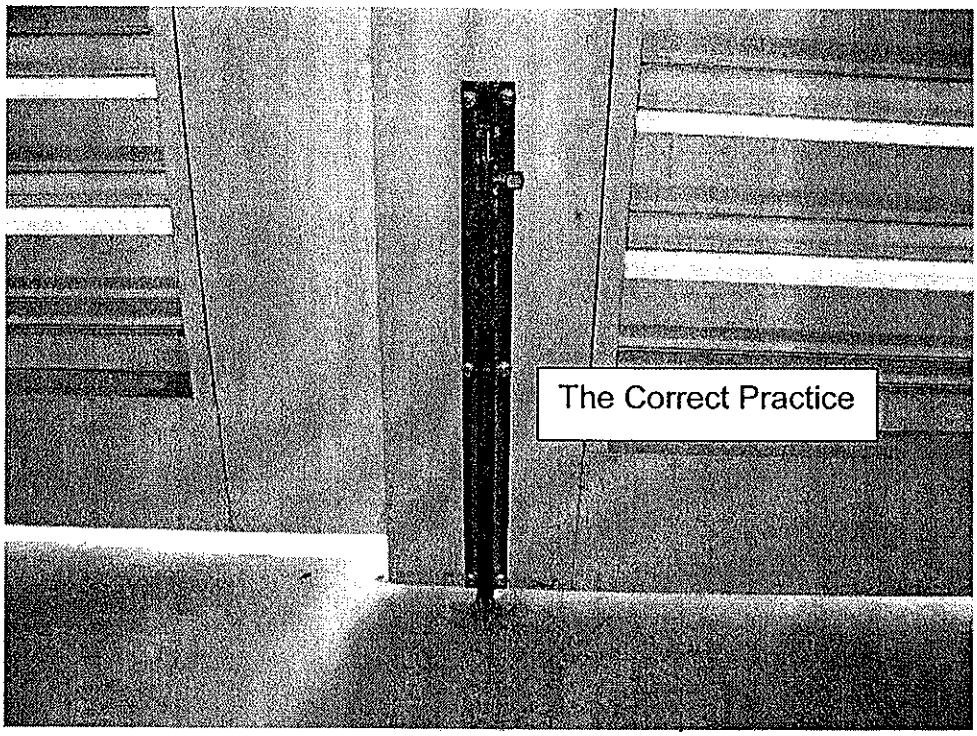
1.2 Both ends of the pipes not covered with removable water-tight plugs.



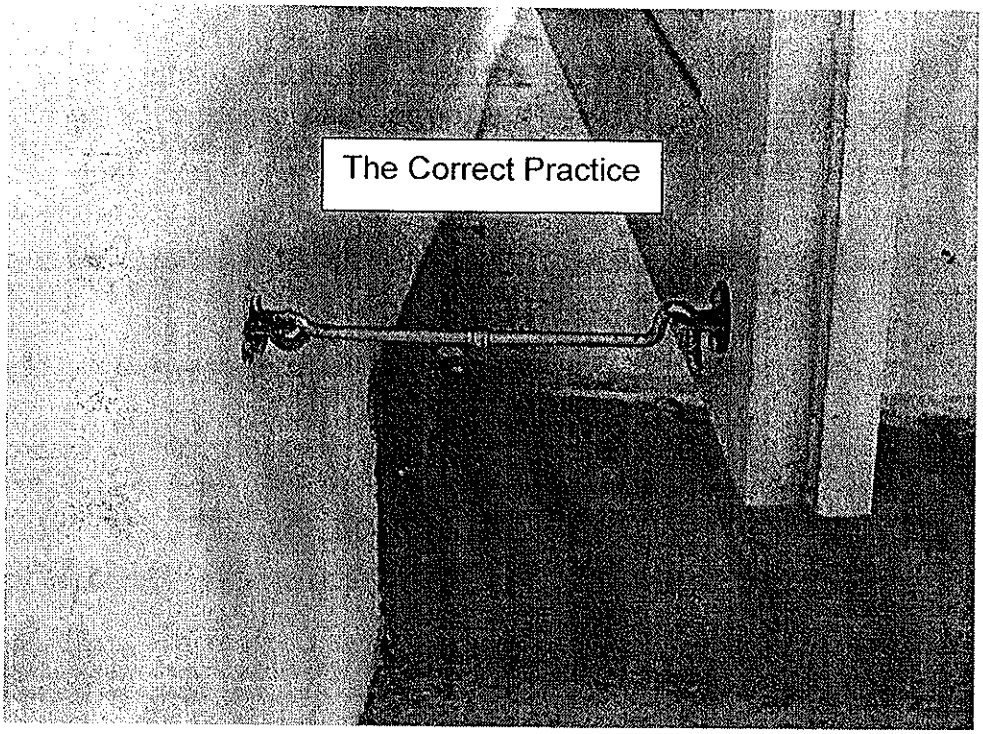
1.3 Cable entry pipes not flushed with wall and have sharp edges around them.



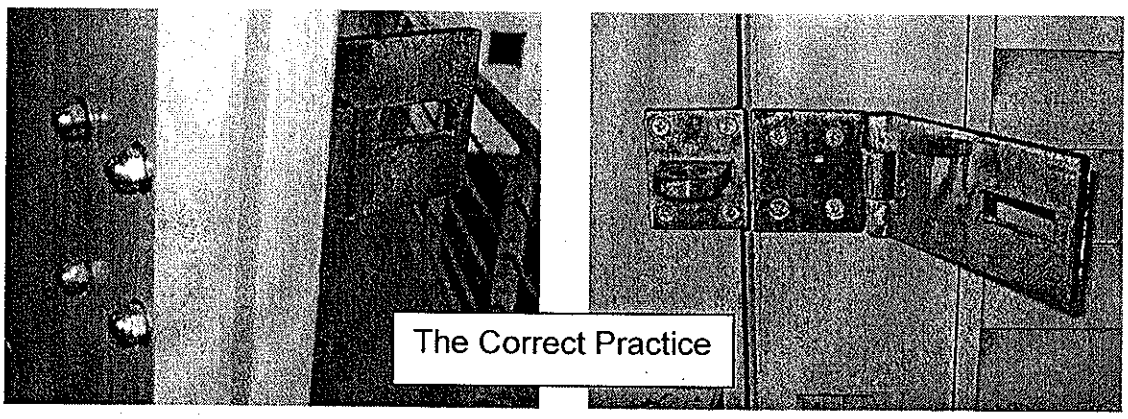
1.4 Shoot-bolt for the substation door not properly fixed or jammed.



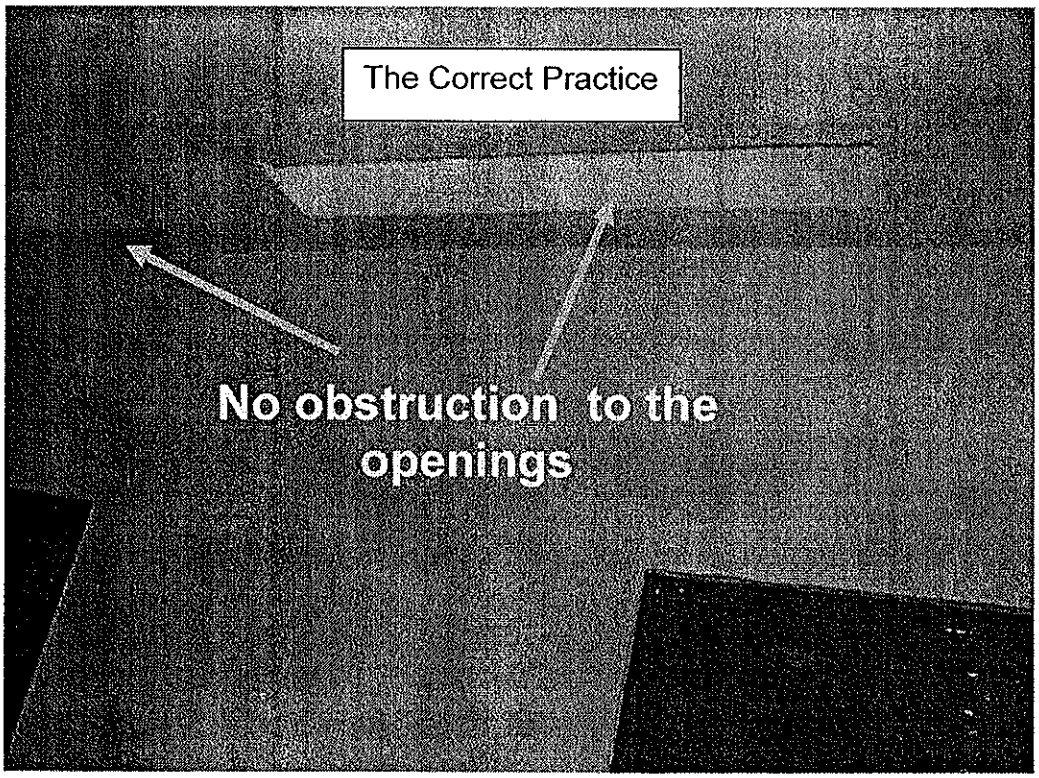
1.5 Door catch for the substation doors not installed.



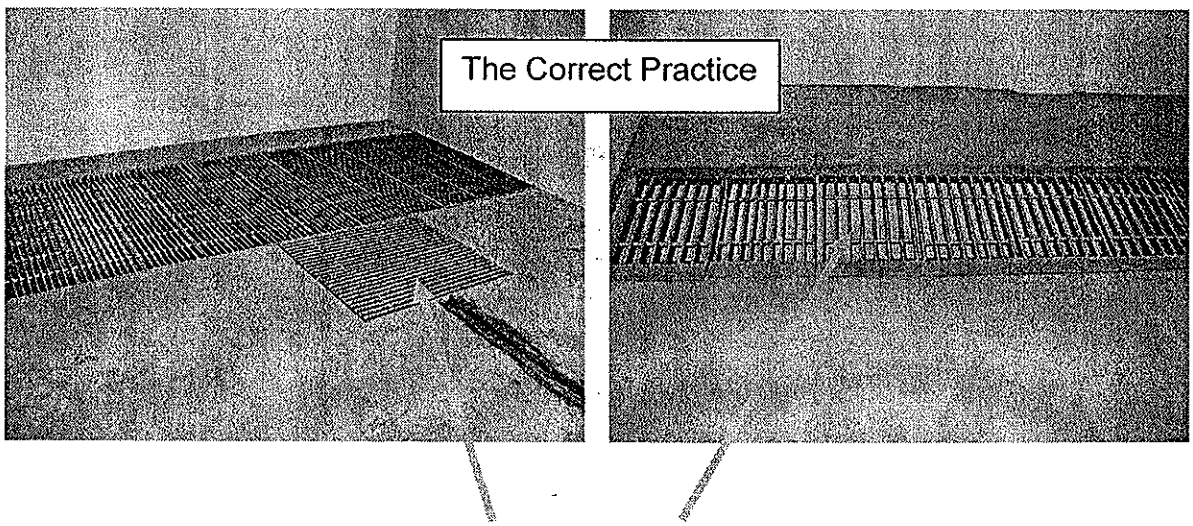
1.6 Hasp & staple not firmly fixed both at the front and back.



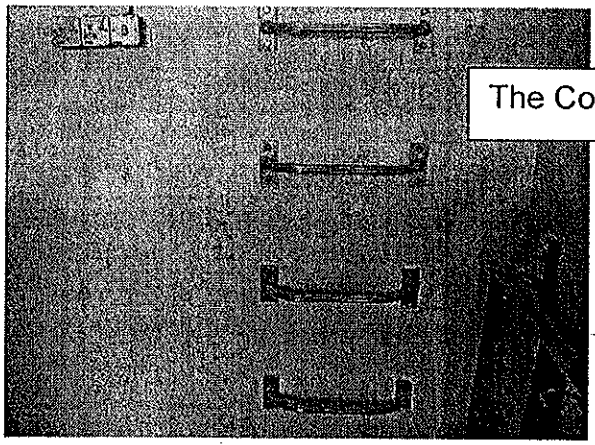
1.7 Position of light fixtures obstructs pilot/marshalling boxes & battery charger openings.



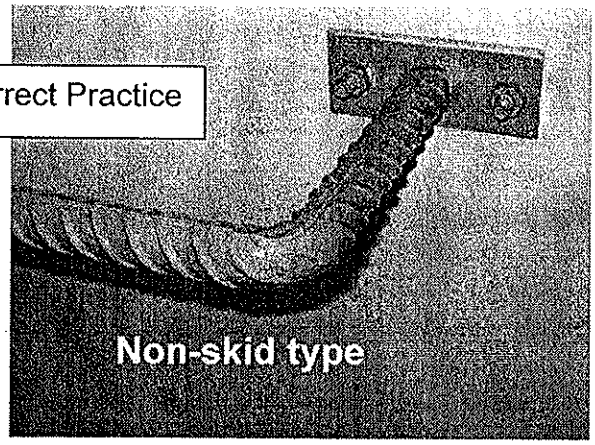
1.8 Removable hot-dipped galvanised mild steel gratings not provided for LT and HT floor opening and trenches.



1.9 Cat ladder rung not of non-skid type.



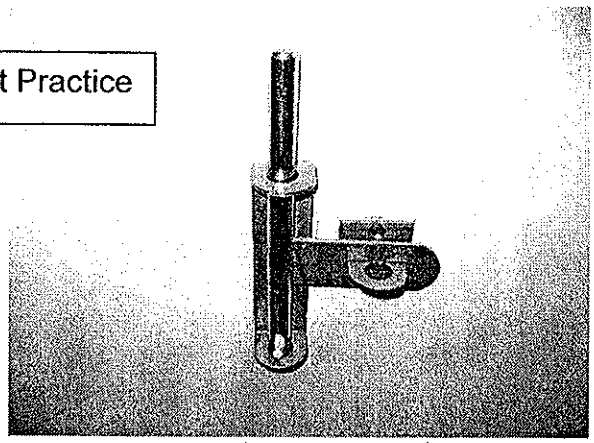
The Correct Practice



1.10 Wall catch for the trap door cover not installed or of removable type.

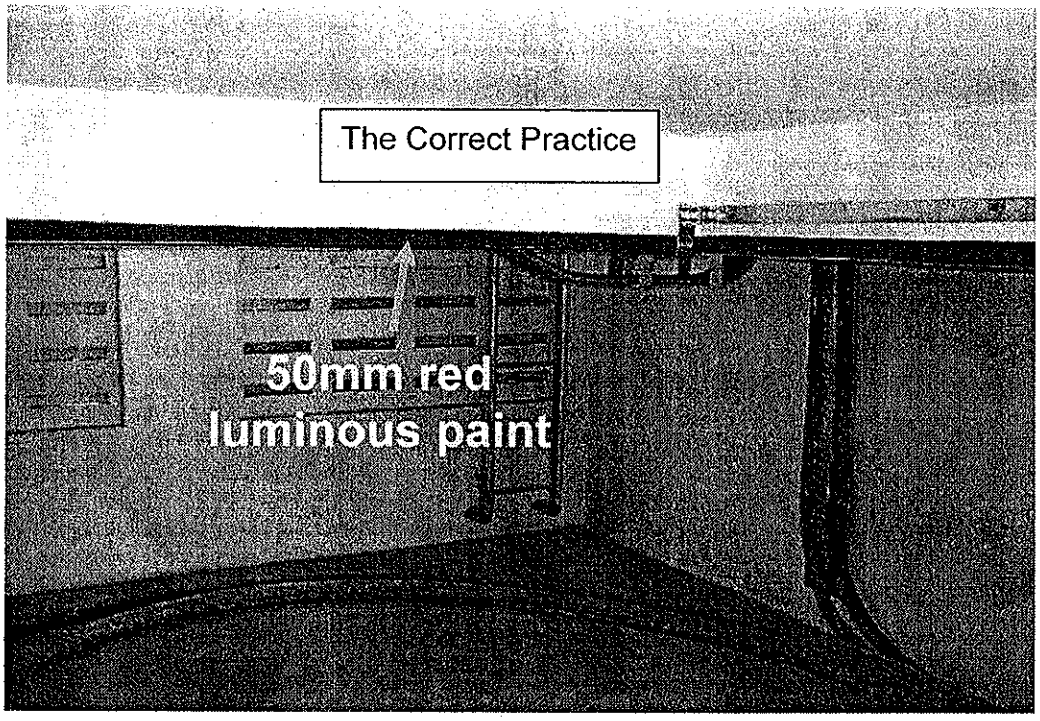


The Correct Practice

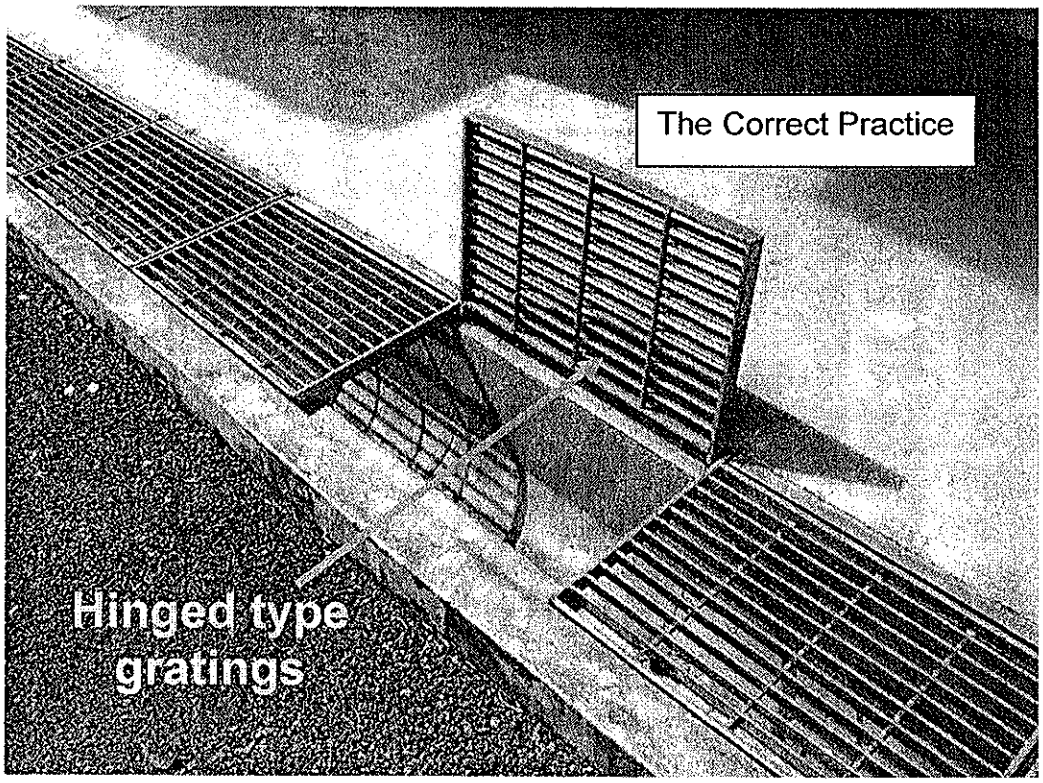


Non removable type wall catch

1.11 50mm red luminous paint not painted on the front and back of all beams at the cable chamber.



1.12 Hinged hot- dipped galvanised mild steel gratings not installed for drainage around substation.

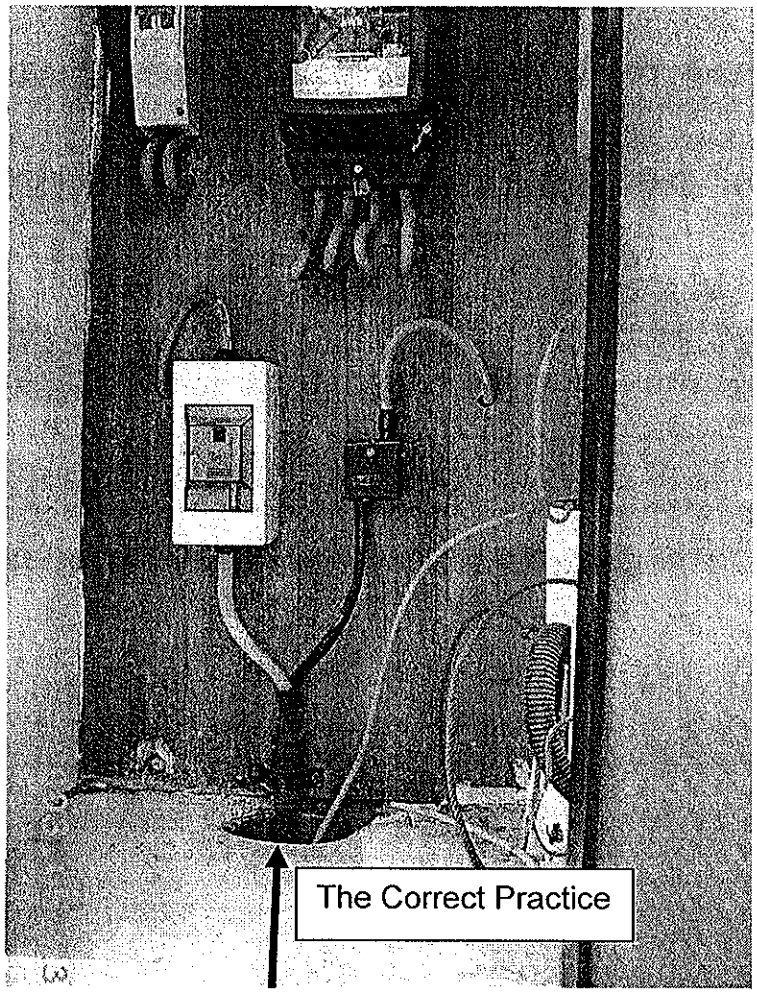


1.13 Fence without embedded concrete base.



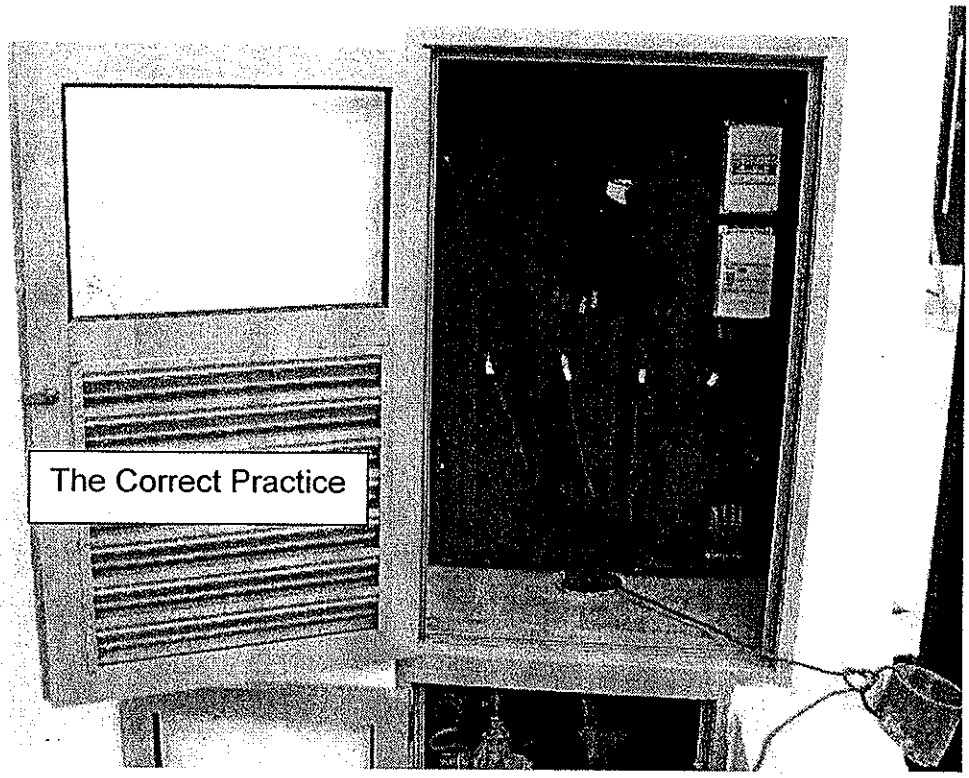
2 Meter Compartments at Gate-Pillar - Deviations

2.1 Entry pipes not correctly aligned with meter board.
2.2 Incorrect size entry pipe installed.
2.3 Entry pipes not flushed with meter compartment concrete base.

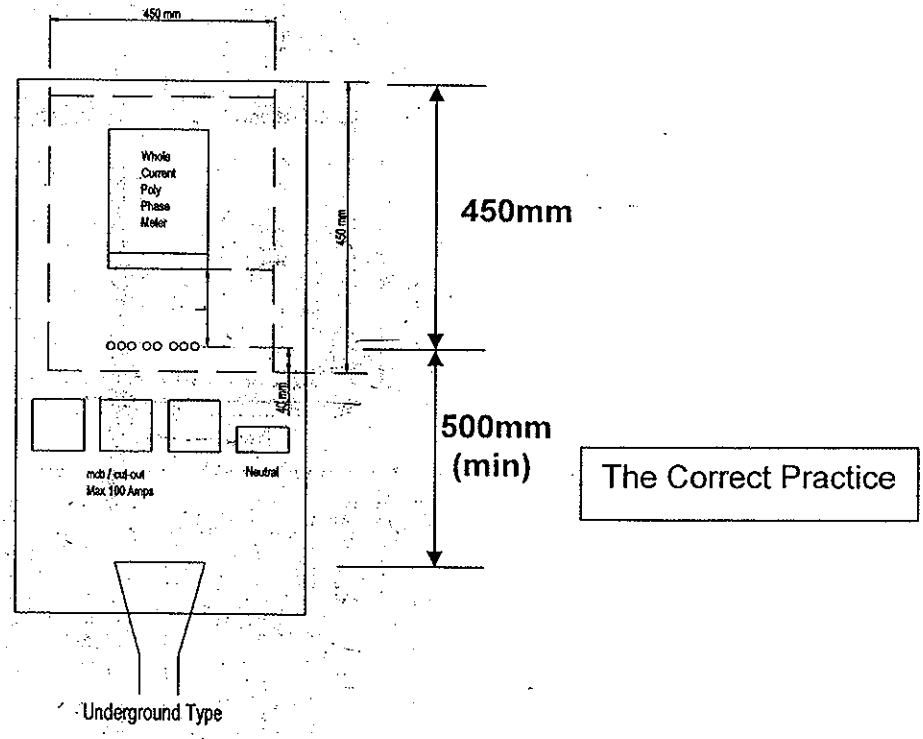


100mm Ø pipe and flush with the base

2.4 Meter compartment door not fixed.



2.5 Insufficient space for the termination of service cable due to incorrect positioning of the wires.



TOPIC 6: METERING REQUIREMENT

Part A – Procedure on Bulk Meter Board Replacement

1 Roles of LEW

1.1 LEW submits Form CS/5 to SA Section, SP Services Ltd.

- LEW can download Form CS/5 from the Internet or collect from Supply Application Counter in Somerset Rd or Installation Branch in SPTI, Woodleigh Park.
- LEW submits completed Form CS/5 to Supply Application.

1.2 LEW submits meter board layout plans to Meter Section, SPPG for approval.

- The plan should clearly show the layout and dimensions of the meter board
- Detailed information is shown in Section 6 (Metering Requirements) in the handbook "How to apply for electricity connection" available at SP Services Ltd customer service counter at SP Building, 111 Somerset Road.

1.3 LEW informs SP Services Ltd before start of work.

- LEW to inform SP Services Ltd to get clearance to break the terminal cover seals and carry out works.
- LEW to prepare Form F when the work commenced.

1.4 On completion, LEW certifies Form F.

- LEW to inspect and check the meter installations and the replaced sub main cables.
- LEW to certify Form F upon completion of work.

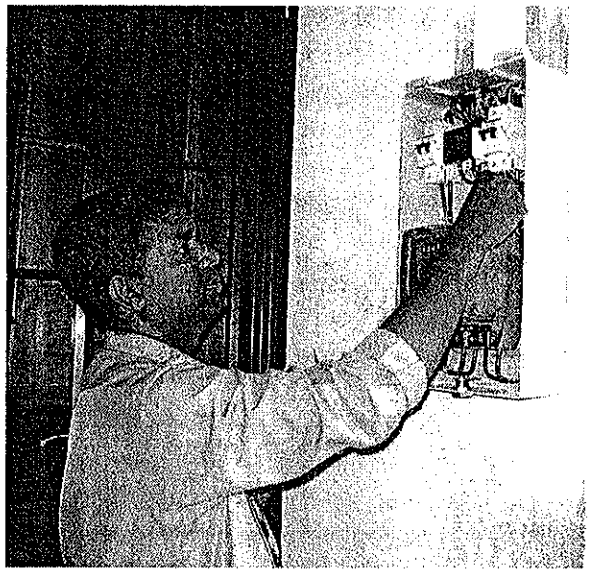
1.5 LEW submits Form F and SPPG's approval to Installation Section, SP Services Ltd, and apply for inspection of meter boards.

- Inspection appointment will be made if documents are in order.
- SP Services Ltd will conduct checks on the installation on the appointed date

2 Roles of SP Services Ltd

2.1 Visual Inspection of meter boards

- To verify whether the meter boards/meter boxes installed at site conform with the meter board plans approved by Meter Section SPPG



2.2 Meter number tallies with Address

- To check that meter numbers serving the respective addresses tally with SP Services Ltd record. This is to ensure that the correct meters serve their respective addresses and billing to the customers is in order.

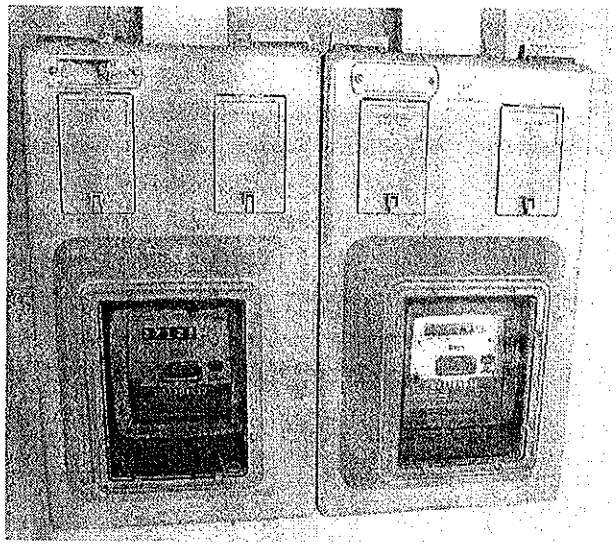
2.3 Meter disc rotation

- The correct rotation of the meter disc is from left to right. Incorrect rotation of the meter indicates that the meter wiring connection is incorrect and rectification is urgently needed to ensure correct registration of the meter.



2.4 Meter not transposed

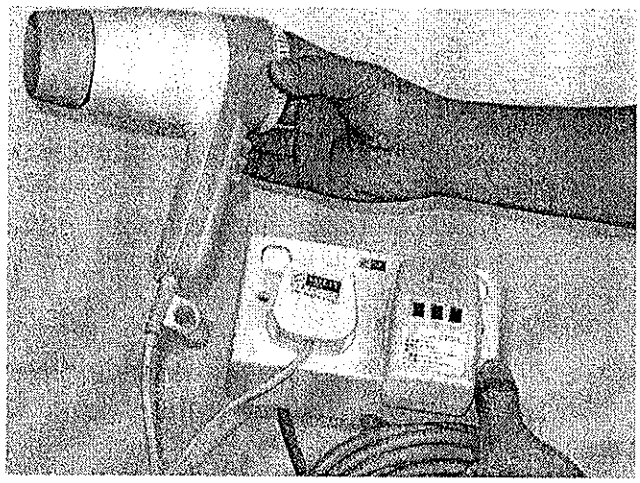
- Two meters located adjacent to each other need special attention to verify the correct address served. Incorrect tagging of meters with their respective addresses will cause billing transposed between two customers.



2.5 Polarity check of SSO

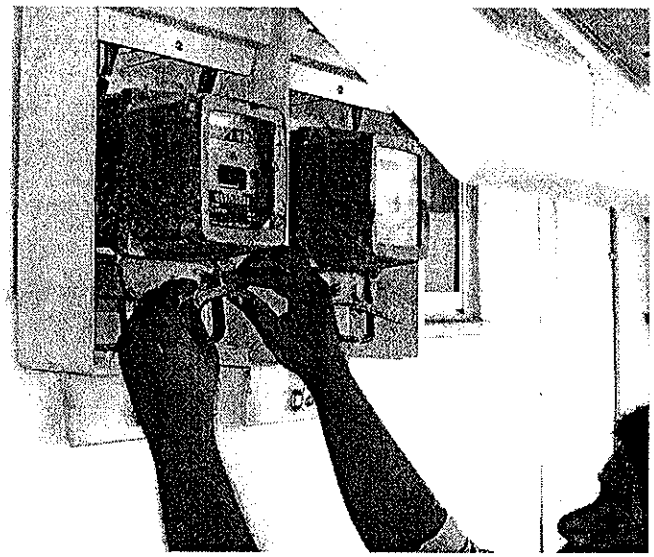
- The polarity check by SP Services to ensure that the polarity (L&N) at the customer's electrical installation is correct.





Example of Site Check

2.6 Sealing of Meter Terminal Cover by SP Services Ltd staff



2.7 SP Services Ltd issues letter of completion to LEW and landlord/MCST

3 Points to Note

3.1 Meter boards properly labeled to ensure that the meters are installed at the correct premises.

3.2 Meters are not transposed for the adjacent units to avoid cross billing to customers.

3.3 Meters are to be mounted vertically.

3.4 Meter terminal wires tightened to avoid poor contact and localized heating at the terminals, which may cause the meter terminal to be burnt.

3.5 Wires correctly terminated. For 1 ph meter, terminal sequence is Live, Neutral, Neutral, Load.

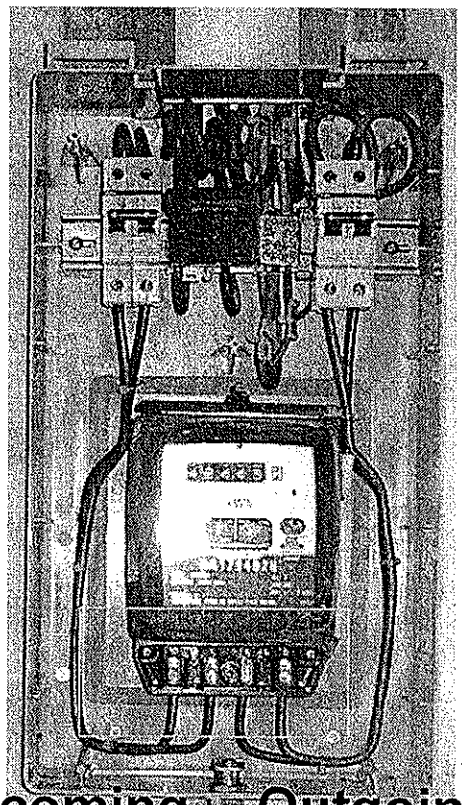
3.6 Do not remove meter cover seals. The meter cover seals must be intact to serve as an indication that the meters' internal elements had not been tampered with.

METER COVER SEALS



Meter Cover Seal

CABLE TERMINATION AT METER TERMINALS



Incoming — Outgoing

Part B – Highlights on General Metering Requirement

4 General Requirements

- Meter board and ancillaries must be ready at site before Meters Section installs meter.
- At least 4 business days lead-time must be given for request to install meter.
- Lockable meter enclosure must be fitted with the master series lockset (Union G1HBG, Yale MK48 or Abloy MK911047).
- The height of the meter register must be between 1.0m and 1.8m above ground level.
- Contestable and HT consumers must provide and maintain functional telephone lines to the meters.

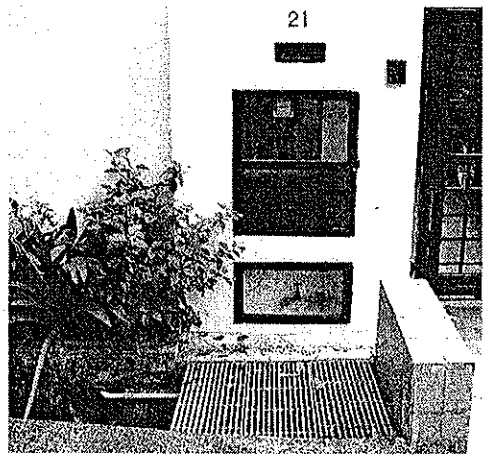
5 Whole Current Meter Installation

- Meter board, wiring, MCB & incoming cable must be ready before meter installation.
- Meter board must be securely fixed with at least 4 screws/bolts.
- House number must be engraved on plastic or metal material and firmly screwed or riveted to solid wall or door.
- The clearance from the surface of the meter board to the access opening must be at least 200mm.

6 Meter Compartment at Gate Pillar

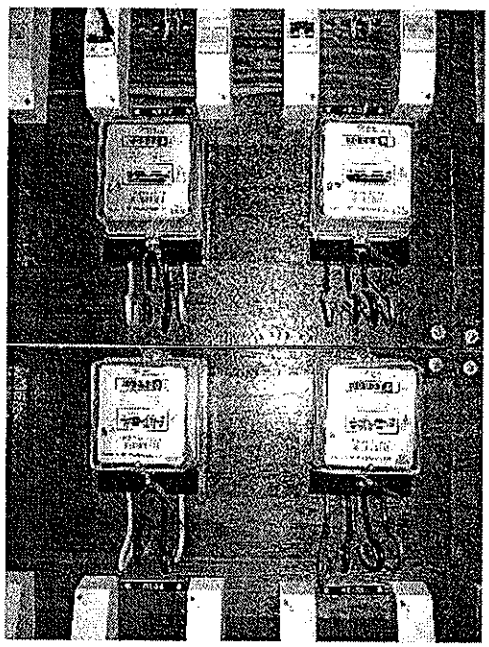
- Provide standing space of 700mm in front of the gate pillar.
- Provide suitable concrete platform or hinged galvanized steel grating over the drain in front of the gate pillar.
- Provide hinged door with a clear glass-viewing window of 200mm(W) x 300mm(H) x 6mm (thickness) directly in front of the meter position.
- Weatherproof compartment with sufficient ventilation.
- Door opening shall have at least 450mm width clearance.





7 Centralised Meter Room

- Access door should be at least 600mm(W) x 2100mm(H).
- At least 2000mm standing height.
- At least 700mm space in front of meter panel (free standing meter panel, At least 700mm space at side and back).
- Unit number to be permanently labeled on each meter board / box in a centralised meter room/riser.

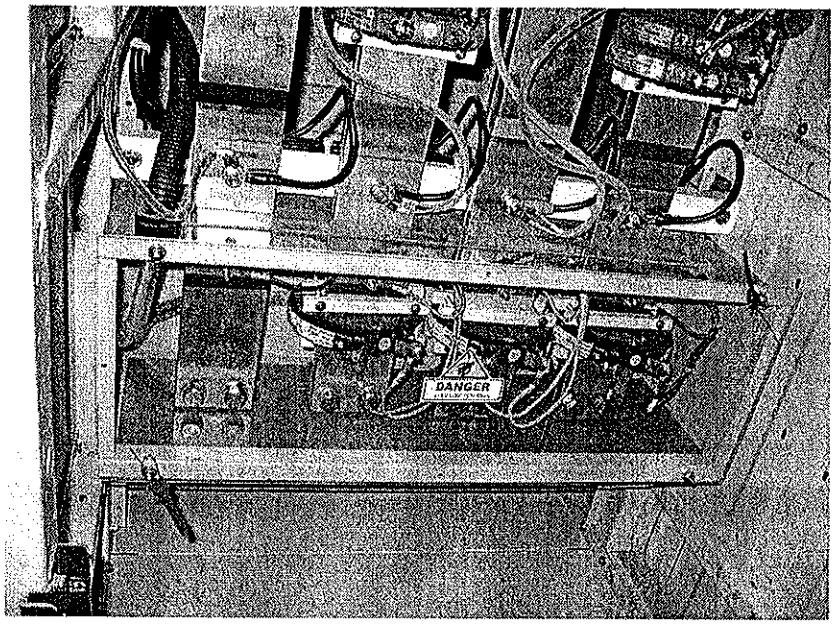


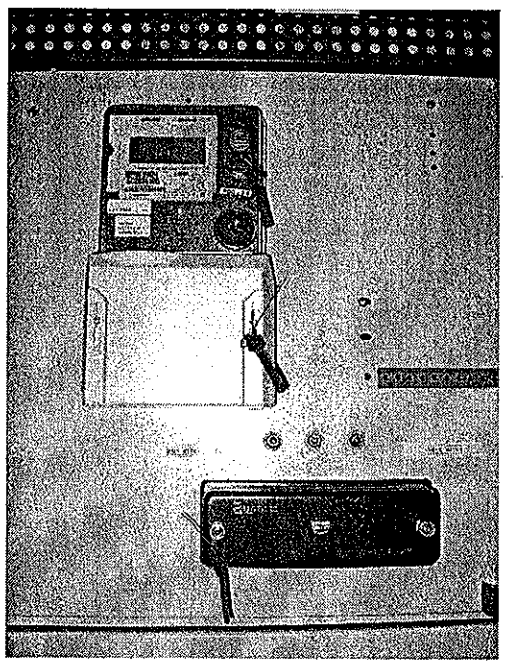
8 Submission of Drawings

- For meter fixing at residential/commercial buildings, LEW must, at the planning stage, submit details on meter layout, meter site location, meter riser/ compartment etc to Meters Section for approval.
- Sample units of typical approved type must be provided for final inspection and approval by Meters Section.

9 Low Tension CT-Operated Meter Installation

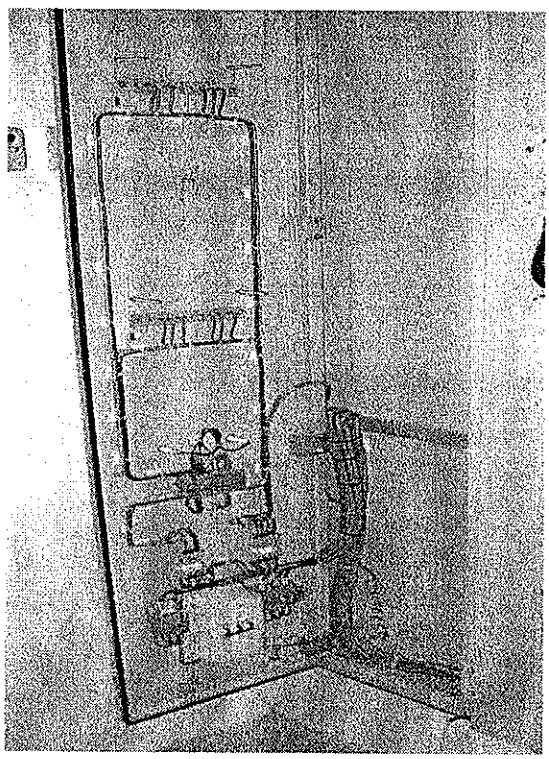
- Pre-wired meter panel and ancillaries must be ready before meter installation.
- Sealable CT and meter compartment.
- Contractor must be present to install CT on the day of meter fixing.

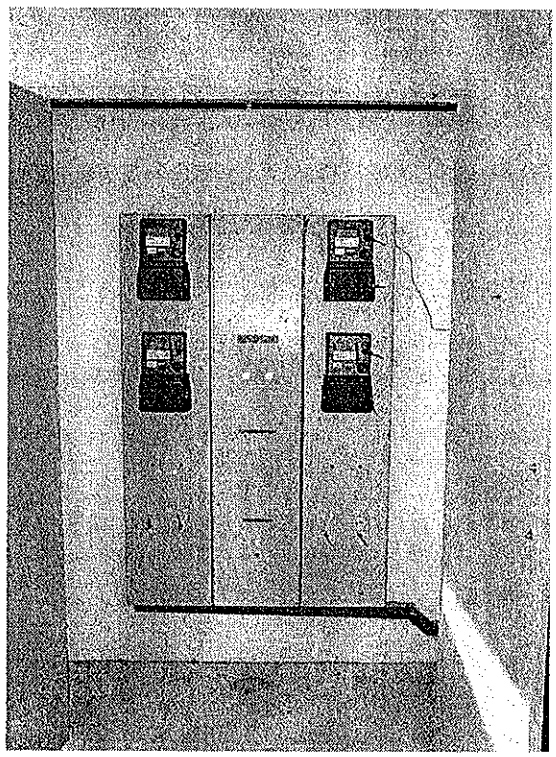




10 High Tension CT-Operated Meter Installation

- Provide pre-wired meter panel.
- Provide appropriate metering CTs and PTs to Meters Section for testing at least 2 weeks prior to installation.
- Submit site test report.
- For 66kV and above, submit PT accuracy test report.
- Provide and maintain functional telephone line at meter kiosk.
- Arrange for inspection of meter kiosk before meter installation.
- Ensure meters are installed before arranging for supply turn-on.

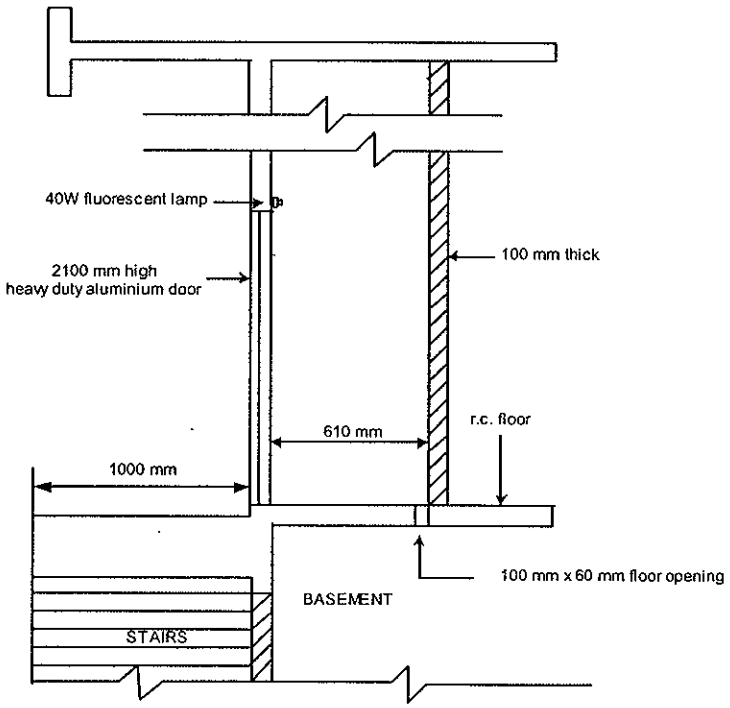




11 Handbook Revision

July 2005 Edition

- Louvers are NOT required inside metering kiosk.
- 3 units single phase voltage transformer connected in star-star configuration



Note : Drawing not be scale. All dimension in mm

Handbook on "How to apply for electricity connection" can be downloaded from the website:

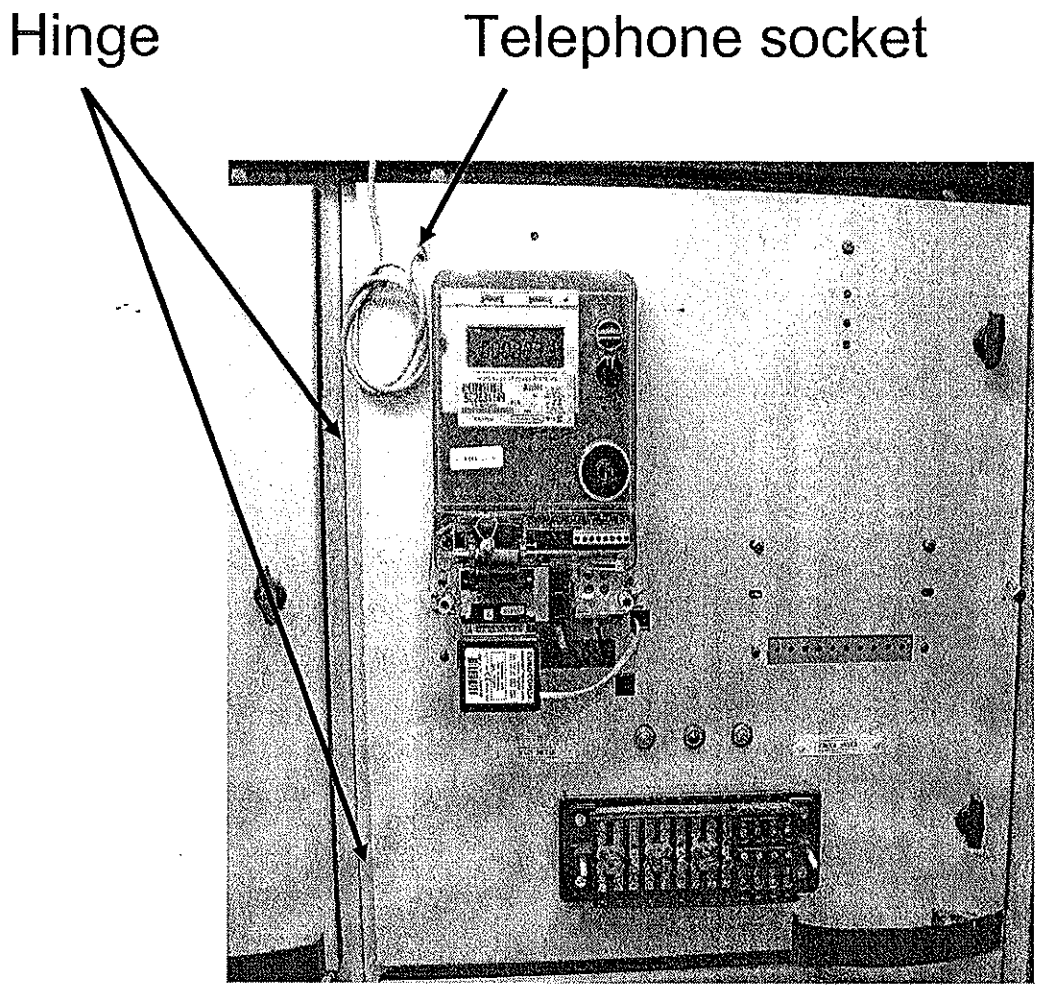
http://www.powergrid.com.sg/PDF/howtoapply.pdf

12 Upgrading of Supply – Points to note

- Arrange with Meters Section for recovery of meters upon shutdown of supply to old switchboard.
- For contestable consumers, where meters are remotely read, there must be a functional telephone line provided at the new switchboard at the time of meter installation.

13 Telephone Line Installation

- Locate telephone socket on the same side as the door hinge.



TOPIC 7: CONSUMER PROTECTION (SAFETY REQUIREMENTS) REGISTRATION SCHEME

1 Background

Consumer Protection (Safety Requirements) Regulations 1991

Objective of the Regulations is protecting the safety of consumers.

Consumer Protection (Safety Requirements) Regulations 2002

Principle Change: Shift from Government Approval to 3rd Party Certification.

The Consumer Protection (Safety Requirements) Registration Scheme (CPS Scheme) was launched on 1 June 1991.

Registration is mandatory and is based on certification.

45 categories of household electrical, electronic and gas products are designated as Controlled Goods.

The Standards, Productivity and Innovation Board (SPRING Singapore) was appointed by MTI as the Safety Authority to administer the CPS Scheme since 1991.

All Controlled Goods must be registered with the Safety Authority before they can be traded, advertised or displayed for sale.

Penalty for infringement: $10,000 fine or 2 years jail or both.

2 Points to note

The CPS Scheme covers Controlled Goods that are operated by layman.

Registration of Residual Current Circuit Breaker (RCCB) is limited to 30 mA sensitivity and the operating time must be less than 0.1 second.

Heating element of Instantaneous Electric Water Heater and Mains Pressure Electric Storage Water Heater must not be of the "bare-element" type.

Water heater incorporated with Residual Current Device (RCD) will require additional testing to sub-clause 9.9.2.1, 9.9.2.2, 9.9.2.3 and 9.16 of SS 97: Part 1: 2000.

3 SAFETY Mark



Officially launched in February 1993 to help consumers and traders to identify registered Controlled Goods.

Comprises of a safety logo enclosed in a square on the left and the word "SAFETY MARK" enclosed in a rectangle on the right. Below these is an unique Certification Number traceable to the registrant. The colour used is Pantone 287C Blue Colour.

4 Key documents

Legislation

- SPRING (Conformity Assessment) Regulations 2002
- Consumer Protection (Safety Requirements) Regulations 2002

Information Booklet

- SPRING (Conformity Assessment) Information Booklet 2002 Edition
- Singapore Consumer Protection (Safety Requirements) Registration Scheme Information Booklet 2002 Edition

5 Functions of the Safety Authority

The Safety Authority performs the following:

- ❑ Registration of New Models and Renewals
- ❑ Maintaining Registers (Controlled Goods/RS/CABs/RTL)
- ❑ Conducting Market Surveillance
- ❑ Investigating Accidents / Incidents / Complaints
- ❑ Public Education
- ❑ Designating Conformity Assessment Bodies (CABs)

5.1 Registration

To date, the Safety Authority has registered about 23,500 models of Controlled Goods.

Abridged version of the register is posted on www.safety.org.sg.

5.2 Market Surveillance

The Safety Authority conducts spot-checks both randomly and based on tip-off and complaints.

Also scans newspaper advertisements for non-registered Controlled Goods.

5.3 Enforcement action

5.4 Accident / Incident Investigations

The Safety Authority investigates accident or incident involving Controlled Goods.

Accident: injury or death to human or damage to private property because of defective Controlled Goods.

Incident: damages are confined to the Controlled Goods.

The Safety Authority reserves the right to prohibit the supply of Controlled Goods if it is found to be unsafe.

Prohibition involves de-registration of the Controlled Goods (may also include recall and/or placing a public safety warning in the mass media).

Penalty for non-compliance: $2,000 fine or 12 months jail or both.

5.5 Public Education

The objective of the Publicity Campaigns is to educate and raise the awareness of consumers and traders on the SAFETY Mark and the CPS Scheme.

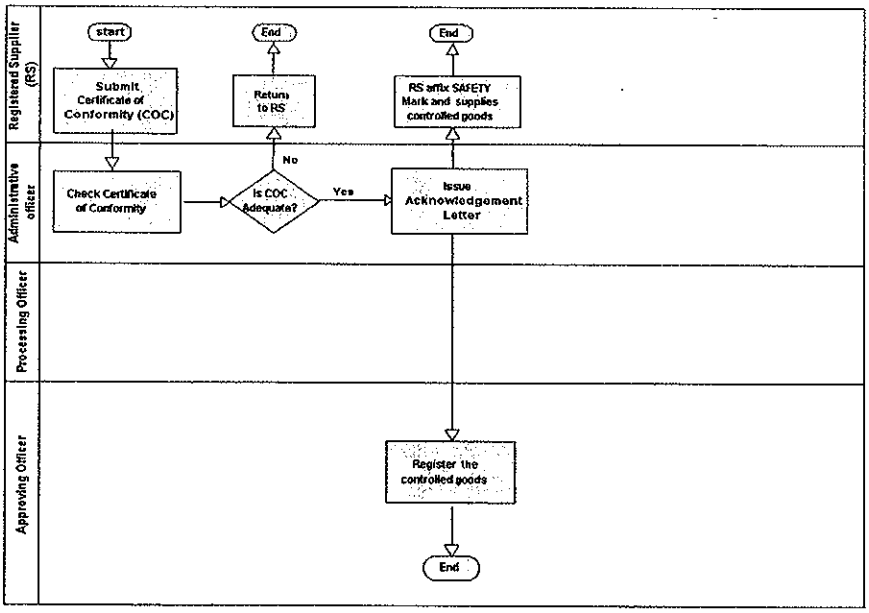
In the latest nationwide survey conducted by in March 2004, the public awareness of the SAFETY Mark is 81%.

Overall, consumers were happy with the CPS Scheme as it gave a sense of safety to the public.

5.6 Designating Conformity Assessment Bodies (CABs)

Improved process based on Certification by Designated Third Party CABs reduced turn-around time for registration of Controlled Goods from about 21 days to 1 day

5.7 Registration of Controlled Goods



6 Role of Registered Suppliers (RS) and Designated Conformity Assessment Bodies (CABs)

6.1 Role of Registered Suppliers (RS)

❑ Ensure Controlled Goods are registered with SPRING Singapore, the Safety Authority.

❑ Keep Technical File for their registered Controlled Goods.

❑ Ensure all modifications (except those involving non-technical changes) are certified by Designated Third Party CABs.

6.2 Role of Designated Conformity Assessment Bodies (CABs)

❑ Provide testing and certification services.

❑ Provide Certification on Controlled Goods to meet specified safety standards.

❑ Provide Certification on subsequent modifications (except those involving non-technical changes).

❑ Provide renewal of Certificate of Conformity (CoC).

7 When dealing with Controlled Goods

For Commercial Buyers:
Insist on the Certificate of Conformity (CoC)

For Licensed Electrical Workers (LEW):
Ensure the presence of the SAFETY Mark (either on the product or its packaging)

For Consumers:
Visit the Website: www.safety.org.sg to confirm that the Controlled Goods are registered

Benefits

❑ Reduce risks to human lives and/or properties.

❑ Minimise dumping of unsafe Controlled Goods.

❑ Improve the quality of Controlled Goods.

8 Contact Information

For more information on the Consumer Protection (Safety Requirements) Registration Scheme, please contact

SPRING Singapore, the Safety Authority at
Tel: *1-800-7733163* or
Email: *enquiry@safety.org.sg*
Website: www.safety.org.sg

TOPIC 8: HIGHLIGHTS IN CODES OF PRACTICE (CP5 & CP88)

1 Introduction to CP5

This Singapore Standard was prepared by the Technical Committee on the Code of Practice for Electrical Installations under the direction of the Electrical Industry Practice Committee.

This code of practice has been drawn up to ensure safety, especially from electric shock and fire in the use of electricity and relates principally to the design, selection, erection, inspection and testing of electrical installations. It is not intended to take the place of detailed specification or to instruct untrained persons or to provide for every circumstance. For installations of a special or complex character, the advice of a suitably qualified professional engineer and consultation with the supply authority will be necessary.

1.1 Contents of CP5: 1998

The contents of CP5: 1998 includes: -

Part 1 - Scope, Object And Fundamental Requirements For Safety
Part 2 - Definitions
Part 3 - Assessment Of General Characteristics
Part 4 - Protection For Safety
Part 5 - Selection And Erection Of Equipment
Part 6 - Special Installations Or Locations
Part 7 - Inspection And Testing
Appendices

2 Fundamental Requirements For Safety

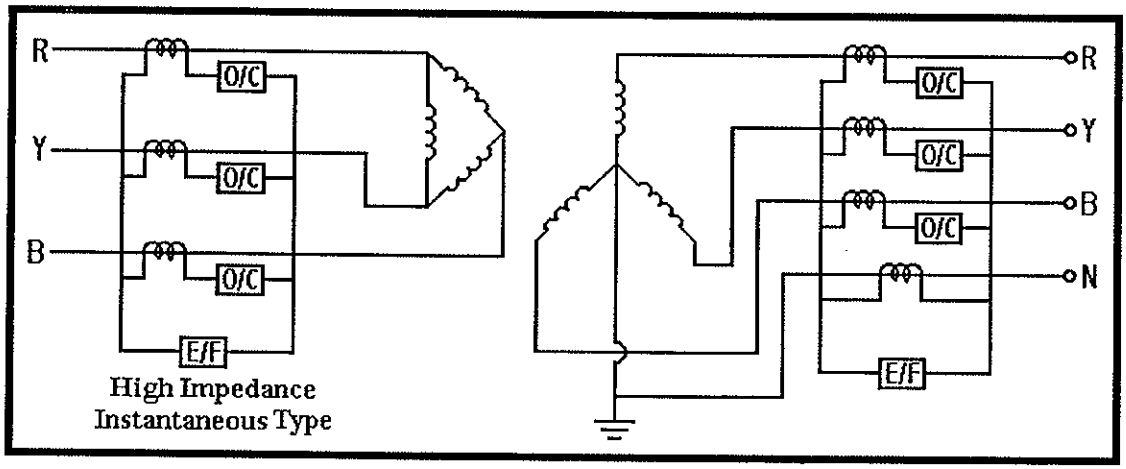


Figure 1

2.1 Overcurrent Protection

Singapore Standard CP5: 1998, Code of practice for electrical installations requires that:-

Clause 130-03-01 Where necessary to prevent danger, every installation and every circuit thereof shall be protected against overcurrent by devices which:

(i) will **operate automatically** at values of current which are suitably related to the safe current rating of the circuit, and

(ii) are of **adequate breaking** capacity and, where appropriate, making capacity, and

(iii) are **suitably located** and are constructed so as to prevent danger from overheating, arcing or the scattering of hot particles when they come into operation and to permit ready restoration of the supply without danger.

2.2 Earth Leakage Protection

Clause 130-04-01, 130-04-02, 130-04-03 and 130-04-04 of the Singapore Standard CP5: 1998 also require that:-

130-04 Precautions Against Earth Leakage and Earth Fault Currents

130-04-01 Where metalwork of electrical equipment, other than current-carrying conductors, may become charged with electricity in such a manner as to cause danger:

(i) the metalwork shall be connected with earth in such a manner as will cause discharge of electrical energy without danger, or

(ii) other equally effective precautions shall be taken to prevent danger.

130-04-02 Every circuit shall be arranged so as to prevent the persistence of dangerous earth leakage currents.

130-04-03 Where metalwork is connected with earth in accordance with Clause 130-04-01 (i) the circuits concerned shall be protected against the persistence of an earth fault current by:

(i) the overcurrent protective devices required by Clause 130-03-01, or

(ii) **a residual current device** or equally effective device.

The method described in item (ii) above shall be used whenever the prospective earth fault current is insufficient to cause prompt operation of the overcurrent protective devices.

130-04-04 Where metalwork of electrical equipment is connected with earth in accordance with Clause 130-04-01(i) and is accessible simultaneously with substantial exposed metal parts of other services, the latter shall be effectively connected to the main earthing terminal of the installation.

2.3 Isolation and Switching

Clauses 130-06-01, 537-02-01 & 537-02-02L of CP5: 1998 requires that:-

130-06 Isolation and Switching

130-06-01 Effective means, suitably placed for ready operation, shall be provided so that all voltage may be cut off from every installation, from every circuit thereof and from all equipment, as may be necessary to prevent or remove danger.

537-02 Devices For Isolation

537-02-01 Except as detailed by Clause 460-01-04, the devices for isolation shall effectively isolate all live supply conductors from the circuit concerned. Equipment used for isolation shall comply with Clauses 537-02-02 to 537-02-10.

537-02-02L The isolating distance between contacts or other means of isolating when in the open position shall be not less than that determined for an isolator (disconnector) in accordance with the requirement of IEC 947-3.

3 Assessment Of General Characteristics Of Electrical Installation

(a) Clause 300-01-01, in the design of electrical installation, an assessment shall be made of the following characteristics of the installation:

(i) the purpose of which the installation is intended to be used and its supplies
(ii) the external influences to which it is to be exposed
(iii) the compatibility of its equipment
(iv) its maintainability

These characteristics shall be taken into account in the choice of methods of protection for safety and the selection and erection of equipment.

(b) Clause 312-02-01, the number and type of live conductors shall be determined, whether it should be:

(i) single phase two-wire A.C.
(ii) three phase four-wire A.C.
or (iii) three phase 3-wire A.C.

(c) Clause 312-02-03, the type of earthing system to be used for the installation shall be determined, whether is should be:

(i) TT system
(ii) TN-S system

(d) Clause 312-01-01, the following characteristics of the supply or supplies, from whatever source, and where appropriate the normal range of those characteristics, shall be determined by calculation, measurement, enquiry or inspection:

(i) the nominal voltage(s)
(ii) the nature of the current and frequency
(iii) the prospective short-circuit current at the origin of the installation
(iv) the earth fault loop impedance of that part of the system external to the installation (Z_e).
(v) the suitability for the requirements of the installation, including the maximum demand.
(vi) the type and rating of the overcurrent protective device acting at the origin of the installation.

(e) Installation Circuit Arrangement

(i) Clause 314-01-01, every installation shall be divided into circuits as necessary to:

- avoid danger in the event of a fault, and
- facilitate safe operation, inspection, testing and maintenance.

(ii) Clause 314-01-02, a separate circuit shall be provided for each part of the installation which needs to be separately controlled for compliance with the Regulations or otherwise to prevent danger, so that such circuits remain energized in the event of failure of any other circuit of the installation, and due account shall be taken of the consequences of the operation of any single protective device.

(iii) Clause 314-01-03, the number of final circuits required, and the number of points supplied by any final circuit, shall be such as to facilitate compliance with the requirements of overcurrent protection, the requirement of isolation and switching and the requirement of current-carrying capacities of conductors.

(iv) Clause 314-01-04, where an installation comprises more than one final circuit, each final circuit shall be connected to a separate way in a distribution board. The wiring of each final circuit shall be electrically separate from that of every other final circuit, so as to prevent the indirect energizing of a final circuit intended to be isolated.

4 Protection Against Electric Shock Protection Against Direct And Indirect Contact

Clause 411-01-01 – protection by SELV and limitation of discharge of energy.

Extra low. Normally not exceeding 50 V A.C. or 120 V ripple free D.C., whether between conductors or to Earth.

SELV (separated extra-low voltage). An extra-low voltage system, which is electrically separated from Earth and from other systems in such a way that a single fault cannot give rise to the risk of electric shock.

4.1 Protection against Direct Contact

(1) Clauses 412-01 to 412-05 explain the four basic measures for protection.

(2) Clause 412-06 requires the use of RCDs as supplementary protection.

CP5: 1998

412-03 Protection By Barriers or Enclosures

412-03-01 Live parts shall be inside enclosures or behind barriers providing at least the degree of protection IP2X or IPXXB except that, where an opening larger than that permitted for IP2X or IPXXB is necessary to allow the replacement of parts or to avoid interference with the proper functioning of electrical equipment both of the following requirements apply:

(i) suitable precautions shall be taken to prevent persons or livestock from touching a live part unintentionally, and

(ii) it shall be established, as far as practicable, that a person will be aware that a live part can be touched through the opening and should not be touched. (See Clause 471-05-02).

412-03-02 The horizontal top surface of a barrier or enclosure, which is readily accessible, shall provide a degree of protection of at least IP4X.

IEC 60439

7.4.2.2.1 All external surfaces shall conform to a degree of protection against direct contact of at least IP2X or IPXXB. The distance between the mechanical means provided for protection and the live parts they protect shall not be less than the values specified for the clearances and creepage distances, unless the mechanical means are of insulating material.

7.4.2.2.2 All barriers and enclosures shall be firmly secured in place. Taking into account their nature, size and arrangement, they shall have sufficient stability and durability to resist the strains and stresses likely to occur in normal service without reducing the clearances.

4.2 Protection against Indirect Contact

Clause 413-01-01 For protection against indirect contact, one of the following basic measures shall be used in accordance with the relevant requirements of this section and the application rules specified in Section 471, including those indicated below:

(i) Protection by earthed equipotential bonding and automatic disconnection of supply.

(ii) Protection by Class II equipment or by equivalent insulation.

(iii) Protection by non-conducting location.

(iv) Protection by earth-free local equipotential bonding

(v) Protection by electrical separation

Clause 413-02-07L and Clause 413-02-19

One or more of the following types of protective device shall be used, former being preferred: -

(a) A residual current device
(b) An overcurrent protective device

For TN-S Earthing System

Clause 413-02-16

The following condition shall be fulfilled: -

$Z_s \times I_{\Delta n} < 50V$, where $I_{\Delta n}$ is the operating current of RCD.

For TT Earthing System

Clause 413-02-20

The following condition shall be fulfilled:

$R_a \times I_a \leq 50V$, where I_a is the operating current of RCD.

5 Protection Against Overcurrent

5.1 Overcurrent

An overcurrent is a current greater than the rated current of a circuit. It may occur in two ways: -

(a) As an overload current, or
(b) As a short-circuit or fault current.

These conditions need to be protected against in order to avoid damage to circuit conductors and equipment. In practice, fuses and circuit breakers are used to protect against overloading or short-circuit.

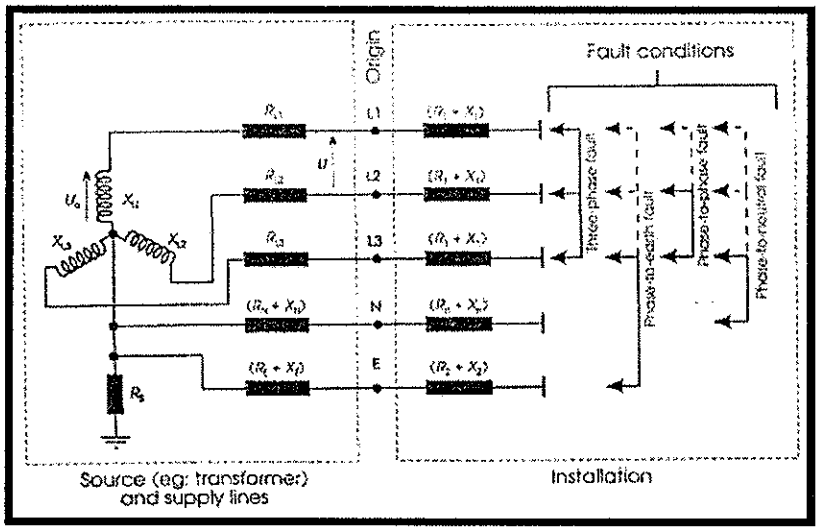


Figure 2 – Examples of the various fault conditions

5.2 Overcurrent Protection Devices

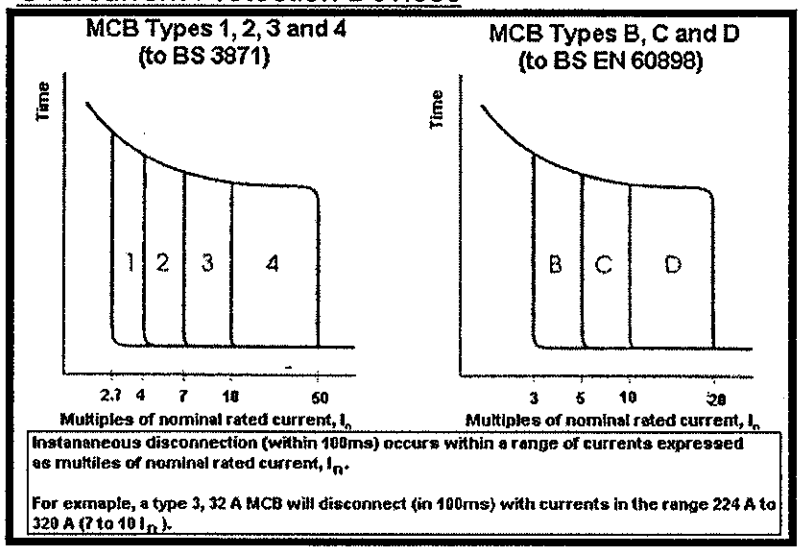


Figure 3 – MCB characteristics

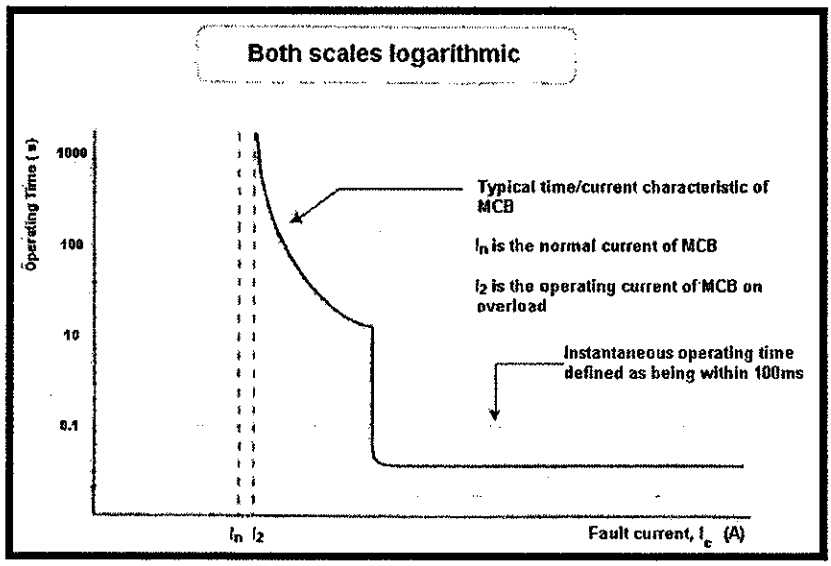


Figure 4 – Typical operating characteristics of an MCB

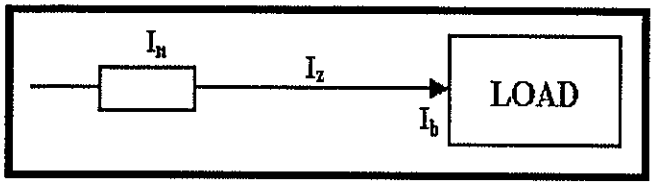
5.3 Overload Consideration

Protection of Cable against Overload Current and Consideration with Protection Device

For some types of cable, particularly wiring cables, the required current rating of the cable must be determined by the overload protective device rather than the circuit current. The rating of the device must not be less than the circuit designed current and, of course, such ratings are in discrete steps.

To provide an adequate protection against overloading, the code of practice for electrical installations requires that the following conditions to be satisfied.

(a) $I_b \leq I_n \leq I_Z$
(b) $I_2 \leq 1.45\ I_Z$



Where
I_b = Design Current of Circuit
I_n = Nominal Current of Protective Device
I_Z = Effective Current Carrying Capacity of Conductor

Figure 5

It means:

(a) The nominal current (I_n) of the protective device must be greater or equal to the design current (I_b) of the circuit so that the device will not trip under normal conditions.

(b) The current-carrying capacity of the conductor (I_Z) must be greater than or equal to I_n, so that the device will trip before damage to the cable.

(c) The current that will operate the protective device (I_2) must not exceed 1.45 times the lowest I_Z of the conductors.

Example:

A circuit with 4 x 16mm^2 PVC single core cable with designed load current, I_b = 52A is protected by a 60A (i.e. I_n = 60A) MCCB with minimum operating current 1.3 x I_n.

(a) Determine the current carrying capacity of the cable and whether the clause 433-02-01 of SS CP5: 1998 on protection against overloading is complied with, assuming ambient temperature is 30°C.

(b) Determine the minimum operating current of the MCCB as required by IEC 947-2 and whether the circuit is adequately protected against overloading.

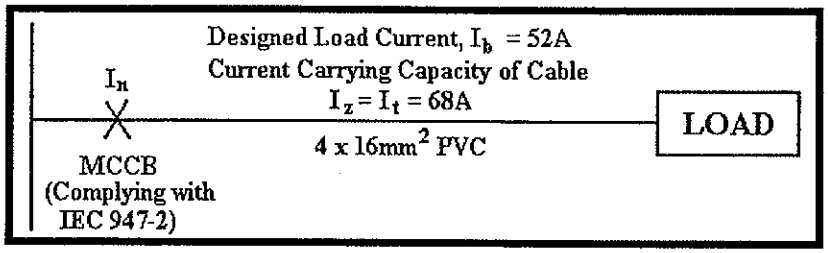


Figure 6

Solution:

(a) From Table 4D1A of SS CP5: 1998, the current carrying capacity of 16mm^2 PVC cable is 68A, i.e. I_Z = 68A at 30°C.

Since I_n = Protection device nominal current = Rating 60A
I_b = Designed continuous load current = 52A
$I_b \leq I_n \leq I_Z$, Clause 433-02-01 is complied with.

(b) Since minimum operating current of protection device,

I_2 = 1.3 x I_n
= 1.3 x 60 = 78A

and 1.45 I_Z = 1.45 x 68 = 98.6A

The requirement of $I_2 \leq 1.45\ I_Z$ is also satisfied, therefore this circuit is provided with adequate overload protection.

However, it is to be noted that though the cable can effectively carry 68A continuously and the MCCB will operate at 78A, there is a small range of current from 68A to 78A for which the cable may be slightly overloaded and become warm. Selection of a bigger size cable (next bigger size) will avoid this problem and also minimize the losses on the cable.

5.4 Short Circuit Consideration

Protection of Cable against Fault Current

Often the conductor size is determined by short-circuit current considerations rather than continuous current requirements. The short-circuit current, which may be 20 or more times the normal continuous current, produces thermal and electromagnetic effects proportional to the square of the current. So far as the cable insulation itself is concerned, much higher conductor temperatures

may be produced and the full temperature will not be sustained for significant time by the insulation.

Short-circuit ratings are not published for individual cables in any official documents, because of the large number of the cable types and sizes involved and the fact that they have to be related to the duration of short circuit which applies to the particular circuit.

IEE regulation and SS CP5: 1998 specifies in Clause 434-03-03 that under fault condition, the clearance time of the protection device shall not result in the admissible limiting temperature of any live conductor being exceeded:

The formula used is $k^2S^2 \geq I_{SC}^2t$

The *t*, in which a given fault current will raise the live conductors from the highest permissible temperature in normal duty to the limiting temperature, can, as an approximation, be calculated from the formula:

$$t = \frac{k^2S^2}{I_{SC}^2}$$

where:

t is the duration in seconds,

S is the nominal cross sectional area of conductor in mm^2,

I_{SC} is the value of fault current in amperes, expressed for A.C. as the r.m.s. value, due account being taken of the current limiting effect of the circuit impedances.

k is a factor taking account of the resistivity, temperature coefficient and heat capacity of the conductor material, and the appropriate initial and final temperature. For the common materials indicated in Table 43A, the k factor shall be as shown in table 43A of SS CP5: 1998.

Typical values of k are: k = 115 for PVC Copper Cable
k = 143 for XLPE Copper Cable

Clause 533-03-01 of CP5: 1998 requires that maximum fault current at the origin of the protective device and minimum fault current at the remote end of the conductor be calculated so that the adiabatic equation in Clause 434-03-03 be calculated in both conditions.

533-03 Selection Of A Device For Protection Of A Wiring System Against Fault Current

533-03-01 The application of the rules of Chapter 43 shall take into account minimum and maximum fault current conditions.

The calculation of Maximum & Minimum Fault Current shall be as follows:

- For a single phase circuit, I_{SC} (Max) is the phase to Neutral Short Circuit Current at the origin of the protective device and I_{SC} (Min) is the phase to Neutral Short Circuit Current at the remote end of the circuit.
- For 3-phase 4 wires system, the I_{SC} (Max) is the symmetrical short circuit current at the origin of the protective device and I_{SC} (Min) is the phase to Neutral Short Circuit Current at the remote end of the circuit.

- For a 3-phase 3 wires system, the I_{SC} (Min) is the symmetrical short circuit current at the origin of the protective device and I_{SC} (Min) is the phase to phase short circuit current at the remote end of the circuit.

6 TT Earthing System & TN-S Earthing System

In Singapore, two types of electrical earthing systems are permitted; these are the TT earthing system and TN-S earthing system.

6.1 TT Earthing System

(a) TT earthing system is used when consumers receive electricity supply at 400V/230V.

(b) As the distribution transformer is installed on the power supply company side, Neutral earthing electrode system is installed at the power supply company's substation.

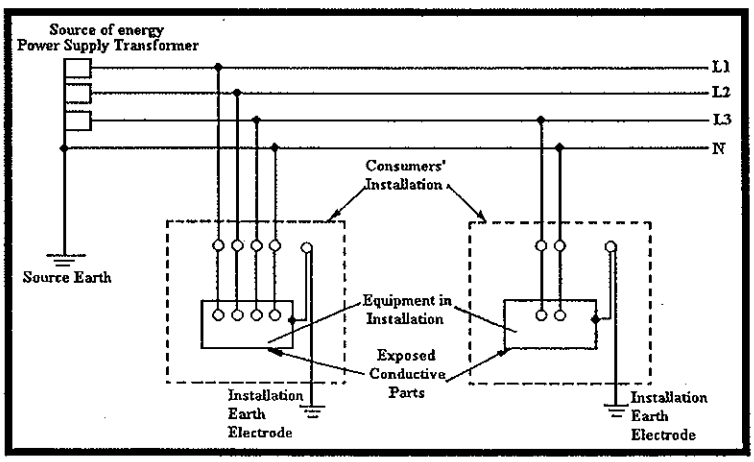


Figure 7 – TT Earthing System

All exposed-conductive-parts of an installation are connected to an earth electrode which is electrically independent of the source earth.

Definition for the Designation 'TT'

The first letter denotes the earthing arrangement at the source of energy, and

T = Direct connection of one or more points to Earth

The second letter denotes the relationship of the exposed conductive parts of the installation to earth, and

T = Direct electrical connection of the exposed conductive parts to Earth, independently of the earthing of any point of the source of energy.

(c) Earth fault loop impedance of TT earthing system is given as

$$Z_{ELFI} = Z_T + Z_P + Z_E + (R_B + R_A) + Z_{N/E}$$
$$\approx (R_A + R_B)$$

where Z_T = Transformer winding impedance
Z_P = Phase conductor's impedance
Z_E = Earth conductor's impedance
$Z_{N/E}$ = Neutral to Earth conductor impedance
R_A = Installation earth electrode resistance
R_B = Neutral earth electrode resistance

6.2 TN-S Earthing System

(a) TN-S earthing system is used when the consumers receive electricity supply at high voltage (22kV or 6.6kV supply in Singapore).

(b) As the distribution transformers are installed on the consumer side, system neutral earthing and installation earthing (i.e. safety earthing for consumer's electrical equipment) share the same electrode system.

The protective conductor (PE) is the metallic covering of the cable supplying the installations or a separate earth conductor.

All exposed-conductive-parts of an installation are connected to this protective conductor via the main earthing terminal of the installation.

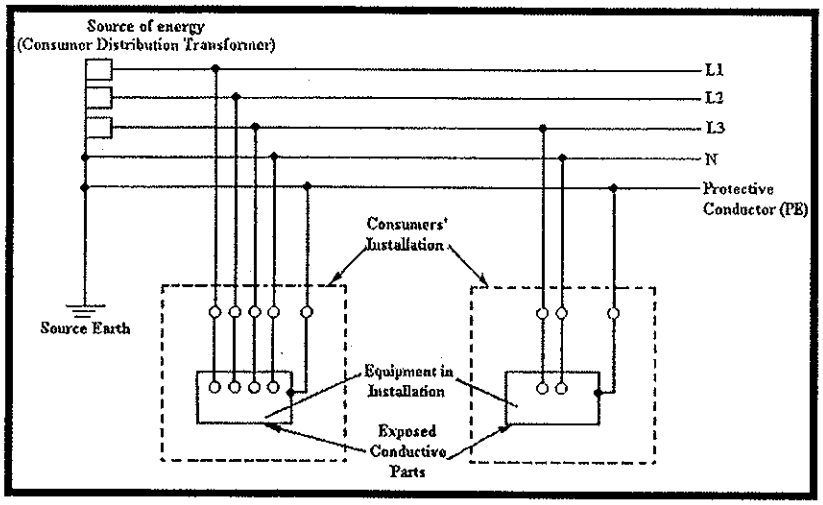


Figure 8 – TN-S System

Definition for the Designation 'TN- S'

The first letter denotes the earthing arrangement at the source of energy, and

T = Direct connection of one or more points to Earth

The second letter denotes the relationship of the exposed conductive parts of the installation to earth, and

N = Direct electrical connection of the exposed conductive parts to the Earth point of the source of energy, which, is usually the Neutral point.

The third letter 'S' denotes the separate conductors being used for Neutral and Earth.

S = Separate conductors for Neutral & Earth

(c) Earth Fault Loop Impedance of TN-S earthing system does not include any of the earth electrode system;

$$Z_{EFLI} = Z_T + Z_P + Z_E + Z_{N/E}$$

where Z_T = Transformer winding impedance

Therefore Phase to Earth Fault current,

$$I_{E/F} = \frac{V_{PH}}{Z_{EFLI}} = \left(\frac{V_{PH}}{Z_T + Z_P + Z_E + Z_{N/E}} \right)$$

Z_P = Phase conductor's impedance
Z_E = Earth conductor's impedance
$Z_{N/E}$ = Neutral to Earth conductor impedance

Note that earth electrode resistance R_B for neutral earthing is not included in the Z_{EFLI} formula.

6.3 Protection against electric shock by Indirect Contact

TN-S Earthing System

413-02-16 If protection is provided by a residual current device the following condition shall be fulfilled:

$$Z_s I_{\Delta n} \leq 50 \text{ V}$$

Where:

Z_s is the earth fault loop impedance in ohms.

$I_{\Delta n}$ is the rated residual operating current of the protective device in amperes.

TT Earthing System

413-02-20 The following condition shall be fulfilled for each circuit:

$$R_a I_a \leq 50 \text{ V}$$

Where:

R_a is the sum of the resistances of the earth electrode and the protective conductor(s) connecting it to the exposed-conductive-part.
I_a is the current causing the automatic operation of the protective device within 5 s;

When the protective device is a residual current device, i_a is the rated residual operating current $I_{\Delta n}$.

6.4 Installation Earthing

A typical earthing arrangement of an electrical installation is shown in Figure 9.

Note:

(a) Cross-sectional area of main equipotential bonding cable shall not be less than half of the cross-sectional area of the main earthing conductor of the installation.

(b) Cross-sectional area of earthing conductor for cable tray and cable trunking shall not be less than the biggest CPC or earth conductor within the cable tray and cable trunking.

Definitions:

(a) Exposed Conductive Part

Exposed Conductive Part is defined as a conductive part of electrical equipment which can be touched and which is not a 'Live' part but which may become live under fault conditions.

Exposed conductive parts of electrical installation essentially include:

(i) Metallic Enclosure of electrical equipment & electrical appliances

(ii) Metallic Enclosure of electrical Switchboard (MSB & SB) & Distribution Boards (DB)

(iii) Metallic cable tray & cable trunking
- connection of cable tray & cable trunking are considered as earthing for electrical safety and not bonding.

(b) Extraneous Conductive Part

Extraneous conductive part is defined as a conductive part of non-electrical services which does not form part of the electrical installation, but is likely to introduce an earth potential.

Extraneous Conductive Parts in the buildings include non electrical services such as:

(i) Water pipes & gas pipes
(ii) Air-conditioning ducting
(iii) Fire protection, wet risers and sprinkler pipings

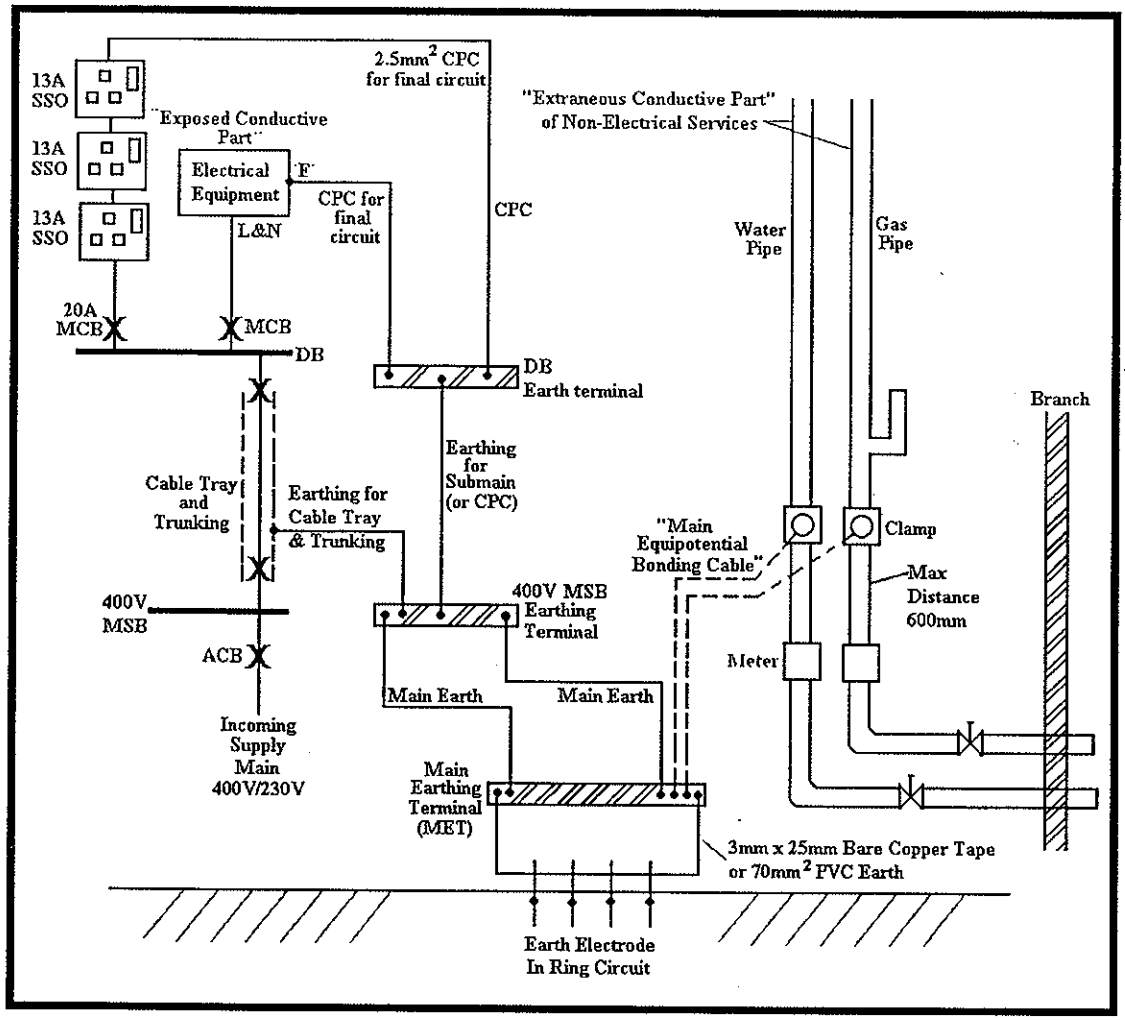


Figure 9 – Typical Earthing arrangement for TT System

As these extraneous conductive parts form a separate earthing system in the building and introduce an earth potential, it is possible that a person could simultaneously touch the exposed conductive part (e.g. metal enclosure of electrical equipment) and the extraneous conductive part (e.g. the water pipe and gas pipe), which may introduce a potential difference especially when the electrical equipment develops a fault and becomes 'live' or partially 'live'

(c) Main Equipotential Bonding Conductor

To eliminate or minimise the potential difference that may exist between exposed conductive part and extraneous conductive part. A bonding conductor is used to connect the extraneous conductive part such as a water pipe & gas pipe to the Main Earthing Terminals (MET) of the electrical system to create an equipotential zone. This is known as main equipotential bonding as shown in Figure 10.

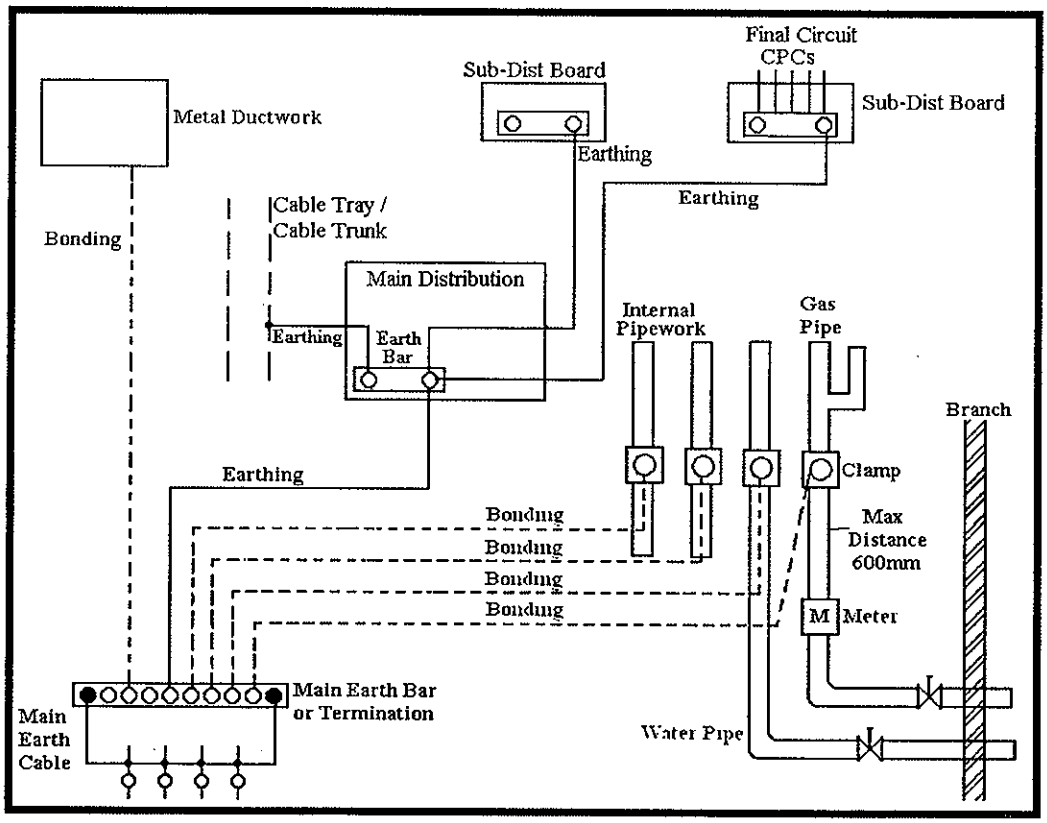


Figure 10 – Earthing & Main Equipotential Bonding

Note:
Clause 547-02-01L of SS CP5: 1998
The main equipotential bonding conductor shall have a cross sectional area not less than half the cross sectional area required for the earthing conductor of the installation.

(d) Circuit Protective Conductors (CPC)

Circuit protective conductor (CPC) is defined as a protective conductor connecting exposed-conductive-parts of electrical equipment to the main earthing terminal.

Size of earth cable on circuit protective conductors (S mm^2) may be determined by the formula given in Clause 543-01-03 of SS CP5: 1998

$$K^2S^2 \geq I_{E/F}{}^2 t \quad \text{or} \quad S = (I_{E/F} \sqrt{t}) / K$$

where:

S is the nominal cross-sectional area of the conductor in mm^2.
$I_{E/F}$ is the value in amperes (r.m.s. for A.C.) of fault current for a fault of negligible impedance, which can flow through the associated protective device, due account being taken of

the current limiting effect of the circuit impedances and the limiting capability (I^2t) of that protective device.
Account shall be taken of the effect, on the resistance of circuit conductors, of their temperature rise as a result of overcurrent – see Clause 413-02-05 of SS CP5: 1998.
t is the operating time of the disconnecting device in seconds corresponding to the fault current / amperes.
k is a factor taking account of the resistivity, temperature coefficient and heat capacity of the conductor material, and the appropriate initial and final temperatures.

Values of k for protective conductors in various use or service are as given in Tables 54B, 54C, 54D, 54E and 54F. The values are based on the initial and final temperatures indicated below each table.

For example: k = 143 for PVC insulated copper Earth cable or CPC not bunched with the phase conductors and k = 159 for bare copper earth cable or CPC where there is no risk of damage to neighbouring material.

Where the application of the formula produces a non-standard size, a conductor having the nearest larger standard cross-sectional area shall be used.

6.5 CPC for Final Circuits and Submains

However, due to the non-availability of t, the operating time of disconnection device, rule of thumbs as given by table 54G of SS CP5: 1998 is often used by designers as a guide to sizing of CPC for submains and final circuits. The size of CPC is determined based on the size of phase conductor in accordance with Table 54G.

From table 54G of CP5: 1998: -

Size of CPC in Relation to the Size of Phase Conductor

Phase conductor size (S), mm^2	Minimum CPC size, mm^2
$S \leq 16$	S
$16 < S \leq 35$	16
$S > 35$	S / 2

Table 1 – Minimum cross-sectional area of CPC in relation to cross-sectional area of phase conductors

6.6 Main Earth Cable

Cross-sectional area (S mm^2) for main earth cable should be determined carefully by the following considerations:

(i) Whether it is TT or TN-S earthing system

(ii) Magnitude of prospective phase to earth fault current $I_{E/F}$

(iii) Duration of the flow of prospective phase to earth fault current t seconds

If actual disconnection time of protective device is not known, maximum duration of 3 seconds or 1 second may be used.

(iv) Thermal stress on earth cable

The main earth cable or protective conductor must be able to conduct the full prospective phase to earth fault current (magnitude and direction) without excessively raising the temperature of the earth cable or protective conductor and causing expulsion of sparks or arcs that could initiate a fire or explosion.

(v) Low impedance path

The impedance of the protective conductor must be low enough to accept the full phase to earth current without causing a voltage drop enough to be dangerous.

Criteria: Touch Voltage < 50 Volts (Limit)

(vi) Earth Fault Loop Impedance: Operation of protective device

The total impedance of the earth fault loop circuit (Earth fault loop impedance) must permit sufficient earth fault current magnitude to operate the protective device in required disconnection time stipulated by SS CP5: 1998.

Example:

For distribution circuit or submain, CP5: 1998 impose **5 seconds** limit & for portable equipment connected to socket outlet CP5: 1998 impose **0.4 seconds** limit. (Refer to relevant clauses of CP5: 1998).

These limits can be achieved by the use of appropriate Residual Current Device (RCD).

6.7 Supplementary Bonding Conductor

Supplementary bonding may be required at locations of increased electric shock risk.

The supplementary bonding conductor shall have cross-sectional area

- Not less than smallest protective conductor connected to the exposed conductive parts
- Minimum of 2.5 sqmm with mechanical protection
- Minimum of 4 sqmm without mechanical protection

7 Introduction To CP88 : Part 1 : 2001

7.1 Introduction

This Part of the Singapore Standard CP 88 was prepared by the Technical Committee on Temporary Electrical Installations under the direction of the Electrical Industry Practice Committee.

It was developed as a result of a review of the Singapore Standard CP 44 : 1998 – 'Code of practice for temporary electrical installations for construction and building sites'.

This Part of CP 88 is drawn up to supplement the general requirements of Singapore Standard CP 5 – 'Code of practice for electrical installations'. As installations operating at voltages up to 1000 V A.C. are widely used in construction and building sites, it is considered necessary to give guidance on good practice for the inspection, testing and maintenance of such installations. In addition, guidance on the installation of generating set and socket-outlet assembly are included to address the common use of generating set and socket-outlets for portable tools at these sites.

It is to be noted that for installations where separated extra low voltage (SELV) is used, references shall be made to the general requirements for protection by SELV in Singapore Standard CP 5.

Installations operating at voltages exceeding low voltage are outside the scope of this Part of the Code.

7.2 The Scope

This Part of the Code of Practice deals principally with temporary electrical installations for building operation and work of engineering construction. It applies to electrical installations set up for the provision of electricity supply during the execution of the following works:

(a) New building construction;
(b) Repair, alteration, extension or demolition of buildings;
(c) Engineering construction;
(d) Earthworks;
(e) Other similar works.

The requirements in this Code shall not apply to installations in construction site offices, meeting rooms, canteens, dormitories, toilets, etc., where the general requirements in the Singapore Standard CP 5 shall apply.

Although some temporary installations at these sites may receive supplies at voltages higher than 1000 V, such parts of the installations are outside the scope of this Code.

This Code also does not cover those aspects of installations in compressed air environment and potentially explosive atmospheres.

7.3 The Objective

The object of this Part of the Code is to protect persons and property against electrical hazards in the use of electricity in construction sites in view of the arduous duty imposed on the electrical equipment and wiring by the construction site conditions.

The general requirements of Singapore Standard CP5 shall be read in conjunction with this Part of the Code.

Because of variations in local circumstances of construction sites, the requirements of this Code are given in general terms, and will normally need to be supplemented by the advice of skilled persons.

8 The Salient Points Of CP88: Part 1

8.1 Source of Supply

Electrical installation at site may draw its supplies from the public electricity supply network or generating sets. Equipment shall be identified with and be compatible with the particular supply from which it is energized and shall contain only components connected to one and the same installation, except for control of signalling circuits and inputs from standby supplies. Due consideration shall be given to the fault level (prospective short-circuit current) at the point of supply.

8.2 Types of supply

(a) Mains voltages of public supply system

(i) Three-phase. 400V is the standard three-phase mains supply system voltage at 50Hz.

(ii) Single-phase. 230V is the standard single-phase mains supply system voltage at 50Hz.

(b) Supply voltage from generating sets

For a generating set supplying low voltages, unless otherwise approved by the skilled person responsible for the design and installation of supply installation, the output voltages shall be as follows:

(i) Three-phase. 400V between phases, and 230V between phases and Earth, 50Hz.

(ii) Single-phase. 230V between phase and Earth, 50Hz.

(c) Reduced voltage

110V single phase. The supply shall be obtained from a double-wound transformer having the centre tap of the secondary winding earthed so that the nominal voltage to Earth is only 55V.

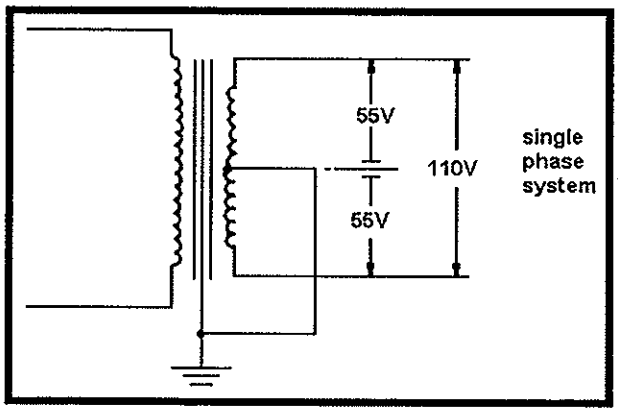


Figure 11 – Arrangement of transformer for safety 110V supply

(d) Extra low voltage

50V single phase. The supply shall be obtained from a double-wound transformer having the centre tap of the secondary winding earthed so that the nominal voltage to Earth is only 25V.

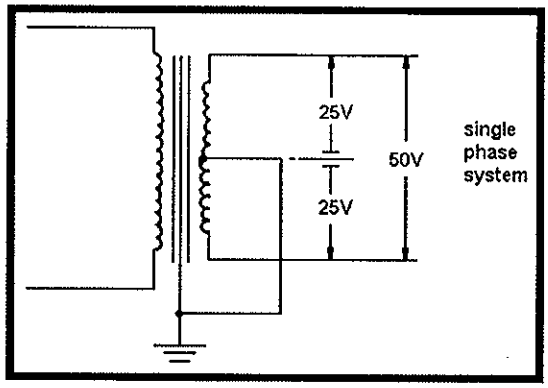


Figure 12 – Arrangement of transformer for safety 50V supply.

8.3 No parallel operation of generating set and the public electricity supply system

No parallel operation of the generating set and the public supply system shall be allowed unless otherwise approved by the public electricity supplier. In a service area where electricity supply is taken from a generating set, no electricity supply from the public supply system shall be introduced into the same service area.

8.4 Supply for equipment

The following voltages shall not be exceeded:

1.	Fixed plant, moveable plant fed via a trailing cable, installations in site buildings such as site offices, workshops, canteens and quarters, fixed flood lighting and site lighting.	400V 230V	Three-phase, or single-phase
2.	Portable electric hand-held tools and portable hand-lamps.	230V	Single-phase
3.	Portable electric hand-held tools and portable hand-lamps used underground such as any shaft, tunnel, caisson or cofferdam.	110V	Single-phase, centre point earthed

4.	Portable electric hand-held tools and portable hand-lamps used in confined locations such as the insides of boilers, tanks, pipes, or in other similar situations.	50V	Single-phase, centre point earthed

8.5 Type of earthing arrangement

1. The earthing system for electrical installations drawing supply from generating sets shall be TN-S.

2. If more than one generating set are used within a site, the electrical installations shall either:

   (i) Share a common earthing system, or

   (ii) Have separate earthing systems and the electrical installations connected to different earthing systems are segregated effectively from one another or effectively bonded to prevent dangerous potential rise between conducting parts which a person can come into simultaneous contact.

   This requirement also applies to more than one electrical installations taking supply from the public supply system within the same site.

   (iii) The design, selection and installation of protective conductors shall be in accordance with Singapore Standard CP5.

8.6 Installation of generating set

(a) General

Generating set shall be suitably barricaded to prevent access by non-authorised persons. Adequate clearance around generating set shall be provided to facilitate operation and maintenance work. Access leading to the generating sets shall be unimpeded to the skilled person or his representatives at all times. Any switch or control for stopping and starting the engines shall be readily accessible. In addition, generating set shall not be installed:

(i) In damp situations or exposed to the weather unless suitably protected; or

(ii) In hazardous areas, unless the equipment and method installation complies with BS 5345 and the additional requirements of any relevant authority.

Care shall be taken to have the fuel and its containers stored in a safe manner.

(b) Earthing arrangements of generating set

Electrical installation supplied from generating sets shall share a common TN-S earthing system with the generator or generators connected to it. In any electrical installation, a main earthing terminal or bar of adequate rating shall be provided and connected to the earthing conductors. The star point of a three-phase generator winding or the mid-point of a single-phase centre-tapped generator winding shall be solidly earthed through adequately rated conductors to the earthing system of the installation.

In addition, the following parts of the generating sets shall be bonded together to form the generator bonding system which shall be connected effectively to the main earthing terminal:

(i) The engine frame;
(ii) The generator frame;
(iii) All exposed metal enclosure for electrical equipment and wiring;
(iv) Earth terminals of all socket-outlet (if any); and
(v) The main frame terminal (marked ⏚)

(c) Protection against direct contact of all live parts

All live parts of a generating set shall be protected against direct contact in accordance with Singapore Standard CP 5.

(d) Labelling on generating set

The following information shall be indelibly and legibly marked on a generating set:

(i) The name of the manufacturer of the set;
(ii) The model number and serial number of the set;
(iii) The type of fuel or fuel-oil mixture;
(iv) Rated output in watts or kilowatts at a stated power factor;
(v) The voltage and frequency;
(vi) Output terminal markings (unless all outputs are socket-outlets);
(vii) The frame terminal: symbol marked ⏚;
(viii) On a set intended for undercover or weather-protected usage, the words "NOT WEATHER-PROOF"

(ix) On a set intended for outdoor use without further protection, the IP classification of its electrical equipment.

(x) In addition, a danger sign board made of durable material with the word DANGER with the specification as detailed in Annex D shall be displayed at a prominent location near the generating set.

8.7 Protection for safety

(a) Control of supply

(i) General

Every electrical installation on construction sites shall be adequately controlled by switchgear readily accessible to the skilled person or his authorized representative in charge of the installation and shall incorporate:

- Means of isolation;
- Means of overcurrent and earth fault protection; and
- Means of earth leakage protection (except extra-low voltage installations)

(ii) Protective device for incoming supply

For an incoming supply up to 300A three-phase, a circuit breaker with residual current device shall be provided at the main switchboard.

For an incoming supply exceeding 300A three-phase, a circuit breaker incorporating overcurrent and earth fault protective devices shall be provided.

(iii) Protection of circuits

Appropriate electrical protection shall be provided for all circuits, including final circuits, against overload, short-circuit and earth-fault current. The protective devices shall be capable of interrupting without damage any fault current that may occur and due consideration shall be given to the fault level of the supply.

(iv) Prohibited use of fuses for final circuits

Fuses shall not be used for protecting final circuits in any part of the installation, except for those socket-outlets incorporated with fuse protection.

(b) Protection against direct contact

One or more of the following basic protective measure shall be used in accordance with the requirements in Singapore Standard CP 5:

(i) Protection by insulation of live parts,
(ii) Protection by a barrier or an enclosure,
(iii) Protection by obstacles,
(iv) Protection by placing out of reach.

(c) Protection against indirect contact for low voltage system

(i) Protection by residual current device

Protection against indirect contact shall be afforded using residual current devices and the following condition shall be fulfilled as appropriate to the type of earthing system:

For TN-S system: $Z_s I_{\Delta n} \leq 25$ V

Where:

Z_s is the earth fault loop impedance in ohms

$I_{\Delta n}$ is the rated residual operating current of the protective device in amperes.

For TT system: $R_a I_{\Delta n} \leq 25$ V

Where:

R_a is the sum of the resistances of the earth electrode and the protective conductor(s) connecting it to the exposed-conductive-part.

(ii) Protection by residual current device for final circuits

Except for final circuits supplying equipment which are protected by other appropriate measures as permitted under this Code and only accessible to and are operated by a skilled person, all other final circuits are to be protected by one or more residual current devices. The type and tripping sensitivities of residual current device to be used for the final circuit of the following rating shall be:

- Residual current circuit breaker with a tripping current not exceeding 30 mA and a tripping time within 0.1 s

complying with SS 97 for final circuits of rating not exceeding 63 A three-phase or single-phase at mains voltage.

- Residual current circuit breaker with a tripping current not exceeding 300 mA complying with SS 97 for final circuits of rating exceeding 63 A but not more than 100 A three-phase or single-phase at mains voltage.

- Residual current device with a tripping current not exceeding 500 mA shall be used for final circuits of rating exceeding 100 A three-phase at mains voltage.

(iii) Earth leakage protection for transportable electrical equipment

For guidance on earth leakage protection for transportable electrical equipment, refer to Singapore Standard CP 16.

8.8 Selection and erection of equipment

(a) Wiring systems

(i) Every item of equipment shall be selected and erected so as to comply with the general requirements stipulated in the Singapore Standard CP 5 and the following clauses in this Section.

(ii) All cables to be laid direct in the ground shall be armoured cables.

(iii) Except for cables installed overhead, all other cables for submains or final circuits operating at voltages exceeding 63 V to Earth (Three-phase system) or 55 V to Earth (Single-phase system) and routed outdoor shall be of armoured construction and buried where possible.

(iv) All cables which are likely to be moved in normal use shall be flexible cables. Where trailing cables are required by nature of the work, they shall be of the armoured type complying with BS 6708 having an over-sheath of heavy duty oil-resisting and flame-retardant compound.

(v) Elevated cables shall be fully insulated having a sheath of PVC or an oil-resisting and flame-retardant or heat resisting sheath. Overhead cables exposed to sunlight shall have suitable non-metallic covering.

(vi) Except for situations (e.g. switch rooms or control rooms) where the risk of mechanical damage is slight, armoured cables having an over-sheath of PVC or an oil-resisting and flame-retardant compound or cables with adequate mechanical protection shall be used.

(b) Flexible cords

(i) Flexible cords shall be of the circular type having heat resisting, oil resisting and flame-retardant rubber-sheath complying with IEC 60245 Part 1 or PVC insulated and PVC sheathed complying with SS 358: Part 5.

(ii) Flexible cords for portable hand-lamps shall be of the circular type having screened Type EM2 rubber-sheath complying with BS 6500.

(iii) Flexible cords of portable electrical equipment shall not exceed 3 m in length or such length as supplied by the original equipment manufacturer.

(iv) Flexible cords of conductor size smaller than 1.0 mm2 (32/0.20 mm) shall not be used.

(c) Installation of cables

(i) Cables, other than those supplying power to portable electrical equipment or mobile plant, shall be fixed on site so that they are clear of building operation or engineering construction work and are not a hazard to persons working on the site.

(ii) All cables are to be installed without obstruction to the use of passageways, walkways, ladders, stairs and the like.

(iii) Where submains cables inside a building or under a covered area are to be suspended or supported from the ceiling or wall, cable trays, brackets or other suitable supports shall be provided. The cable supports shall not cause damage to the cable insulation or subject the cables to undue mechanical stress.

(iv) Laying of cables on the ground or the floor of a structure shall be avoided. Where it is unavoidable to lay cables on the ground or the floor of a structure, the cables shall be of the armoured type complying

with BS 6708 having an over-sheath of heavy duty oil-resisting and flame-retardant compound or PVC insulated, steel wire armoured and PVC sheathed complying with SS 443 and shall be laid in such a manner that the risk of mechanical damage is prevented.

(v) Elevated flexible cables used indoor shall be provided with suitable mechanical protection and securely supported in such a manner as not to damage the sheath of the flexible cables and not subject the cables or their terminations to undue mechanical stress.

(vi) No flexible cord shall be used as submain or final circuit for the purpose of distribution of electricity supply.

(vii) Cables buried direct in the ground shall be marked by cable covers and shall be buried at a minimum depth of 300 mm to avoid being damaged by any disturbance on the ground. The cable route for all supply cables and submains buried underground shall be marked on site drawings.

(viii) Cables passing under roadways or accessways for transport and mobile plant shall be laid at a minimum depth of 600 mm. A cable marker shall be installed at both ends of each crossing.

(ix) Overhead cables shall be so placed and at such height as to be out of reach of any source of mechanical damage reasonably to be foreseen in the area where they are erected.

(x) Overhead cables shall be installed at a height such that a clear vertical distance between the lowest part of the overhead cables and the highest point of vehicles, mobile cranes or other mobile plant likely to pass underneath them is 2 m minimum but under no circumstances shall the clear height to ground of the overhead cables be less than 5 m where they cross roadways or accessways.

(xi) Overhead cables shall be supported by catenary wires or proper cable support in a manner such that the cables are not subjected to undue mechanical stress. The catenary wires or metallic cable support shall be effectively bonded to Earth.

(xii) Poles supporting overhead cables shall be so located or arranged that the risk of mechanical or vehicular damage is prevented. Poles shall be sufficiently sized with adequate mechanical strength and properly anchored.

(xiii) Metal pole of minimum diameter 100 mm with adequate mechanical strength shall be used. Poles are made of wood or plastic material shall not be used for this purpose.

(xiv) All cables shall be installed so that they are at least 150 mm clear of piped services such as steam, gas and water and shall not be located directly below and parallel to these pipes.

(xv) All armoured cable terminations shall be provided with cable glands and earth tags for bonding to associated gland plate and adjacent cables in order to maintain satisfactory earth loop impedance. The armour of the cable shall not however be relied on as circuit protective conductor for the cable.

(xvi) All joints shall be mechanically and electrically sound and fully insulated.

8.9 Switchgear and controlgear

Enclosure for low-voltage assembly

(a) The enclosure of each assembly for the distribution of electricity shall be robustly constructed so as to have adequate strength and rigidity to resist damage that could result from transportation, rough handling and heavy objects falling on it.

(b) Except for socket–outlet assembly, the enclosure for outdoor installation shall have:

(i) A degree of protection of at least IP44 to ensure the safe and satisfactory operation of the enclosed equipment; and

(ii) A roof so designed to prevent stagnation of water on its surface.

NOTE – It is recommended that the roof shall extend at least 76 mm beyond the main body of the enclosure.

(c) The enclosure shall be so placed, installed and safeguarded:

(i) To prevent damage by external influence that may affect the design and safe operation of the equipment; and

(ii) Shall be provided with adequate and safe means of access and working space for operation and maintenance purposes.

Switchboard and distribution board

Every switchboard and distribution board shall incorporate means for isolating and switching the incoming supply. Isolating switches or circuit breakers used for this purpose shall be suitable for securing in the OFF position.

8.10 Assembly of socket-outlet

Purpose of the SOA

The intention for the use of the SOA is to move the construction industry towards a more systematic approach in these setting up of temporary electrical installations.

Socket–outlet assembly (SOA)

One of the key recommendations in the CP 88 is the introduction of the use of socket-outlet assembly (or SOA). The SOA is basically a metal or plastic cabinet or box in which the various circuit protective devices are housed, and is typically equipped with up to six industrial socket-outlets.

These industrial socket-outlets will allow for the connection of portable electrical equipment such as electrical hand tools, lamps and welding sets and water-pumps.

Thus, it is necessary for each and every piece of portable electrical equipment to be connected up using only industrial plug. This will enable the equipment to be plugged directly into the industrial socket outlet fitted on the SOA.

The SOA has to be manufactured in accordance with standards specified in the CP. It can be designed for wall mounting or fitted with castors so that it can be moved around in the worksite.

Socket-outlets assembly

Socket-outlet assembly shall be used for the connection of portable electrical equipment at locations where fixed socket-outlets may not be available.

Enclosure for socket-outlet assembly

(a) The enclosure for the socket-outlet assembly shall be fabricated from:-

(i) Galvanised sheet steel of minimum 1.5mm thickness finished in epoxy powder coating; or

(ii) Aluminum sheet of minimum 2mm thickness finished in epoxy powder coating; or

(iii) Self-extinguishing, non-hygroscopic polycarbonate thermoplastic with high impact strength (6 joule), high resistance to UV rays, high resistance to chemical elements and high resistance to abnormal heat and fire C (glow wire test according to SS 145 Part 2).

(b) The degree of protection of the enclosure shall be of minimum IP44 to SS IEC 60529.

(c) The enclosure can be of floor standing or wall mounting and shall be totally enclosed with all live parts protected from direct contact. Floor standing socket-outlet assembly shall be:-

- Fitted with supports to afford a minimum clearance of 150mm from the ground; and
- Provided with handles and lifting lugs.

(d) Every cable connection to and from the enclosure shall be means of plugs and socket-outlets as specified in subclause 5.5 of CP 88.

Single-phase socket-outlet assembly fed from single-phased source

(a) The assembly shall be fed from a 32A single-phase 230V source.

(b) A fixed plug rated at 32A single-phase 230V shall be provided to receive the 32A single-phase 230V incoming supply. A 32A double-pole MCB shall be provided to control the incoming supply.

(c) A maximum of up to six numbers of 16A 2-pole and earth socket-outlets shall be provided. Each socket-outlet shall be controlled by a double-pole MCB not exceeding 16A current rating. All socket-outlets shall be protected by residual current circuit breaker complying with Singapore Standard SS 97 having a rated residual current not exceeding 30mA.

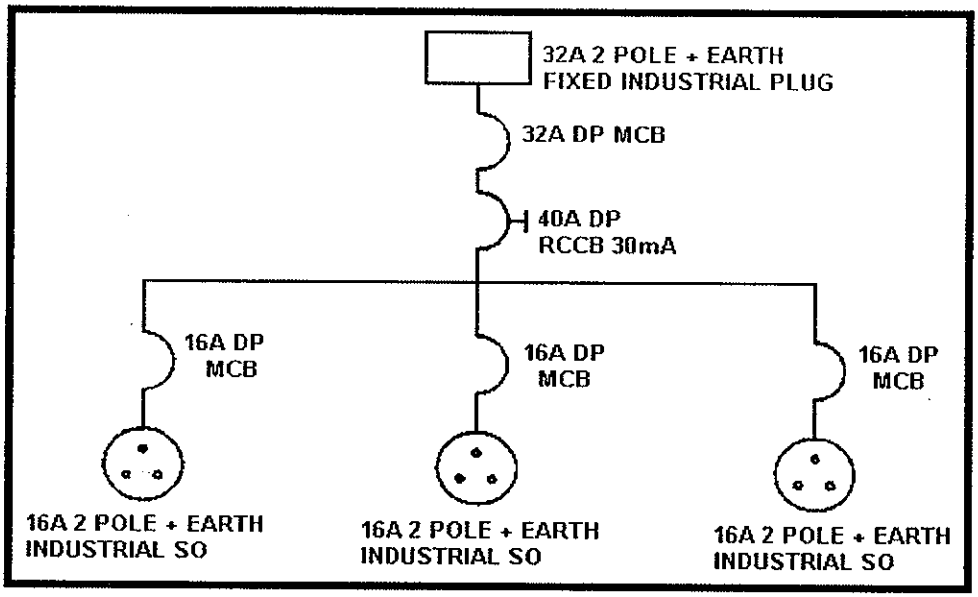


Figure 13 – Example of single-phase socket-outlet assembly fed from single-phase source

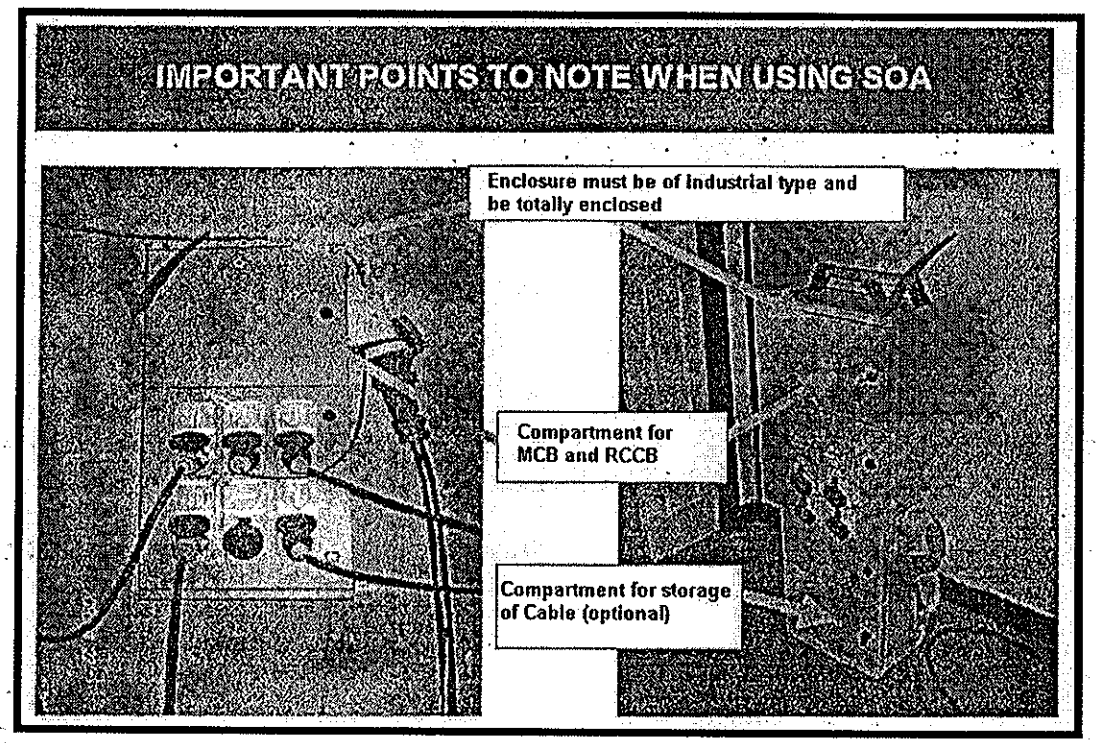


Figure 14 – Typical wall mounted SOA

Single-phase socket-outlet assembly fed from three-phase source

(a) The assembly shall be fed from a 32A three-phase 400V source.

(b) A fixed plug rated at 32A three-phase 400V shall be provided to receive the 32A three-phase 400V incoming supply. A 32A 4-pole MCB shall be provided to control the incoming supply.

(c) A maximum of nine numbers of 16A 2-pole and earth socket-outlets shall be provided. Each socket-outlets shall be controlled by a double-pole MCB not exceeding 16A current rating. All socket-outlets shall be protected by residual current circuit breaker complying with Singapore Standard SS 97 having a rated residual current not exceeding 30mA.

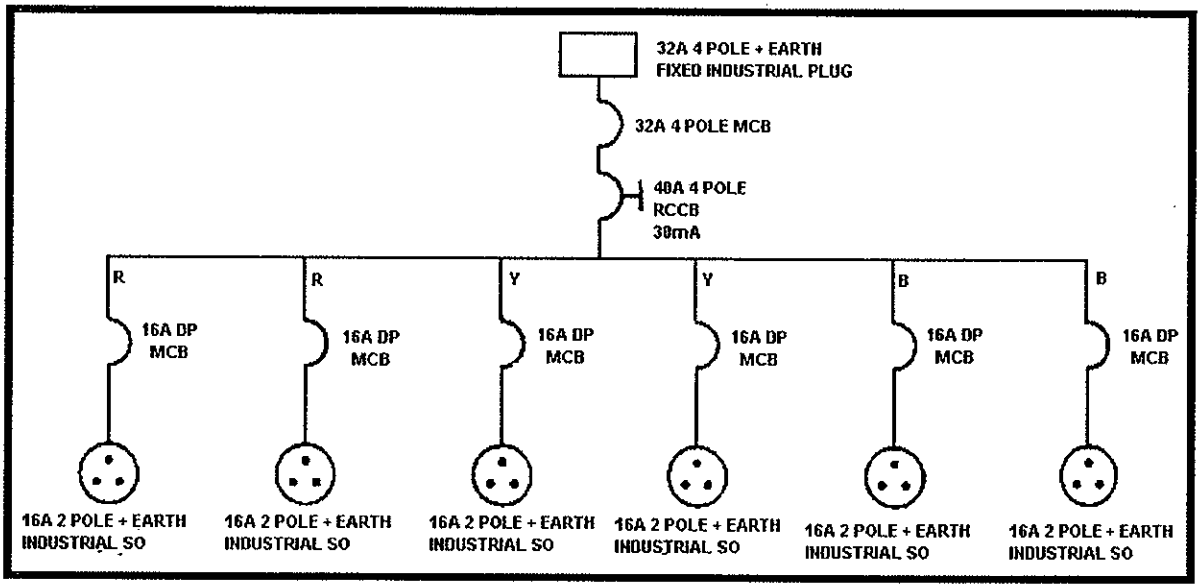


Figure 15 – Example of single-phase socket-outlet assembly fed from three-phase source

Three-phase socket-outlet assembly

(a) The assembly shall be fed from a 32A three-phase 400V source.

(b) A fixed plug rated at 32A three-phase 400V shall be provided to receive the 32A three-phase 400V incoming supply. A 32A 4-pole MCB shall be provided to control the incoming supply.

(c) A maximum of three numbers of 16A 4-pole and earth socket-outlets shall be provided. Each socket-outlet shall be controlled by a TP&N MCB not exceeding 16A current rating. All socket-outlets shall be protected by residual current circuit breaker complying with Singapore Standard SS 97 having a rated residual current not exceeding 30mA.

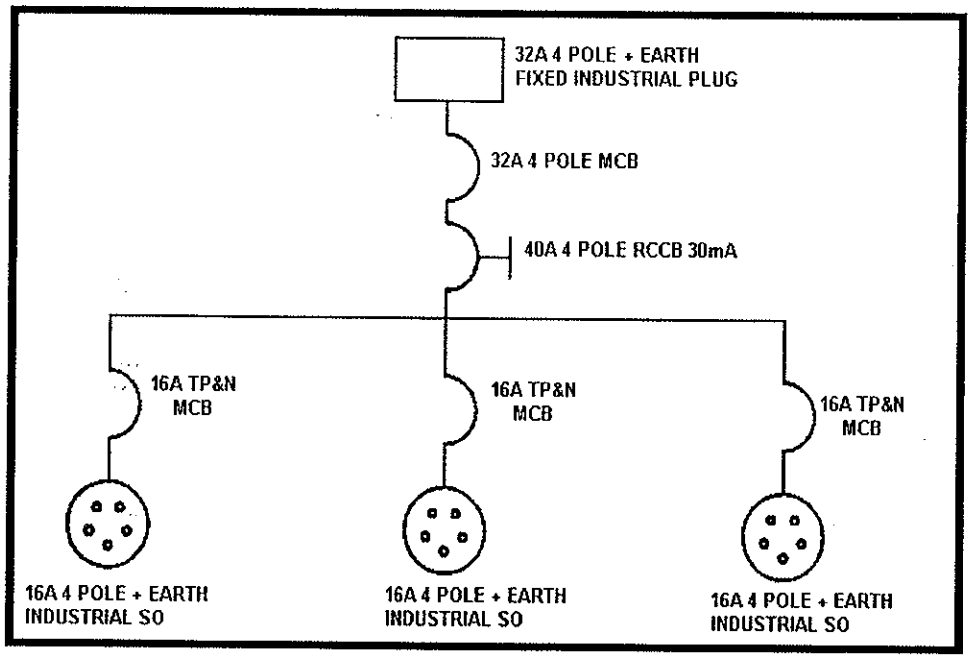


Figure 16 – Example of three-phase socket-outlet assembly

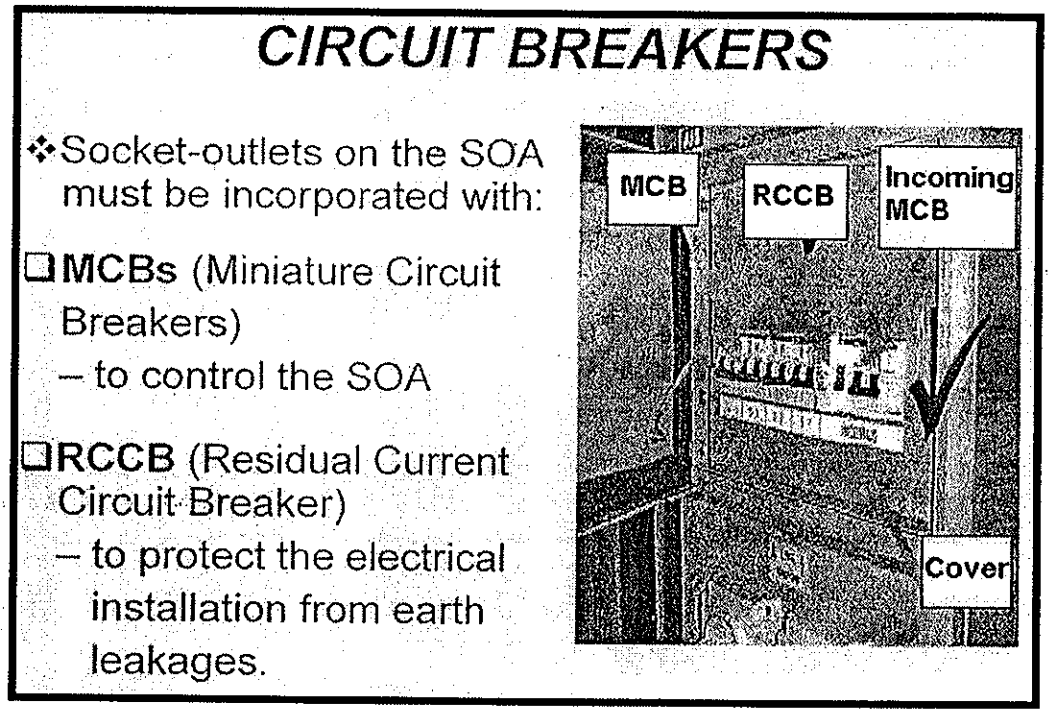


Figure 17 – Circuit breaker inside the SOA

Three-phase and single phase socket-outlet assembly

(a) The assembly shall be fed from a 32A three-phase 400V source.

(b) A fixed plug rated at 32A three-phase 400V shall be provided to receive the 32A three-phase 400V incoming

supply. A 32A 4-pole MCB shall be provided to control the incoming supply.

(c) A maximum of two numbers of 16A 4-pole and earth socket-outlets and a maximum of three numbers of 16A 2-pole and earth socket-outlet shall be provided. Each socket-outlet shall be controlled by a TP&N MCB/double-pole MCB of current rating not exceeding 16A. All socket-outlets shall be protected by residual current circuit breaker complying with Singapore Standard SS 97 having a rated residual current not exceeding 30mA.

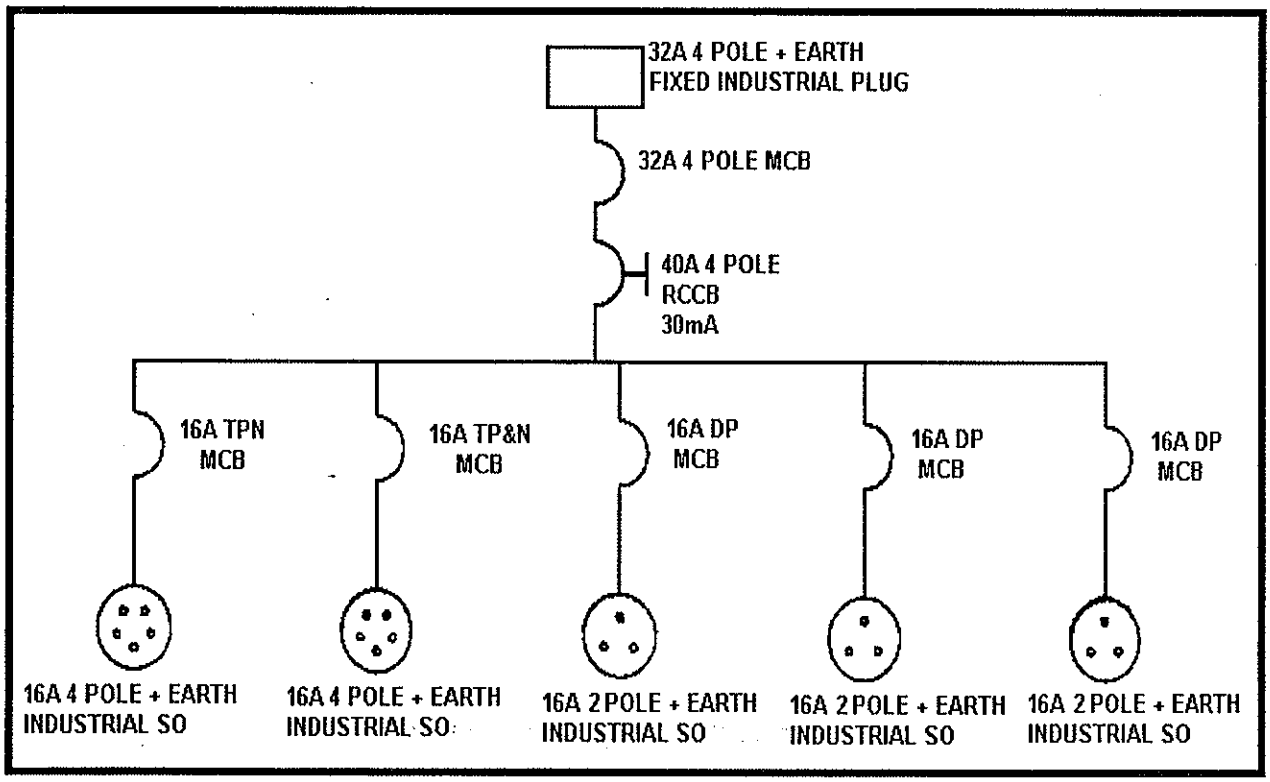


Figure 18 – Example of three-phase and single-phase socket-outlet assembly

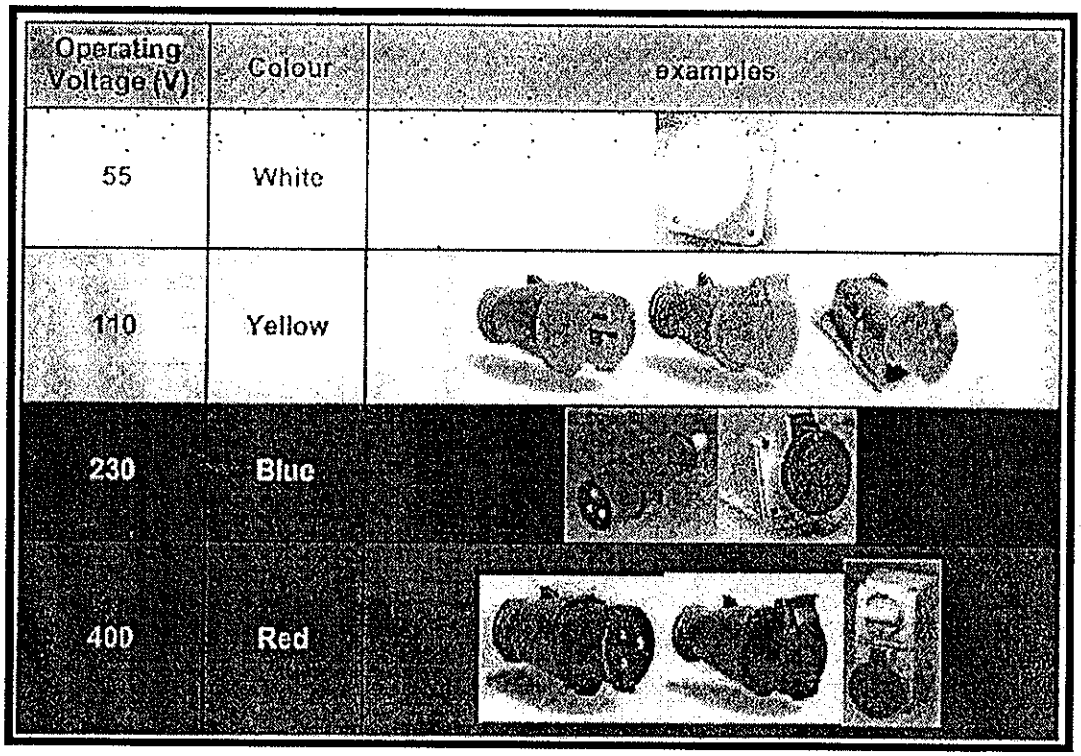


Figure 19 – Plug and socket-outlet on SOA

Plugs, socket-outlets and cable couplers

(a) All plugs, socket-outlets and cable couplers shall comply with the requirements of IEC 60309.

(b) All plugs, socket-outlets and cable couplers likely to be exposed to the weather shall be contained in a weatherproof enclosure unless they are of the weatherproof type (minimum IP44 to SS IEC 60529).

(c) Plugs of one voltage system shall not be capable of entering socket-outlets of other voltage systems used in the same site.

(d) Plugs, socket-outlets and cable couplers of a 110V single-phase operation shall be of the 3-pin and the 'numbered hour position' shall be 4H.

NOTE – Numbered hour position indicates the position of earth contact-tube in relation to the keyway.

(e) Plugs, socket-outlets and cable couplers for use with 230V single-phase system shall be of the 3-pin type with the numbered hour position 6H.

(f) Plugs, socket-outlets and cable couplers for use with 400V three-phase system shall be of the 5-pin type, 3-pole and neutral and earth, and numbered hour position 6H.

(g) Where several voltages are used in the temporary installation, all plugs, socket-outlets and cable couplers shall be identified by different colours as given in Table 2.

Operating voltage (V)	Colour
55	White
110	Yellow
230	Blue
400	Red

Table 2 – Colour coding

8.11 Connection to socket-outlets

(a) Connection of flexible cables or flexible cords to socket-outlets shall be by means of plugs.

(b) Where heavy electrical plants such as rail-mounted tower cranes requires the use of plugs and socket-outlets as a convenient form of connection at mains, such plugs and socket-outlets shall be mechanically interlocked. Electrical interlock can be used as an additional feature.

8.12 Cable for SOA Connection

An extension cable may be used to connect portable equipment to a SOA and such extension cable shall comply with the following conditions:

(a) the cable shall be appropriately sized and provided with suitable mechanical protection;

(b) the cable shall be connected to an industrial plug of appropriate rating on one end and a switched industrial socket-outlet at the other end to facilitate emergency switching; and

(c) the industrial plug and switched socket-outlet shall be as specified in clause 5.5 of CP 88.

8.13 Earthing arrangement and protective conductor

Every earthing arrangement and protective conductor shall be selected and erected to comply with the requirements of the Singapore Standard CP 5. Attention shall also be paid to the need for equipotential bonding of extraneous metallic parts.

(a) **Protective earthing of metalwork**

Metalwork not belonging to the installation including steel scaffolding which is liable to come into fortuitous contact and become live in the event of a failure of insulation of the installation shall be effectively earthed at all times.

(b) **Earthing of portable appliances and tools**

Exposed metalwork of all portable appliances and tools shall be connected to the circuit protective conductors in the flexible cables or flexible cords unless they are double-insulated as specified in SS 236 or of extra-low voltage system. For further guidance, refer to the appropriate clause in Singapore Standard CP 16 on earthing of portable appliances and tools.

(c) **Earthing of metal sheath and armour of cables**

Metal sheath and armour of cables shall be effectively earthed. However, the metal sheath or armour of the cable shall not be used as circuit protective conductor.

(d) **Metal sheath and/or armour of flexible or trailing cables**

Metal sheath and/or armour of flexible or trailing cables shall not be the sole circuit protective conductor but in addition to the earth cores of the cables.

(e) **Earthing of metal enclosure for switchboards and distribution boards**

Constructional precautions shall be taken to ensure electrical continuity between the exposed conductive parts of the switchboard and distribution boards and between these parts and the protective circuits of the installation.

8.14 Other equipment

(a) **Light fixtures**

Light fixtures used outdoor or at locations where there is likelihood that such fixtures are subjected to water splashing shall be of the weatherproof type. Light fixtures installed shall be

equipped with suitable guards if they are exposed to risk of mechanical damage.

(b) **Portable hand-lamps**

Portable hand-lamps supplied through flexible cords shall be of the moulded composition or other type designed for the purpose and equipped with a handle. Hand-lamps shall also be equipped with substantial guard attached to the lampholder or the handle.

(c) **Prohibited use of lampholders fitted with pin contacts**

The use of lampholders fitted with pin contacts intended to be penetrated into tough rubber sheath or polychloroprene sheath cable is prohibited.

(d) **Electrical welding system**

Every A.C. welding set must be equipped with low voltage shock preventor. The preventor shall effectively reduce the open circuit secondary voltage to a safe level not exceeding 25 V.

The low voltage shock preventors shall be of the built-in type or be housed in a weatherproof metal casing and effectively secured or locked to prevent tampering by welders and other unauthorized persons. The workpiece should be connected to the return terminal of the welding set through a proper return conductor.

8.15 Equipment for reduced voltage system

(a) **Plug, socket-outlet and cable coupler of a reduced voltage system**

Every plug, socket-outlet and cable coupler of a reduced voltage system shall have a protective conductor contact and shall not be dimensionally compatible with any plug, socket-outlet or cable coupler for use at any other voltage or frequency in the same installation.

(b) **Switches for reduced voltage circuits**

Switches controlling single-phase supplies on installations operating up to and including 110 V shall be of the double-pole type with circuit protection provided in each line conductor.

8.16 Inspection, testing and maintenance

(a) Electrical installation on site shall be inspected and tested in accordance with the requirements of Part 7 – Inspection and

Testing of Singapore Standard CP 5 before installation is energised.

(b) Strict maintenance and periodic inspection of the electrical installation and the wring distribution system shall be carried out by a skilled person to promote safety and to ensure efficient operation.

(c) All temporary electrical installations shall be inspected by a skilled person at least once a month. Upon completion of the inspection, the skilled person shall complete and sign the checklist shown in Annex C and hand it over to the operator of the electrical installation or his representative.

(d) Where any defect or unsafe condition is revealed during the inspection, the skilled person shall take measures, such as by rectifying the defects, or by isolating or disconnecting the defective part or parts from electricity supply, to render the electrical installation safe. Appropriate measures taken shall be clearly indicated in the checklist.

9 Introduction to CP88: Part 2: 2004

9.1 Introduction

This Part of the Singapore Standard CP 88 was prepared by the Technical Committee on Temporary Electrical Installations under the direction of the Electrical Industry Practice Committee.

Temporary electrical installations for festive lighting, trade-fairs, mini-fairs and exhibition sites such as bazaar, exposition and decorative lighting installation erected in conjunction with festive, religious or commercial events, are becoming increasingly common. This Code has been prepared to meet the need. It is drawn up to supplement the general requirements of Singapore Standard CP 5 – 'Electrical installations' and includes recommendations with regard to inspection, testing and maintenance.

In preparing this Code, reference was made to the IEC 60364-7-740 – 'Electrical installations of buildings, Part 7: Requirements for special installations or locations, Section 740 : Temporary electrical installations for structures, amusement devices and booths at fairgrounds, amusement parks and circuses' and SS 263 – 'Specification for luminaires, Part 10 : Particular requirements for lighting chains.'

The Technical Committee on Temporary Electrical Installations would also like to acknowledge the contribution of an initial draft by the Technical Committee on Festive Lighting.

Note – Temporary electrical installations other than that for festive lighting, trade-fairs, mini-fairs and exhibition sites may be covered in other parts of this Code.

9.2 Scope

This part of the Code deals principally with outdoor electrical installation set up for the provision of electricity supply for:

(a) trade-fairs or mini-fairs;

(b) exhibition;

(c) amusement park;

(d) decorative lighting in public place; or

(e) any outdoor electrical installation set up for festive, religious or commercial event accessible to the public.

It specifies the minimum electrical installation requirements to facilitate the safe design, installation and operation of mobile and temporarily installed electrical machines and structures, which incorporate electrical equipment. The machines and structures are intended to be installed repeatedly, without loss of safety, temporarily or permanently, at fair/exhibition sites, amusement parks or any other similar sites.

This Code does not cover decorative lighting within domestic premises as the requirement is provided by Singapore Standard CP 5.

However, some temporary installations may receive supplies at voltages higher than 1000 V, such parts of the installations are outside the scope of this Part of the Code.

Discharge lighting installation operating at high voltage for the purpose of decoration is also outside the scope of this code.

This code does not apply to the electrical equipment of machines.

NOTE – The titles of the publications referred to in this standard are listed at the end of the standard.

9.3 Objective

The objective of this Code is to ensure safety, especially protection against electric shock in the use of electricity in outdoor electrical installations, typically for festive lighting, trade-fairs, mini-fairs and exhibition sites, which are in open areas easily accessible by the public and subject to environmental conditions.

This Code is drawn up to supplement the general requirements of Singapore Standard CP 5.

The requirements of this Code are given in general terms, and will normally need to be supplemented by the advice of skilled persons.

10 Salient points of the CP 88: Part 2

10.1 Source of supply

- Public electricity supply network
- Generating sets

10.2 Types of supply

10.3 Supply voltage

- Reduced voltage
- Extra low voltage
- Separated extra-low voltage (SELV)

10.4 Type of earthing arrangement

- Generating sets – TN-S

10.5 Installation of generating set

- General
- Earthing
- Protection against direct contact to live parts
- Labelling on generating set

10.6 Protection for safety

10.7 Protection by residual current device

Protection against indirect contact shall be afforded using residual current devices and the following condition shall be fulfilled as appropriate to the type of earthing system:

For TN-S system: $Z_s I_{\Delta n} \leq 25$ V

Where:

Z_s is the earth fault loop impedance in ohms

$I_{\Delta n}$ is the rated residual operating current of the protective device in amperes.

For TT system: $R_a I_{\Delta n} \leq 25$ V

Where:

R_a is the sum of the resistances of the earth electrode and the protective conductor or conductors connecting it to the exposed-conductive-part.

10.8 Protection by residual current device for final circuits

Except for final circuits supplying equipment which are protected by other appropriate measures as permitted under this Code and only accessible to and are operated by a skilled person, all other final circuits are to be protected by one or more residual current devices. The type and tripping sensitivities of residual current device to be used for the final circuit of the following rating shall be:

(a) Residual current circuit breaker with a tripping current not exceeding 30mA and a tripping time within 0.1s complying with SS 97 for final circuits of rating not exceeding 63 A three-phase or single-phase at mains voltage.

(b) Residual current circuit breaker with a tripping current not exceeding 300mA complying with SS 97 for final circuits of rating exceeding 63 A but not more than 100 A three-phase or single-phase at mains voltage.

(c) Residual current device with a tripping current not exceeding 500mA shall be used for final circuits of rating exceeding 100 A three-phase at mains voltage.

10.9 Earthing of metal structures

All metallic tent structures within a fair or exhibition site shall be bonded effectively to the earthing system of the electrical installation. Where decorative lighting is installed, all associated metallic-supporting structures shall also be bonded to the same earthing system.

Every item of equipment shall be selected and erected so as to comply with the general requirements stipulated in the Singapore Standards CP 5 and the following clauses in this Section.

10.10 Wiring system

Installation of cables

(a) All cables shall meet the requirements of IEC 60332-1. Where appropriate, cables shall be of flexible construction.

NOTE – Where enhanced performance is required, cables should meet the requirements of IEC 60332-3; where low smoke cables are needed, the minimum recommended performance is given in IEC 61034-2.

(b) Cables shall have a minimum voltage designation of 450/750 V, except that, within amusement devices, cables and cords having a minimum voltage designation of 300/500 V may be used.

(c) Armoured cable or cables protected against mechanical damage shall be used where there is risk of mechanical damage. The armour of the cable shall not be relied on as a circuit protective conductor for the cable.

(d) The routes of cables buried in the ground shall be marked at suitable intervals. Buried cables shall be protected against mechanical damage.

(e) Cables shall not be run across public roads or walkways unless:

(i) Adequate protection of the cables is provided against mechanical damage; and

(ii) Such installation will not cause any obstruction or pose any danger to the public.

(f) Cables installed for fixed wiring within the area covered by tents shall not cause obstruction to the public.

(g) Except for rubber-insulated cables, such as neoprene, ethylene propylene rubber, etc, non-metallic sheathed PVC insulated cables used for fixed wiring within the area covered by tents outdoor shall be installed in conduit or trunking.

Electrical connections

Joints shall not be made in cables and cords, except where necessary as a connection to a circuit. Where joints are made:

(i) Cable couplers complying with the requirements of IEC 60309-2 shall be used; or

(ii) Connection units complying with SS 241 or equivalent IEC standards and installed in an enclosure with a degree of protection suitable to the environmental conditions but not less than IP 4X shall be used. If the enclosure cover can be removed without the aid of

tools or keys, the connections inside the enclosure shall be protected to at least IP 2X.

All cable coupler and connection units shall be supported above floor or ground level in such a manner that the risk of mechanical damage is prevented.

Where strain may be transmitted to terminals, cable anchorage shall be provided.

10.11 Devices for isolation and switching

(a) A means for isolation and switching shall be provided and readily accessible at every switchboard or distribution board for the purpose of disconnecting all phases, poles and the neutral.

(b) Every electrical installation of a booth, stand or amusement device shall have its own means of isolation and overcurrent protection, which shall be readily accessible.

10.12 Switchgear and controlgear

(a) Enclosure for low-voltage assembly

(b) Switchboard and distribution board

10.13 Other equipment

(a) General requirements for equipment installed outdoor including tents

All switches, socket-outlets, distribution boards, or accessories such as junction boxes, ceiling roses, etc. shall be properly installed and suitable for the environmental conditions. All equipment or accessories, which are likely to be exposed to the weather or water splashing, shall have a degree of protection of minimum IP44 complying with SS IEC 60529 or shall be contained in weatherproof enclosures.

(b) Luminaires and fans

All luminaires, fans and decorative chains shall be securely attached to the structure or support intended to carry them. The supply cable shall not carry their weight unless it has been selected and erected for this purpose.

Luminaires and decorative chains mounted less than 2.5m (arm's reach) above floor level or otherwise accessible to accidental contact shall be firmly fixed, and so sited or guarded as

to prevent risk of injury to persons or ignition of materials. Access to the fixed light source shall only be possible by removing a barrier or an enclosure, a procedure that shall require the use of a tool.

(c) Lampholders

Insulation-piercing lampholders shall not be used.

(d) Lamps in shooting galleries

All lamps in shooting galleries and other sideshows where projectiles are used shall be suitably protected against accidental damage.

(e) Lighting chain

The lighting chain shall comply with the requirements specified in Part 10 of SS 263.

(f) Floodlights

All floodlights shall be mounted so that the luminaire is inaccessible to the public. The supply cables shall be flexible and adequate mechanical protection shall be provided.

(g) Fire risks for luminaires and floodlights

Luminaires and floodlights shall be so fixed and protected that a focusing or concentration of heat is not likely to cause ignition of any material.

(h) Electrical discharge lamp installations

Every installation of luminous tube, signs or lamps on a booth, stand or amusement device with an operating voltage higher than 230/400 V A.C. shall comply with the requirements of BS 559.

(i) Location

The sign or lamp shall be installed out of arm's reach (more than 2.5m above floor) or shall be adequately protected to reduce the risk of injury to persons.

(ii) Installation

The fascia or material behind luminous tube, signs or lamps shall be non-ignitable.

Controlgear with output voltages higher than 230/400 V a.c shall be mounted on non-ignitable material.

(iii) Emergency switching devices

A separate circuit shall be used to supply such signs or lamps, which shall be controlled by an emergency switch. The switch shall be easily visible, accessible and marked in accordance with Singapore Standard CP 5.

(i) Safety isolating transformers and electronic converters

Multiple connection safety isolating transformers shall comply with IEC 61558-2-6 or provide an equivalent degree of safety.

A manually reset protective device shall protect the secondary circuit of each transformer or electronic converter (see IEC 60204-1).

Safety isolating transformers shall be mounted out of arm's reach of the public and shall have adequate ventilation. Access by skilled or instructed persons for testing and protective device maintenance shall be provided.

Electronic converters shall conform to IEC 61046.

Enclosures containing rectifiers and transformers shall be adequately ventilated and all vents not obstructed when in use.

(j) Overground or control boxes

Overground or control boxes shall preferably be made of high impact PVC or insulating material. The use of such material is to provide supplementary insulation to reduce risk of overground or control boxes becoming live in the event of fault.

Overground or control boxes that housed the circuit breakers, socket-outlets, etc for the purpose of distributing supply shall be suitable for environmental conditions.

(k) Socket-outlets, plugs and couplers

An adequate number of socket-outlets shall be installed to allow the user's safety requirements to be met.

All socket-outlets shall be firmly installed and suitable for the environment. Socket-outlets, plugs and couplers that are likely to be exposed to weather conditions shall comply with IEC 60309-2 or contained in weatherproof enclosures.

Not more than one flexible cable or cord shall be connected to a plug unless the plug is specifically designed for multiple connections.

Multiple-way plug-in type adapters shall not be used.

10.14 Decorative lightings

(a) Definition of decorative lighting

- Locations
  - Outdoor
  - Indoor
- Voltage level
  - Low voltage system (230/400 V)
  - SELV (<25 V AC RMS or 60 V ripple-free DC)
    - For lighting accessible/within reach/accessible to accidental contact, it shall be SELV operated.
- Type of luminaries

(b) Section 5.6 decorative lighting of CP 88 part 2

- Decorative lighting can be operated at either low voltage or SELV
- Protection by residual current circuit breaker of 30mA sensitivity for each decorative lighting circuit
- Protection by SELV not exceeding 25 V (AC RMS) or 60 V (ripple –free DC)

(c) Selection of decorative lighting
CP 88 Part 2
Section 5.5(other equipment)

5.5.1 General requirement

- Suitable for the application environment
- Min. IP 44 (lightly exposed to weather/water splashing) or in weatherproof enclosures

5.5.2 Installation

- Securely attached to structure or support
- Supply cable carry the fitting if designed for

- Sited/guarded to prevent risk of injury/ignition of material (if it is mounted less than 2.5m height)
- Protected by barrier/enclosure and access by tool only (if it is mounted less than 2.5m height)

5.5.6 Floodlights

- Inaccessible to the public
- Supply cable for floodlight shall be flexible /mechanical protection
- Position of floodlights to avoid focus or concentration of heat to cause ignition of any materials

5.5.8 Discharge lamp (>230/400 V A.C)

- Installed out of arm's reach or adequately protected to reduce injury
- Fascia/back shall be non-ignitable
- Controlgear to be mounted on non-ignitable material
- Emergency switch be easily visible/accessible

10.15 Inspection, testing and maintenance

(a) Electrical installation on site shall be inspected and tested in accordance with the requirements of Part 7 – Inspection and Testing of Singapore Standard CP 5 before installation is energised.

(b) Strict maintenance and periodic inspection of the electrical installations and the wiring distribution system shall be carried out by a skilled person to promote safety and ensure efficient operation.

(c) All temporary electrical installations shall be inspected periodically by a skilled person. Upon completion of the inspection, the skilled person shall complete and sign the checklist shown in Annex B and hand it over to the operator of the electrical installation or his representative.

(d) Where any defect or unsafe condition is revealed during the inspection, the skilled person shall take measures, such as by rectifying the defects, or isolating or disconnecting the defective part(s) from electricity supply, so as to render the electrical installation safe. Appropriate measures taken shall be clearly indicated in the checklist.

11 Conclusion

The design, installation and maintenance of electrical distribution systems are essential to the reliability of the plants and buildings, and the

safety of the personnel in the buildings. Thorough understanding of the code of practice requirements and strict compliance to ensure electrical safety is our duty and responsibility.

TOPIC 9: ELECTRICAL ACCIDENT INVESTIGATIONS

1 Case Study 1

1.1 Background

The fatal accident occurred in 1999 at a construction site. The deceased received a fatal electric shock while trying to use an electric stirrer to mix some cement for cement plastering work. The deceased was sent to the hospital unconscious and was pronounced dead by the doctor on duty upon arrival at the hospital.

1.2 Observations

Equipment involved in the accident were as follows:- (See Photo No. 1)

(i) An electric stirrer rated at 700W connected with two lengths of 3-core PVC/PVC flexible cable. The first length of 0.3m was joined to the second length of 2.1m which was terminated with a moulded 13A plug. At the joint, the live, neutral and protective (earth) stranded conductors were hand twisted and supposedly were individually insulated by PVC insulation tape. (See Photo No. 2)

(ii) One set of metal-clad 13A 2-gang extension socket-outlets (ESO) connected to a length of about 70m of 4-core PVC/PVC flexible cable terminated with a 13A plug. The fourth core of the cable was cut and was not in use.

The electricity supply for this construction site was supplied from a diesel driven generator rated at 75kVA. There were 2 Nos. 10mm^2 PVC/PVC cables (live and neutral) connected to the generator's yellow phase and neutral terminals respectively and 1 No. 10mm^2 PVC/PVC cable (earth) connected to the earth terminal and these 3 cables were connected to a universal connectors housed in a junction box.

The incoming supply to the distribution board (DB) was taken from the junction box and was controlled by a 32A double-pole miniature circuit breaker (MCB). There were 4 Nos. of outgoing MCBs rated at 20A (1 No.), 16A (2 Nos.) and 6A (1 No.) in the DB and protected by a residual current circuit breaker (RCCB) rated at 40A and 30mA tripping sensitivity. The set up of the installation from the generator to the DB was as shown in Diagram No. 1.

1.3 Investigation and findings

Polarity test at the universal connectors revealed that the connections of the live and neutral conductors were transposed, as a result, the yellow phase of the generator supply was connected to the neutral bar and the neutral of the generator supply was connected to the live bar of the DB.

The polarity and insulation tests on the electric stirrer were found to be satisfactory. The metal frame of the electric stirrer was found to have electrical continuity with the Earth pin of the moulded 13A plug top.

Continuity test was conducted on the wall mounted 13A switched socket-outlet that was used to supply electricity to the electric stirrer, and it was found that there was no earth continuity. It was revealed that the earth conductor had been dislodged from the Earth terminal of the wall mounted 13A switched socket-outlet. (See Photo No. 3)

Polarity test on the 13A plug of the ESO revealed that the terminations of the live and neutral conductors were transposed. At the metal-clad 13A 2-gang switched socket-outlets of the ESO, it was found that the live, neutral and earth conductors were all wrongly connected such that the ESO was wired up as shown in Photos No. 4, 5 Diagram No. 2.

Insulation test on the pair of slippers that the deceased was reported to be wearing at the time of the accident was found to be satisfactory.

A voltage of 227 V was measured between the exposed live conductor at the joint and the metal frame of the electric stirrer. As such the deceased who was reported to be wearing a pair of slippers would be well insulated from Earth. The deceased could have received an electric shock while he was holding the metal frame of the electric stirrer in one hand and accidentally came into contact with the said exposed live conductor with his other hand. The path of the electric current would be as shown in Diagram No. 3.

The RCCB at the DB was tested and it was found that the RCCB did not trip off. However, another test was conducted after the dislodged earth conductor at the wall mounted 13A switched socket-outlet had been re-terminated properly in the Earth terminal. This time the RCCB at the DB tripped off at 32 milliseconds when the RCCB tester was set at 30mA tripping sensitivity.

1.4 Conclusion

From the above finding, it was likely that the electric stirrer was not functioning at the time the deceased was trying to use it. The deceased might have attempted to check on the PVC insulation tape joint of the flexible cables connected to the electric stirrer and could have inadvertently come into contact with the exposed strands of the live conductor at the joint and received a fatal electric shock.

1.5 What should be done to avoid danger at this work site?

- The main contractor should have engaged a licensed electrical worker (LEW) to take charge of the temporary supply installation, the LEW would ensure proper set up of the generator set, switchboards, earthing system, protective devices and electrical wiring.

- The risk of electrical hazard would be minimized if the electrical installation is regularly inspected by LEW who would rectify or isolate any defect found at the installation to prevent danger.

- The main contractor (holder of supply installation licence) should ensure that all electrical works are carried out under the direct supervision of his appointed licensed electrical worker.

- Site safety officer, supervisor and the worker should conduct regular checks on the portable equipment before issuing them out for use. Any defects discovered, such as loose connection, damage of insulation, etc. should be rectified promptly before the equipment is issued out or put into use.

- In today's context, the Code of Practice CP 88 : 2001 Part 1 requires the use of socket-outlet assembly (SOA) for the connection of portable electrical equipment at work site. SOA is equipped with a residual current circuit breaker of 30 mA tripping sensitivity. This will enhance safety at work site.

Photo No. 1 Equipment involved

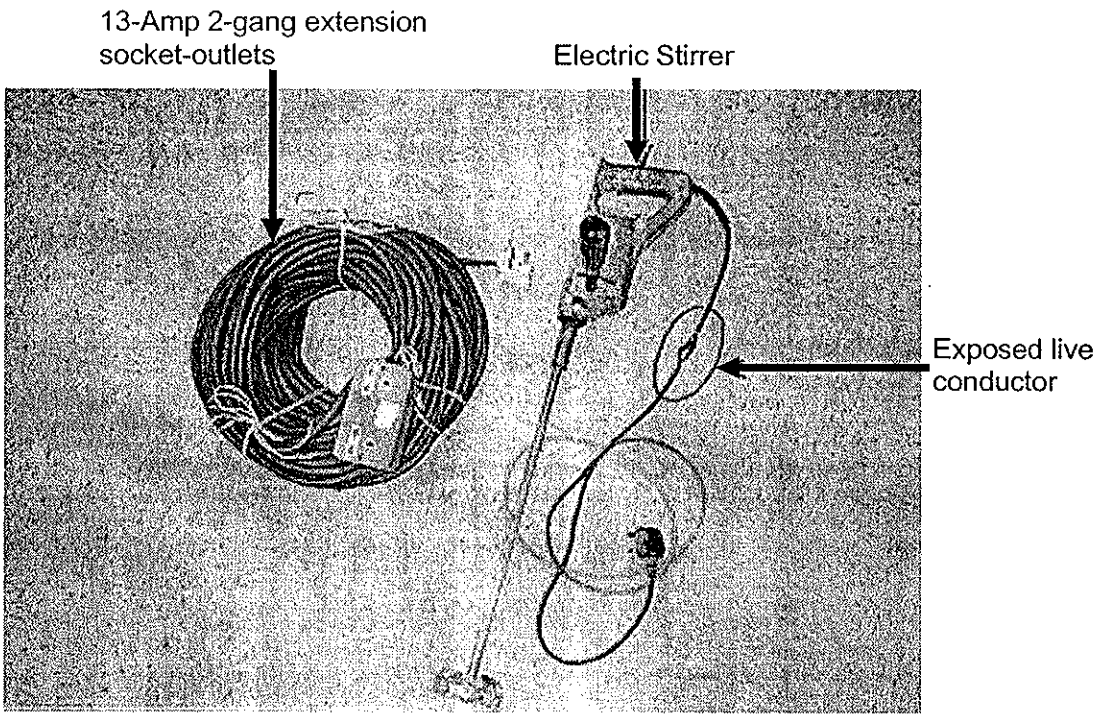


Photo No. 2

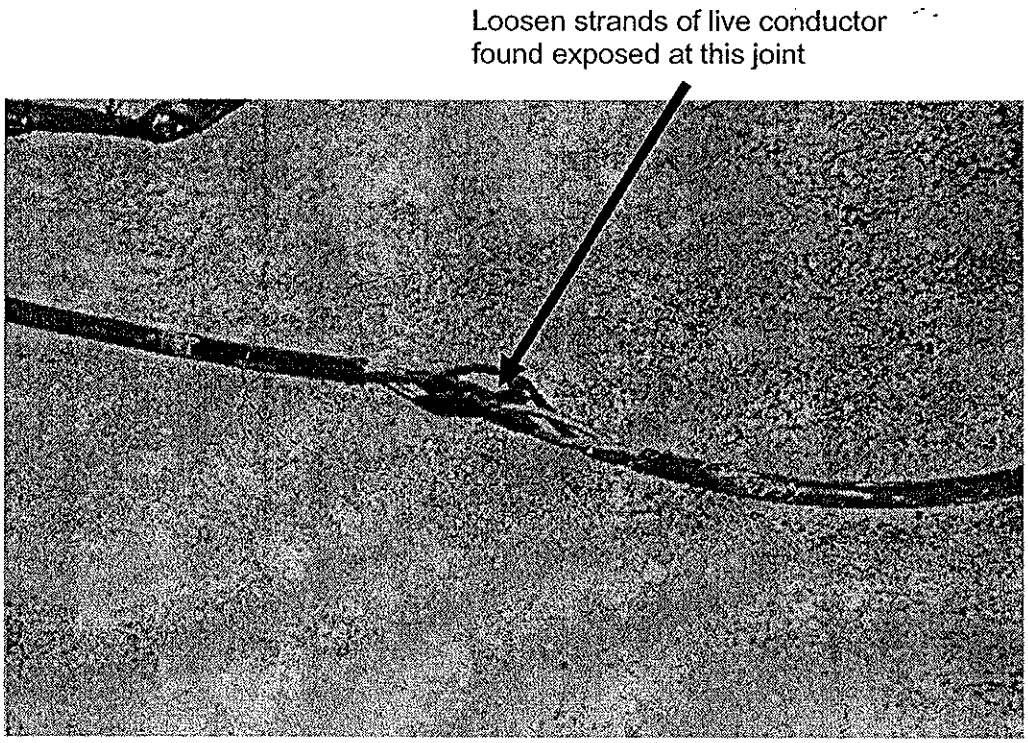


Photo No. 3

Earth conductor dislodged from terminal

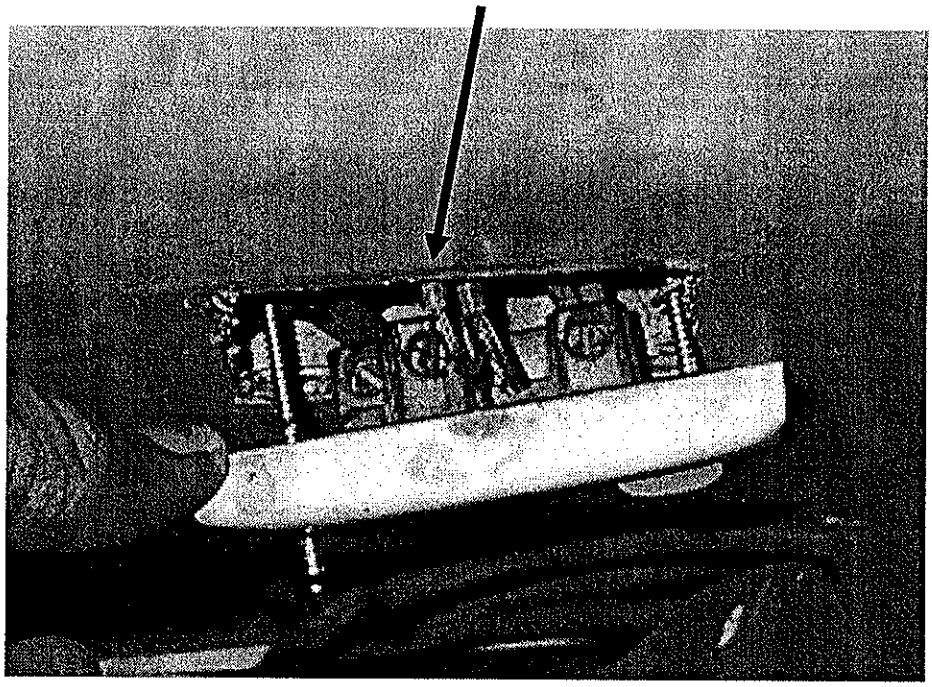


Photo No. 4 Transposed live and neutral at plug of ESO

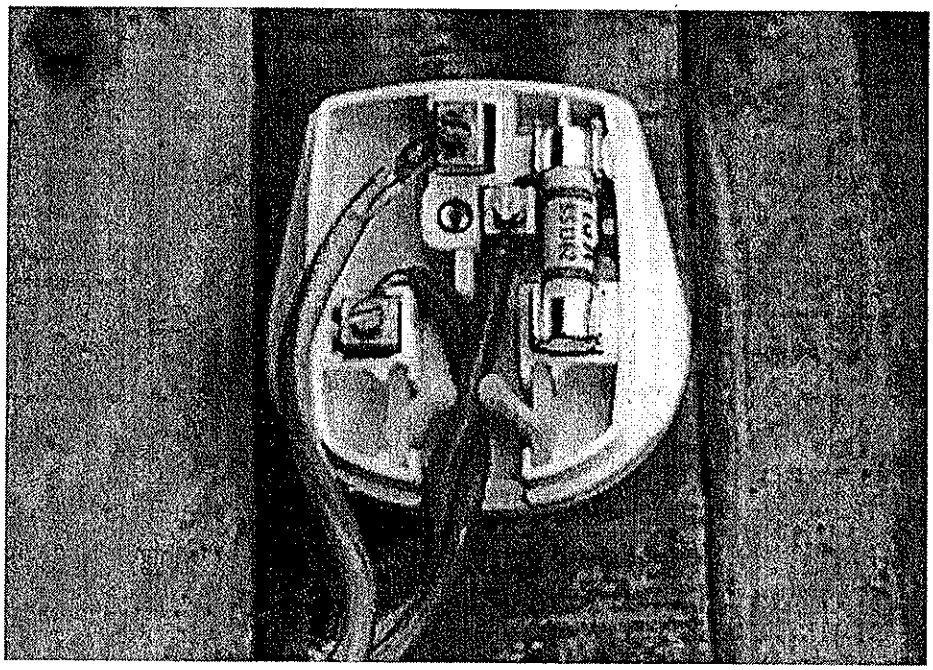


Photo No. 5 All connection at the metal-clad 13A 2-gang switched socket outlet were wrongly connected

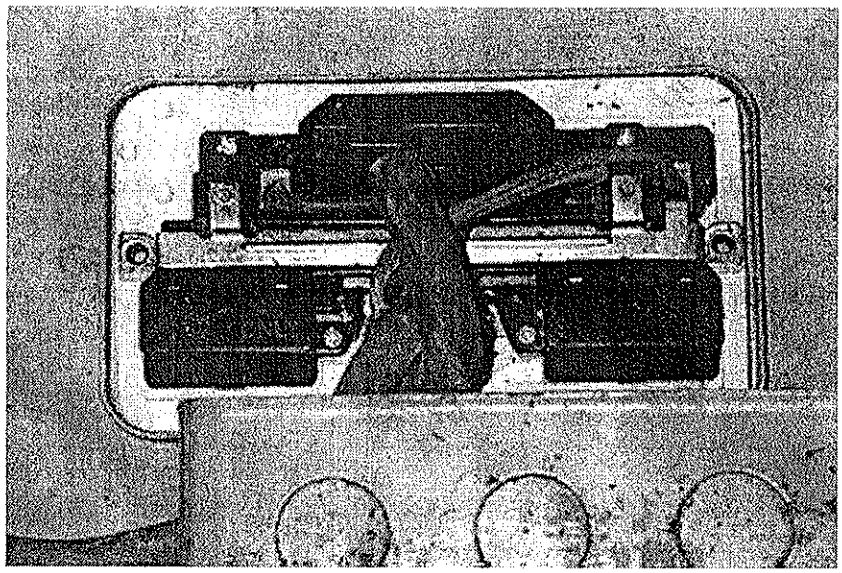


Diagram No. 1 The set up of the installation from the generator to the distribution board at the work site

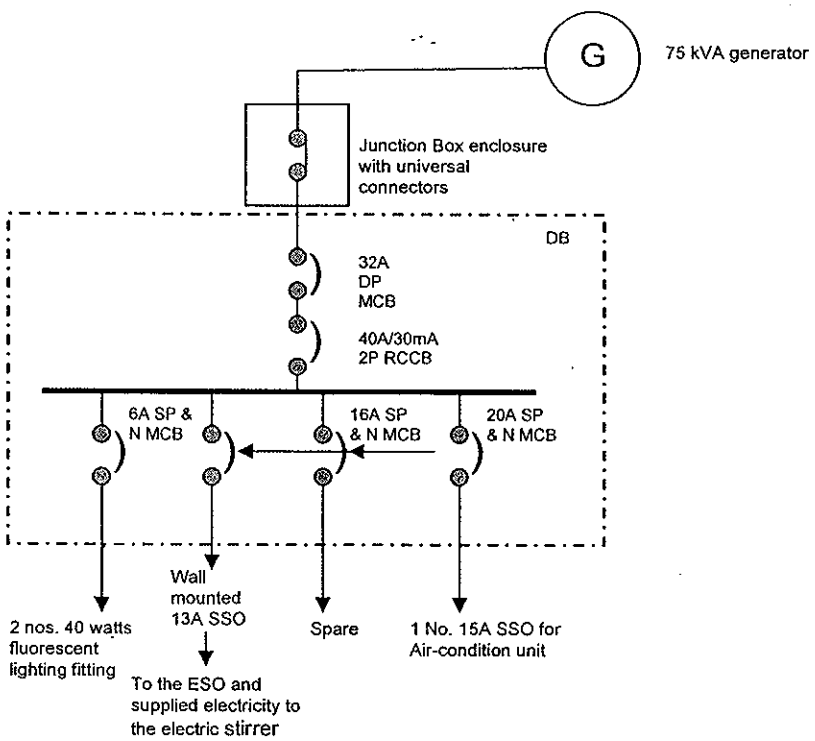


Diagram No. 2 shows the connection of the metal-clad 13-Amp 2-gang extension socket-outlets

Metal-clad 13-Amp 2-gang socket-outlets

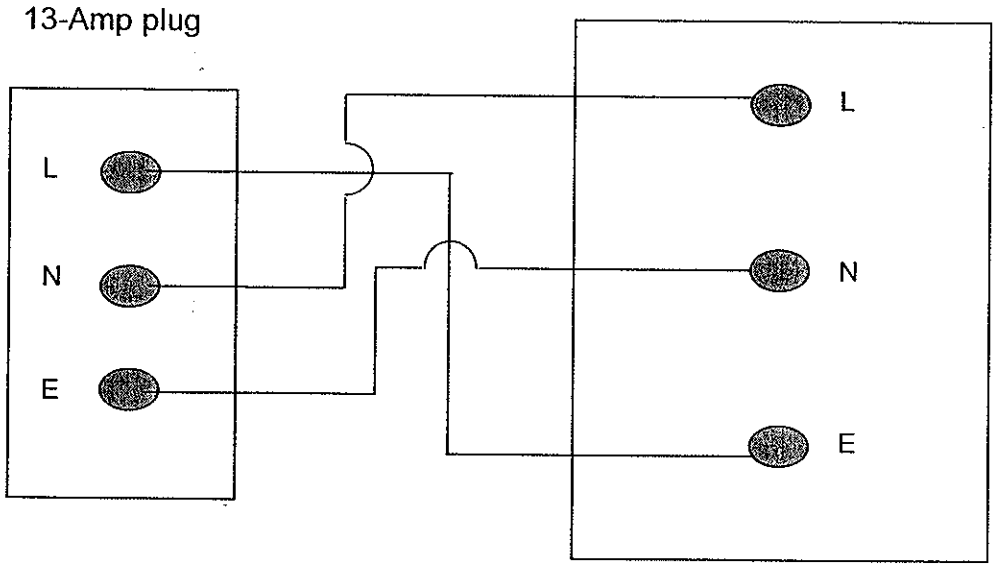
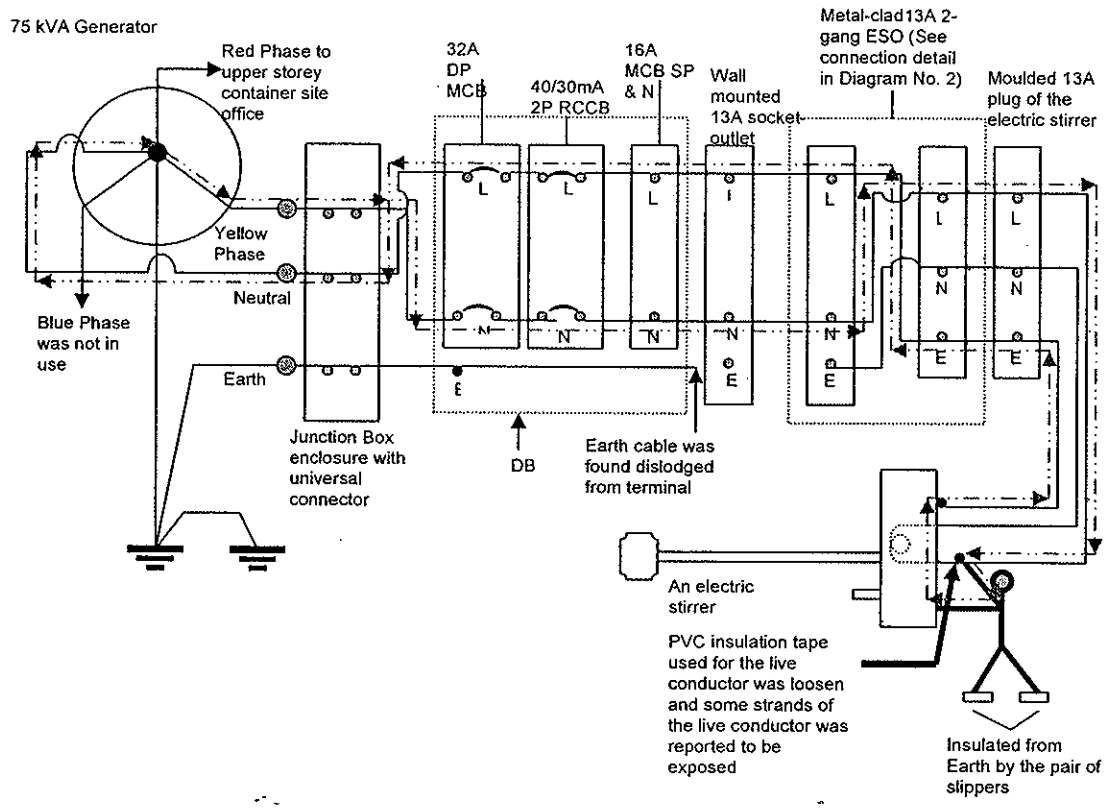


Diagram No. 3 shows the path of an electric current flowing through the deceased



2 Case Study 2

2.1 Background

The fatal accident occurred in 1999 at a residential condominium building. The deceased received a fatal electric shock while in the process of fixing current transformers (CTs) at the busbars compartment of the main incoming switchboard.

2.2 Observations

The back covers for the lower compartment of the switchboard panel No. X were found to be removed. (See Photo No. 3) Two MCCBs were installed in this compartment, one on top of the other. The MCCB that was on top was rated at 500A and the MCCB at the bottom was rated at 300A.

3 CTs had been found inserted in place into the respective phases of the 300A MCCB. (See Photo No. 1)

A ring spanner was found in electrical contact with the blue phase outgoing terminal of the 300A MCCB catching on to a hexagonal nut. (See Photo No. 1)

There was no intermediate barrier put up to prevent direct contact with the busbars of the 500A MCCB while the deceased was working at the 300A MCCB. (See Photo No. 2)

There were bloodstains on the metal frame of the switchboard panel (See Photo No. 2) and patches of burned human tissues were also found stuck at the red phase outgoing terminal of the 500A MCCB. (See Photo No. 3)

The 2 main incoming 1400A air circuit breakers had been successfully commissioned prior to the accident and the electrical set up for the residential condominium project was as shown in Diagram No. 1.

2.3 Investigation and findings

After taking the necessary precautions, the 500A MCCB was switched on. Voltage readings of 400V between phases and 230V between various phases and neutral were measured at the outgoing terminal with the 500A MCCB.

2.4 Conclusion

Since the spanner was still catching on the hexagonal nut at the blue-phase 300A MCCB outgoing terminal and the 3 CTs already in place, it was possible that the deceased could be tightening the nut securing the lug fitted on the conductor at the blue phase terminal after inserting the last CT when his left shoulder accidentally came into contact with the exposed 'live' (red phase) outgoing terminal of the 500A MCCB. His other parts of his body were in contact with the metal frame of the panel and formed a return path for the current to flow through his body and received a fatal electric shock.

2.5 What should be done to avoid danger at this site?

- The accident could have been avoided if the 500 A MCCB had been switched off while work was being carried out at the lower compartment of panel No. X.

- Alternatively, if it was required to supply some loads, some insulating barrier should be used to cover the 'live' outgoing terminals of the 500 A MCCB so as to prevent accident contact by person working at the panel.

- The holder of the electrical installation licence should have informed his licensed electrical worker (LEW) of the need to carry out such electrical work so that the LEW could put the necessary safety measures in place before commencement of work. The holder of the electrical installation licence shall ensure that all electrical works are carried out under the direct supervision of his appointed licensed electrical worker.

Photo No. 1 Current transformers in place and the ring spanner found on the blue phase outgoing terminal of the 300A MCCB

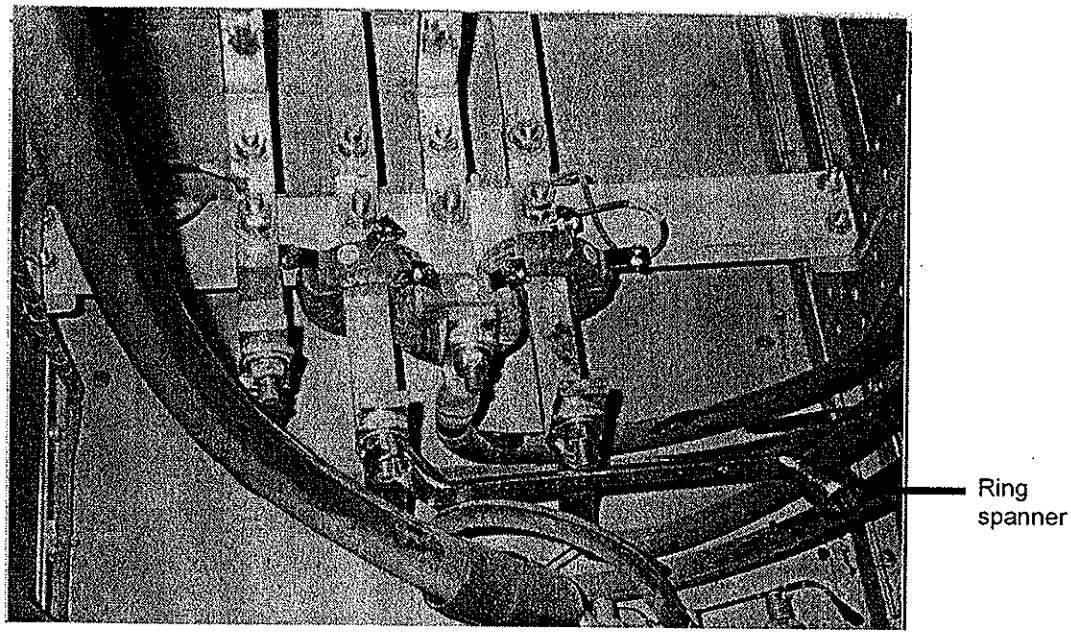


Photo No. 2 "Live" outgoing terminals of the 500A MCCB were not covered with an insulating barrier while work was being carried out

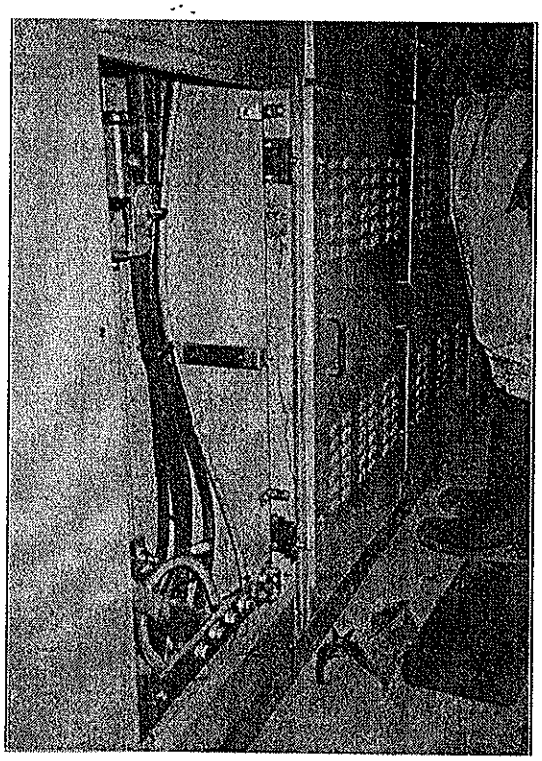


Photo No. 3 Patches of burned human tissues stuck at the red phase outgoing terminal of the 500A MCCB

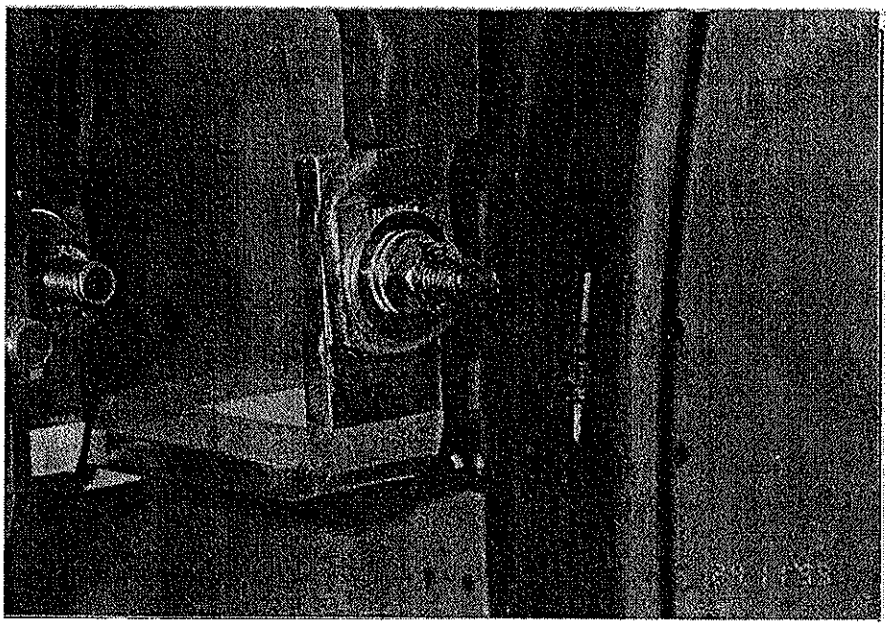
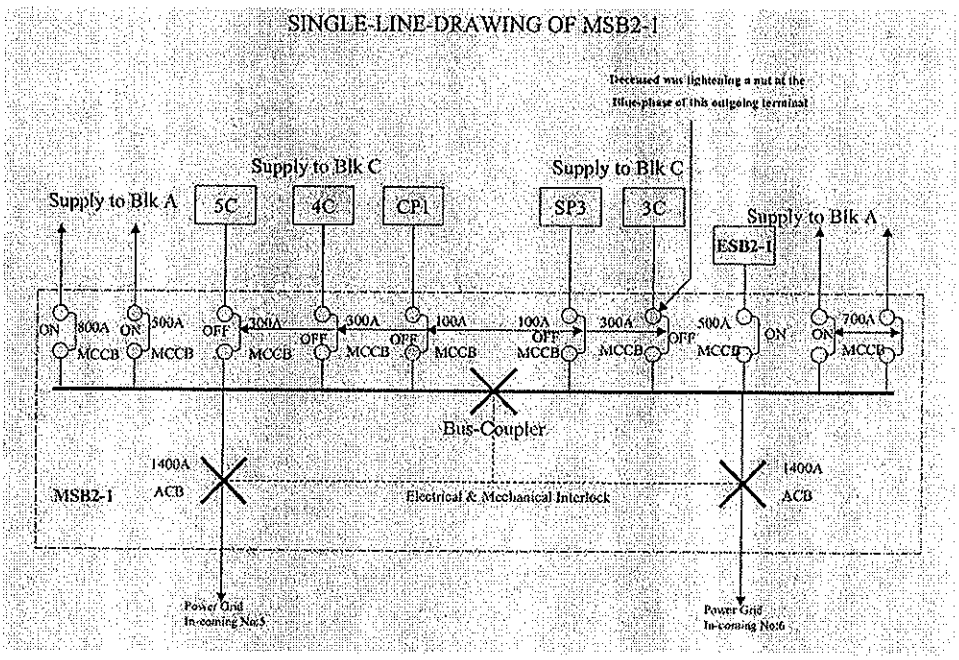


Diagram No. 1 The electrical set up at the residential condominium building



3 Case Study 3

3.1 Background

The fatal electrical accident occurred in 1999 on board a vessel berthed at the wharf of a shipyard. The deceased received a fatal electric shock while carrying out welding work for the bracket of a fabricated cable tray. The deceased was sent to the hospital unconscious and was pronounced dead upon arrival at the hospital.

3.2 Observations

The equipment involved in the accident were:

(i) An alternating current (ac) arc welding set with the following specifications:

Rated power:	37.2 kVA
Rated primary voltage:	415 V
Rated secondary voltage:	500 A (set at 150 A)
Frequency:	50 Hz
Secondary load voltage:	80 V
Secondary no load voltage:	20 V

The set is equipped with a low voltage shock preventor. The welding set together with the other 5 similar sets were housed in a common metal hauling cage standing on the main deck.

(ii) A set of electrode holder

The electricity supply for the ac arc welding set was taken from an over-ground box at the quay-side (supplied by the public electricity supply network) and was protected by a 60-Amp double-pole moulded case circuit breaker (MCCB).

(iii) The deceased was supposed to weld a 1.6m long section of a fabricate cable tray which was to be anchored at 4 points under one of the deck floor in the engine room. The other 3 co-workers were stationed on staging platforms and supporting the cable tray. When the deceased began welding the first support point, all the other co-workers experienced electric shock and immediately let go of the cable tray; the deceased collapsed.

3.3 Investigation and findings

3.3.1 The electrode holder which the deceased was holding at the time of the accident was tested and no leakage of electricity was detected (Fig. 1).

3.3.2 Insulation test was conducted between the primary and secondary winding of the ac arc welding set and the results were satisfactory (Fig. 2).

3.3.3 The voltages at the terminals of the primary and secondary windings of the a.c. arc welding set were measured and they were found to be 427 V and 20 V respectively. It was observed that on activating the test button of the a.c. arc welding set, the voltage at the secondary winding:

a. attained its full voltage of 74.6 V after a lapse of about 1.7 seconds and
b. returned to a safe voltage of 20 V in 0.8 seconds.

This showed that the low voltage shock preventor incorporated in the a.c. arc welding set was operating satisfactorily.

3.3.4 It was found that there was no proper conductor to serve as return path for the welding current on the work piece, in this case, the cable tray. The low impedance path required for the welding return current was formed by the cable tray, the metal under-floor of the deck in contact with the cable tray, the legs of the metal hauling cage standing on the main deck and the short cable bridging the cage frame to one terminal of the secondary winding of the arc welding set (see Fig. 3). The space where the deceased was working was cramped and confined.

3.3.5 In the process of welding, the full voltage of 74.6 V would be present at the welding electrode. To maintain the welding process, there must be a low impedance path for the welding return current. The moment the cable tray broke contact with the metal under-floor of the deck, the loss of the low impedance path would cause the welding process to be interrupted and if the deceased were to attempt to re-initiate the welding process, the deceased would have to bring the welding electrode into contact with the cable tray. If this was done within 0.8 seconds of the extinguishing of the welding arc there would be a full voltage of 74.6 V at the cable tray and any person in contact with the cable tray could be subjected to an electric shock under these circumstances (see Fig. 4).

3.4 Conclusion

It was possible that when the welding process was interrupted, the deceased could have tried to re-initiate the welding process before the a.c. arc welding set revert to the safe voltage of 20 V, and could have received a fatal electric shock from the cable tray which was charged to a full voltage of 74.6 V.

3.5 What should be done to avoid danger for welding work?

For the above-mentioned case, the workpiece (cable tray) should be effectively connected to the return terminal of the a.c. arc welding set through a proper return conductor to create an effective low impedance return path for the welding return current and the secondary winding neutral terminal of the welding set shall be isolated from Earth. The welder shall exercise precaution to prevent coming into contact with the "live" part of the electrode holder.

D.C. arc welding set should be used.

3.6 A.C. and D.C. arc welding

Due to the inherent design of a.c. arc welding set, the electrode will be charged to about 70 V during welding process. Hence, under no circumstance should any a.c. arc welding set without a shock preventor be used for any welding work. A.C. arc welding is also not recommended for welding work to be carried out in confined space where the welder is likely to come into contact with the surrounding metallic part.

To enhance electrical safety for welding works d.c. arc welding sets should be used for all general welding work in place of a.c. arc welding sets. The operating voltage of a d.c. welding set of 50 – 60 V d.c. is well within safety limits and this eliminates the possibility of electric shock for welders. D.C. welding set is particularly suitable for welding work in confined space.

A comparison of a.c. and d.c. arc welding set is given in Fig. 5.

Fig. 1 Welding electrode

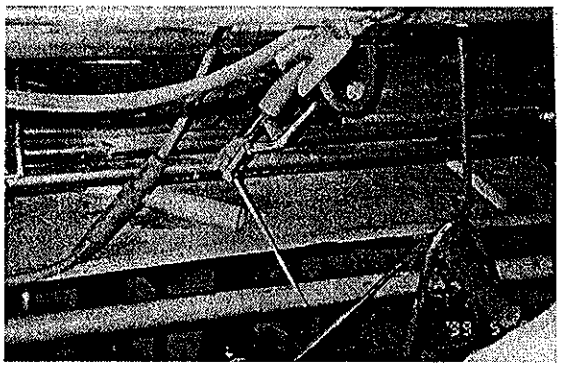


Fig. 2 A.C. Arc Welding Set

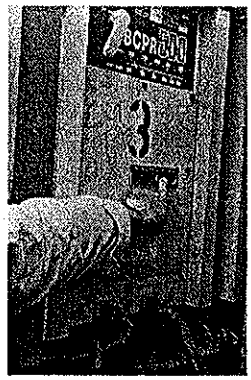


Fig. 3 The return path to the terminal of the secondary welding set was connected by means of a short cable to the cage frame.

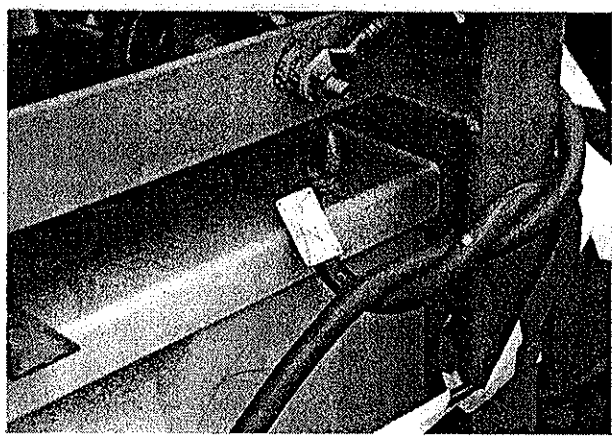


Fig. 4 Illustration of Cause of Accident

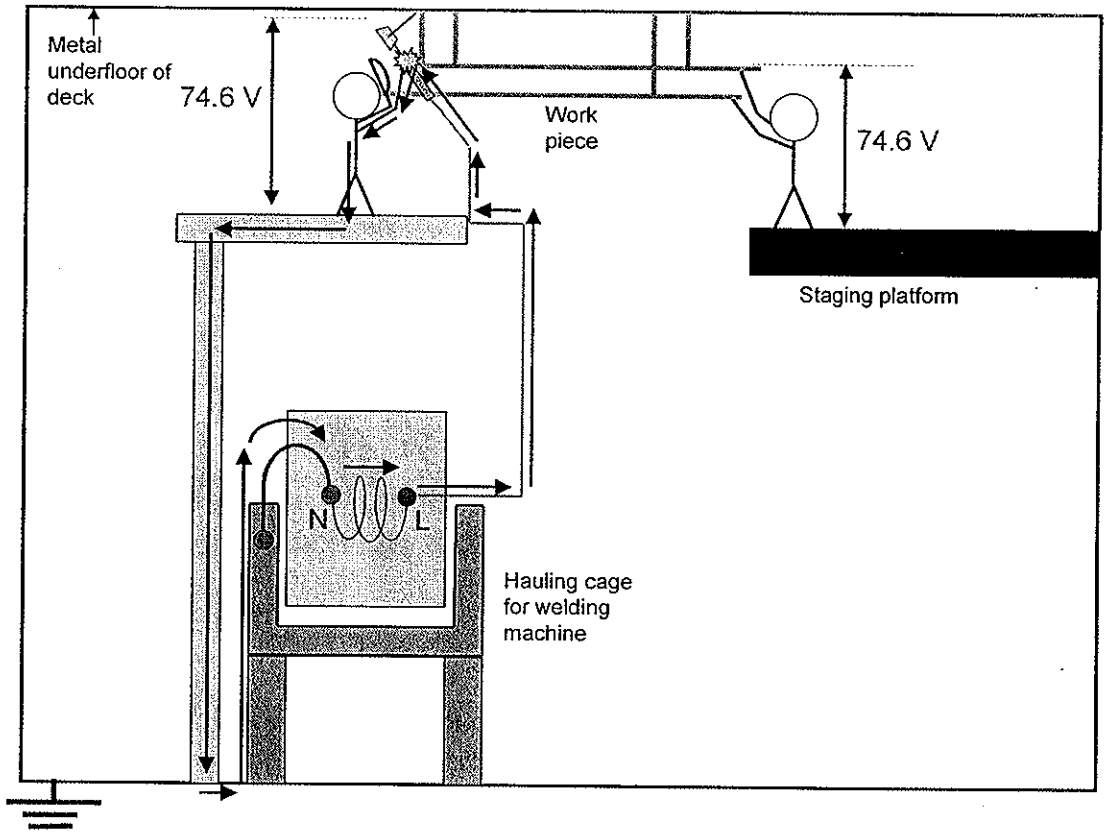


Fig. 5 Comparison of AC & DC Arc Welding

Description	AC Arc Welding	DC Arc Welding
Open Circuit Voltage	High (65-95 V a.c. which exceeds the touch voltage of 50 V a.c.) [Low voltage shock preventor may cut in between 3s-10s, during which the dangerous voltage exists.]	Low (50-60 V d.c. well below the safety limit of 120 V d.c.)
Danger of Electric Shock	• Frequent, 11 cases during the last 10 years, about 1.1 cases per year • Can cause electrical shock in direct contact with the bare electrode holder • Welders usually in wet conditions after long hours of work hence body resistance is low making him more susceptible to electric shock	• Nil • No danger of electric shock in contacting bare electrode or holder • Electric current may cause burning
Power Consumption	High	Low
Stability of Arc	Less stable	Excellent
Change in polarity	Impossible	Possible
Noise	Quiet	Quite for rectifier type
Welding Rods	Available	More varieties available; cost of rods for common tasks similar to that for a.c, set
Price	Low	Low (comparable with a.c. set)
Maintenance cost	Low, machine is robust	Higher than a.c. set (thyristor for rectifier may need replacement)

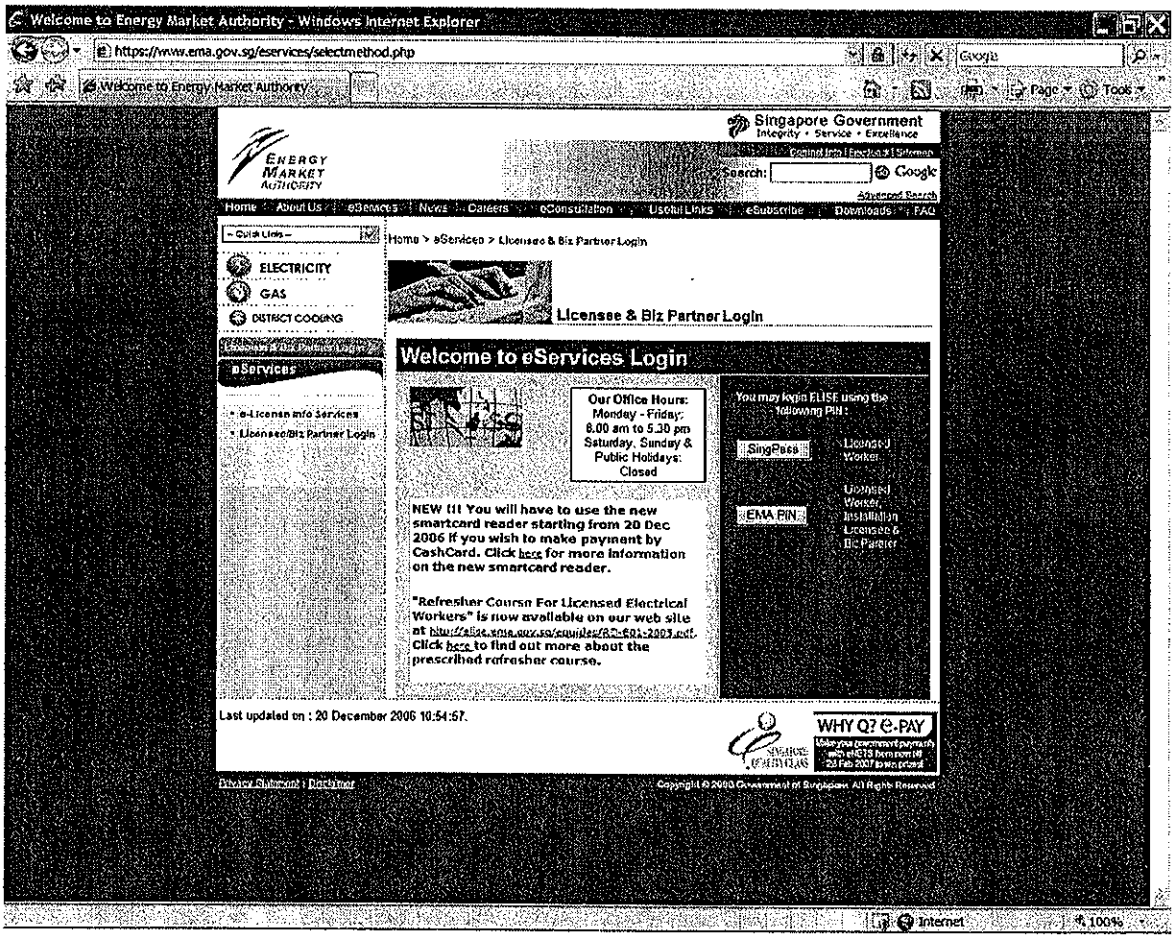
TOPIC 10: STEP BY STEP GUIDE USING ELISE

1 Renewal of Worker Licence

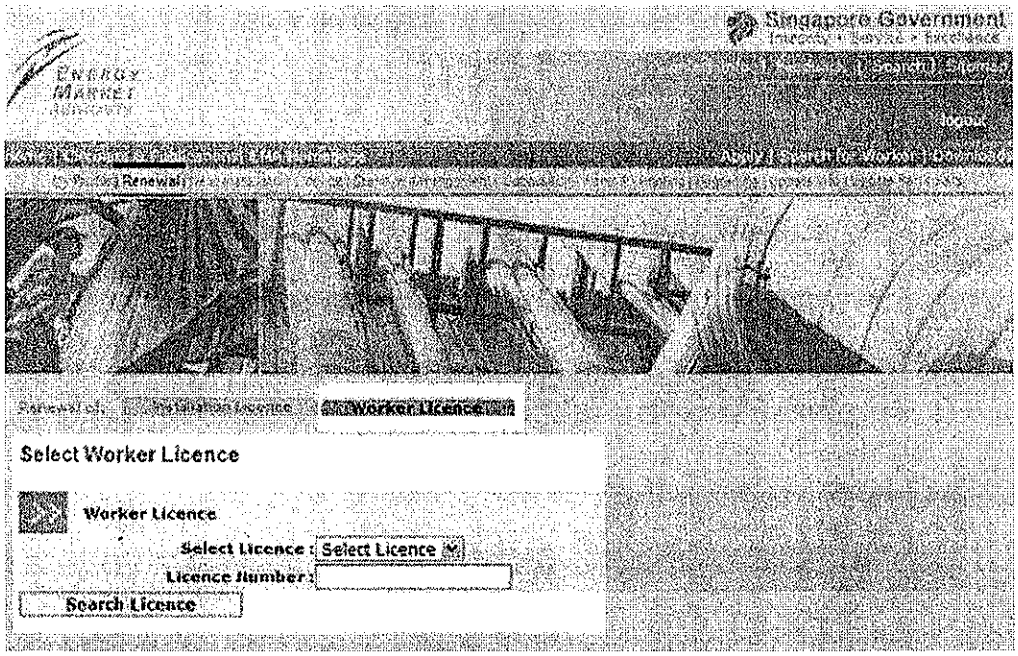
The renewal of your worker licence shall be submitted to the Authority not later than one month prior to the date of expiry of the licence. You are not required to furnish us the documents which had been submitted previously.

Step 1: Goto to EMA Web Site at http://www.ema.gov.sg

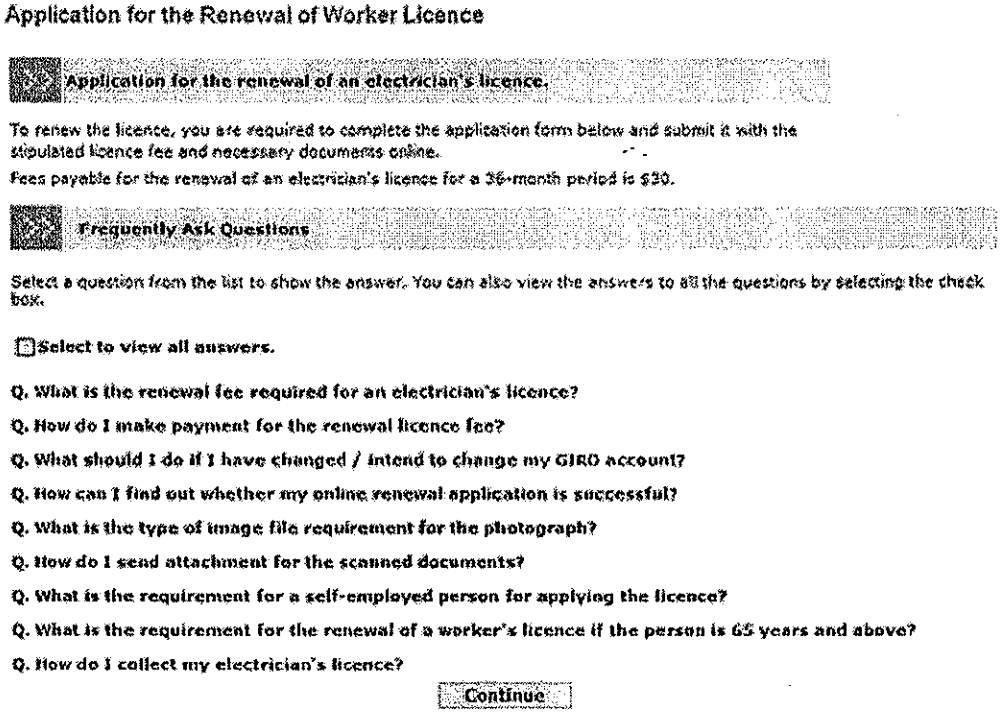
Step 2: Click on "eServices" and select "SingPass" or "EMA PIN" to login.



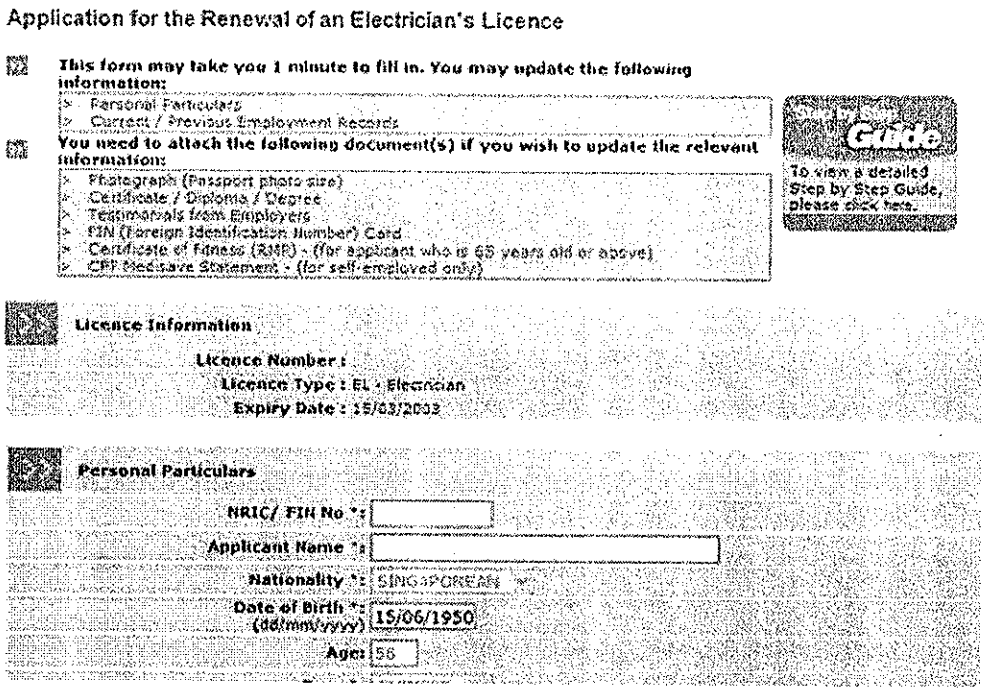
Step 3: Upon successful login, click "Renewal" on the top navigation menu and click on "Renewal of Worker Licence". Select licence from the drop down list box and enter licence number to be renewed. Click "Search Licence" to retrieve licence details.



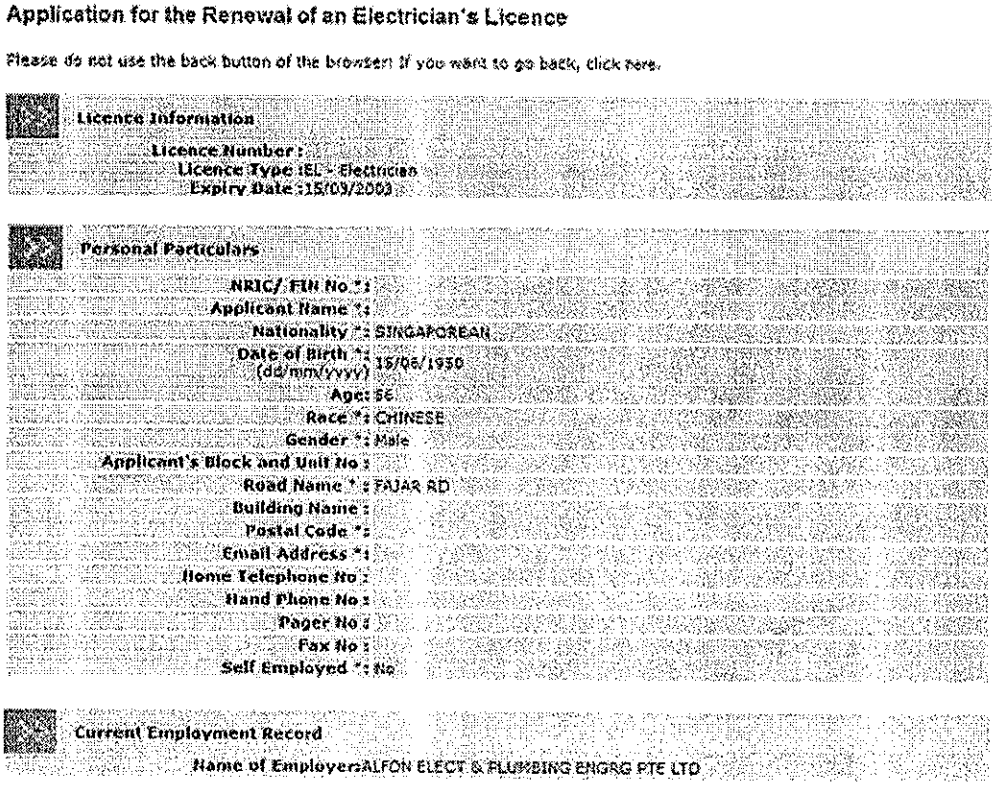
Step 4: Explanatory notes and frequently asked questions for renewal application of worker's licence are displayed. Click "Continue" button to proceed with the renewal application.



Step 5: Renewal form is displayed. Verify all records and make necessary changes. Click on "Continue" button to proceed.

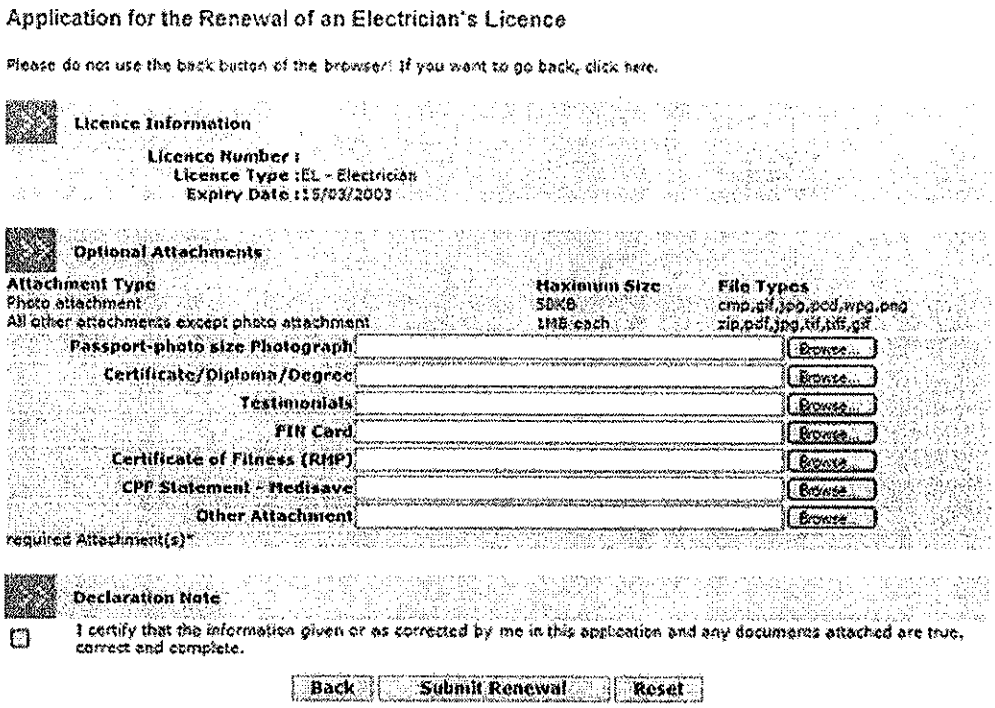


Step 6: System will verify the data entry. You may require re-entering, if your data do not fulfill the condition. A confirmation page will be displayed for your verification.



Step 7: Upon verification of data entry, click "Continue" to proceed, else, click "Back"for amendments.

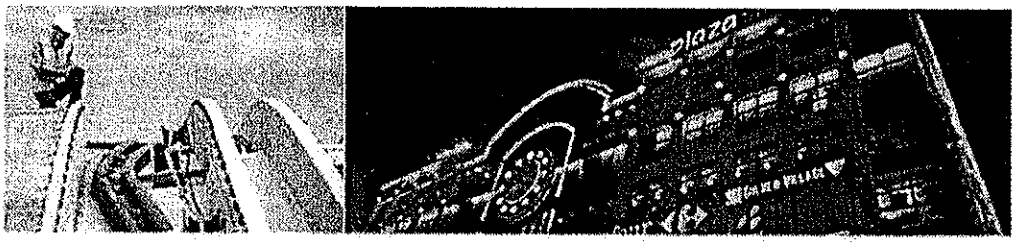
Step 8: Applicant is required to submit the documents marked *. Click "Browse" to retrieve the relevant document.



Step 9: Check on the declaration notes and click continue to submit the application and the attachments.

Step 10: The System will present the payment page to allow the user to make payment using one of the following modes: eNETS CashCard, eNETS VCard and eNETS Debit. If there is valid GIRO or GIRO-On-Demand account link with the licence additional modes including GIRO or GIRO-On-Demand will be provided. See Make Payment for Licence fee for details.

Step 11: Upon successful payment, an acknowledgement for the application will be presented on the browser. You may print the page for future reference.



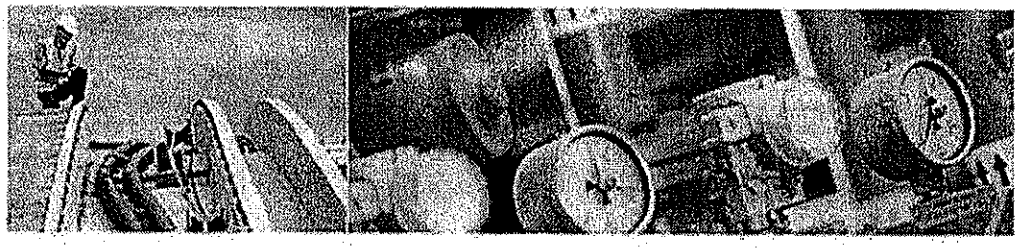
Acknowledgement

04/10/2006 15:05:54

We acknowledge receipt of your application. Please note your application reference number is **WT06003220**. You may log on to the EMA website: http://www.ema.gov.sg to check your application status. We will inform you about the outcome of your application within 10 days.

Print

Note: If payment is not complete, system always displayed page "Payment Required". To continue with payment, click "here" to complete.



Payment Required

04/10/2006 15:02:28

You have not made a successful payment. Click here to make payment.

You could disable the 'Pop-up Blocker' in the Internet Explorer. Select 'Tools', 'Internet Options', 'Privacy' and unchecked the 'Block pop-ups' function.

2 New Application of Electrical Installation Licence

Electrical Installation refers to any electrical wiring, fitting or apparatus used for the conveyance and control of electricity in any premises. A EMA licence is required to use or operate an electrical installation of approved load exceeding 45 KVA used for non-domestic purposes.

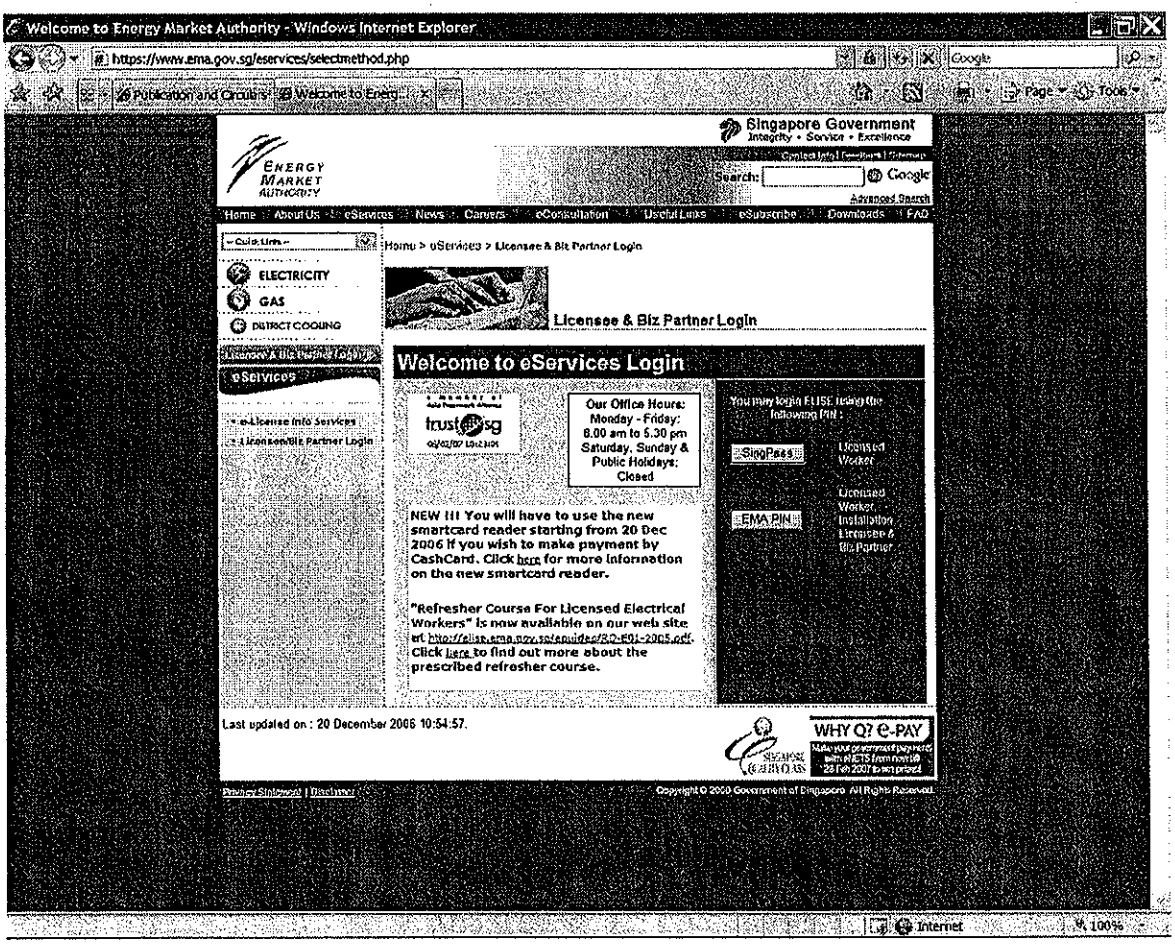
Electrical installation in premises used for "hazardous trades", irrespective of their approved load are also required to be licensed. Examples are motor paintshops, wood-working or saw-milling, petrol stations, paints and petroleum products, and temporary supply for building sites or engineering construction works.

Electrical installations are licensed to ensure that they are operated and maintained by licensed electrical workers and are safe to use.

Consumer 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.

Step 1: Goto to EMA Web Site at www.ema.gov.sg

Step 2: Click on "eServices" then select "SingPass" or "EMA PIN" to login.

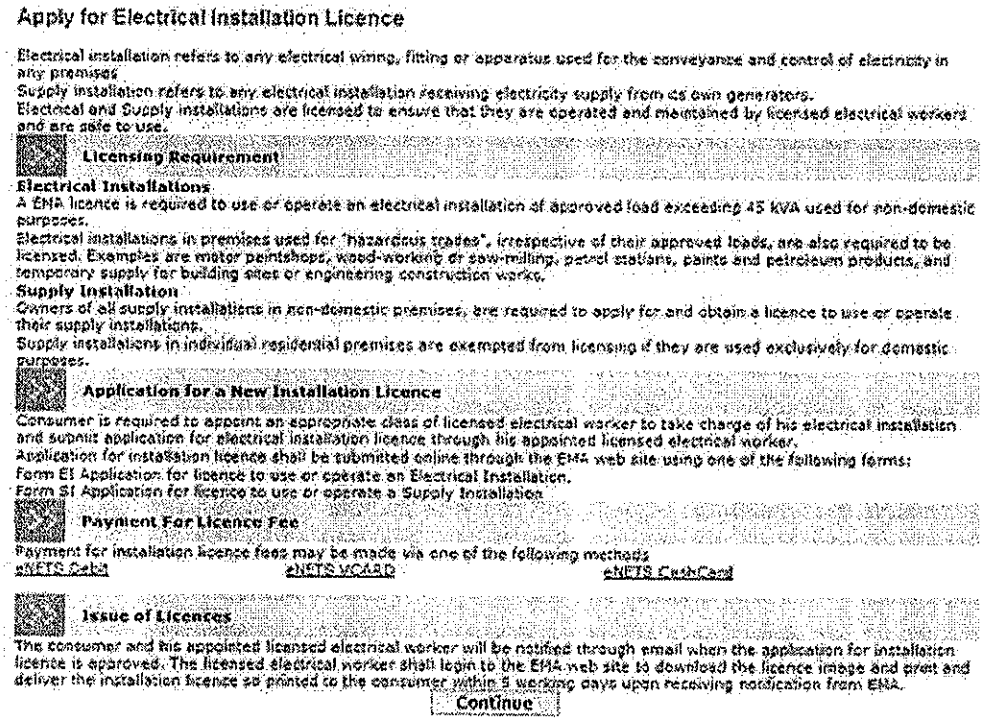


Step 3: Upon successful login, click "New Installation Licence" on the top

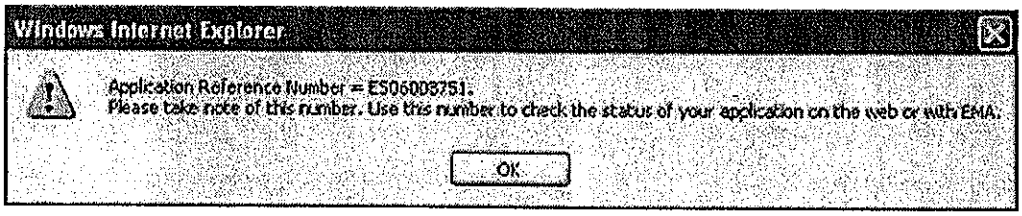
navigation menu. Click on "Electrical" to apply for Electrical Installation Licence.



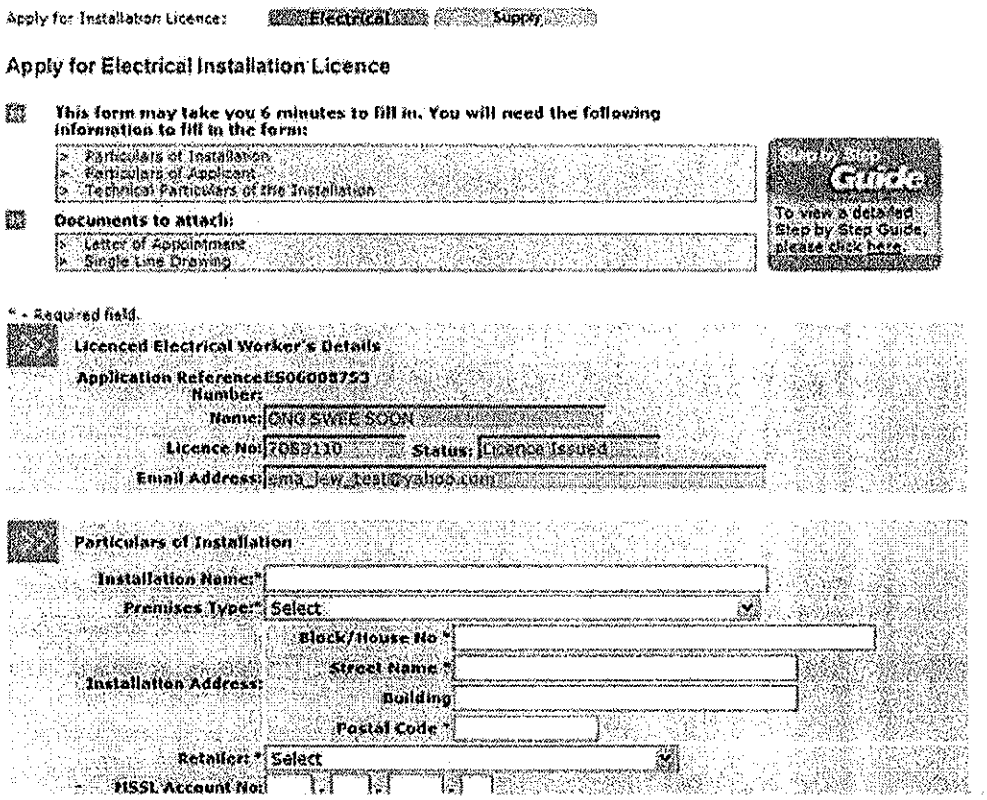
Step 4: Read the explanatory notes for application of Installation Licence requirements. Click "Continue" button at the bottom of the page to proceed with the application.



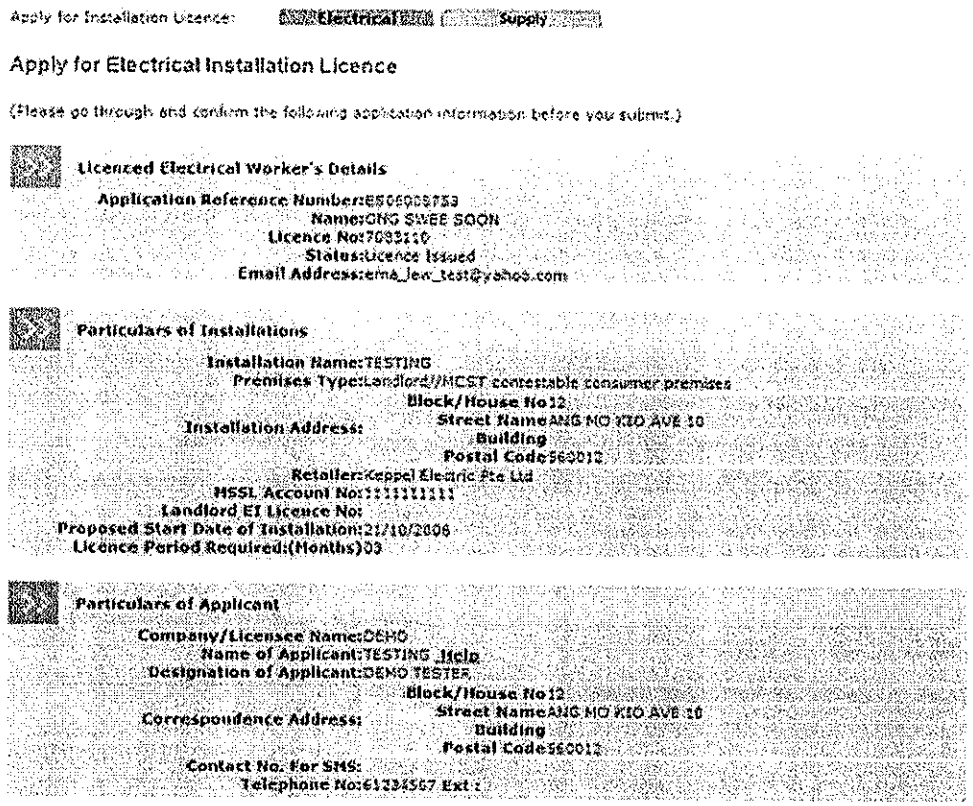
Step 5: An "Application Reference Number" will be issued and displayed. Please take note of this number. This number will enable you to check the online application status upon successful submission of application.



Step 6: Applicant is required to fill in the required fields (denoted by *) such as particulars of installation, particulars of applicant, technical particulars, and check all the declaration statements.

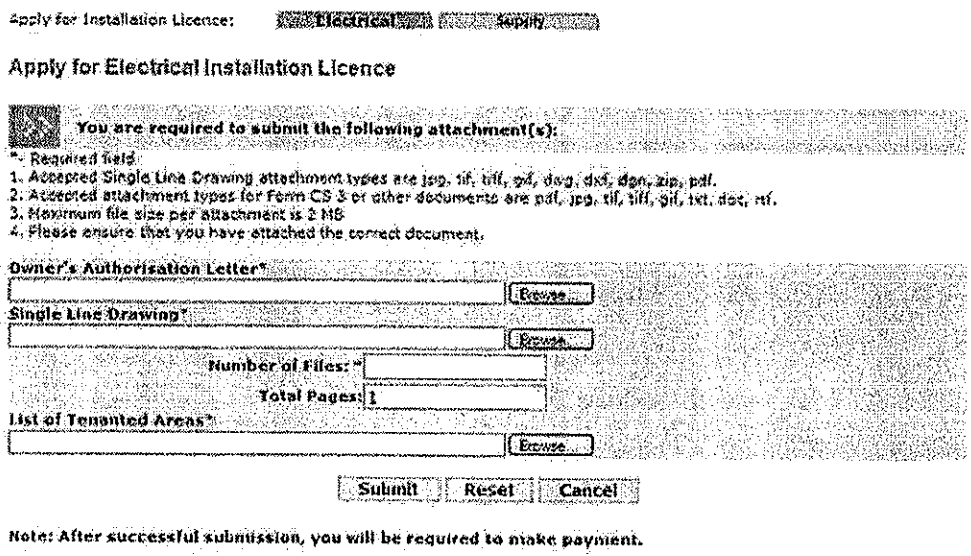


Step 7: Upon completion of data entry, click "Submit" and system will verify the data entry. You may need to re-enter the data if your data do not fulfill the condition. A confirmation page will be displayed for your verification.



Step 8: Upon verification of data entry, click "Confirm" to proceed, else, click "Back"for amendments.

Step 9: Applicant is required to submit the documents marked *. Click "Browse" to retrieve the relevant document.



Step 10: The System will present the payment page to allow the user to make payment using one of the following modes: eNETS CashCard, eNETS VCard and eNETS Debit. See Make Payment for licence fee for details.

Step Upon successful payment, an acknowledgement for the application will

11: be presented on the browser. You may print the page for future reference.



Acknowledgement

Date/Time: 05/10/2006 10:32:14

We acknowledge receipt of your application. Please note your application reference number is ES06008753. You may log on to the EMA website: http://www.ema.gov.sg to check your application status. We will inform you about the outcome of your application within 10 days.

Print

Note 1: If payment is not complete, the "Payment Required" page will be displayed. To continue with payment, click "here to make payment" to select another mode of payment, otherwise you may cancel the application by clicking "here to cancel this application"



Payment Required

Date/Time: 05/10/2006 10:32:16

You have to complete the payment for this application. Click here to make payment if the payment window does not launch automatically after 10 seconds.
Click here to cancel this application.

Print

Note 2: Acknowledgement will be given to the cancelled application as well. You may print the page for future reference.



Application Cancelled

Date/Time: 05/10/2006 10:36:14

We notice that you have cancelled your online application. Please take note of this Cancelled Application Reference Number ES06008756 in case you have further enquiry.

Print

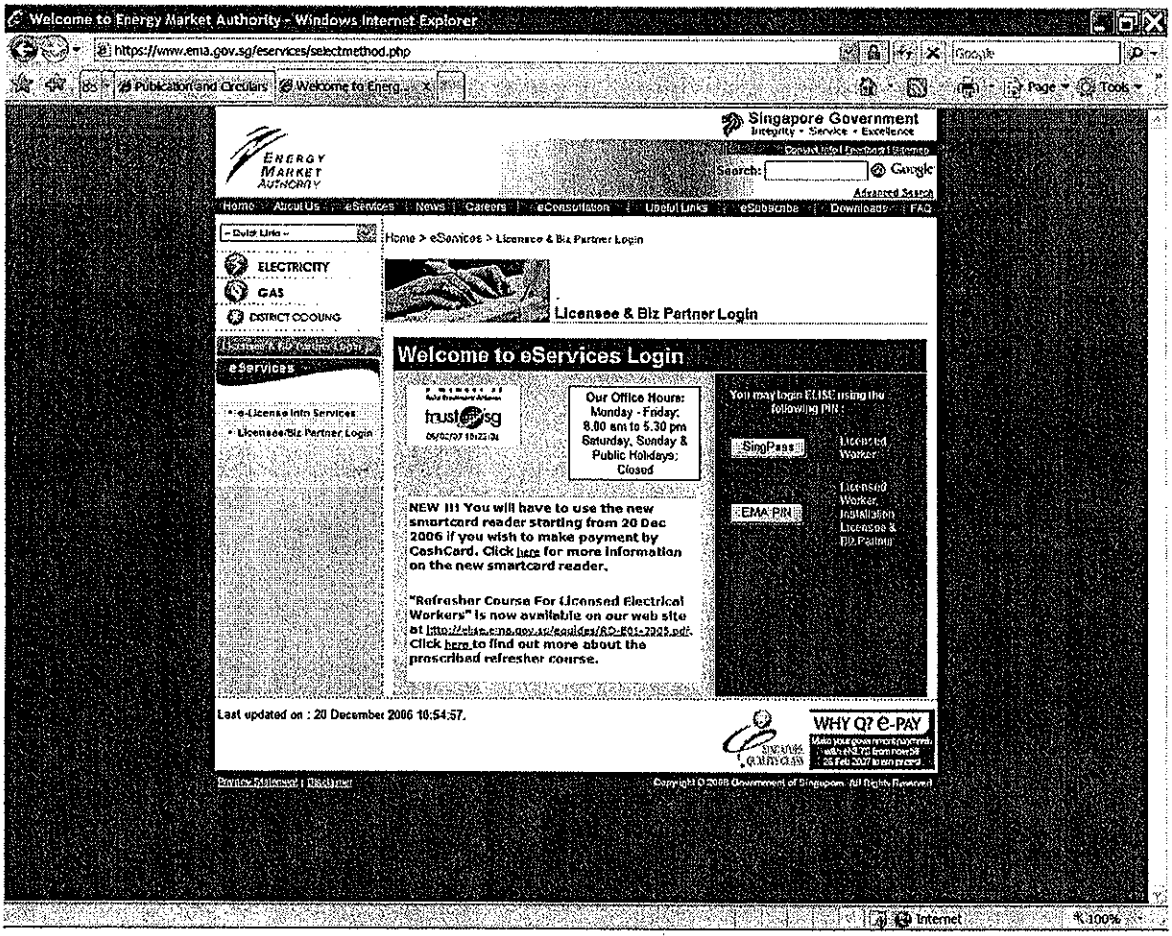
3 Renewal of Electrical Installation Licence

An application for the renewal of an electrical installation licence shall be made to the Authority not later than one month prior to the date of expiry of the licence.

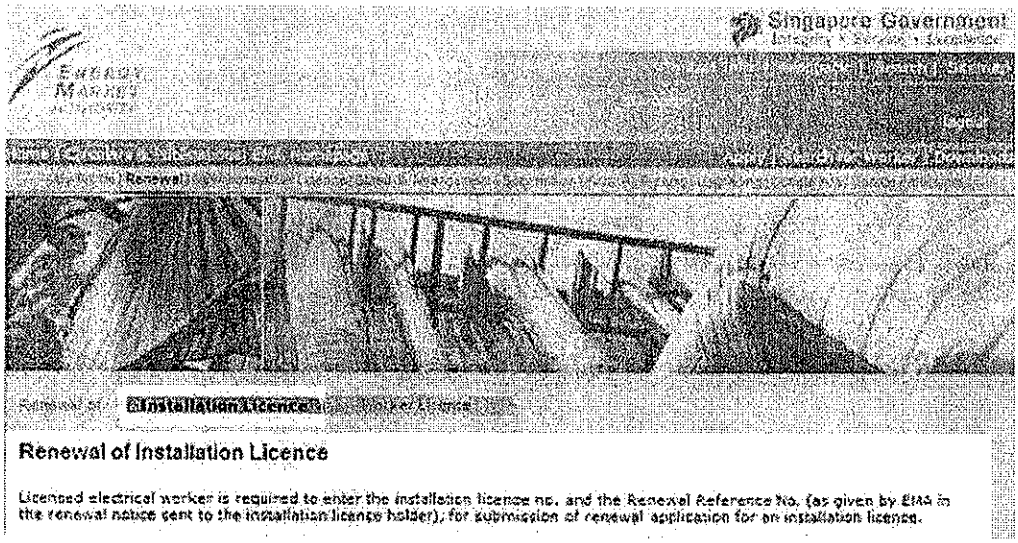
Licensed electrical worker is required to enter the installation licence no. and the Renewal Reference No. (as given by EMA in the renewal notice sent to the installation licence holder), for submission of renewal application for an installation licence.

Step 1: Goto to EMA Web Site at www.ema.gov.sg

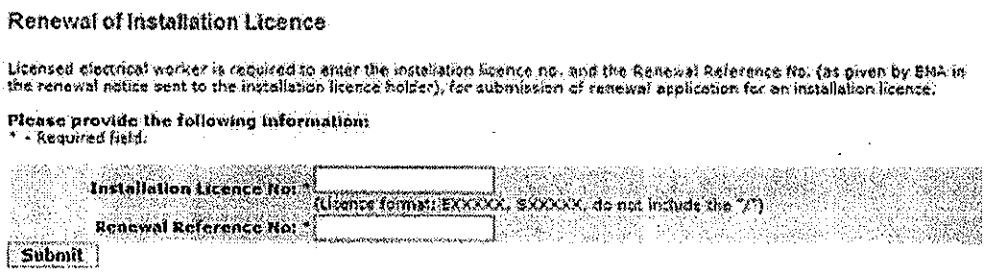
Step 2: Click on "eServices" then select "SingPass" or "EMA PIN" to login.



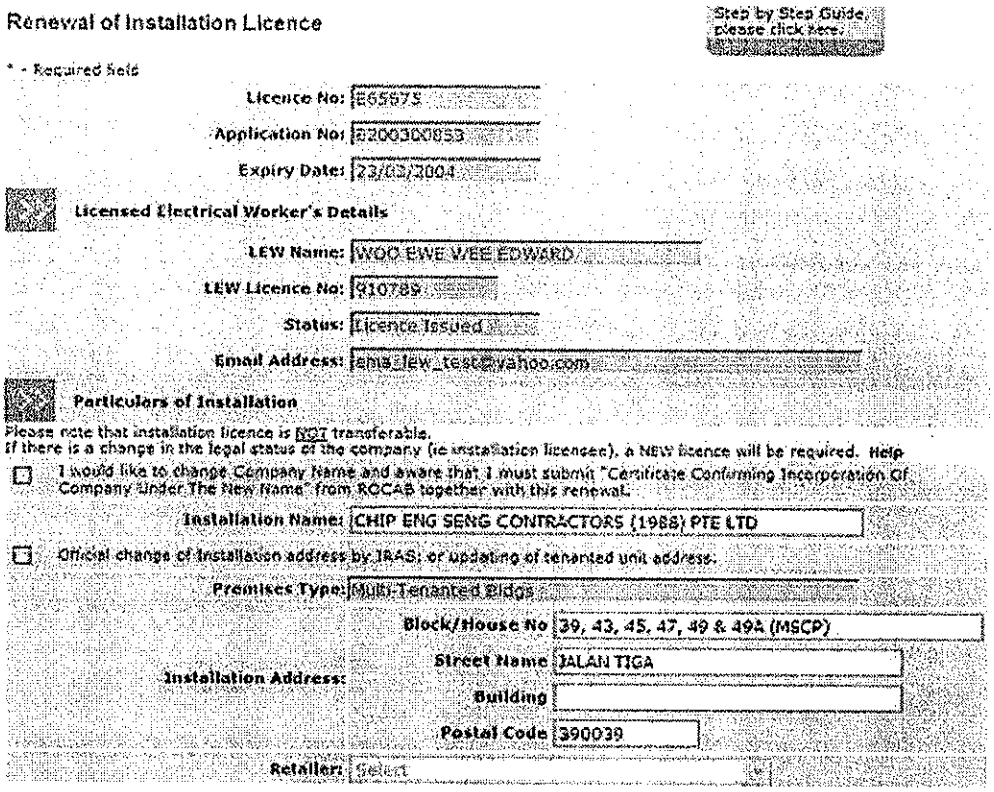
Step 3: Upon successful login, click "Renewal" on the top navigation menu. Click on "Renewal of Installation Licence" and read the explanatory notes for Renewal of Installation Licence requirements.



Step 4: Enter "Installation Licence No" and "Renewal Reference No", click "Submit" button to proceed with renewal application.

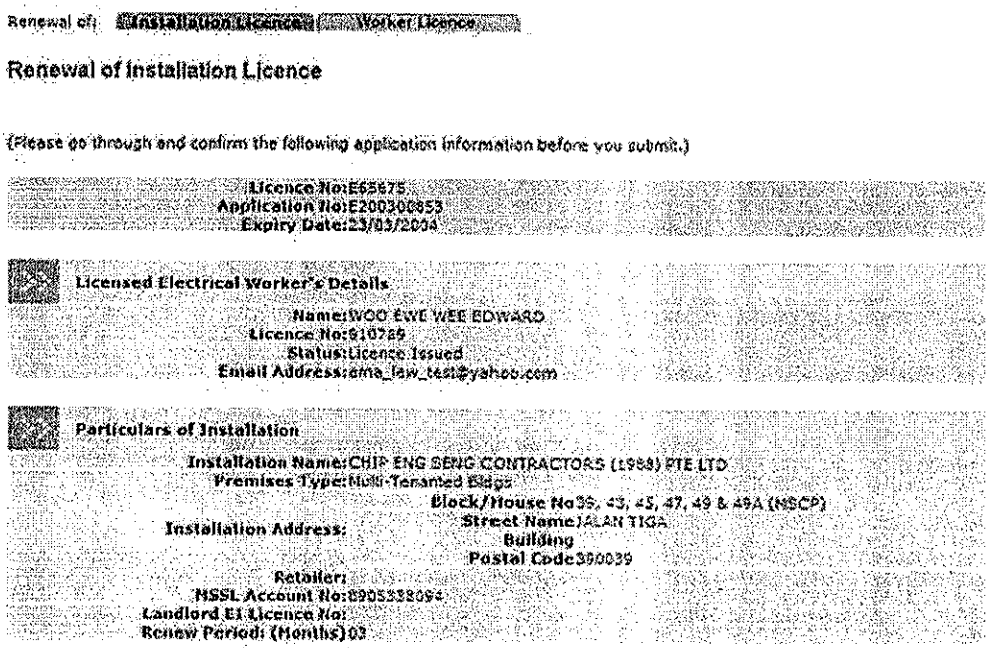


Step 5: Applicant is required to fill in the required fields denoted by * , update any relevant information and check all the declaration statements.



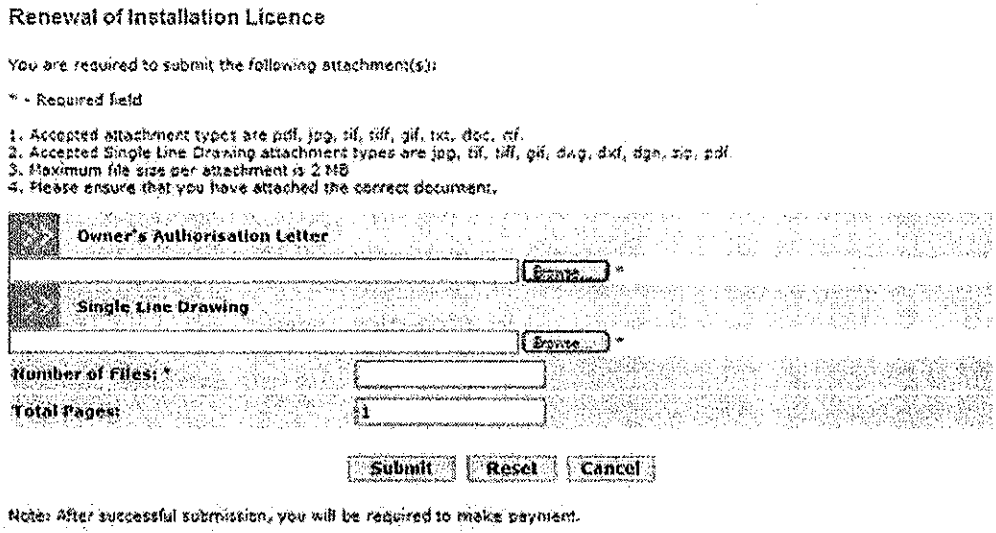
Step 6: System displays GIRO or GIRO-On-Demand information in the online renewal form if there is existing valid GIRO or GIRO-On-Demand linked with particular installation licence. Click on the check box to confirm payment using GIRO or GIRO-On-Demand.

Step 7: Upon completion of data entry, click "Submit" and system will verify the data entry. You may need to re-enter the data, if your data do not fulfill the condition. A confirmation page will be displayed for your verification.



Step 8: Upon verification of data entry, click "Confirm" to proceed, else, click "Back" for amendments.

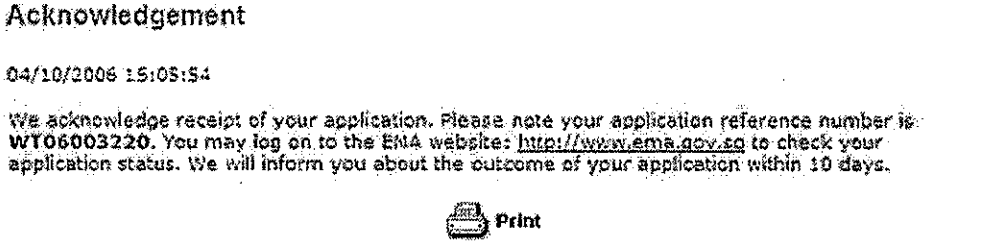
Step 9: Applicant is required to submit the documents marked *. Click "Browse" to retrieve the relevant document.



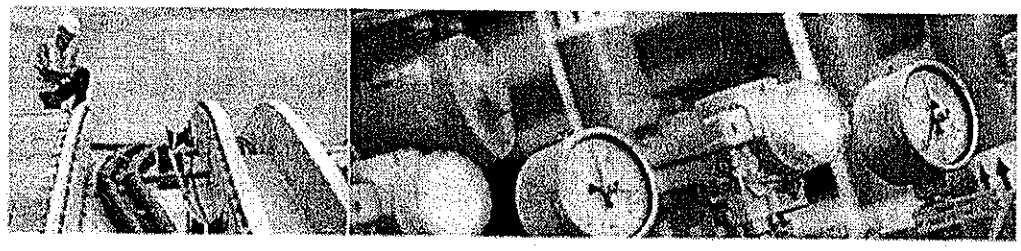
Step 10: The System will present the payment page to allow the user to make payment using one of the following modes: eNETS CashCard, eNETS VCard and eNETS Debit. If there is valid GIRO or GIRO-On-Demand account link with the licence and Licensed Electrical Worker had confirmed to pay by this mode (check box ticked), additional modes including GIRO or GIRO-On-Demand will be provided. See Make Payment for licence fee for details.

Step 11: Upon successful payment, an acknowledgement for the application will be presented on the browser. You may print the page for future reference.





Note 1: If payment is not complete, the "Payment Required" page will be displayed. To continue with payment, click "here to make payment" to select another mode of payment, otherwise you may cancel the application by clicking "here to cancel this application"



Payment Required

04/10/2006 15:02:28

You have not made a successful payment. Click here to make payment.

You could disable the 'Pop-up Blocker' in the Internet Explorer. Select 'Tools', 'Internet Options', 'Privacy' and unchecked the 'Block pop-ups' function.

Note 2: Acknowledgement will be given to the cancelled application as well. You may print the page for future reference.

Application Cancelled

Date/Time: 05/10/2006 16:47:53

We notice that you have cancelled your online application. Please take note of this Cancelled Application Reference Number ES05008762 in case you have further enquiry.

Print

4 New Application of Supply Installation Licence

Supply Installation refers to any electrical installation receiving electricity supply from its own generators.

Owner of all supply Installations in non-domestic premises, are required to apply for and obtain a licence to use or operate their supply installations.

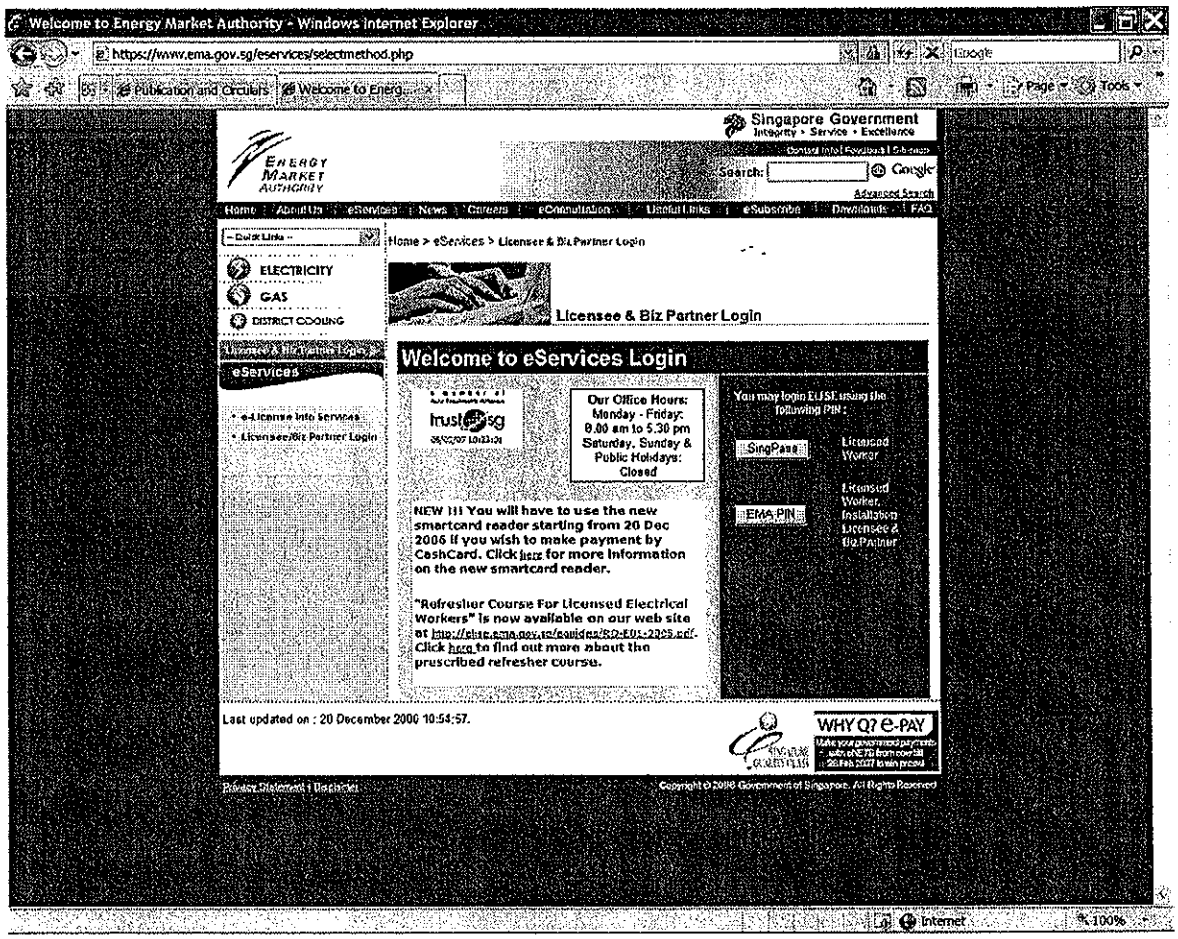
Supply installation in individual residential premises are exempted from licensing if they are used exclusively for domestic purposes.

Supply installations are licensed to ensure that they are operated and maintained by licensed electrical workers and are safe to use.

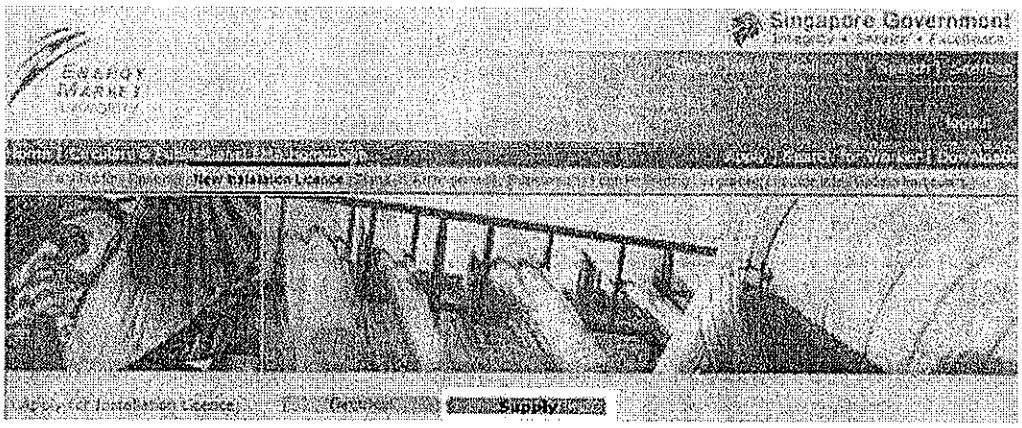
Consumer is required to appoint an appropriate class of licensed electrical worker to take charge of his supply installation and submit application for supply installation licence through his appointed licensed electrical worker.

Step 1: Goto to EMA Web Site at www.ema.gov.sg

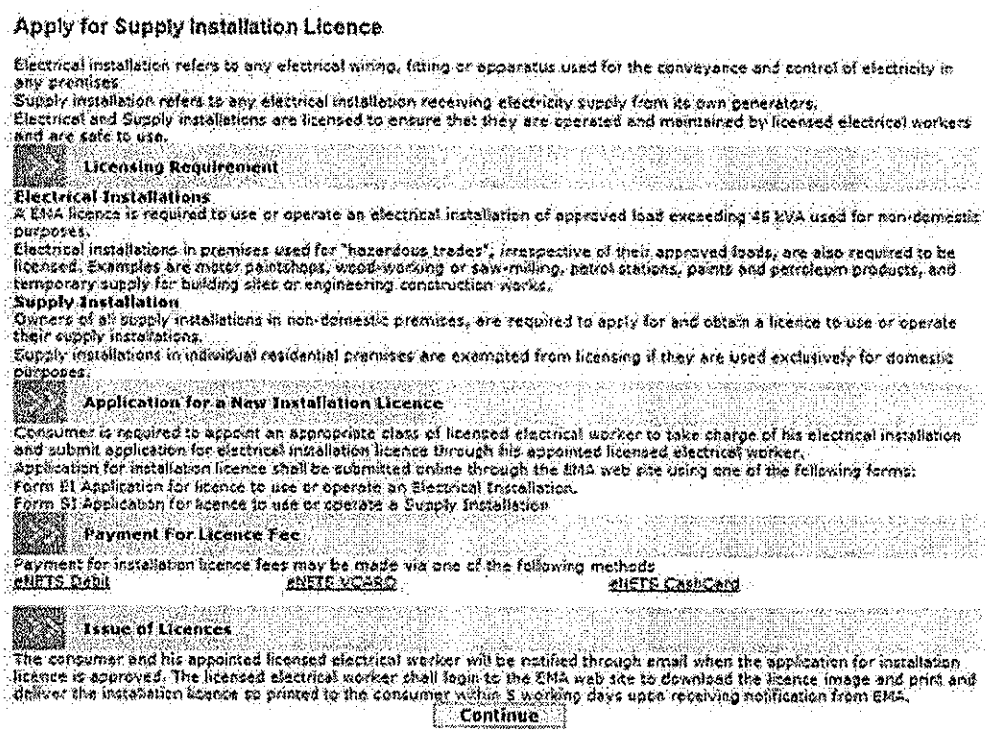
Step 2: Click on "eServices" then select "SingPass" or "EMA PIN" to login.



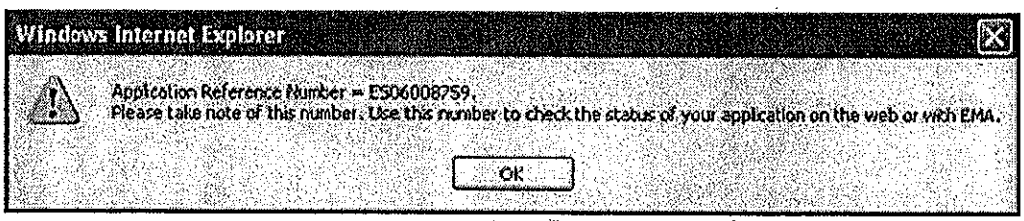
Step 3: Upon successful login, click "New Installation Licence" on the top navigation menu. Click on "Supply" to apply for Supply Installation Licence.



Step 4: Read the explanatory notes for application of Installation Licence requirements. Click "Continue" button at the bottom of the page to proceed with the application.

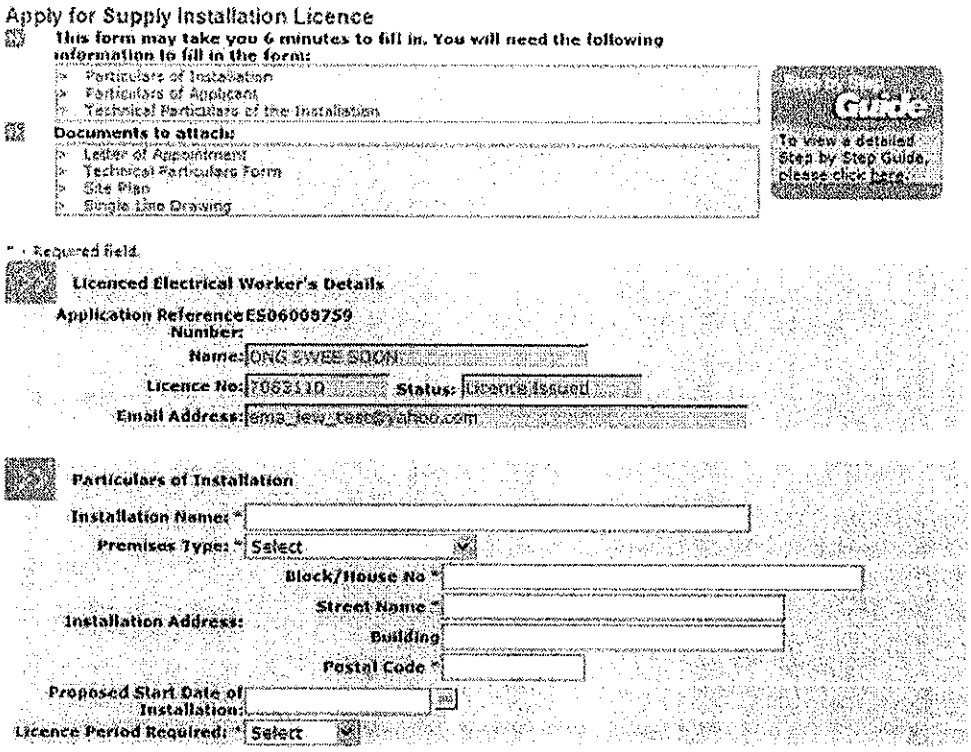


Step 5: An "Application Reference Number" will be issued and displayed. Please take note of this number. This number will enable you to check the online application status upon successful submission of application.

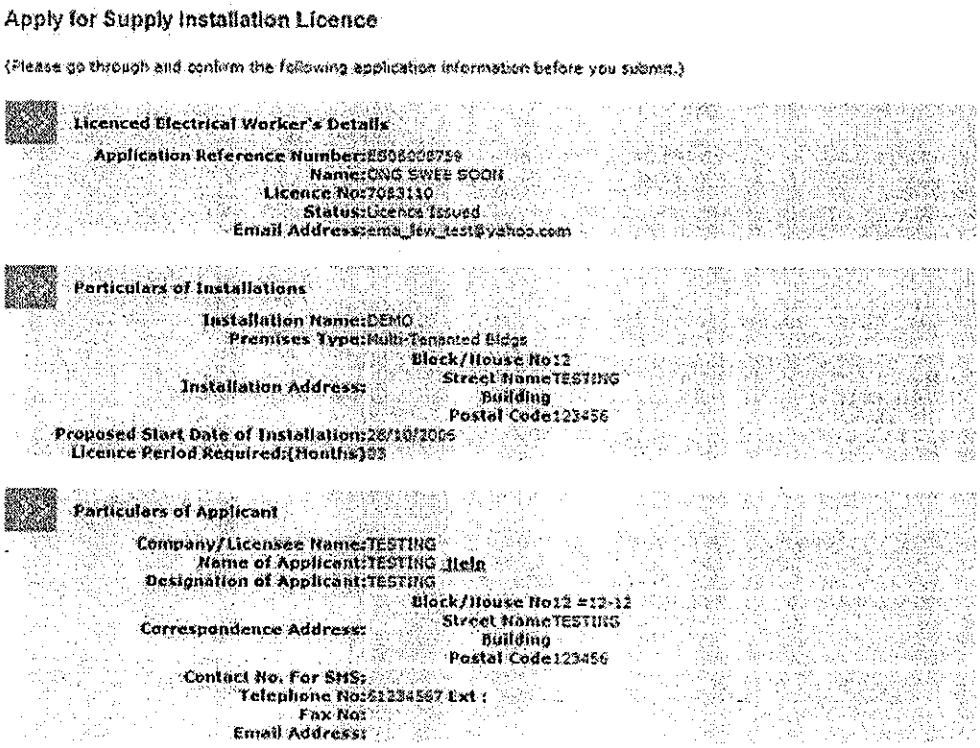


Step 6: Applicant is required to fill in the required fields (denoted by *) such as particulars of installation, particulars of applicant, technical particulars,

and check all the declaration statements.



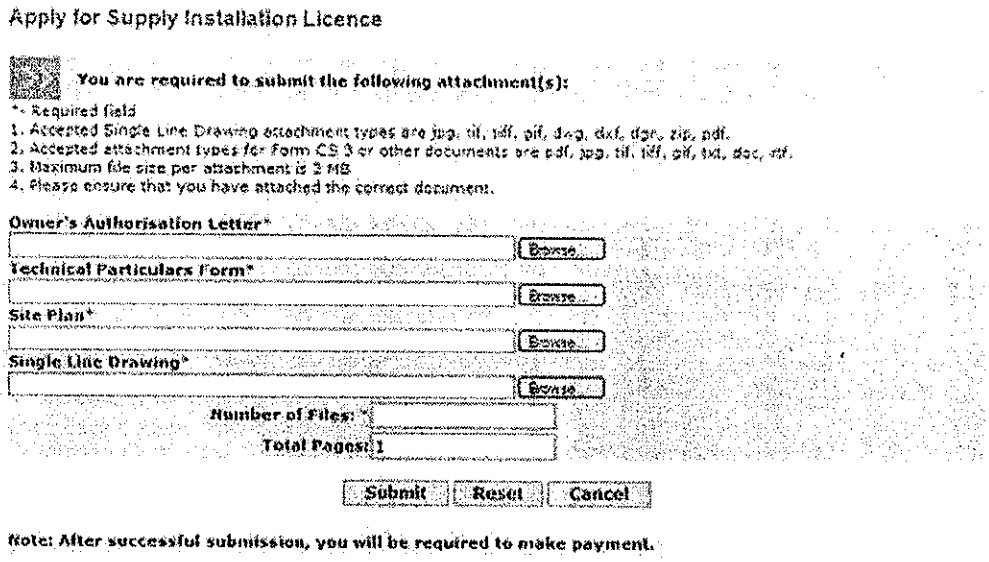
Step 7: Upon completion of data entry, click "Submit" and system will verify the data entry. You may need to re-enter the data, if your data do not fulfill the condition. A confirmation page will be displayed for your verification.



Step 8: Upon verification of data entry, click "Confirm" to proceed, else, click

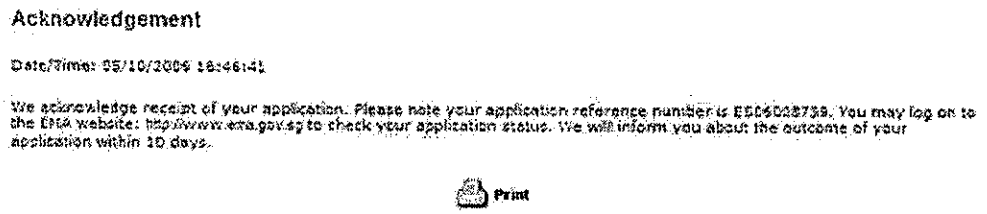
"Back" for amendments.

Step 9: Applicant is required to submit the documents marked *. Click "Browse" to retrieve the relevant document.

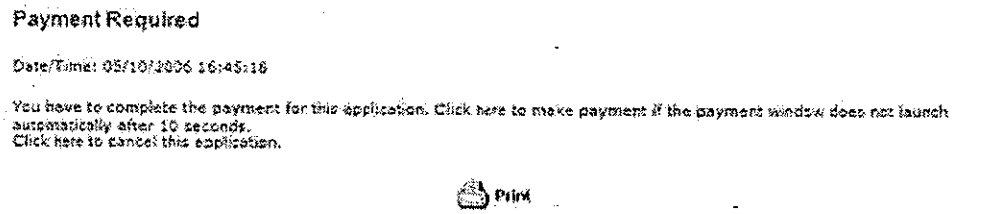


Step 10: The System will present the payment page to allow the user to make payment using one of the following modes: eNETS CashCard, eNETS VCard and eNETS Debit. See Make Payment for licence fee for details.

Step 11: Upon successful payment, an acknowledgement for the application will be presented on the browser. You may print the page for future reference.



Note 1: If payment is not complete, the "Payment Required" page will be displayed. To continue with payment, click "here to make payment" to select another mode of payment, otherwise you may cancel the application by clicking "here to cancel this application"



Note 2: Acknowledgement will be given to the cancelled application as well. You may print the page for future reference.

Application Cancelled

Date/Time: 05/10/2006 16:47:53

We notice that you have cancelled your online application. Please take note of this Cancelled Application Reference Number E506308763 in case you have further enquiry.

Print

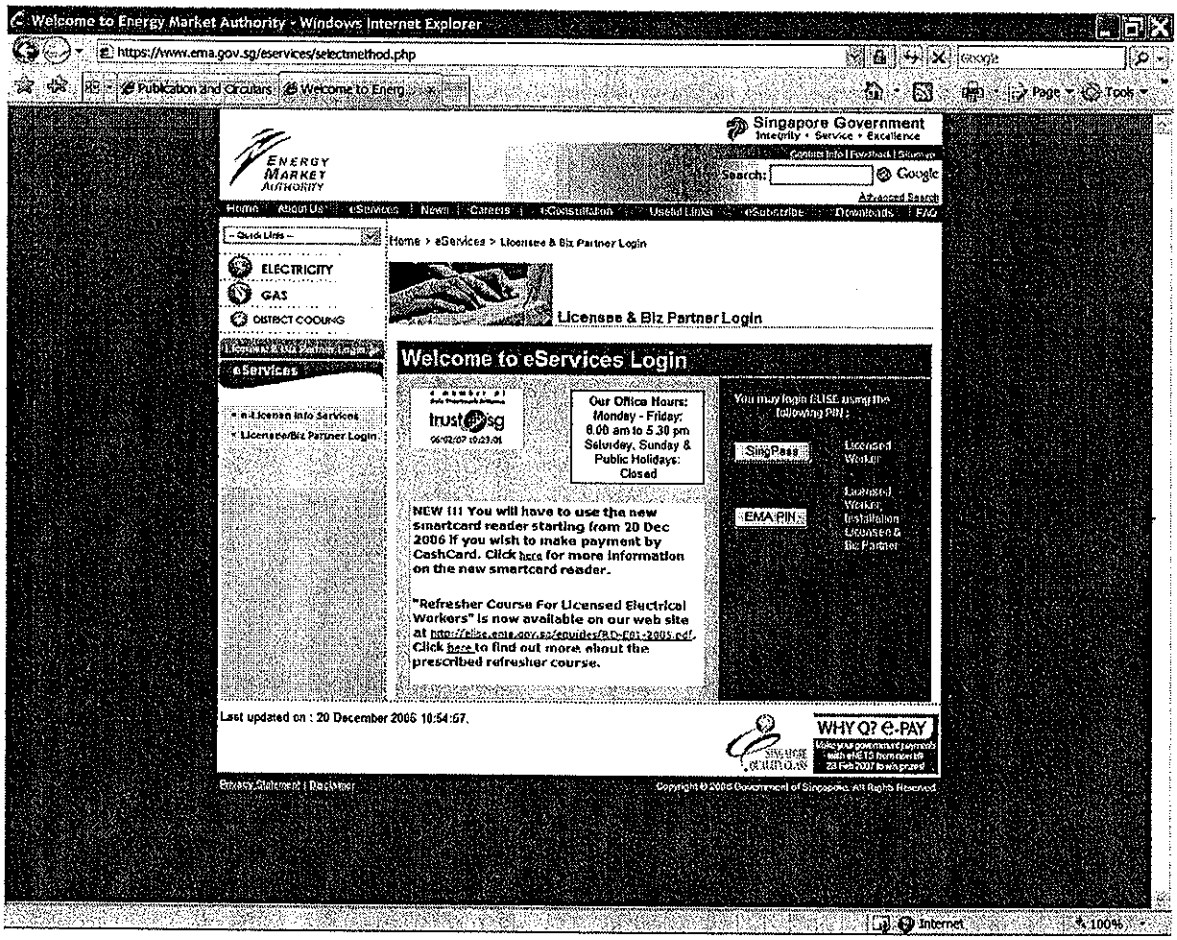
5 Renewal of Supply Installation Licence

An application for the renewal of a supply installation licence shall be made to the Authority not later than one month prior to the date of expiry of the licence.

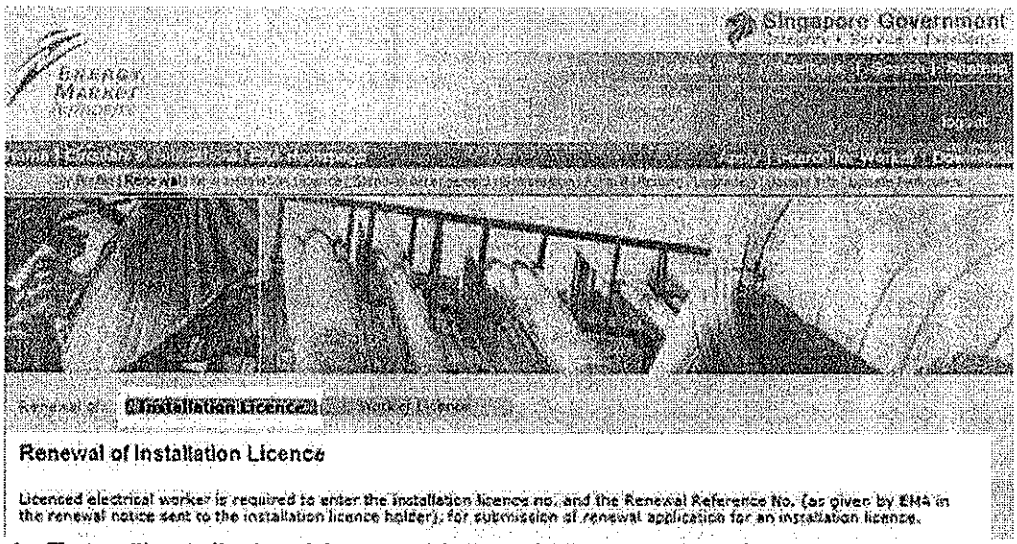
Licensed electrical worker is required to enter the installation licence no. and the Renewal Reference No. (as given by EMA in the renewal notice sent to the installation licence holder), for submission of renewal application for an installation licence.

Step 1: Goto to EMA Web Site at www.ema.gov.sg

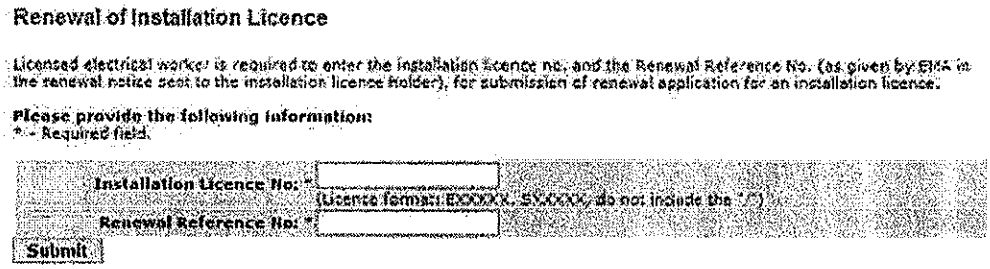
Step 2: Click on "eServices" then select "SingPass" or "EMA PIN" to login.



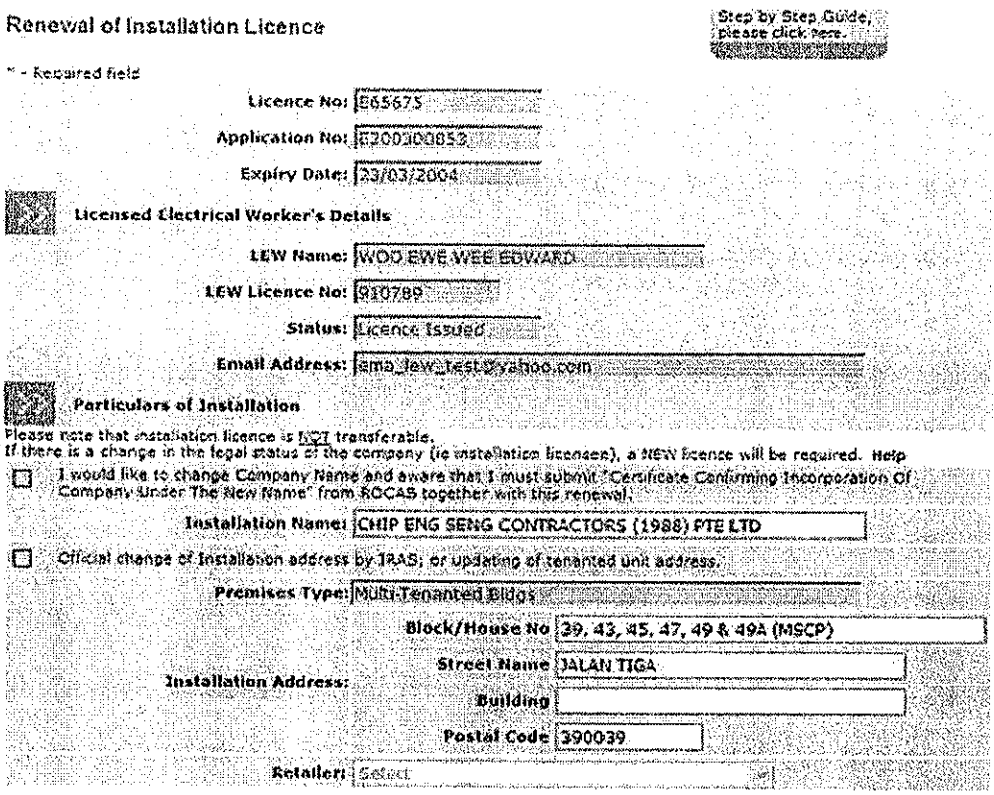
Step 3: Upon successful login, click "Renewal" on the top navigation menu. Click on "Renewal of Installation Licence" and read the explanatory notes for Renewal of Installation Licence requirements.



Step 4: Enter "Installation Licence No" and "Renewal Reference No", click "Submit" button to proceed with renewal application.

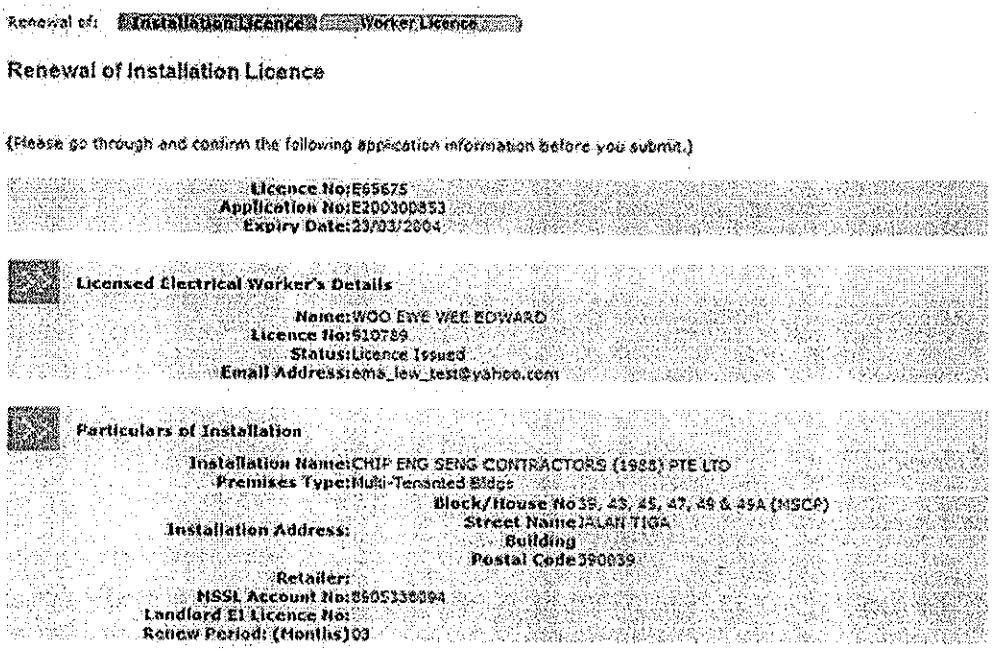


Step 5: Applicant is required to fill in the required fields denoted by *, update any relevant information and check all the declaration statements.



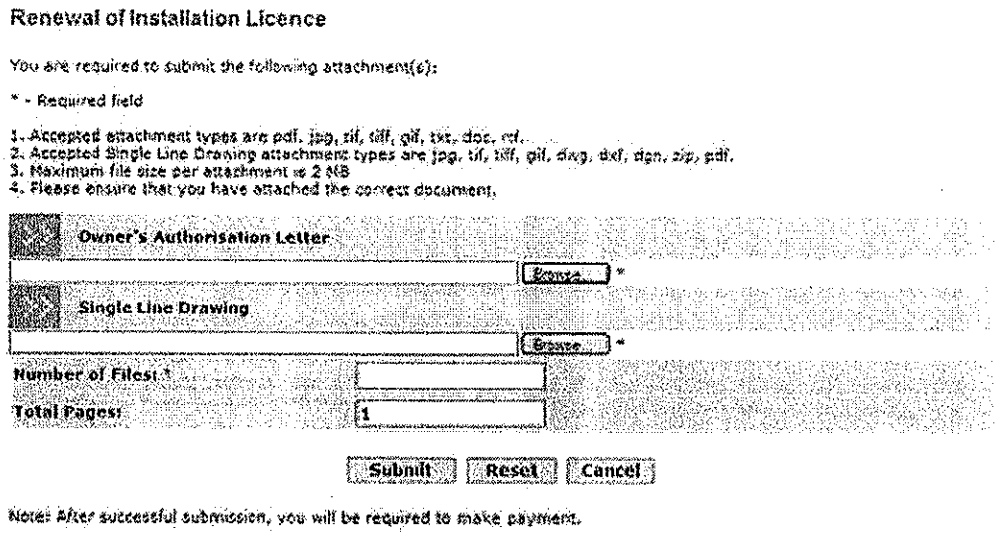
Step 6: System displays GIRO or GIRO-On-Demand information in the online renewal form if there is existing valid GIRO or GIRO-On-Demand linked with particular installation licence. Click on the check box to confirm payment using GIRO or GIRO-On-Demand.

Step 7: Upon completion of data entry, click "Submit" and system will verify the data entry. You may need to re-enter the data, if your data do not fulfill the condition. A confirmation page will be displayed for your verification.



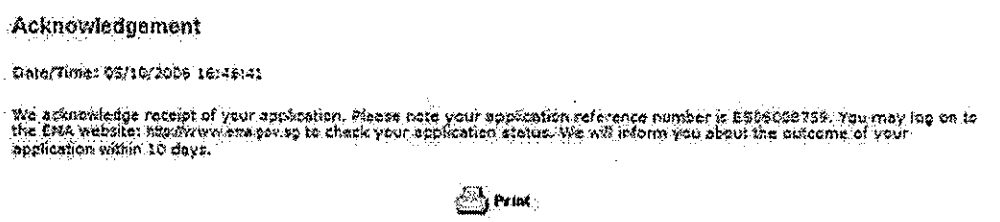
Step 8: Upon verification of data entry, click "Confirm" to proceed, else, click "Back" for amendments.

Step 9: Applicant is required to submit the documents marked *. Click "Browse" to retrieve the relevant document.



Step 10: The System will present the payment page to allow the user to make payment using one of the following modes: eNETS CashCard, eNETS VCard and eNETS Debit. If there is valid GIRO or GIRO-On-Demand account link with the licence and Licensed Electrical Worker had confirmed to pay by this mode (check box ticked), additional modes including GIRO or GIRO-On-Demand will be provided. See Make Payment for licence fee for details.

Step 11: Upon successful payment, an acknowledgement for the application will be presented on the browser. You may print the page for future reference.



Note 1: If payment is not complete, the "Payment Required" page will be displayed. To continue with payment, click "here to make payment" to select another mode of payment, otherwise you may cancel the

application by clicking "here to cancel this application"



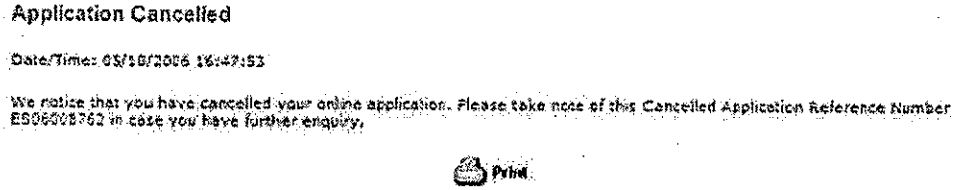
Payment Required

Date/Time: 05/10/2006 16:45:16

You have to complete the payment for this application. Click here to make payment if the payment window does not launch automatically after 10 seconds.
Click here to cancel this application.

Print

Note 2: Acknowledgement will be given to the cancelled application as well. You may print the page for future reference.



Application Cancelled

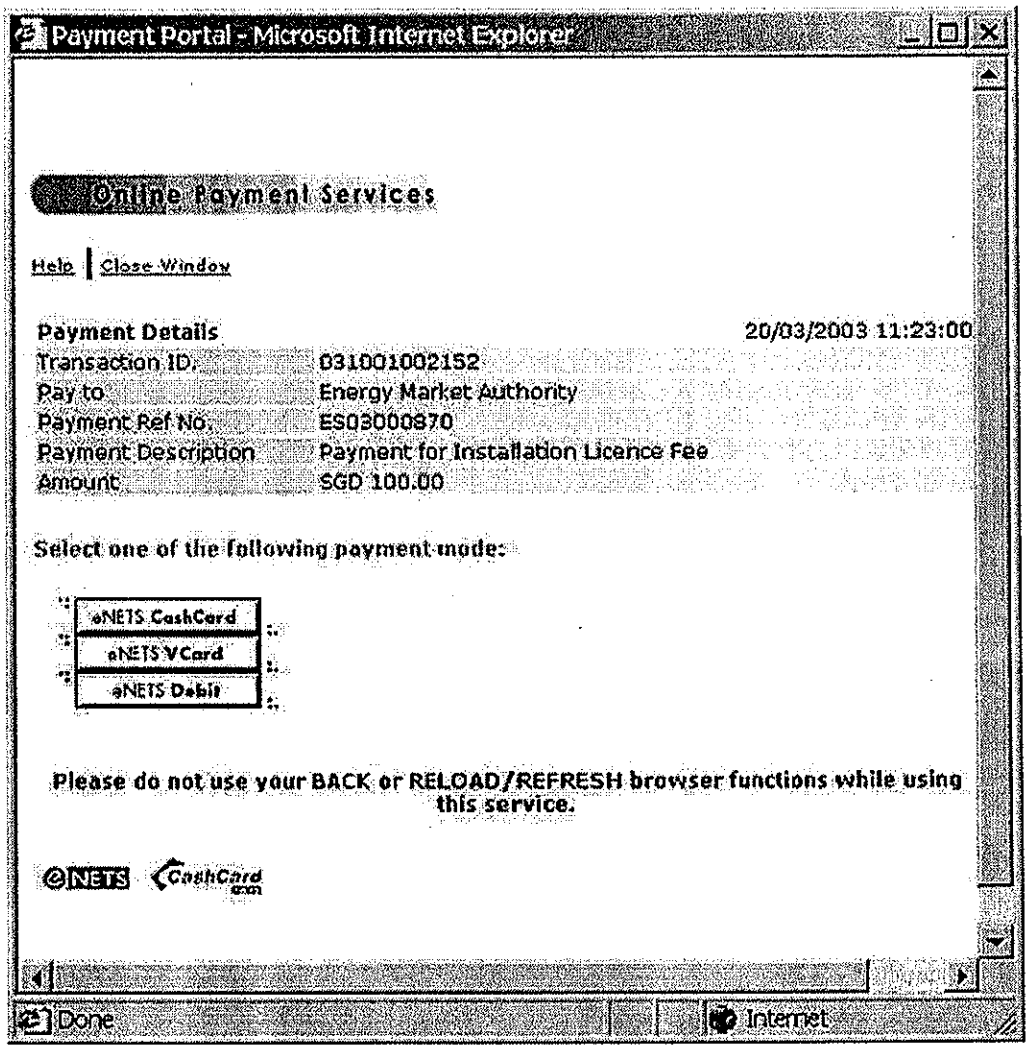
Date/Time: 05/10/2006 16:47:53

We notice that you have cancelled your online application. Please take note of this Cancelled Application Reference Number ES06008762 in case you have further enquiry.

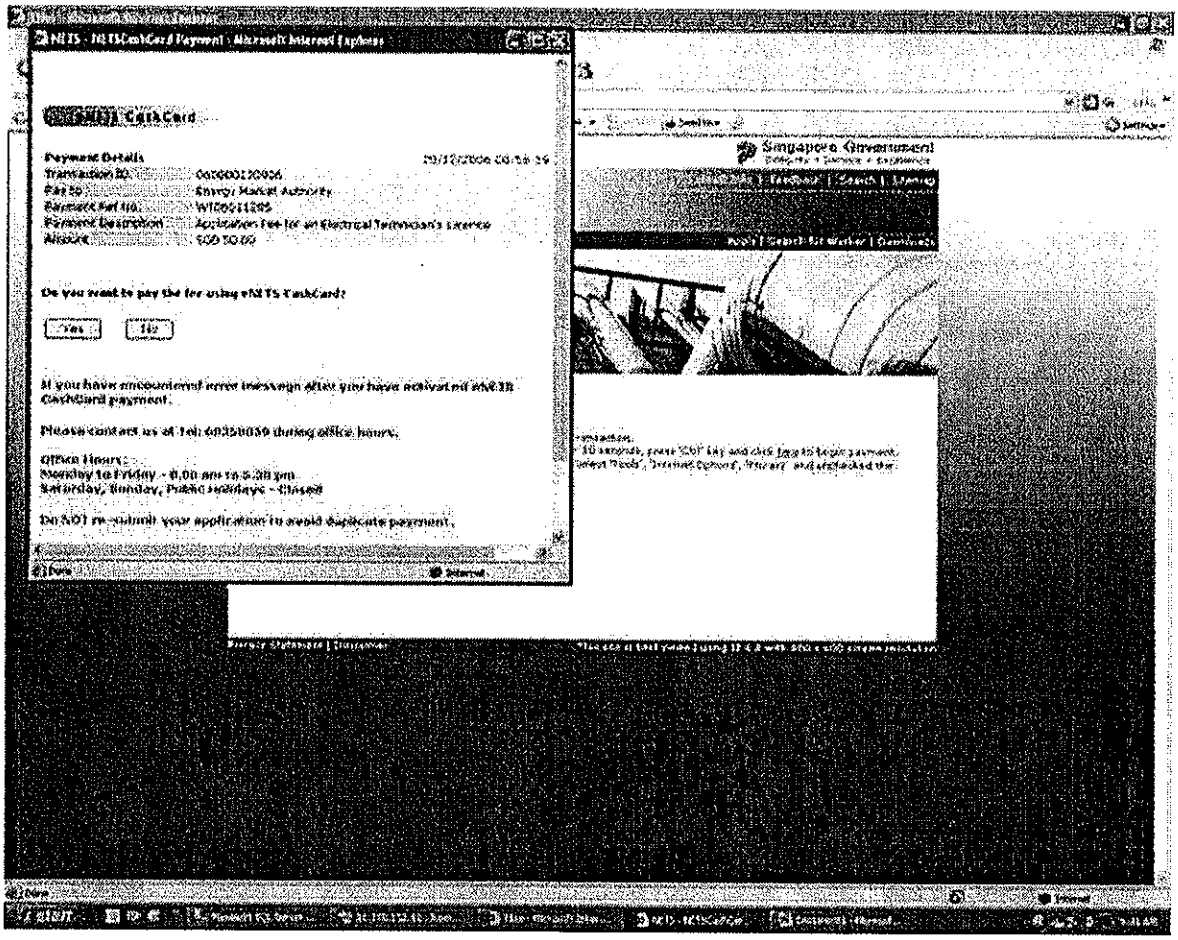
Print

6 Making payment by eNETS CASHCARD

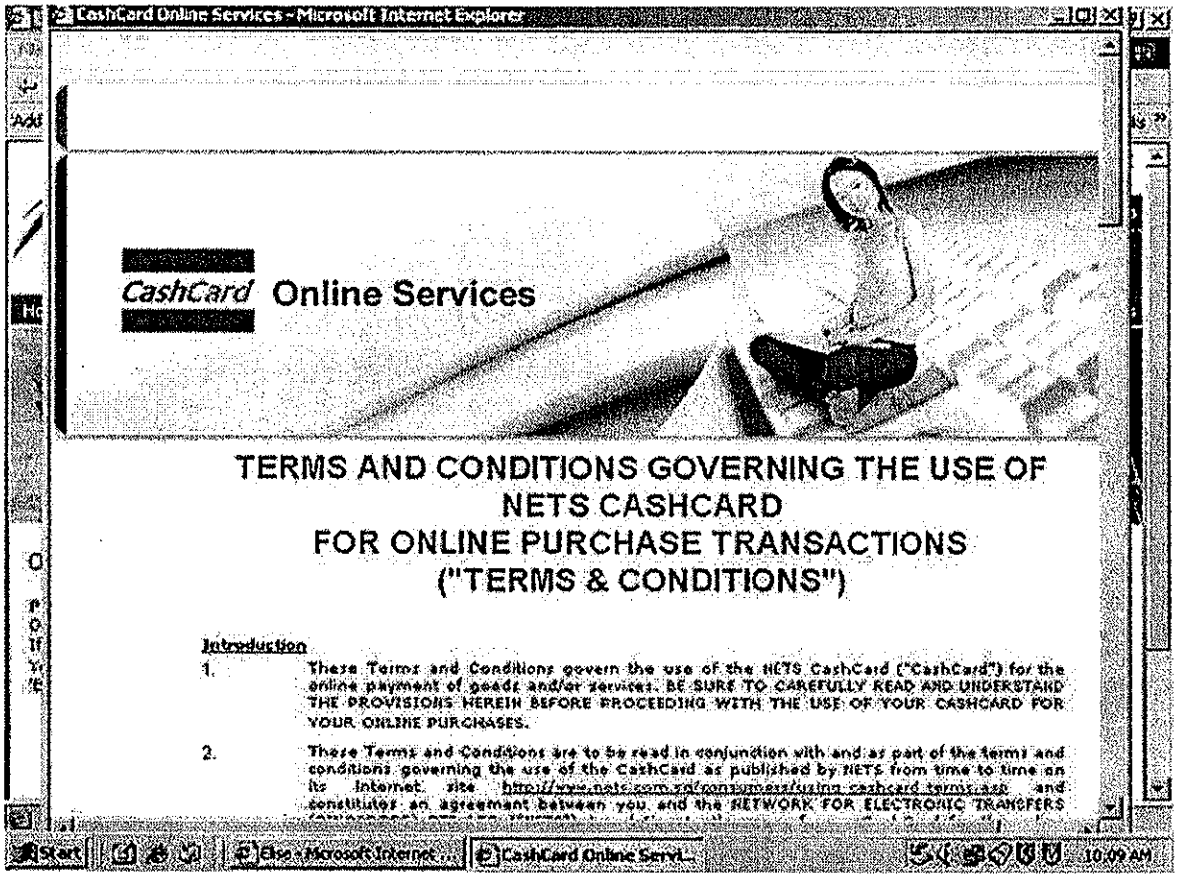
Step 1: The following modes will be provided: eNETS CashCard, eNETS VCARD and eNETS Debit. Select eNETS CashCard as the mode of payment.

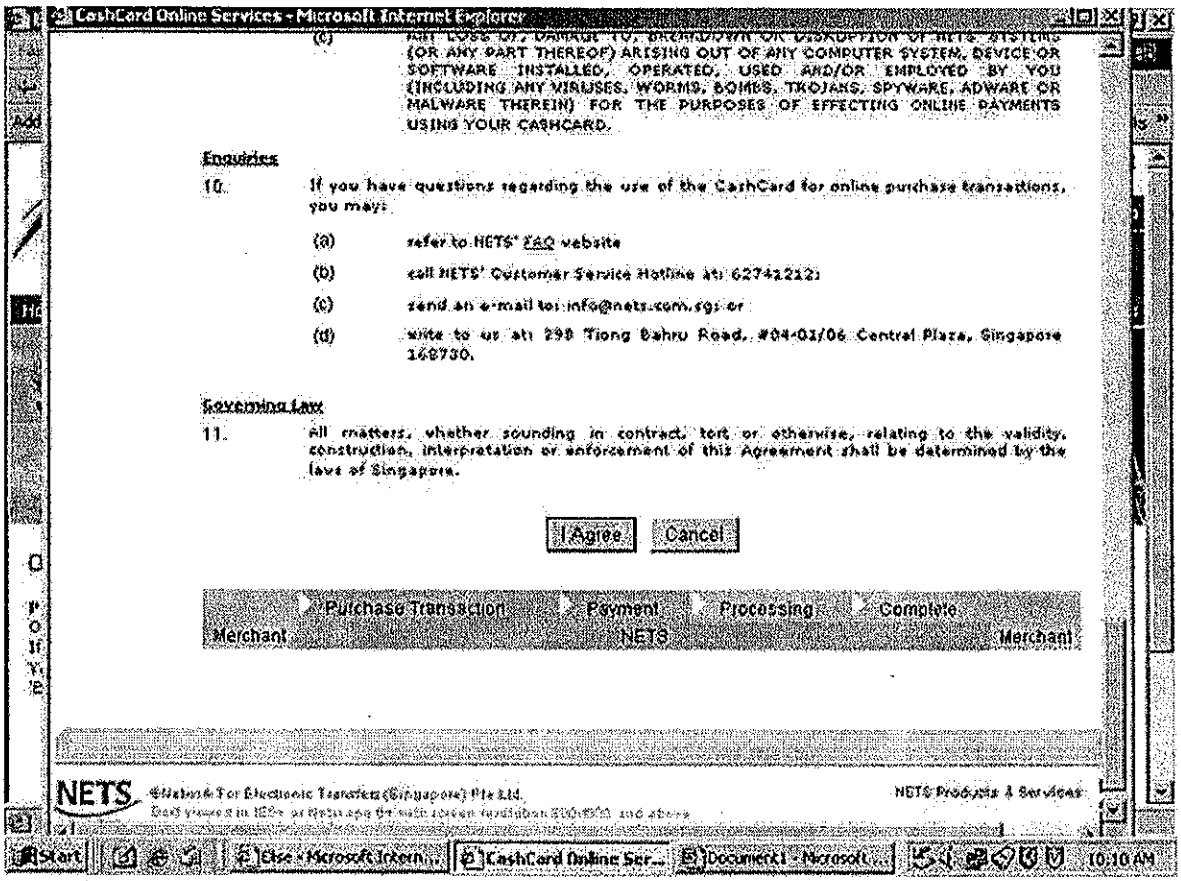


Step 2: Click "Yes" button to proceed for eNets CashCard Payment. Otherwise, click "No" to abort the process.

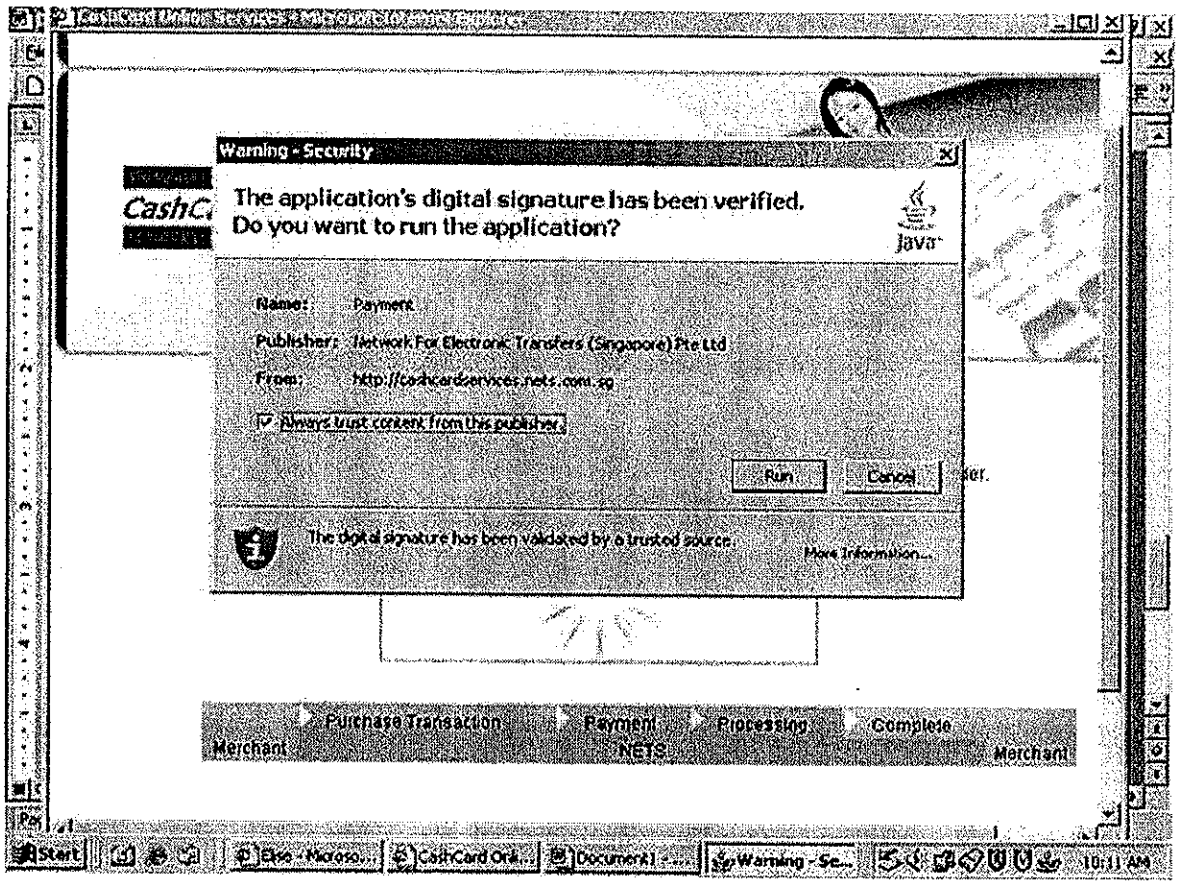


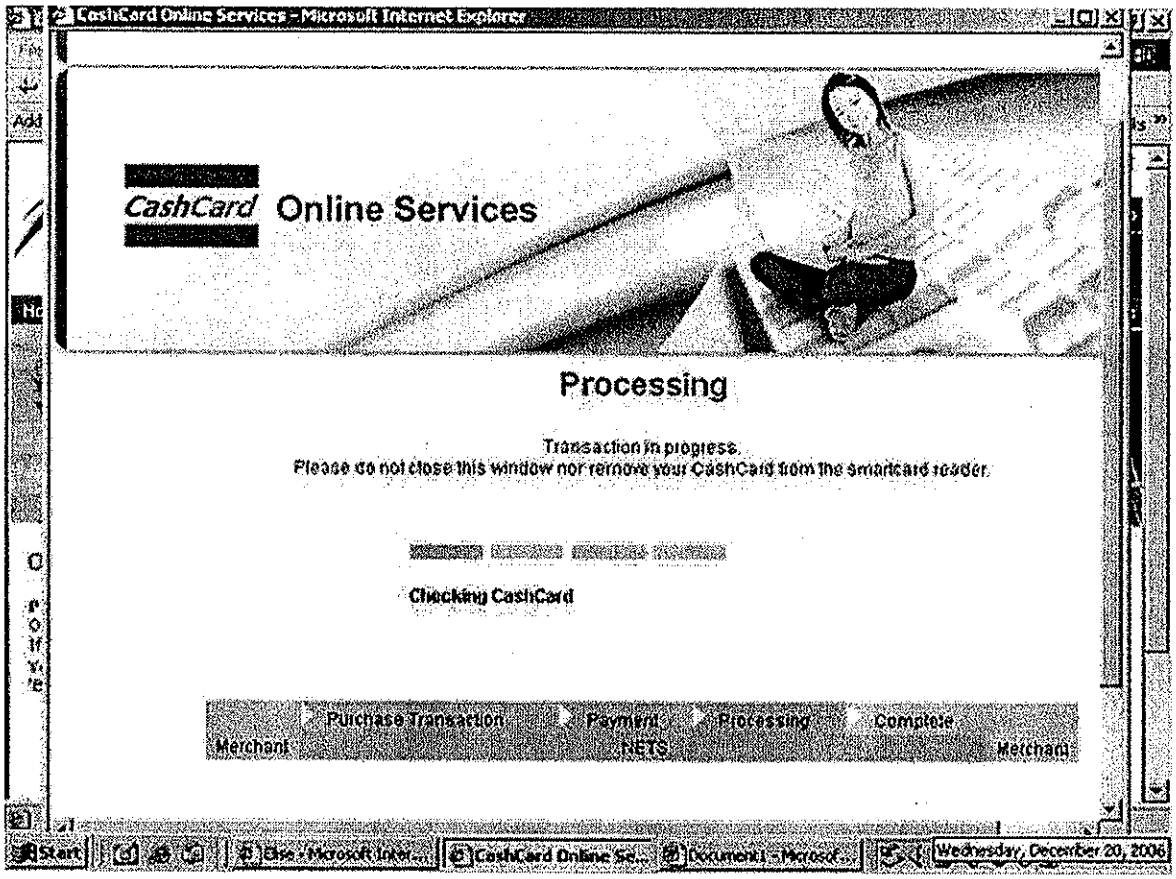
Step 3: Click on "I Agree" to proceed further. When the system prompt you to insert the cash card, please insert the cash card into the smartcard reader, and click "Ok" to proceed. Otherwise, click "Cancel" to abort the process


CashCard Online Services - Microsoft Internet Explorer
CashCard Online Services
TERMS AND CONDITIONS GOVERNING THE USE OF NETS CASHCARD FOR ONLINE PURCHASE TRANSACTIONS ("TERMS & CONDITIONS")
Introduction
1. These Terms and Conditions govern the use of the NETS CashCard ("CashCard") for the online payment of goods and/or services. BE SURE TO CAREFULLY READ AND UNDERSTAND THE PROVISIONS HEREIN BEFORE PROCEEDING WITH THE USE OF YOUR CASHCARD FOR YOUR ONLINE PURCHASES.
2. These Terms and Conditions are to be read in conjunction with and as part of the terms and conditions governing the use of the CashCard as published by NETS from time to time on its Internet site http://www.nets.com.sg/consumers/using_cashcard_terms.asp and constitutes an agreement between you and the NETWORK FOR ELECTRONIC TRANSFERS

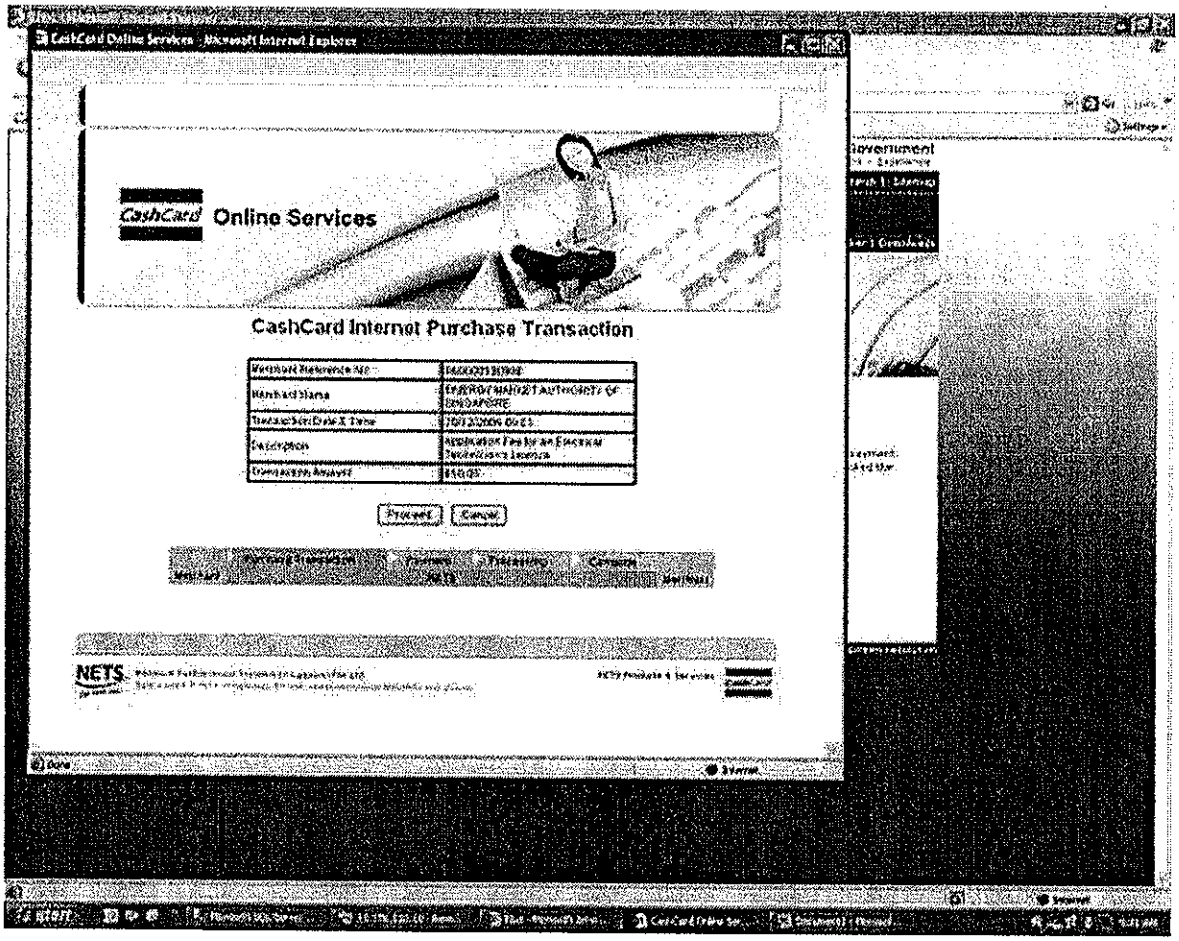

CashCard Online Services - Microsoft Internet Explorer
(c) ... (OR ANY PART THEREOF) ARISING OUT OF ANY COMPUTER SYSTEM, DEVICE OR SOFTWARE INSTALLED, OPERATED, USED AND/OR EMPLOYED BY YOU (INCLUDING ANY VIRUSES, WORMS, BOMBS, TROJANS, SPYWARE, ADWARE OR MALWARE THEREIN) FOR THE PURPOSES OF EFFECTING ONLINE PAYMENTS USING YOUR CASHCARD.
Enquiries
10. If you have questions regarding the use of the CashCard for online purchase transactions, you may:
(a) refer to NETS' FAQ website
(b) call NETS' Customer Service Hotline at: 62742212;
(c) send an e-mail to: info@nets.com.sg; or
(d) write to us at: 298 Tiong Bahru Road, #04-01/06 Central Plaza, Singapore 168730.
Governing Law
11. All matters, whether sounding in contract, tort or otherwise, relating to the validity, construction, interpretation or enforcement of this Agreement shall be determined by the laws of Singapore.
I Agree
Cancel
Purchase Transaction
Payment
Processing
Complete
Merchant
NETS
Merchant
NETS
NETS Products & Services

Step 4: The system will prompt the Digital signature popup, to proceed click "Run". Otherwise, click "Cancel" to abort the process.





Step 5: The CashCard Online Services will retrieve and display information regarding the merchant and the payment details. At the same time, a Purchase Order page will be displayed on your browser for you to verify your items of purchase. If the details are correct, click "Proceed" on the CashCard Internet Purchase Transaction. Otherwise, click "Cancel" to abort the process.



Step 6: Upon successfully deducted the required amount from the cash card, the software will display the remaining amount in the cash card. Click "OK" to continue. Receipt will be generated for this transaction.



Help | Close Window

Your payment transaction has been completed.
Please print a copy for reference.

Payment Details	08/01/2003 15:46:02
Transaction ID.	030001002157
Bank Ref. No.	1348
Pay to	Energy Market Authority
Payment Ref No.	GA00731992
Payment Description	Renewal Fee for a Gas Service Worker Licence
Amount	SGD $2.00

Thank you for using eNETS electronic payment.

For any enquiry, please email or contact Regulation Division at:

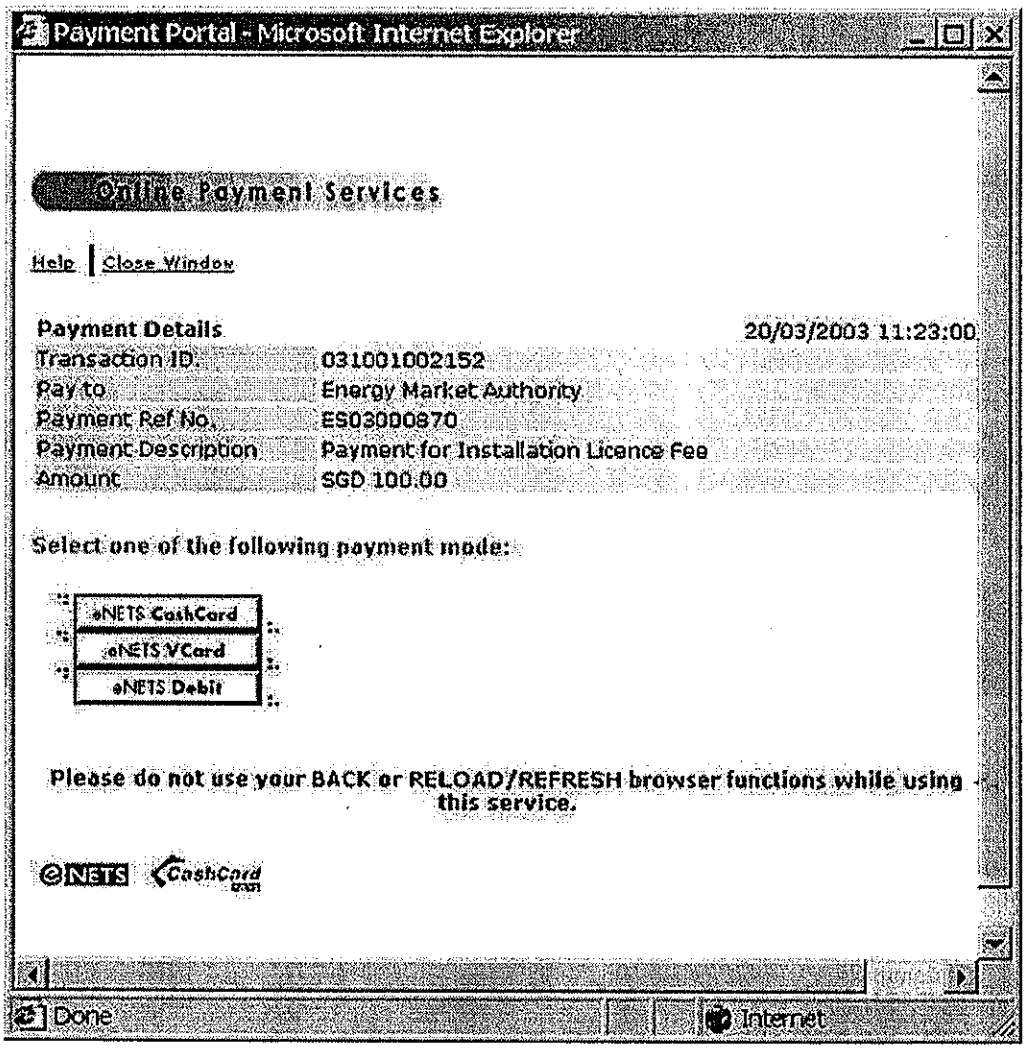
Address:
111 Somerset Road
#15-05 Singapore 238164

Telephone:(65) 6835 8075
Fax:(65) 6835 8044
Email: ema rd.gov.sg

Step 7: Print the receipt and exit the CashCard Online Services. Upon successfully payment, an acknowledgement for the application will be presented on the browser. You may print the page for future reference.

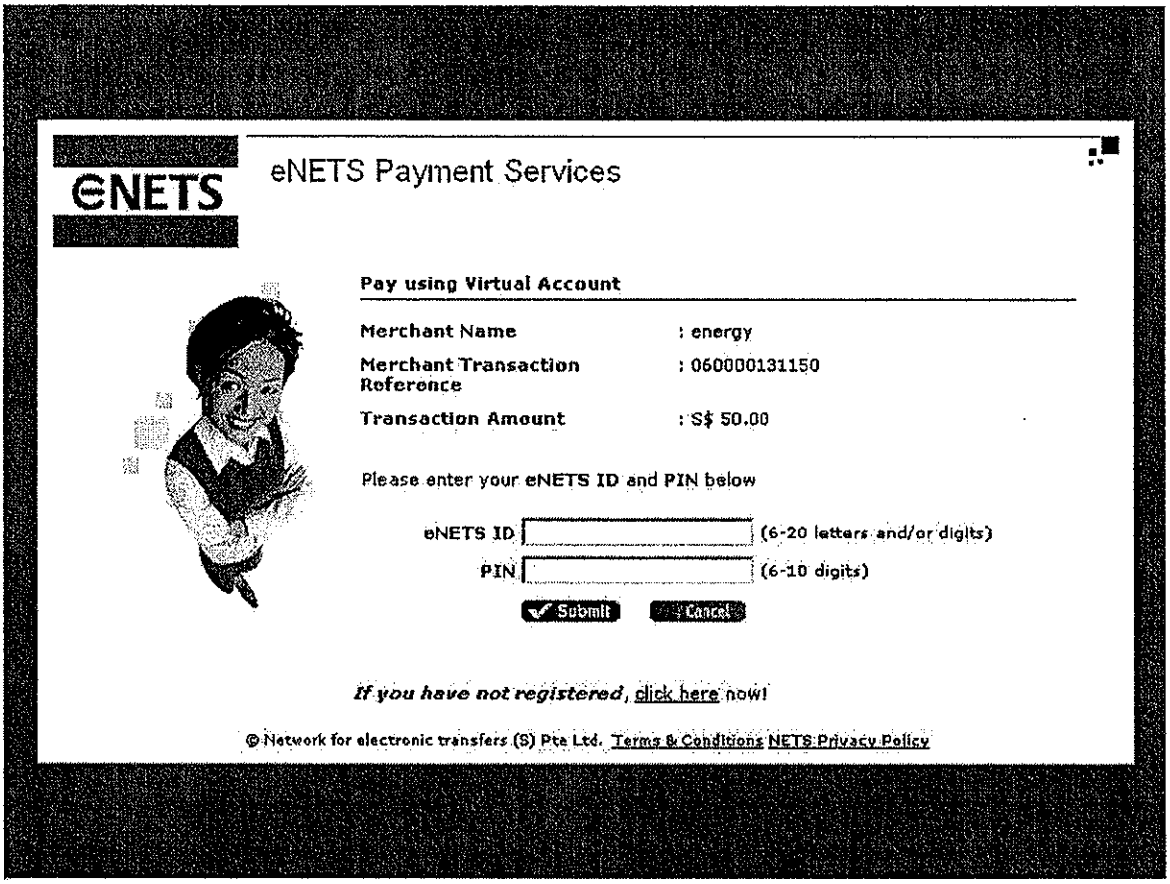
7 Making Payment by eNETS VCARD

Step 1: The following modes will be provided: eNETS CashCard, eNETS VCARD and eNETS Debit. Select eNETS CashCard as the mode of payment.



Step 2: For eNETS VCARD payment, click on the "eNETS VCARD" button.

Step 3: You will be re-directed to eNETS VCARD payment page. Enter your eNETS ID and PIN to proceed with payment.



Step 4: Upon successfully deducted the required amount from the VCARD account, receipt will be generated for this transaction.

Step 5: Print the receipt.

Step 6: Upon successful payment, an acknowledgement for the application will be presented on the browser. You may print the page for future reference.

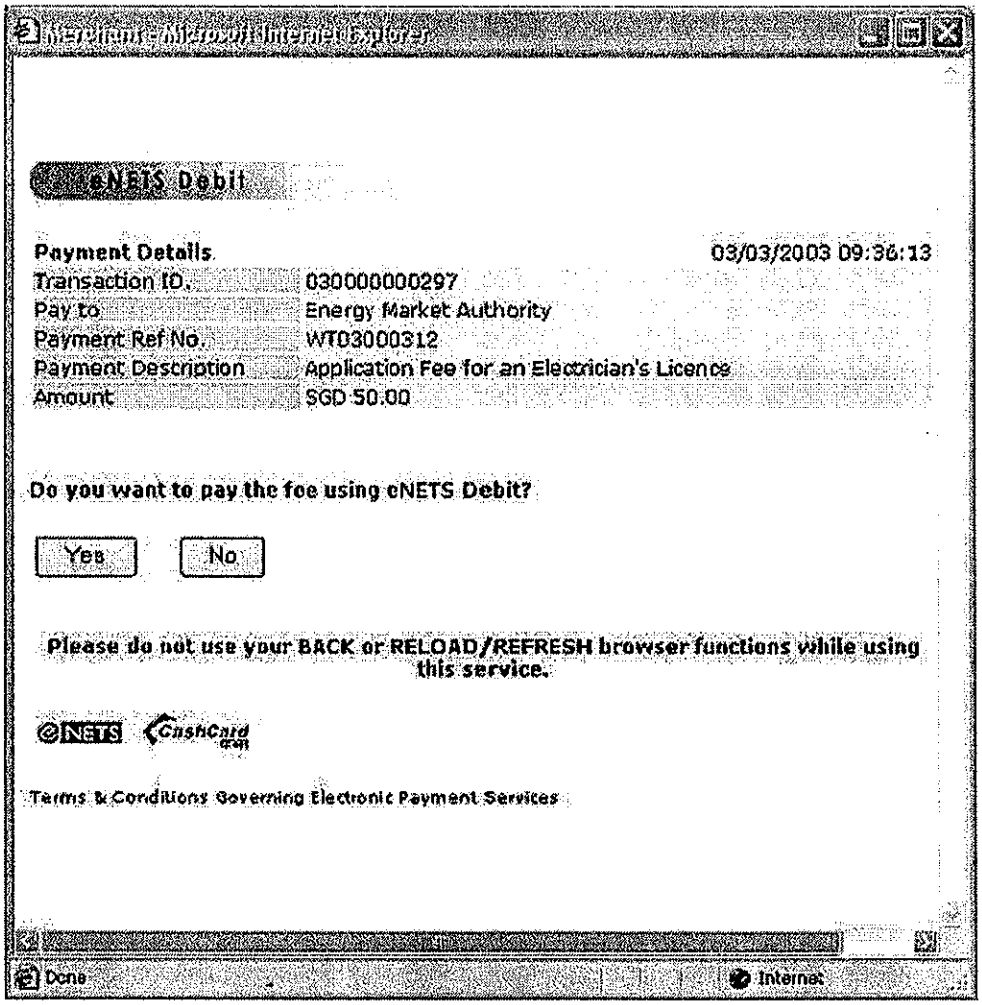
8 Making payment by eNETS Direct Debit

Step 1: The following modes will be provided: eNETS CashCard, eNETS VCARD and eNETS Debit.

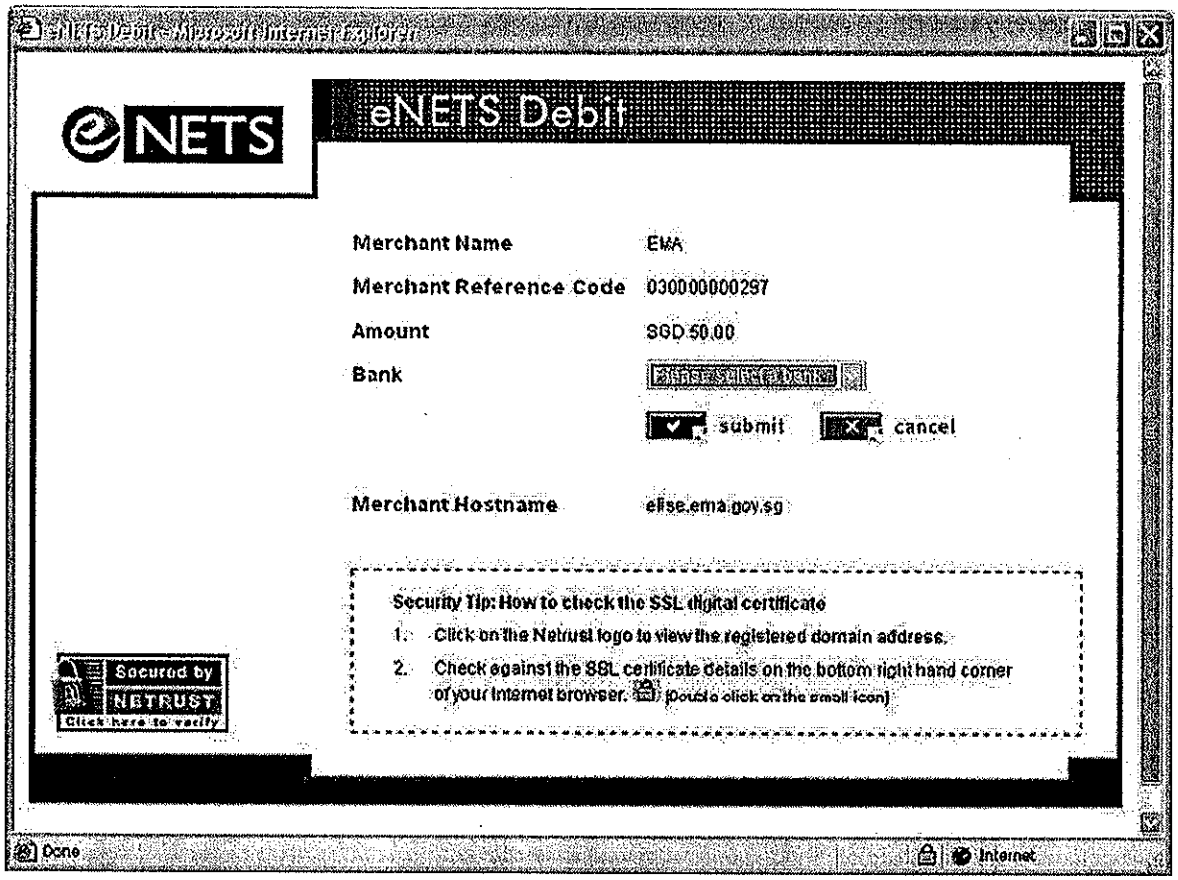


Step 2: For eNETS Direct Debit payment, click on the "eNETS Debit" button.

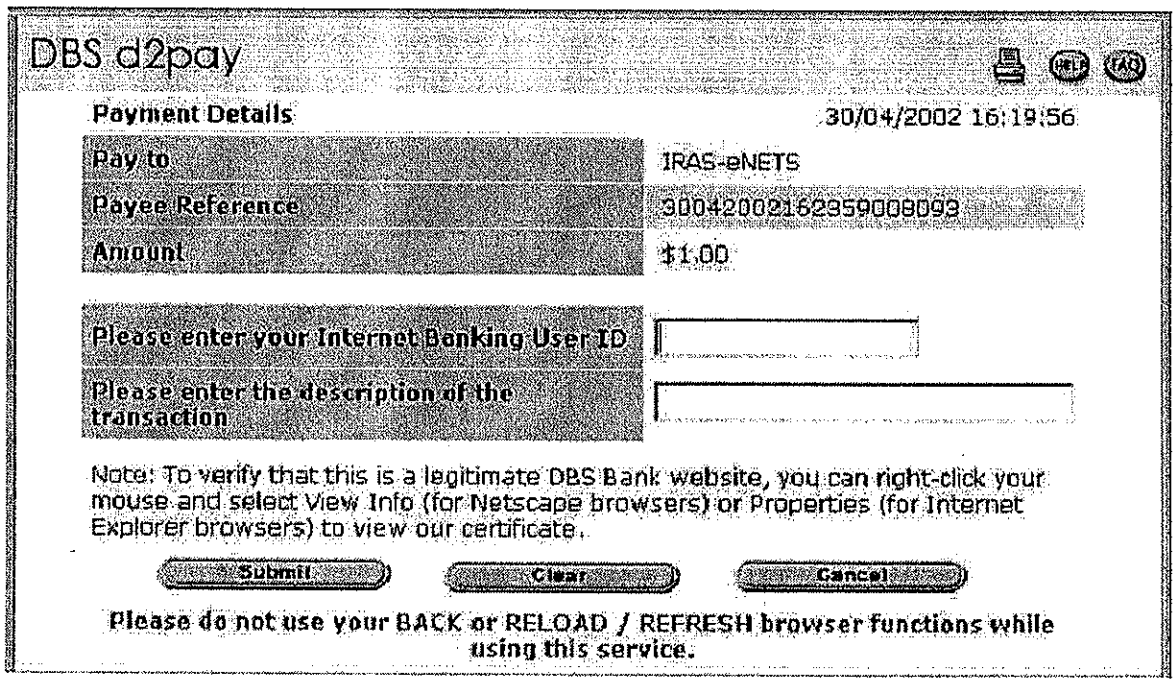
Step 3: Verify payment details, to confirm payment click "Yes", otherwise click "No" to cancel payment.

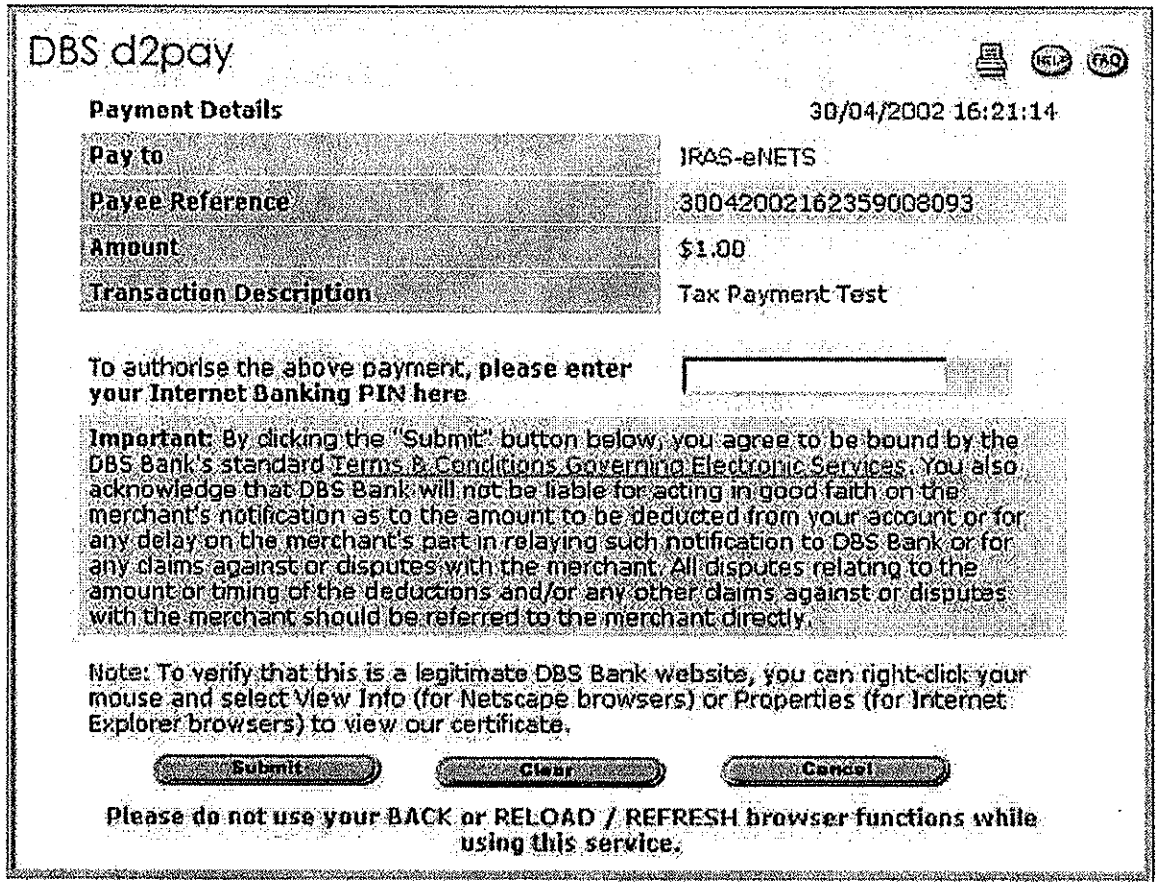


Step 4: Verify transaction amount, select the bank from the drop down list box and click "Submit" to proceed, otherwise click "Cancel" to cancel payment.

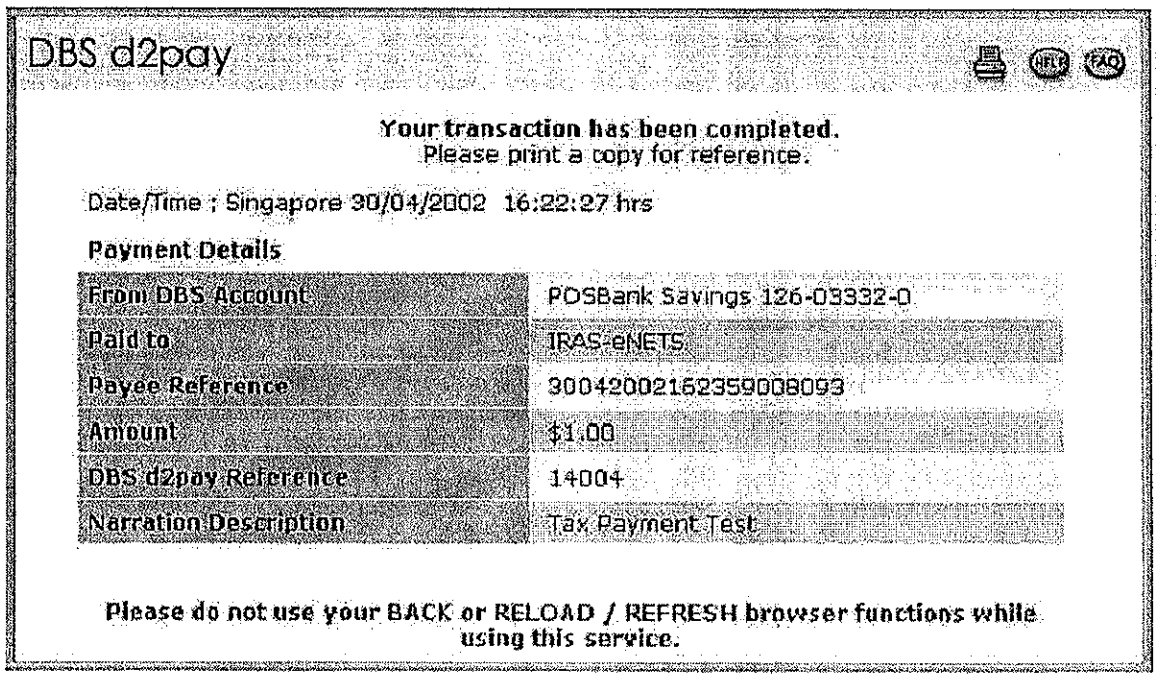


Step 5: Enter internet banking user id, password and click "Submit" to proceed; otherwise click "Cancel" to cancel payment.





Step 6: Receipt will be generated upon successful transaction. Print the receipt for future reference.

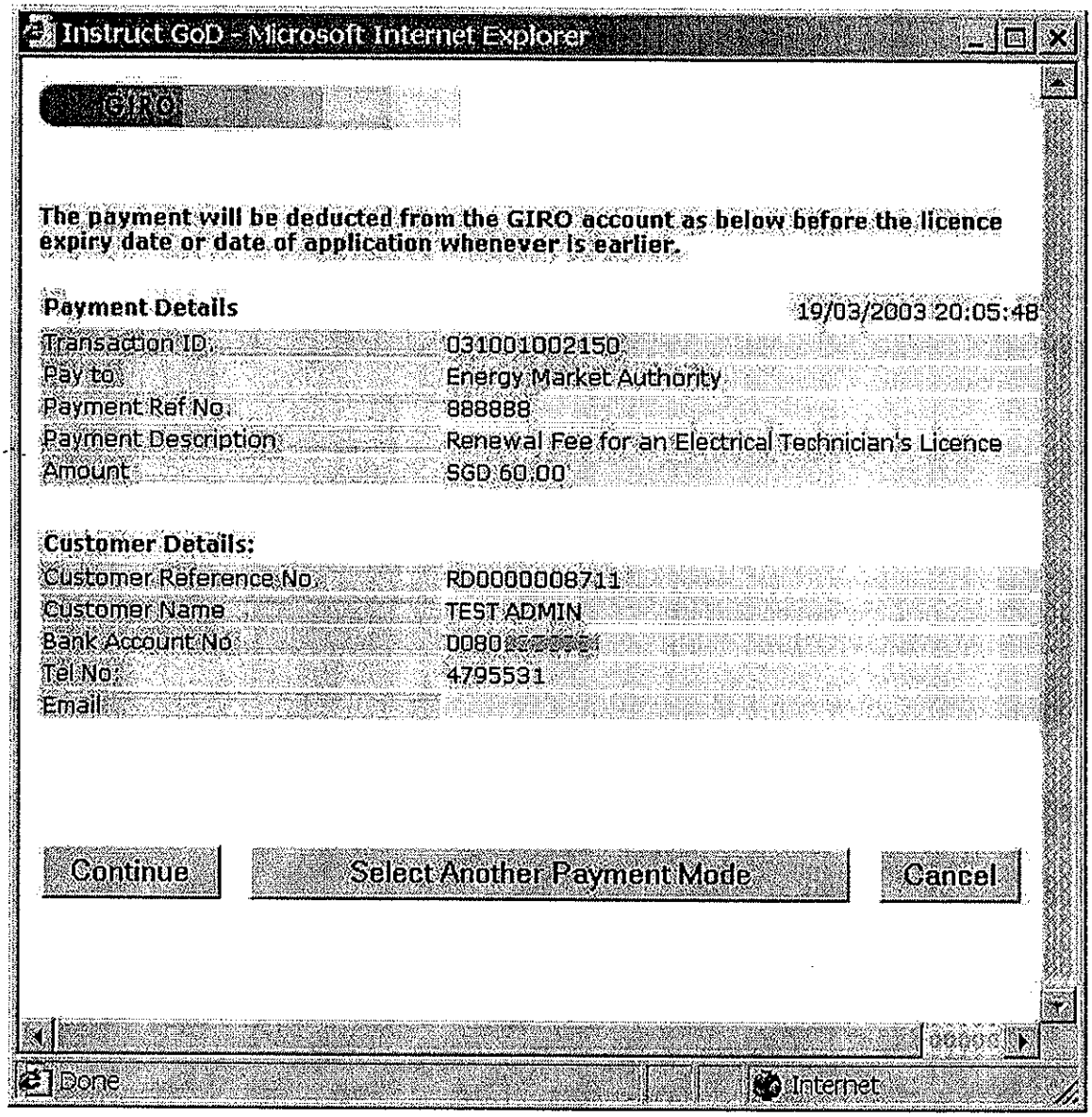


Step 7: Upon successful payment, an acknowledgement for the application will be presented on the browser. You may print the page for future reference.

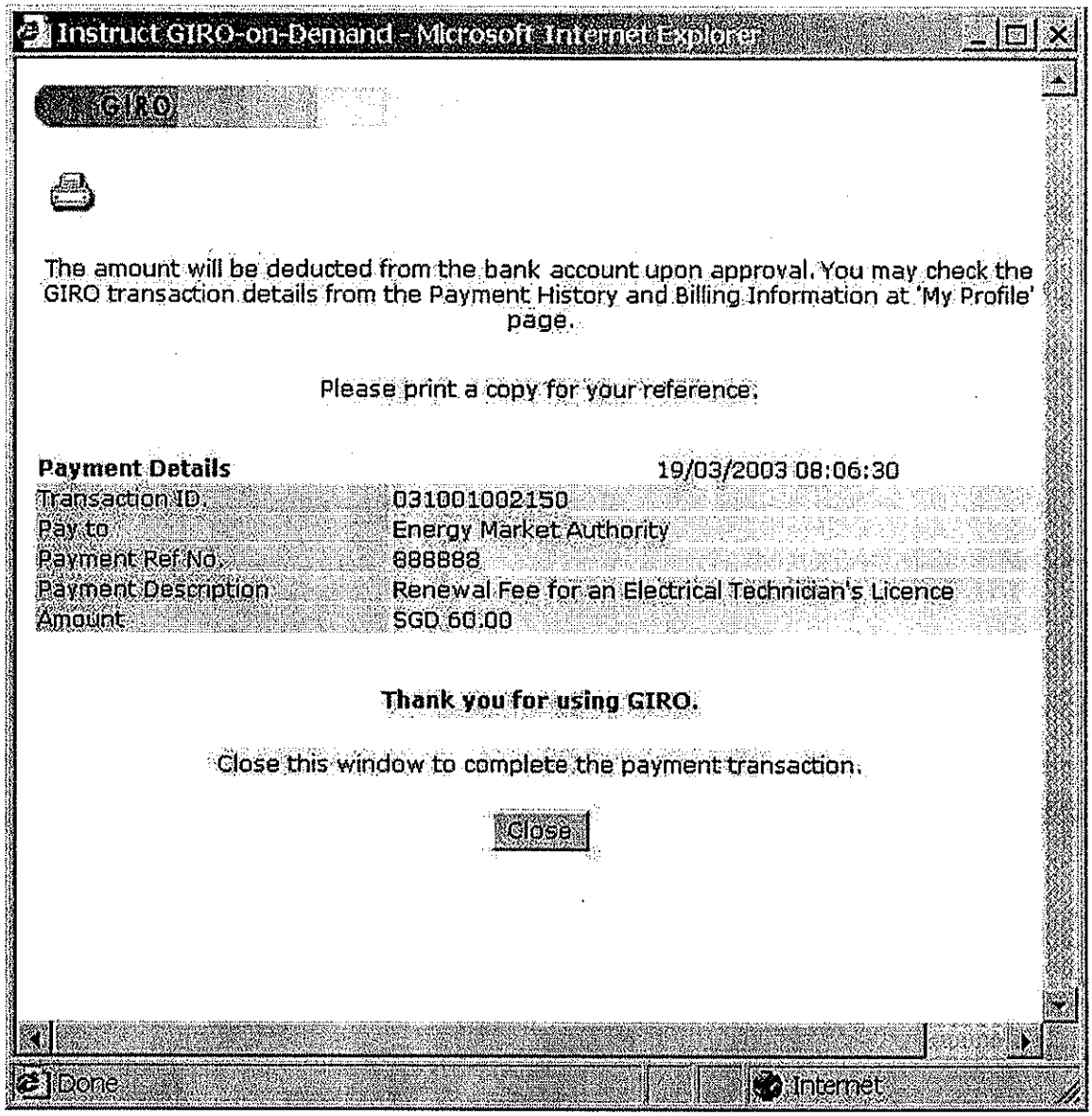
9 Making payment by GIRO

Step 1: Upon successful submission of the application data and attachments, the browser will display the GIRO account information if the licence is linked to a valid GIRO account.

Step 2: Check that the account information displayed and the amount to be deducted is correct. Click on the "Continue" to proceed with the payment using GIRO. If wish to change to another mode of payment, click on the "Select Another Payment Mode" to make payment using eNETS CashCard, eNETS VCARD or eNETS Debit. If wish to cancel payment, click on "Cancel".



Step 3: Receipt will be generated, print the receipt for future reference

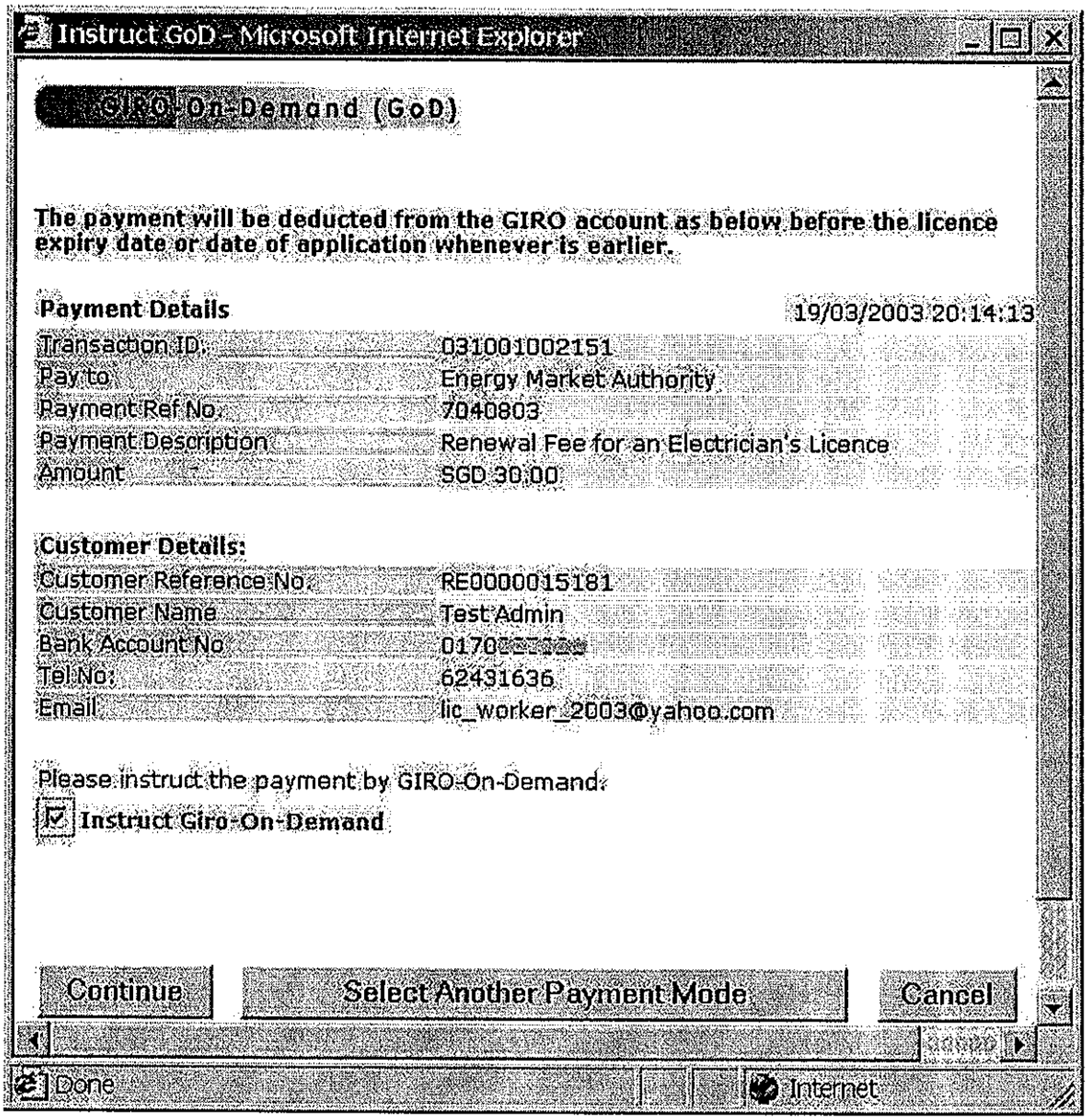


Step 4: Upon successful payment, an acknowledgement for the application will be presented on the browser. You may print the page for future reference.

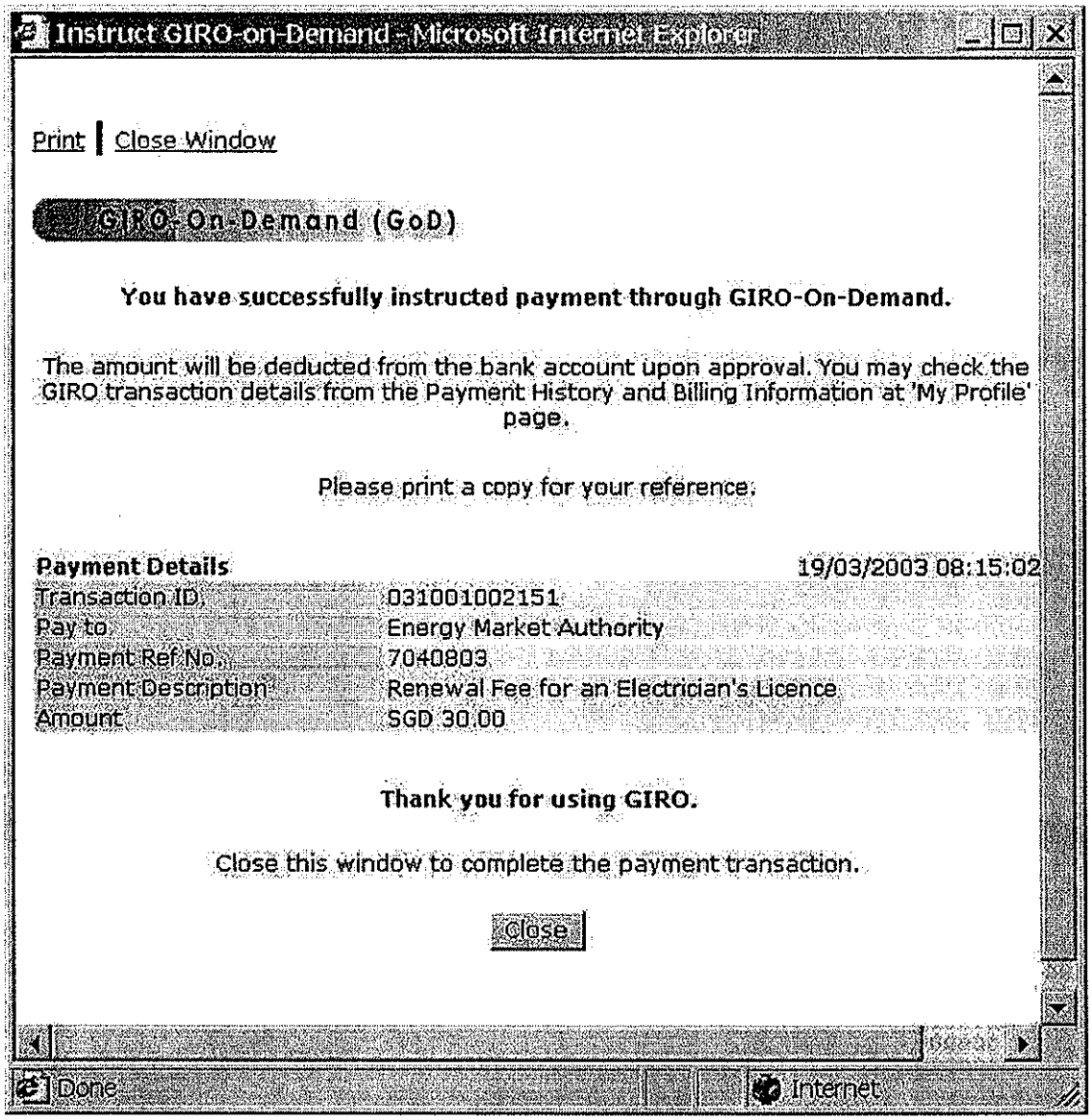
10 Making payment by GIRO-On-Demand (GOD)

Step 1: Upon successful submission of the application data and attachments, the browser will display the GIRO-On-Demand account information if the licence is linked to a valid GIRO-On-Demand account.

Step 2: Check the account information displayed and the amount to be deducted is correct. Click on the check box to instruct payment and click on the "Continue" to proceed with the payment using GIRO-On-Demand. If wish to change to another mode of payment, click on the "Select Another Payment Mode" to make payment using eNETS CashCard, eNETS VCARD or eNETS Debit. If wish to cancel payment, click on "Cancel".



Step 3: Receipt will be generated, print the receipt for future reference

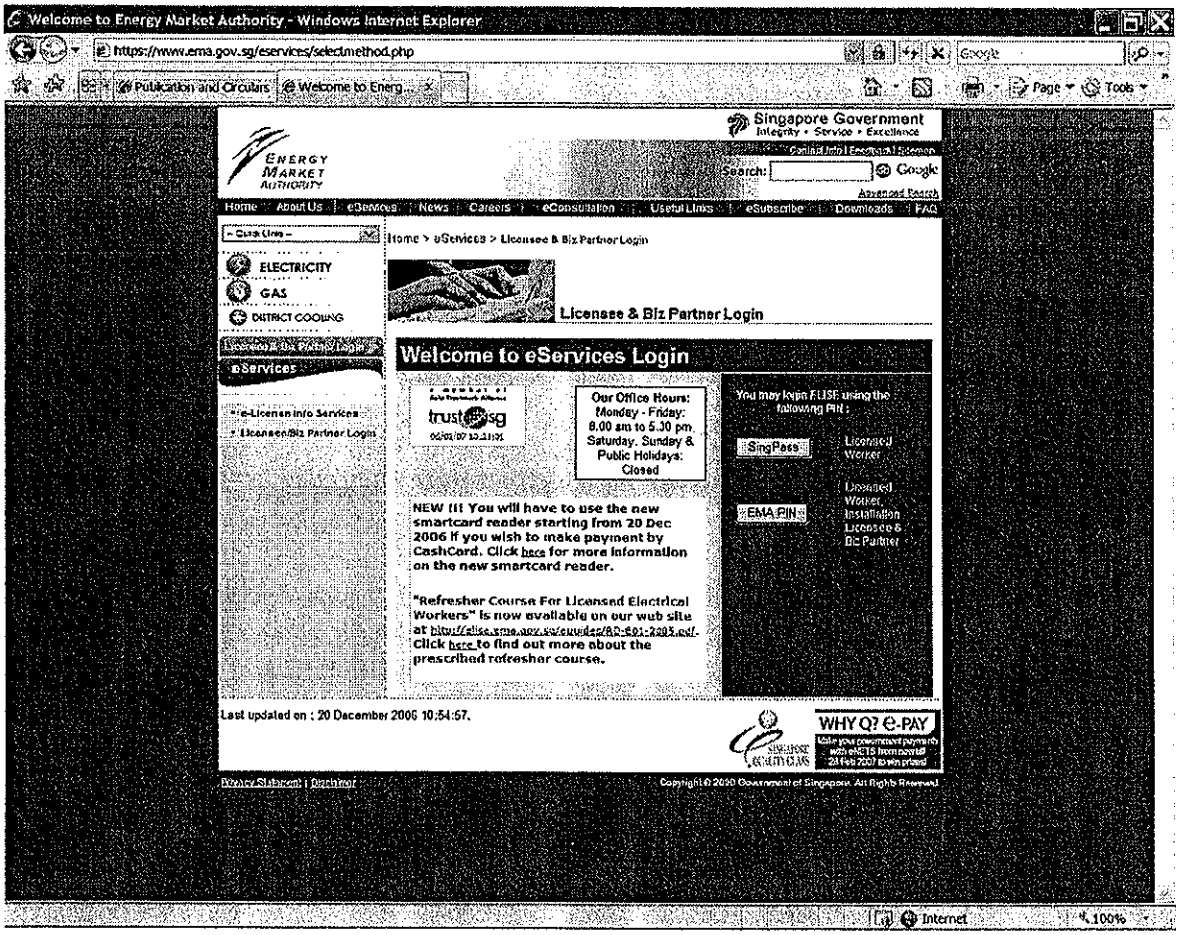


Step 4: Upon successful payment, an acknowledgement for the application will be presented on the browser. You may print the page for future reference.

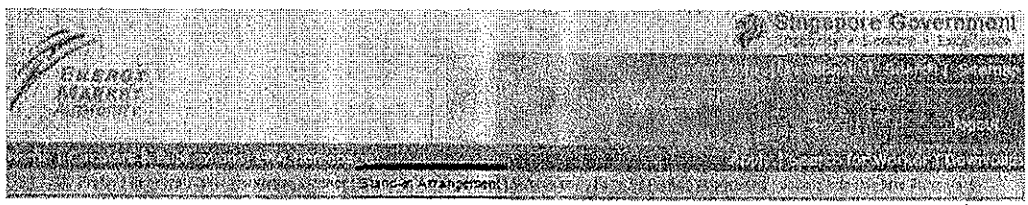
11 LEW Stand-In Arrangement

If you are unable to perform your duties for any period of time in respect of the electrical installation under your charge, you are required to seek EMA's approval for another LEW (who has consented) to stand-in for you during such period.

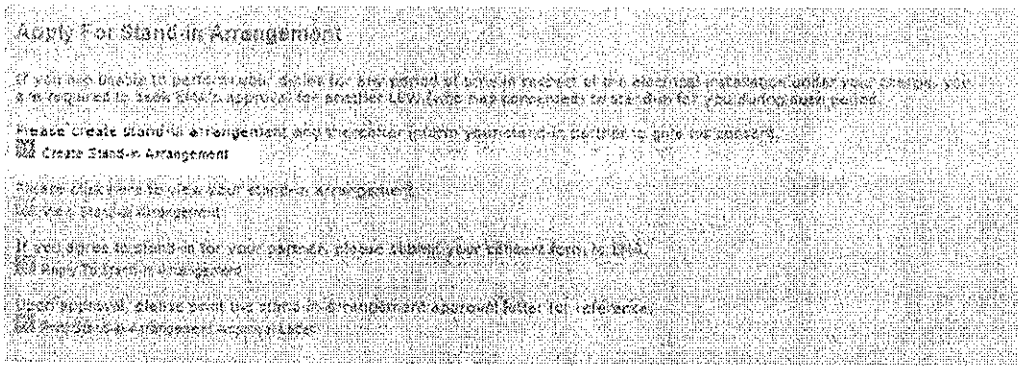
Step 1: LEW logon to EMA Web and Sign In to ELISE with UserID and Password.



Step 2: Select "Apply for Stand-in Arrangement" on the navigation menu.



Step 3: Click "Create Stand-in Arrangement".



Step 4: Select the type of Stand-in Activity from the drop down box in the Activity field.

There are 3 choices:

A. Take charge of all installations: You may authorise one LEW to take charge of all the installations under your charge.

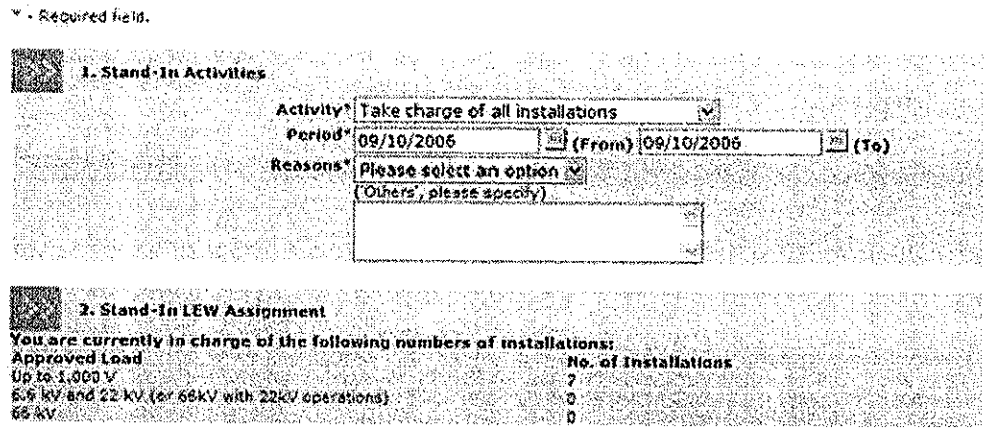
B. For turn on installation: You may authorise a LEW to attend to the turn on of a particular installation.

C. Take charge of installations by voltage levels: You may authorise more than one LEWs to take charge of installations according to the voltage levels. A maximum of 3 LEWs are allowed. For example: one LEW to take charge of all installations rated up to 1000 V, a second LEW to take charge of all the installations rated at 6.6 kV and 22 kV and a third LEW to take charge of installation rated at 66 kV.

Once the arrangement has been made, an email will be sent to the stand-in LEW to inform him or her on the arrangement. At the same time, a stand-in record will be created in the list. Click on the record to view the stand-in record. The status of the stand-in arrangement will be changed from "In Process" to "Approved" or "Disapproved" once it has been processed by the authorised EMA officer.

12 LEW Stand-In Arrangement – Take charge of all installations

Step 1: Select "Take charge of all installations".

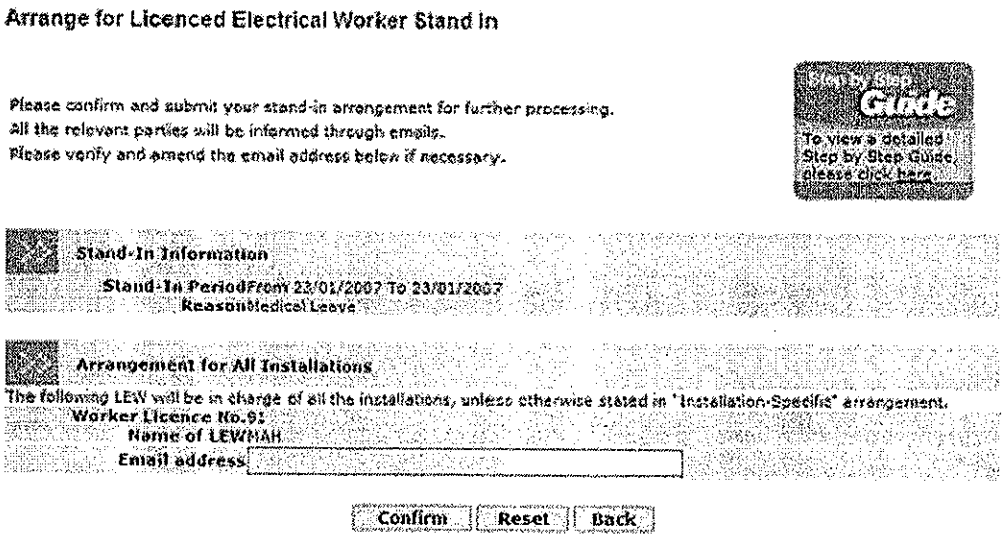


Step 2: Enter the Period of stand-in, the Reason for stand-in and the required particulars.

Step 3: Scroll down the form page and enter the licence no. of the Authorized Stand-in LEW. Make sure that the 'All installations' box is checked. If you wish to explicitly assign a LEW to a specific installation, check on "Specific Installation" checkbox and specify the licence no. of the LEW and the installation.

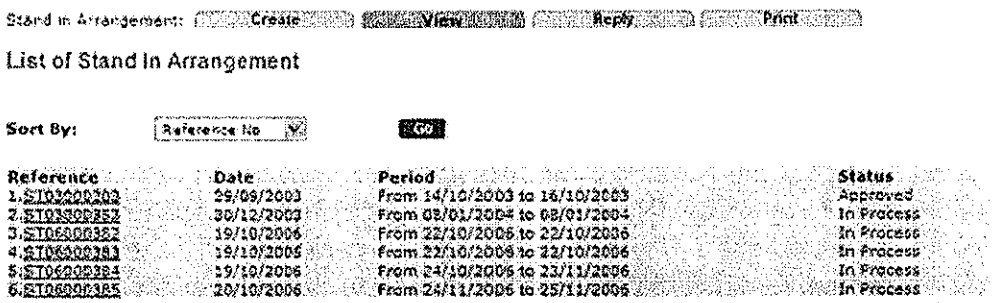
Step 4: Click on the declaration notes and then "Next".

Step 5: Verify and confirm on the details of the Stand-in Arrangement. Click "Confirm" to submit the application.

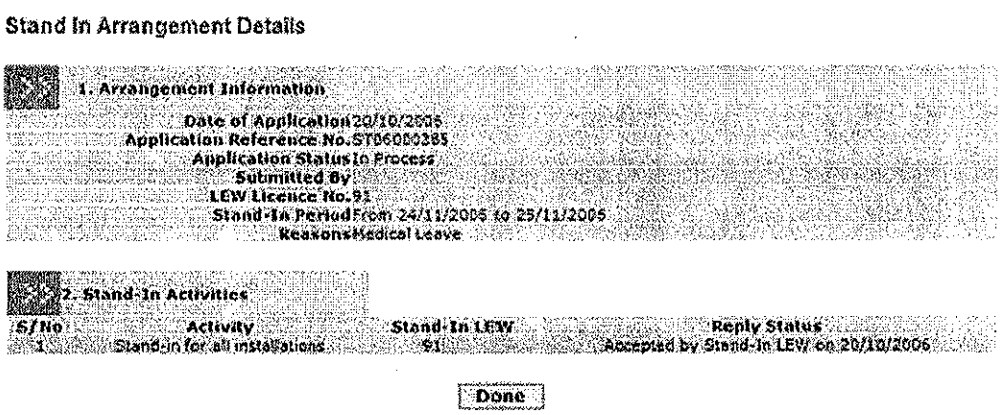


Step 6: Take note of the reference number generated for future reference. Click

"reference no.", if you wish to view the Stand-in Arrangement details.

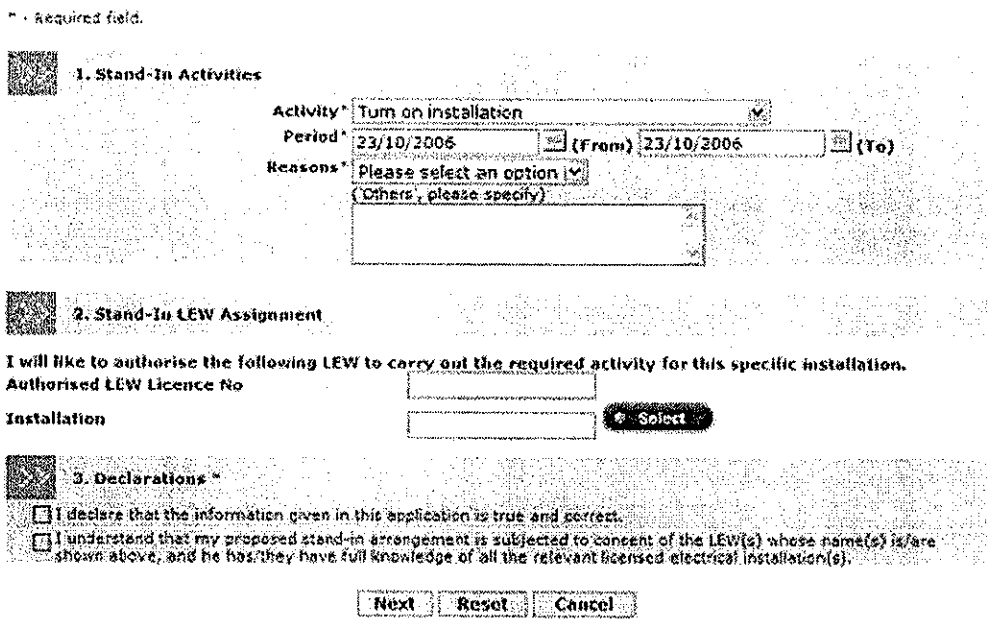


Step 7: Click on the link to see arrangement details.



13 LEW Stand-In Arrangement – Turn On Installation

Step 1: Select "Turn on installation" as the activity.

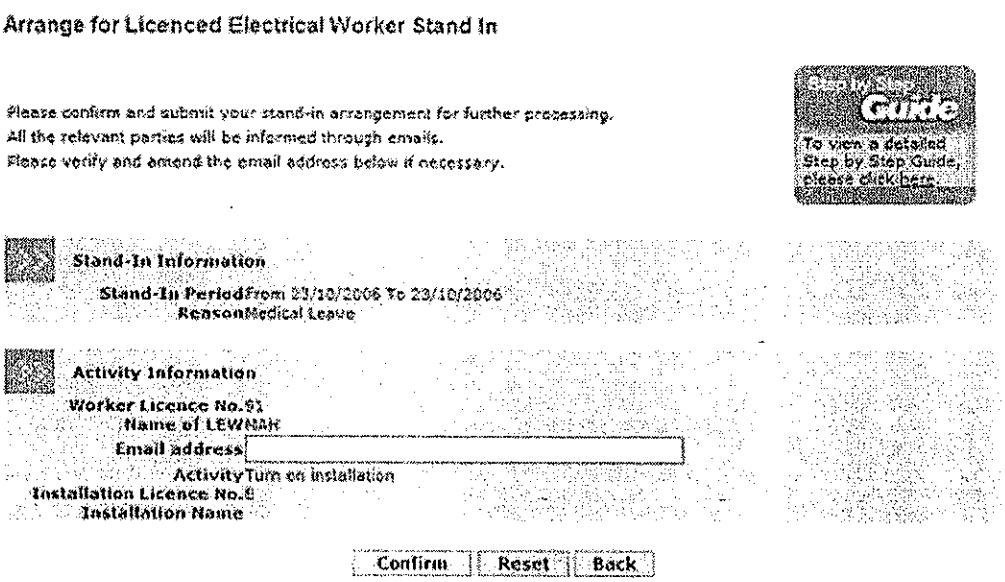


Step 2: Enter the Period of stand-in, the Reason for stand-in and the required particulars.

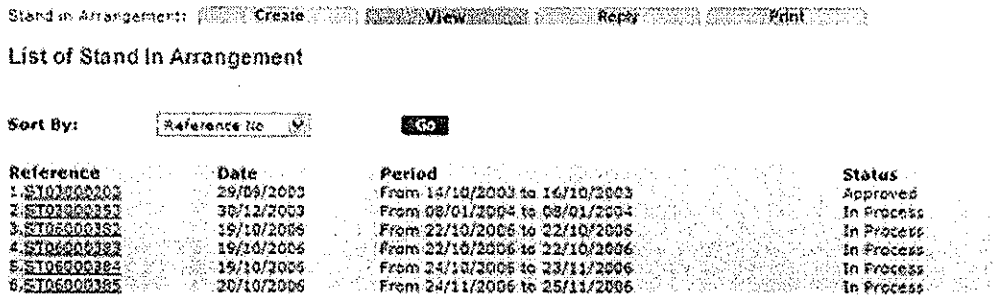
Step 3: Scroll down the form page and enter the licence no. of the Authorized Stand-in LEW and the licence no. of the installation to turn on.

Step 4: Click on the declaration notes and then "Next".

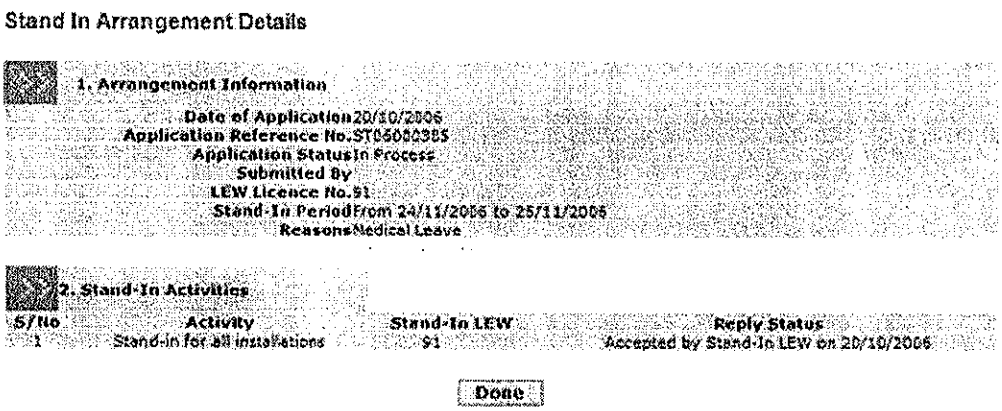
Step 5: Verify and confirm on the details of the Stand-in Arrangement. Click "Confirm" to submit the application.



Step 6: Take note of the reference number generated for future reference. Click "reference no.", if you wish to view the Stand-in Arrangement details.

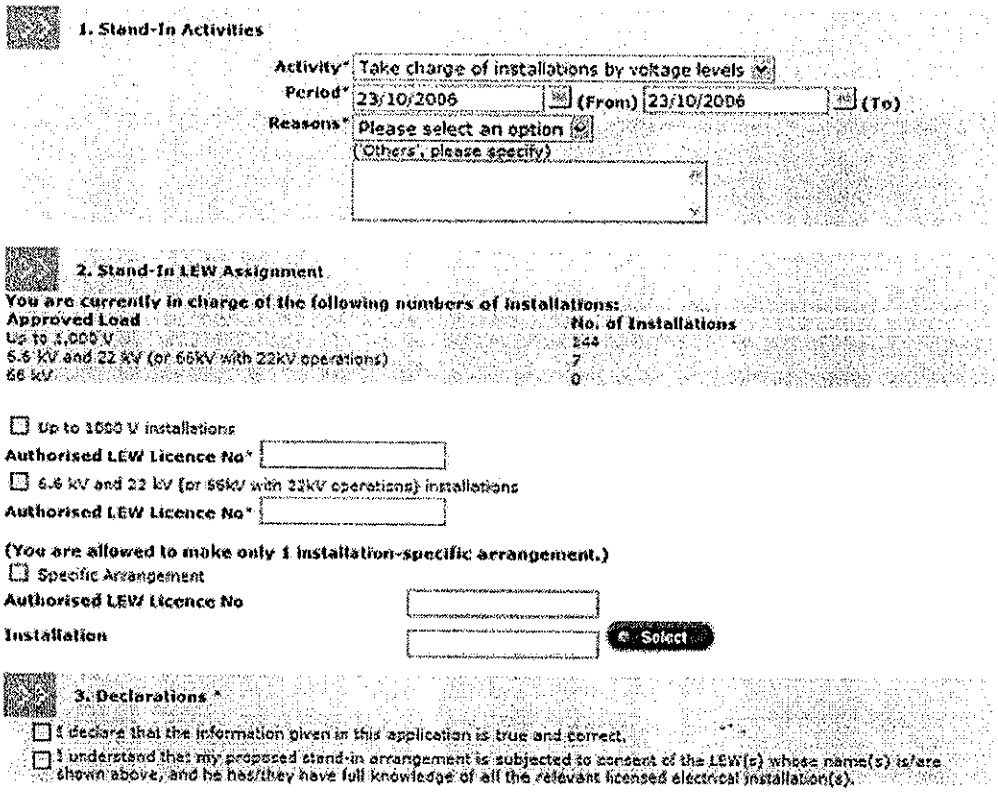


Step 7: Click on the link to see arrangement details.



14 LEW Stand-In Arrangement – To authorize more than 1 LEWs to take charge of electrical installations at different voltage levels

Step 1: Select "To take charge of installations by voltage levels"

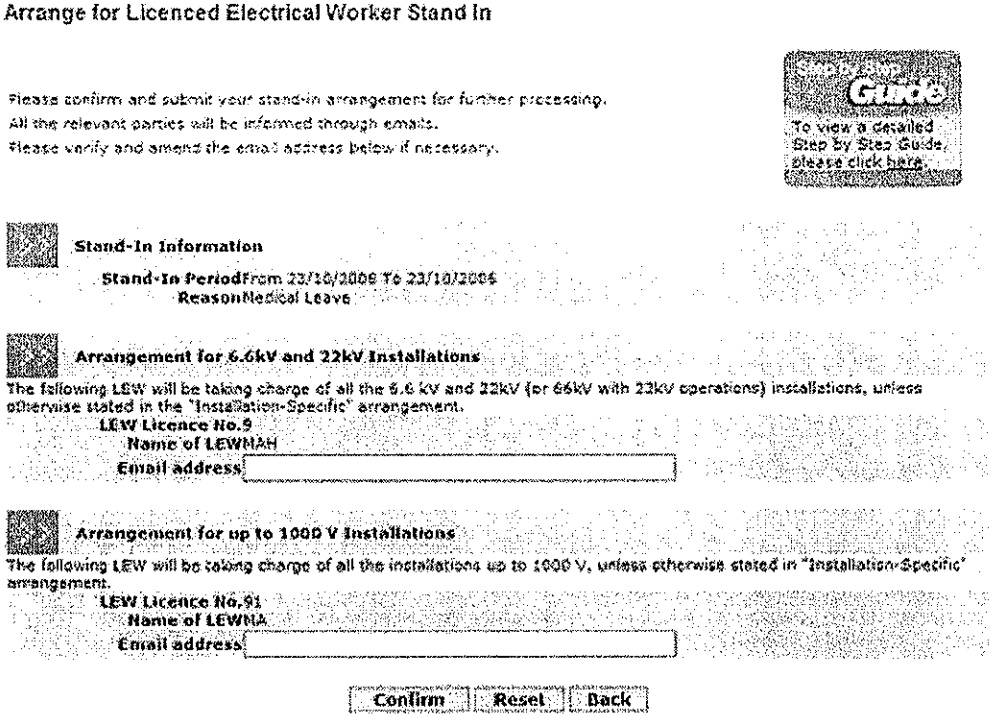


Step 2: Enter the Period of stand-in, the Reason for stand-in and the required particulars.

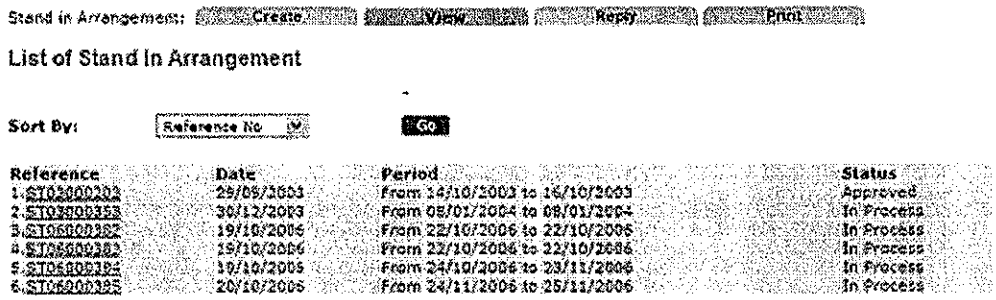
Step 3: Scroll down the form page and enter the licence no. of the Authorized Stand-in LEW for each voltage rating. Make sure that the checkbox beside each rating is checked.

Step 4: Click on the declaration notes and then "Next".

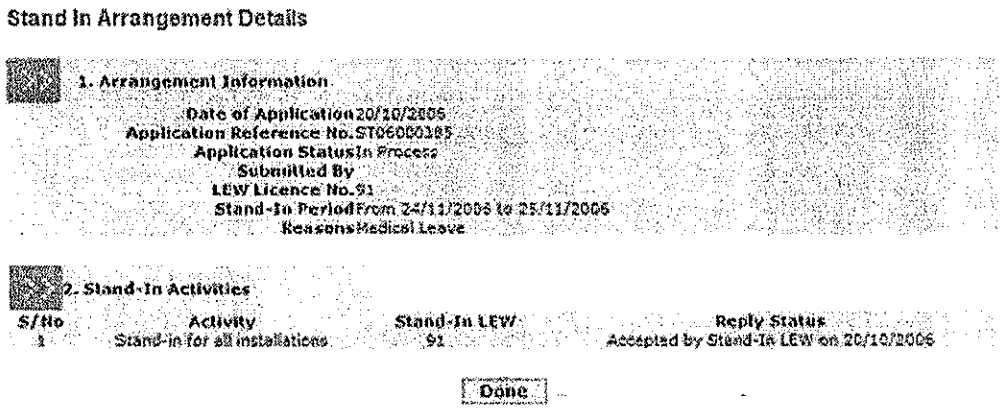
Step 5: Verify and confirm on the details of the Stand-in Arrangement. Click "Confirm" to submit the application.



Step 6: Take note of the reference number generated for future reference. Click "reference no.", if you wish to view the Stand-in Arrangement details.

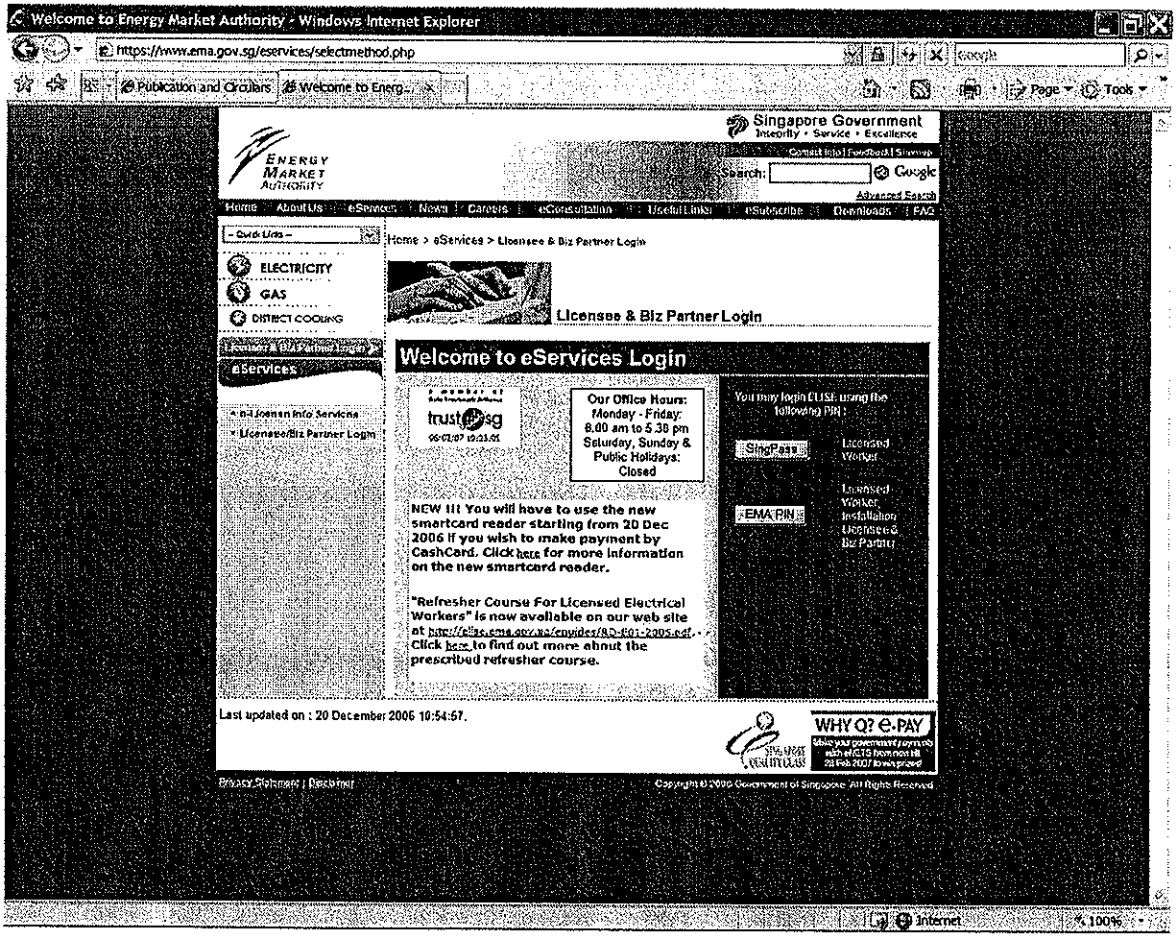


Step 7: Click on the link to see arrangement details.

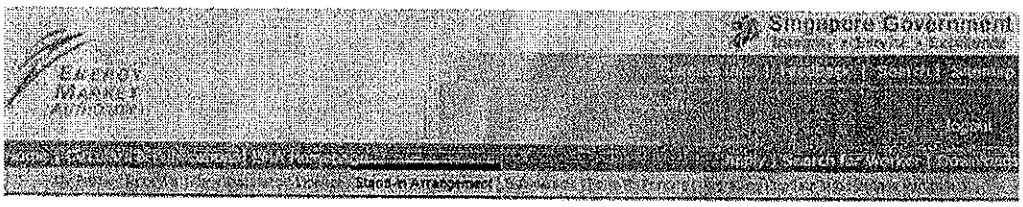


15 Reply to Stand-In Arrangement

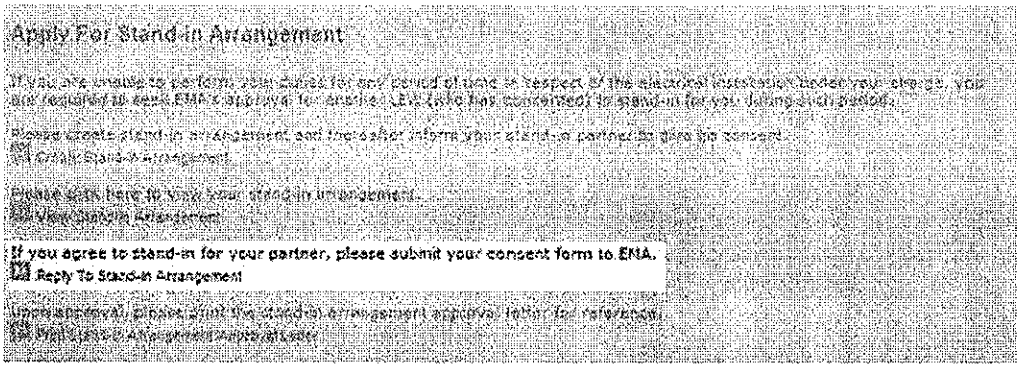
Step 1: LEW logon to EMA Web and Sign In to ELISE with UserID and Password.



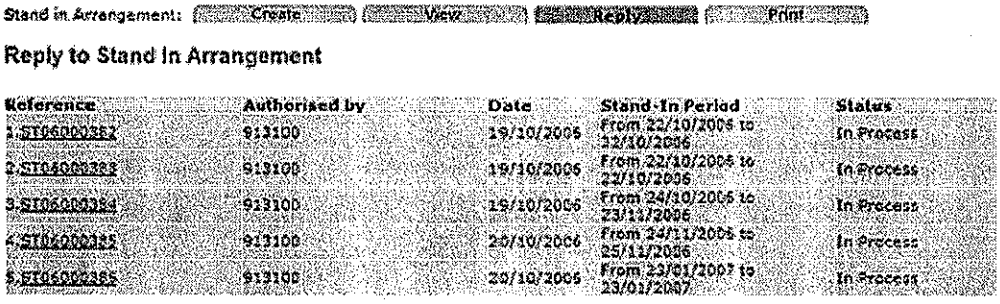
Step 2: Select "Apply for Stand-in Arrangement" on the top navigation menu.



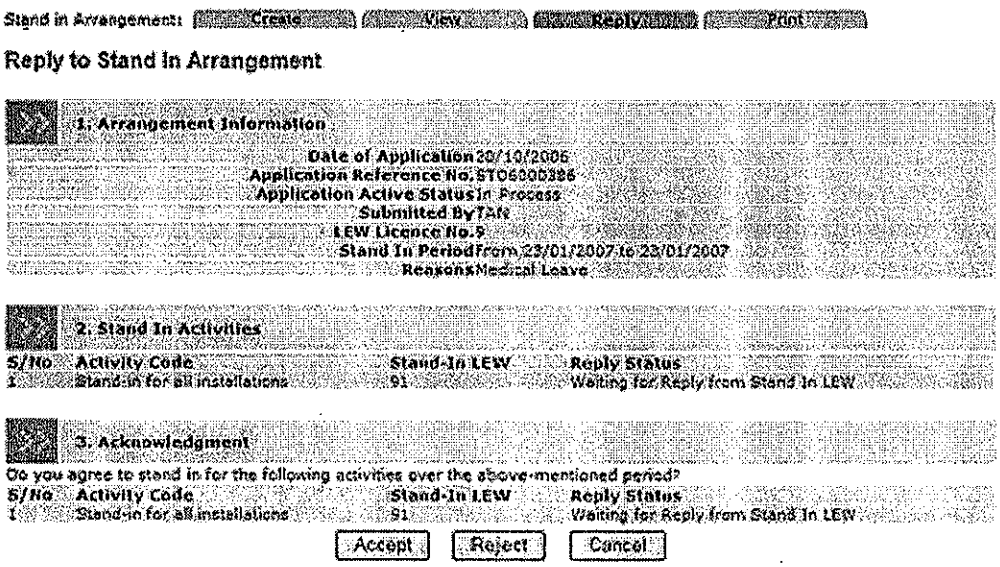
Step 3: Click "Reply for Stand-in arrangement".



Step 4: Select the "Reference No." of the arrangement to reply to.



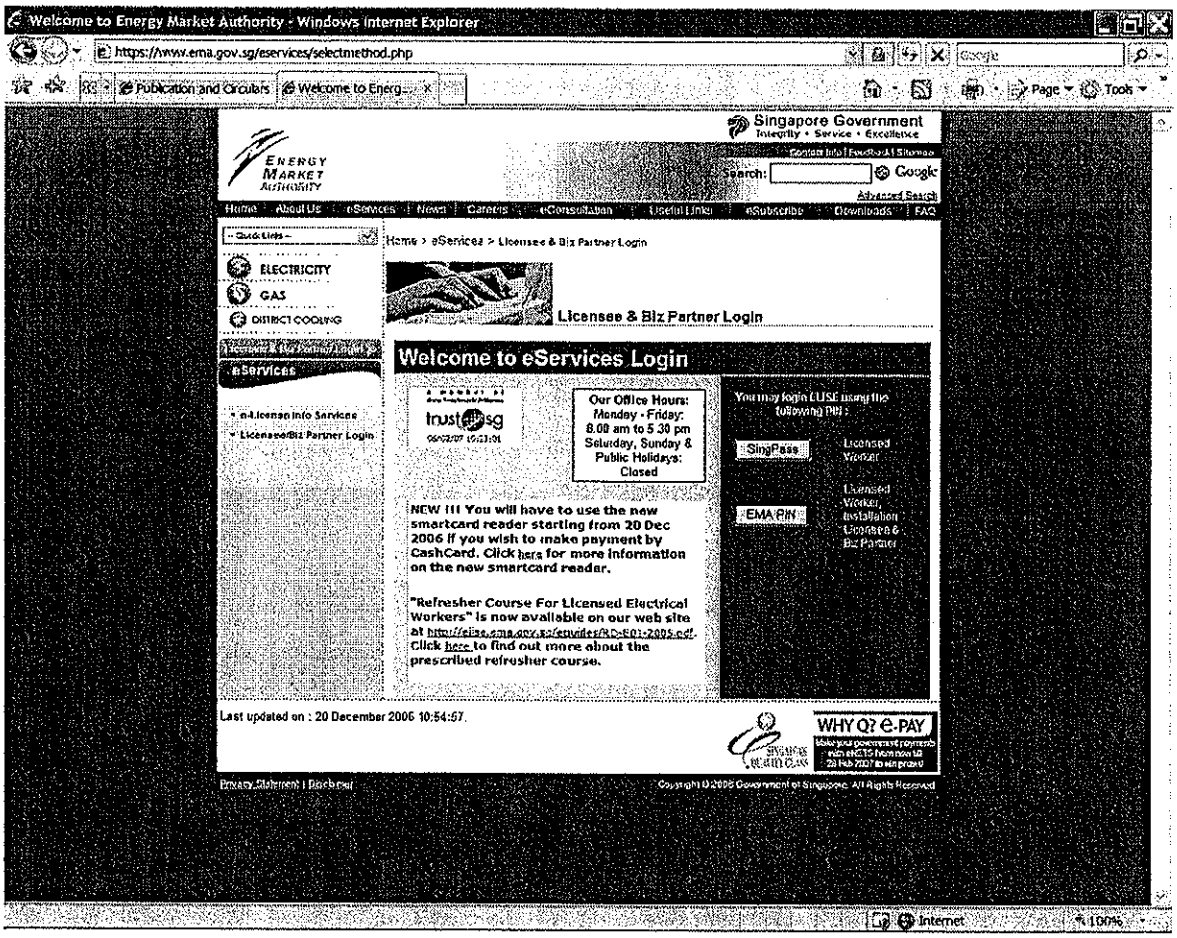
Step 5: Stand-in LEW click "Accept"(if he accepts the arrangement) or "Reject" (if he rejects the arrangement)



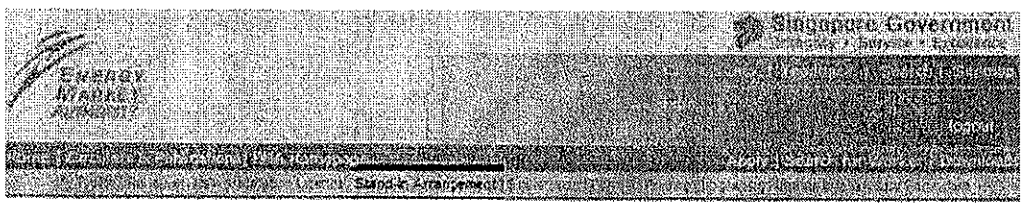
Once the Stand-In LEW has acknowledged the arrangement, an email will be sent to the LEW authorised the stand-in to inform him or her on the stand-in LEW's decision.

16 Print Approval Letter for Stand-In Arrangement

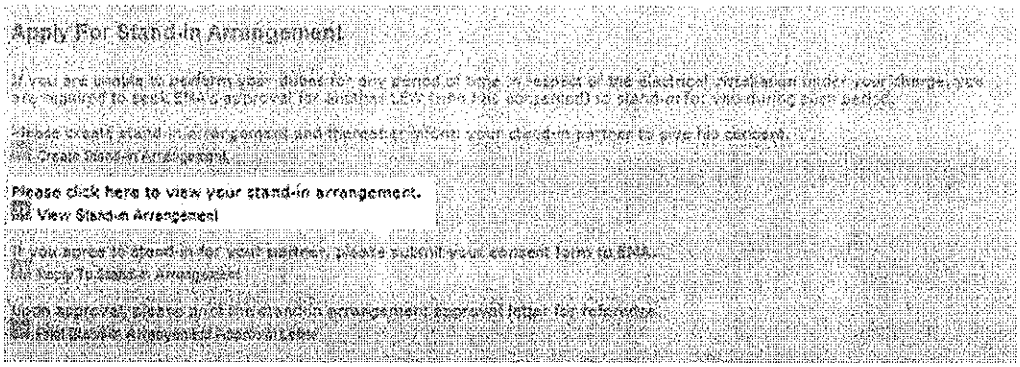
Step 1: LEW logon to EMA Web and Sign In to ELISE with UserID and Password.



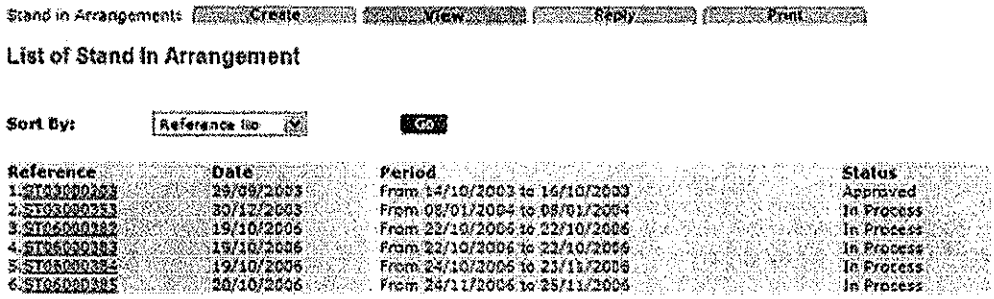
Step 2: Select "Stand-in Arrangement" on the top navigation menu.



Step 3: Select "View Stand-in Arrangement".



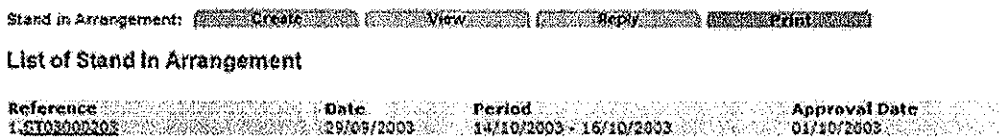
Step 4: Once application for Stand-In is approved, you can proceed to print approval letter.



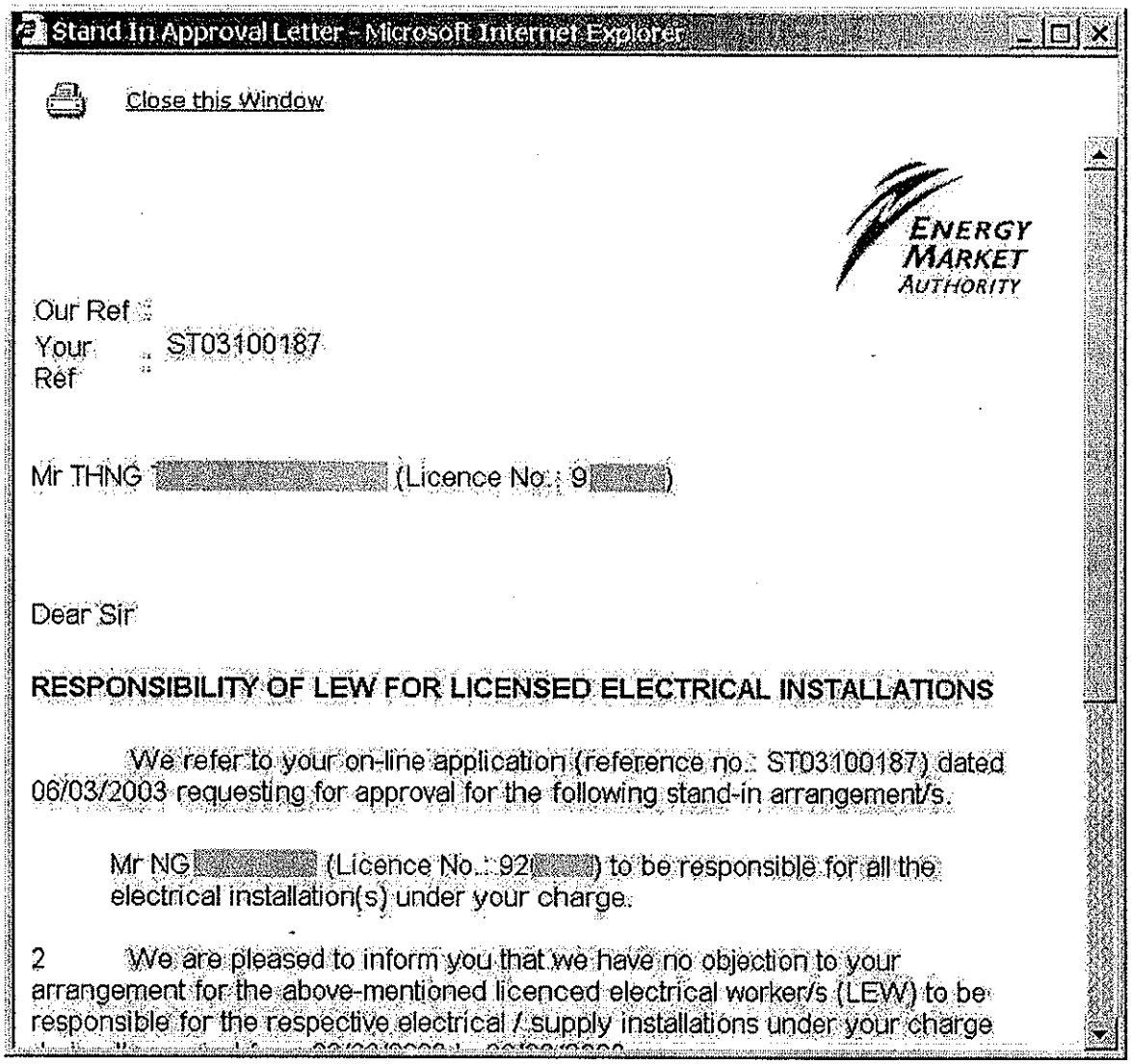
Step 5: Select "Print" tab.



Step 6: Select the "Reference No." of the arrangement to print the approval letter. The approval letter will be posted once the stand-in arrangement has been approved by EMA.



Step 7: Once the approval letter of the selected arrangement has been displayed, Click on the Printer icon at the top left corner to print the approval letter.


Stand In Approval Letter - Microsoft Internet Explorer

Close this Window

ENERGY MARKET AUTHORITY

Our Ref :
Your Ref : ST03100187

Mr THNG [redacted] (Licence No.: 9[redacted])

Dear Sir

RESPONSIBILITY OF LEW FOR LICENSED ELECTRICAL INSTALLATIONS

We refer to your on-line application (reference no.: ST03100187) dated 06/03/2003 requesting for approval for the following stand-in arrangement/s.

Mr NG [redacted] (Licence No.: 92[redacted]) to be responsible for all the electrical installation(s) under your charge.

2 We are pleased to inform you that we have no objection to your arrangement for the above-mentioned licenced electrical worker/s (LEW) to be responsible for the respective electrical / supply installations under your charge

The approval letter will be removed from the web at the end of the stand-in period.