



PNG POWER Ltd

ELECTRICAL TRADE CIRCULAR

Standard Guide For Safety in Electrical Industry Practices

4th Edition

ISSUED BY REGULATORY SERVICES

INTRODUCTORY NOTES

10TH NOVEMBER 2016

1. This is the 4th Edition of Electrical Trade Circulars, since the first being circulated in loose leaf booklet form in 1980.
2. Changes have occurred to specific Wiring Rule reference numbers, with the introduction AS/NZS3000:2007 Wiring Rules, gazette as PNGS 1022 Wiring Rules, in Papua New Guinea.
3. The contents of these Trade Circulars specify certain methods, procedures and statements of PNG Power Policy. In all cases where the meaning of a Trade Circular is not clearly understood, reference must be made to the Manager Regulatory Services for clarification before proceeding with any electrical work.
4. Trade Circulars may be withdrawn or reviewed from time to time, to allow for new methods, materials or procedures, as they become available to the industry.
5. It is a requirement but not limited to all licensed electricians to be holders of this Booklet and to maintain a current copy of any future issues or revisions.
6. PNG Power Staff will use Trade Circulars as Engineering Standards, reference to any specific instructions to them for their action only.
7. The index to these circulars has been revised and previously issued Circulars may now be incorporated into new circulars. Holders should therefore familiarize themselves with these revised editions before planning any works.
8. Where amendments to the Wiring Rules alter a Rule Number quoted in these Circulars, the amended Rule is automatically applicable.
9. Copies of Standards quoted in these Circulars are available from NISIT, the National Institute of Standards & Industrial Technology, P O Box 5286, BOROKO, National Capital District- Papua New Guinea.


Alex Oa 20/09/2017
Acting Chief Executive Officer

PREFACE

This Standard was prepared by PNG Power (Regulatory Services Group) to supersede the Third Edition of the Electrical Trade Circular which had been issued in 1992.

The team is confident of the document being technically auditable, easy to understand and enabling regulatory compliant, a must for all electrical undertaking or practices in Papua New Guinea.

The circular provides 'high level' safety performance outcome/conditions without prescriptive work methods that demonstrate means of compliance and provides uniform essential elements that constitute the minimum regulatory requirement for a safe electrical installation.

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FOREWORD

It is important to take note that when reference is made to this Electrical Trade Circular the initials 'ETC' will appear before the numbers and unless specified, any others rule number will mean AS/NZS Wiring Rules.

Engineering Standard: HQH-GCW 014
First Issued: 20.11.1978
Reviewed & Reissued: 21.07.1987, 05.07.2016

TRADE CIRCULAR 1**MINIMUM SIZE OF CONSUMERS MAINS**

1.1 GENERAL**1.1.1 Application**

The AS/NZS Wiring Rule No. 3.4.1 states that every conductor, including Consumers Mains have limits to the current it can safely carry so selecting the correct size is of great importance.

1.2 CONSUMERS MAINS

Consumers Main is selected after the maximum demand has been calculated in accordance with AS/NZS 3008.1 series.

NOTE: PNG Standards 1022 maintained that housing in Papua New Guinea shall have a minimum size of consumers mains based on a current carrying capacity of forty five (45) amperes. i.e. 10mm (7/052) **installed enclosed, in non-metal wiring enclosure, in free air, visible and into the meter box**. Consumer mains shall be terminated at approved mains box.

1.2.1 Minimum size on multi-phase installation

All multi-phase installations shall have minimum size consumer mains with a current carrying capacity of at least 35 amperes per phase.

1.2.2 Rating of Protection for consumers mains

The rating of the protective device protecting the consumer's mains shall not exceed the current carrying capacity of the maximum demand and the current carrying capacity of the consumer's mains conductor.

Refer to AS/NZS Wiring Rule No. 2.5.3.1 for operating characteristics of device protecting a conductor against overload.

1.2.2.1 Prohibited Use of Semi-enclosed Rewireable Fuses

Semi-enclosed rewireable fuses shall not be used for protection device. The semi-enclosed rewireable fuse is prohibited for users, electrician or layman putting wrong fuse element into the holder as protective device. The elimination of semi-enclosed should minimize hazardous situation such as fire cause by overheating and electrocution by fuse failing to interrupt the fault condition.

1.2.3 Neutral conductor

The minimum size of the neutral conductor in a Single Phase and Multiphase circuit must be obtain from AS/NZS Wiring Rules No. 3.5.2 (a)(b).

1.2.3.1 No Switching Of Neutral

In accordance to AS/NZS Wiring Rules No. 2.3.2.1.1 for alternating current system no switch or circuit breaker shall be inserted in the neutral conductor of:

- (a) consumer mains;
- (b) where the neutral conductor is used as a combine protective earthing and neutral conductor for protective earthing for any sub- mains of an electrical installation,
- (c) incoming neutral to a MEN switchboard, AS/NZS Rule No. 7.3.8.1 & 7.3.8.1.1

The switching on /off of neutral conductor has damaged a lot of electrical equipment due to floating neutral.

NOTE: Electrical equipment with neutral switching should **not** be allowed.

Engineering Standard: HQH-GCW 001

First Issued: 02.06.1980 Revised and Reissued: 31.12.1987

Revised & Reissued: 12.05.2016

TRADE CIRCULAR 2

SAFETY SERVICES

2.1 GENERAL

2.1.1 Application

PNG Power responsibility for electrical installation associated with Lifts, Cranes, Hoists and Conveyor systems is now withdrawn and is superseded by Safety Services, which includes Fire Detectors, fire hydrant and booster pumps.

The Introduction of Safety Services is to provide minimum safety standard in relation to the selection and its associated electrical installations with the intention to maintain continues unintentional uninterrupted supply in cases of emergency.

NOTE:

The Electrical Contractors carrying out installation shall comply with AS/NZS 3000/2007 Wiring Rule No. 1.5.2, 1.5.12 and Section 7.2 Safety Services installation requirement and AS/NZS 1735

2.2 SAFETY SERVICES

2.2.1 Control and Isolation

Control of safety services shall be arranged so that the control devices are separate from the control of other equipment and not unintentionally interrupted by operators of the other equipment.

2.2.3 Main switch

Arrangement for Main switches for safety services shall be connected on the supply side of all general electrical installation main switches. Any switch for the control of safety services installed in an outbuilding and provided on the switchboard within the outbuilding shall be regarded as main switch. The installation shall be arranged in accordance with AS/NZS 3000/2007 Wiring Rule No. 7.2.3.1.

- (a) Protection shall be provided against fire initiated or propagated by components of electrical installation.
- (b) Main switches controlling safety services shall be identified to indicate the safety service equipment that they control; marked:

'IN THE EVENT OF FIRE, DO NOT SWITCH OFF'

The **Figure 2.1** shows the diagram of typical arrangement of Safety Services.

2.2.4 Wiring system

- (a) The selection of wiring system shall be of type that is capable of maintaining supply to equipment with compliance to AS/NZS 3000:2007 Rule No.7.2.7.2 (a) & (b) (i) (ii).
- (b) Safety Services wiring system shall be capable of maintaining an adequate supply to such equipment when exposed to fire.
- (c) The type of wiring shall comply with AS/NZS 3000:2007 Rule No. 7.2.7.2 and cable selected according to AS/NZS 3031 and Wiring System classification (WS) as specified.

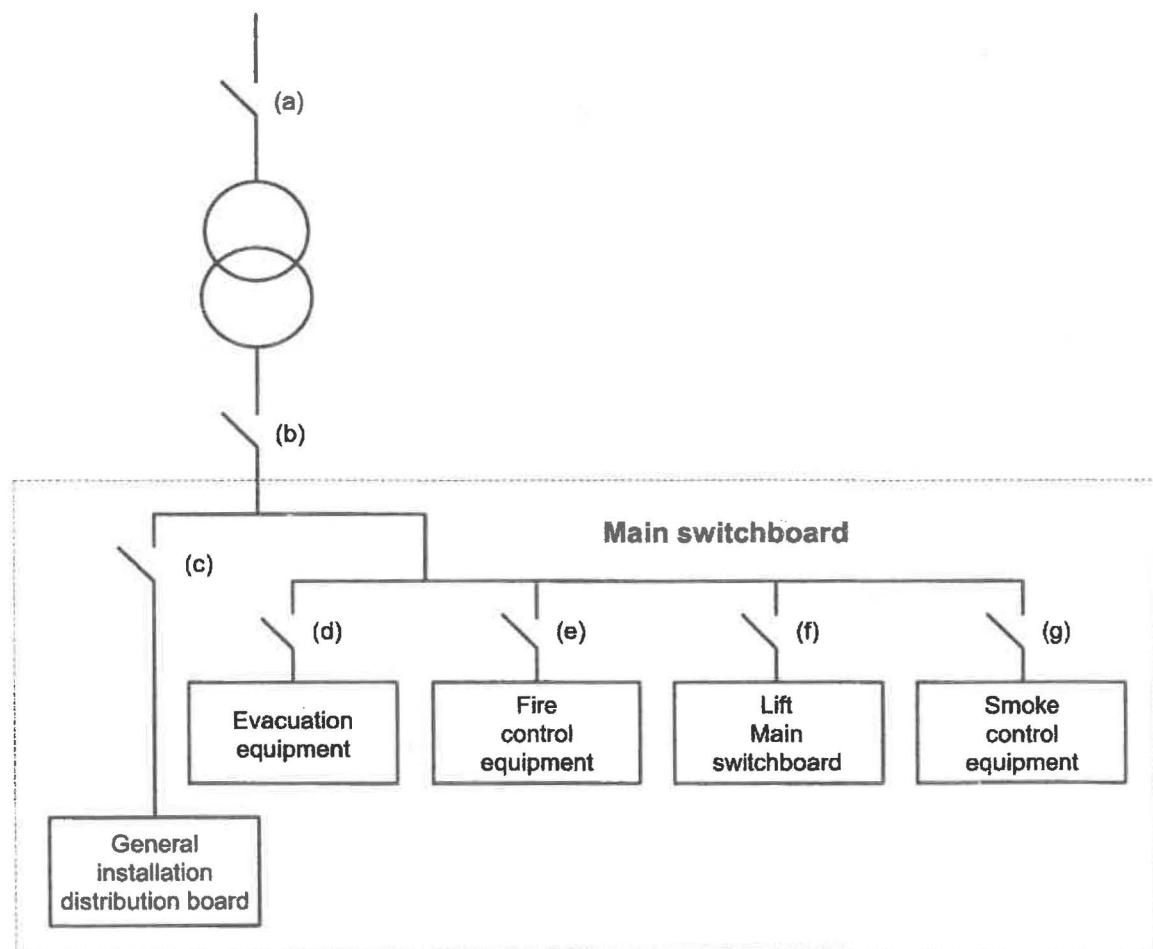


Figure 2.1

Figure 2.1 Show the typical arrangement of safety services

NOTES:

1. Switch (a) is not regarded as general electrical installation main switch.
2. Switch (b) is not regarded as general electrical installation main switch if the switch is locked to prevent manual operation by other than an authorized person in accordance with AS/NZS 3000/2007 Wiring Rule No. 7.2.4.1
3. Switch (b) must discriminate with (c) in accordance with AS/NZS 3000/2007 Wiring Rule No. 7.2.2.2.
4. Switch (c) is general installation main switch
5. Switch (d), (e), (f) and (g) are main switches of safety devices

2.2.5 PNG Power responsibility

It is the sole responsibility of the Electrical Installation Inspector to ensure that lifts, cranes, conveyors and hoists are suitable for connection to supply mains. To enable him to do this, the cooperation of the Lifts and Cranes' Inspector should be sought at all times with the Occupational Health and Safety Division, Department of Labour & Employment.

Engineering Standard: HQH-GCG 005 AFM30 001

First Issued: 19.09.1980

Reviewed & Reissued: 31.12.1987, 17.05.2016

TRADE CIRCULAR 3 INSTALLATION ARRANGEMENT OF EQUIPMENT
ASSOCIATED WITH ALTERNATE SOURCE OF SUPPLY

3.1 GENERAL

3.1.1 Application

The provisions of Electrical Trade Circular 3 outlines the standard requirement with regard to the installation of the equipment associated with alternate source of supply as stand-by where a normal supply is available from either PNG Power, a power supply operated under the "Electricity Supply (Government Power Station) Act, 1970" or an (Electrical) undertaker registered under the Electricity Industry Act or ICCC Act.

This instruction circular does not apply to generators that are the sole source of supply.

3.2 INSTALLATION ARRANGEMENTS

3.2.1 Selection of transfer equipment

Stand-by Generating Equipment falls in two categories, Automatic Mains Failure Equipment and Manual Start and Transfer Equipment.

3.2.2 Assessment of equipment

There are five factors which apply in the assessment of capacity of equipment needed, and in most cases the consideration is with the cost of purchasing and installing equipment, as related to method of transfer, starting, and portions of the installation to be supplied.

The five factors are:-

- (a) If the load of the complete installation is to be supplied.
- (b) If only load of essential items only are to be supplied and non-essential items disconnected.
- (c) The method of starting the equipment and transfer, either automatic or manual.
- (d) The electrical layout of the installation's switchboard is to allow implementation of (a) or (b) above.
- (e) Earthing of the Stand-by Equipment in relation to the Installation Earthing System.

3.2.3 Transfer method

The method of supply transfer is conditional and relational and as such, all electrical drawings with regard to transfer method shall be submitted for approval to PNG Power, Attention:- Manager Regulatory Services Group.

3.2.4 Cost of equipment

The selecting method largely depend on the cost of the transfer equipment, as automatic stand-by controlled generators are more expensive and the consumer's choice may be dependent on certain manufacturing processes which require start-up within a given time to avoid production problems.

3.2.4.1 Automatic transfer equipment

The **automatic change-over equipment or Automatic Transfer Switch (ATS)** shall include a series of mechanical and electrical interlocks, controlled by sensing devices incorporated within the equipment, that will ensure that under **no circumstances** will the generating equipment be capable of feeding back through the control or contactor arrangement and energizing the **metering equipment** of the installation.

3.2.4.2 Manual transfer equipment

In the case of **manual change-over equipment** the same applies but the operation of switching from PNG Power (normal) supply to generator (alternate) supply must be carried out in such a manner and through such an arrangement that **no feedback** can occur **under any circumstances**. This arrangement must be acceptable to the supply authority and in **all cases** is subject to inspection by PNG Power Electricity Inspector before the equipment is **energized or test-run**.

3.2.5 Assessment of the installation

Generator shall be installed in accordance with AS/NZS 3010 "Electrical installations - Generating sets" and this circular.

3.3 POINT OF SUPPLY

In all cases, **the point of supply** from the generating, equipment will be at the **main switchboard**.

Under no circumstances will equipment for control of or introduction of supply from generator; be mounted on the **meter panel**, **within the generator** or in **PNG Power substations**.

3.3.1 Segregation required

Sub-circuits or sub-mains being supplied as **essentials** must be **segregated** from other circuits or sub mains that are regarded as **non-essentials**.

This would normally be done by the installation of a separate switchboard, controlled by the arrangement laid down in "Transfer Method".

3.3.2 Segregation not required

Where the complete installation is to be supplied, the above "segregation" is not necessary. However, in all cases the control equipment and electrical layout must be clearly labeled to ensure that unskilled operator can carry out the start-up and switching function.

3.3.3 Existing installations considering essential and non-essential functions

Many existing installations have been installed with no thought given to stand-by facilities, and as such, certain problems will be experienced should the installation require segregation into essential and non-essential functions. This may be an important consideration with regard to domestic installations, where fixed appliances or heavy load, like stoves and hot water units may be required, to be excluded from stand-by capacity. In these cases an isolation and control arrangement must be acceptable to PNG Power, as the control and operation of the stand-by generator will invariably be carried out by non-technical persons.

3.3.4 Earthing

An earth conductor, of sufficient size to carry an earth fault current, in relation to the output of the generator, must be run from the generator frame to the main earth bar at the main switchboard, and labeled "**Generator Earth**". The earthing conductor shall be sized, to the rated current output of the generator, as per AS/NZS 3000/2007 Wiring Rule No. 5.3.3.1.2 and Table 5.1

3.3.5 Neutral conductor

A Neutral Conductor of sufficient size in relation to the output of the generator is to be run to the main Neutral Bar on the main switchboard and connected adjacent to the M.E.N point on the bar, and labeled, "**Generator Neutral**". The neutral conductor size shall be related to the size of the active conductors as per AS/NZS 3000/2007 Wiring Rule No.3.5.2.

3.4 AREA TO BE SUPPLIED

3.4.1 General

The requirement of this section satisfies the power supply arrangement in which only one source of power supply is made available at any one time to a building, irrespective of number of lease tenants, and that the change-over originate from a main distribution board.

3.4.2 Area specification

The area to be supplied by a stand-by generator, or combination of generators which satisfy the requirement of ETC 3.4.1 is that the area must be contained within the same building or buildings situated on a block, or blocks of land, owned by one party.

3.4.3 Restricted supply routes

Under no circumstances is private stand-by generated electricity permitted:

- (a) To pass-over, on, or under the boundary, associated with two or more blocks of land owned by different parties.
- (b) For a consumer to construct stand-by mains or sub-mains, over, on, or under a gazette road or reserve.

3.4.4 Alteration to existing metering arrangement

Where it is desired to supply a number of buildings, on separate and adjacent blocks of land, that are owned by one party, and each building has its own existing individual PNG Power Supply, then the complex of buildings, must revert to **one PNG Power supply only**, for the whole complex, and the point of transfer, from PNG Power supply to standby generated supply, must be situated on the main switchboard for the whole complex.

UNDER NO CIRCUMSTANCES are:

- (a) Separate buildings to be electrically connected with a single stand-by generator supply, where each building, has its own existing individual PNG Power supply.
- (b) Multiple stand-by generator supply to be introduced to a building with multiple tenants.

3.5 METHOD OF CONTROL

Installation of stand-by generators come with method of control and Figures 3.1, 3.2, 3.3, and 3.4 shows methods of control which are to be used.

3.5.1 Permanently connected A.C generator mounted on or in equipment which may be supplied by a supply authority through a flexible cord or cable

3.5.1.1 Application

Typical applications for this arrangement are boats, caravans, showground and carnival equipment, mobile food dispensing equipment.

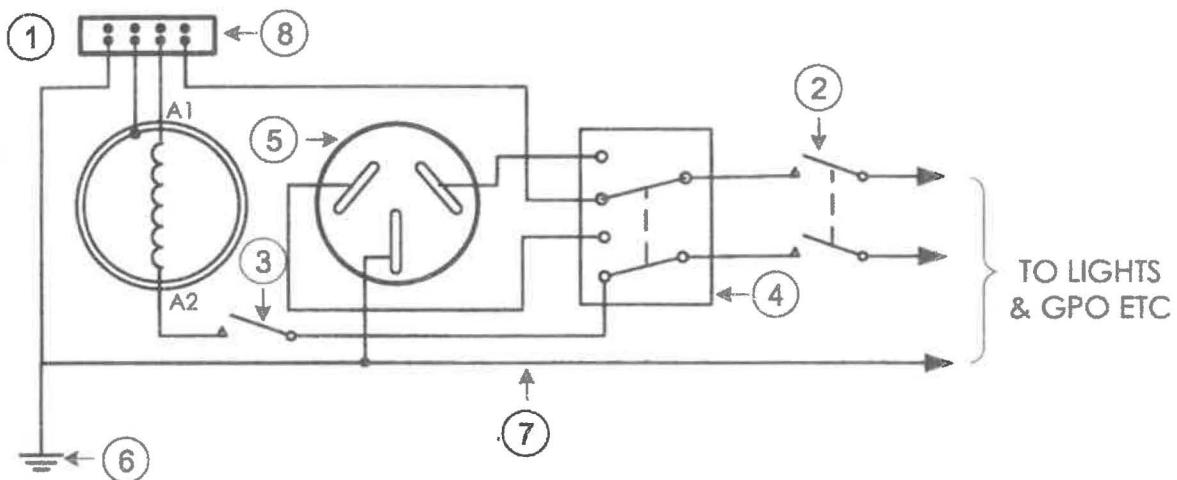


Figure. 3.1

Figure 3.1 Show diagram of permanently connected A.C generator mounted or equipment supply which may be supplied by authority through a flexible cord or cable

NOTES TO FIGURE 3.1

- (1) A three phase installation is to be arranged in a similar manner in respect to the neutral and earthing conductor with an appropriate increase in the number of phase conductors and accessory contacts.
- (2) A circuit breaker operating in all live conductors shall be installed when load limitation is required by the relevant Australian Standard or may be installed at the proprietor's election.
- (3) A circuit breaker operating in all live active conductors should be installed as close as practicable to the A.C Generator to limit the A.C. Generator current unless the characteristics of the A.C. Generator has a self-limiting feature installed and effective installation arrangement, not inferior to double insulation, is provided for the prevention of short

circuit currents between the A.C. Generator and the circuit breaker described in item 2.

- (4) Multi-pole changeover switch which operates in all live conductors and has a minimum contact separation of 3mm.
- (5) Inlet to socket to accept supply from the Supply Authorities Mains which has an appropriate male pin configuration (diagram illustrates a rear view) and an enclosure suitable for the location where it is installed. (Refer to AS 1939 Classification of degree of protection provided by enclosures for electrical equipment)
- (6) Earth connection to metal chassis or frame of equipment and other metal work required to be earthed by the appropriate standard.
- (7) Earthing conductor.
- (8) Neutral Link.

3.5.2 A.C. Generator connected by a flexible cord to a permanent electrical installation

3.5.2.1 Application

Typical application for this arrangement would be premises where it was necessary to maintain supply e.g. premises which contain dialysis machines, rural consumers which may be subjected to extended outages, small commercial consumers where limited supply is required during an outage by the supply authority e.g. telephone exchanges

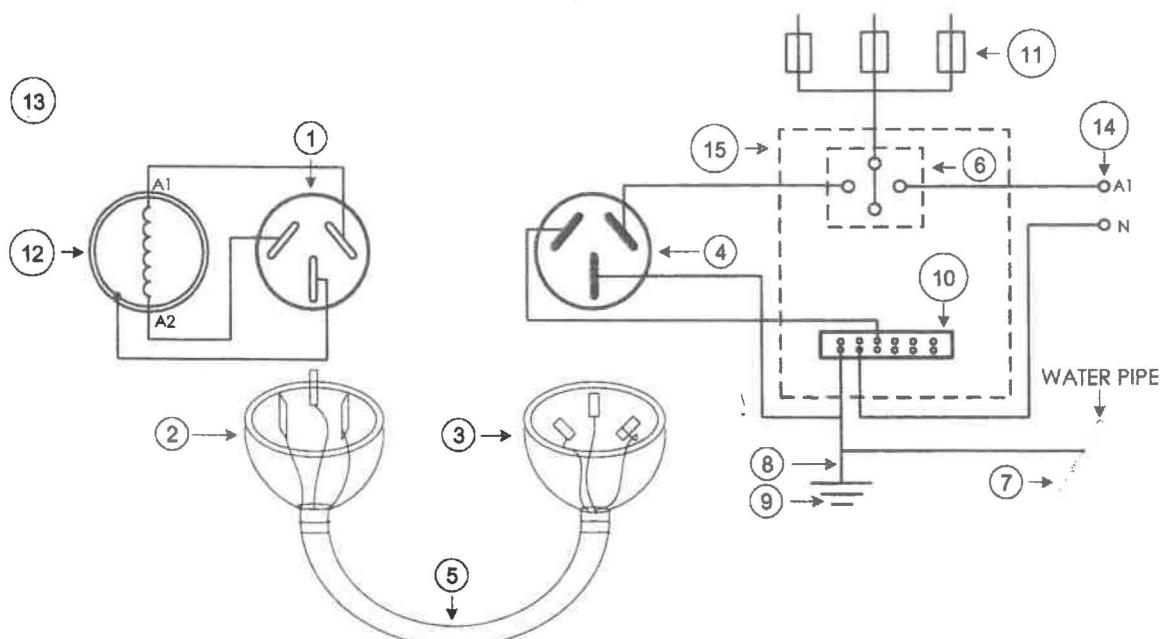


Figure. 3.2

Figure 3.2 Show the diagram of the generator connected by a flexible cord to permanent electrical installation

NOTES TO FIGURE 3.2

- (1) Plug base mounted on a portable A.C. Generator
- (2) Plug top
- (3) Cord extension socket (Appliance plug)
- (4) Double insulated type "C" appliance inlet socket complying with AS C109 (Caravan inlet sockets are generally acceptable)
- (5) Three conductor flexible cord not inferior to ordinary duty.
- (6) Change-over switch. These switch may incorporated on "off" position and satisfy the requirements of AS/NZS 3000-2007 Rule No. 7.2.2.3 alternatively a change over switch without an 'off' position may be used but main control would have to be effected by an additional accessory or accessories.
- (7) Metallic water piping system of applicable)
- (8) Main earthing conductor.
- (9) Earth electrode.
- (10) Consumer's neutral link.
- (11) Consumer's circuit protection equipment.
- (12) A.C Generator with no internal connection between winding and frame.
- (13) A Three phase installation is to be arranged in a similar manner in respect to the neutral and earthing conductors with an appropriate phase conductors and accessory contacts increase.
- (14) Supply Authority's consumer's terminals.
- (15) Consumer's main switchboard.

3.5.3 A.C. Generator permanently installed and connected to the electrical installation through the installations main switchboard

3.5.3.1 Application

In general this arrangement would be employed where the supply from the A.C. Generator is required as an alternative to supply from a supply Authority during outages from normal operational requirement e.g. light power, machinery etc. but supply is not required for life support equipment e.g. hospital, fire protection equipment and lifts

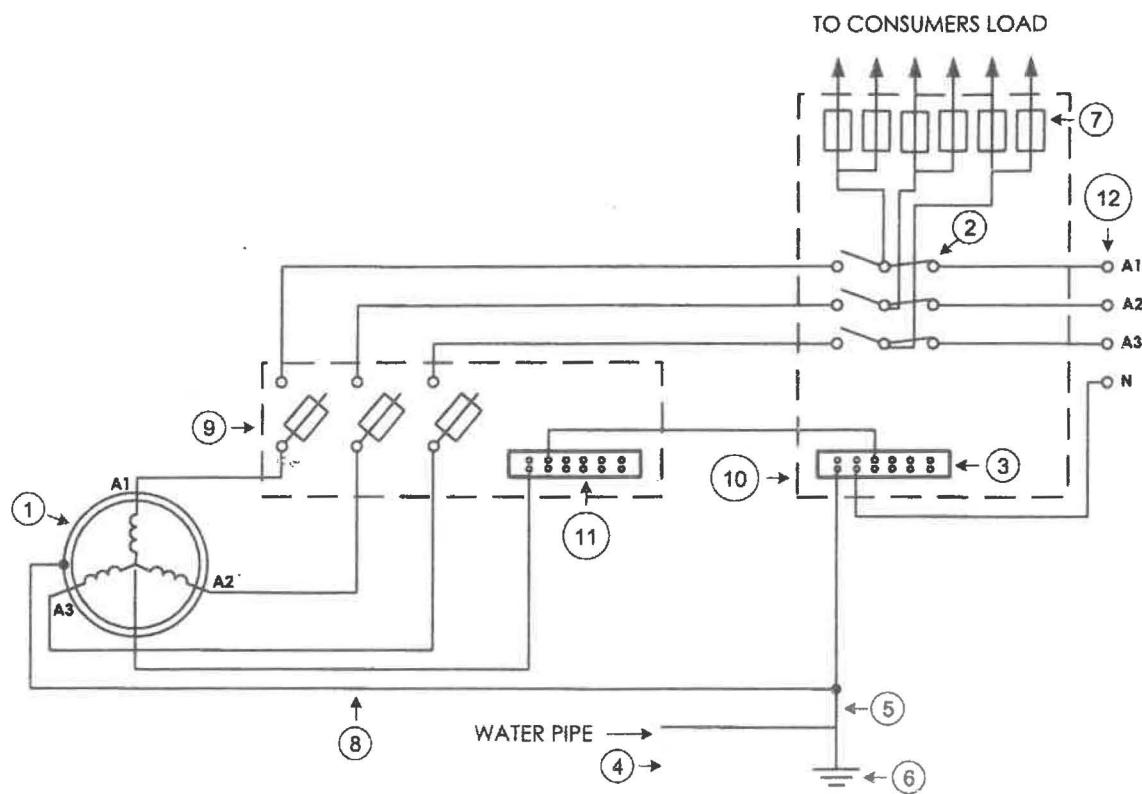


Figure. 3.3

Figure 3.3 Show the diagram of a.c generator permanently installed and connected to the electrical installation switchboard

NOTES TO FIGURE 3.3

- (1) A.C. Generator
- (2) Changeover switch.

This switch may incorporate an "off" position and satisfy the requirements of AS/NZS 3000:2007 Rule No. 7.2.2.3. Alternative a changeover switch without an "off" position may be used but main control would have to be effective by an additional accessory or accessories.

- (3) Consumer's Neutral link.
- (4) Metallic water piping system (if applicable.)
- (5) Main earthing conductor.
- (6) Earth electrode
- (7) Circuit protection devices
- (8) A.C. Generators frame's earthing conductor

(9) A.C. Generator Switchboard.

Control and Protection may be provided by (a) Switch and fuses assembly

(b) Circuit Breaker (c) Separate isolator and fuse assembly.

(10) Main switch board

(11) A.C. Generator's Neutral Link.

(12) Supply Authority's Consumers Terminals.

3.5.4 A.C. Generator permanently installed and connected to the electrical installation not through the installations main switchboard.

3.5.4.1 Application

In general this arrangement should be employed where supply from the A.C. Generator is required for life support equipment e.g., hospitals, fire protection equipment, and lifts.

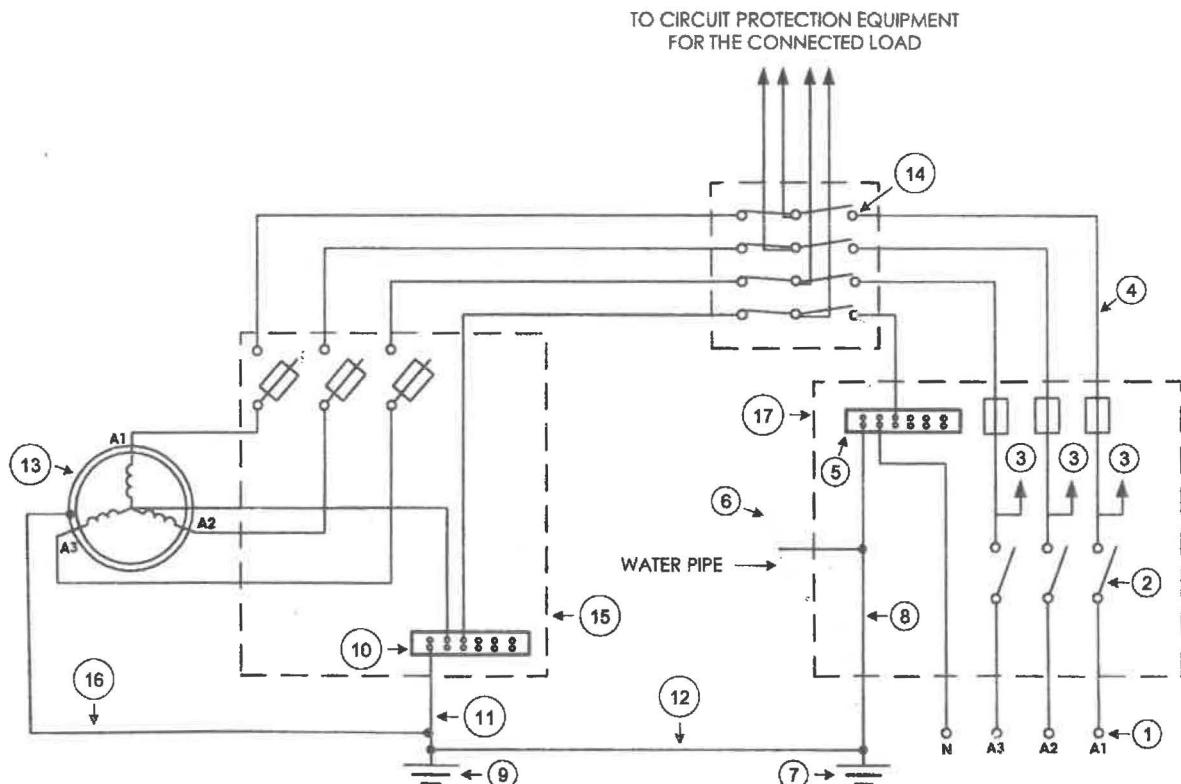


Figure. 3.4

Figure 3.4 Show the diagram of A.C generator permanently installed and connected to the electrical installations not through the installation main switchboard

NOTES TO FIGURE 3.4

- (1) Supply Authorities consumer terminal.
- (2) Main control
- (3) Other sub-mains and final sub circuits.
- (4) Sub-mains to the portion of the installation which is supplied with local A.C. generator supply.
- (5) Main switchboard's neutral link
- (6) Metallic water piping system (if applicable.)
- (7) Earth electrodes for the installation's switchboard.
- (8) Main earthing conductor for the electrical installation which is supplied from the Supply Authority's Mains.
- (9) A.C. Generator's earth electrode.
- (10) A.C. Generator's neutral link
- (11) Main earthing conductor for the A.C .generator.
- (12) The A.C. generator and the "Supply Authorities" supply earth bonding conductor. The size of this conductor is determined on the basis of the capacity of the A.C generator
- (13) A.C. Generator.
- (14) Four poles changeover switch. (Normally this is remote from the Main and Generator switchboards). No connection is permitted between the neutral and earthing conductor after this point in the installation. Notwithstanding the above, where the ESR system is employed a three pole changeover switch shall be used.
- (15) A.C Generator Switchboard.
Control and protection may be provided by (a) Switch fuse assembly
(b) circuit breaker (c) separate isolator and fuse assemblies.
- (16) A.C. generator frame's earthing conductor
- (17) Main switchboard.

3.6 LABEL

In addition to the provisions of ETC 3.3.4 and ETC 3.3.5 for labeling of generator conductor, the transfer equipment shall be labeled

3.6.1 Manually Operated

The label shall have the wording "**MAINS/GENERATOR TRANSFER SWITCH**"

3.6.2 Automatic Mains Failure Operated:

The label shall have the wording "**DANGER, MAINS SUPPLY CONTACTOR/ CIRCUIT BREAKER ENTRY TERMINALS ARE ALIVE AT ALL TIMES**"

3.6.3 Location for the Label

As majority of the mains failure equipment is contained in a separate cubicle, before and adjacent to the main switchboard, operation of the MAIN SWITCH does not isolate the mains supply contactor. Thus the label outlined in ETC 3.6.2 must be fixed to the cubicles door containing the mains supply contactor/circuit breaker.

3.6.4 Other Notices of Warning

In all cases, where a stand-by generation capacity exists at an installation, either automatic mains failure or manual start up types, then suitable warning signs must be fixed adjacent to all affected switchboards to indicate that there is available another source of supply.

3.7 MULTI-METERED AREAS & APPROVALS

In the case of block of flats, or multi-floor buildings each installation should be assessed on the basis of installed wiring, such as rising sub-mains etc. and location for metering positions.

PNG Powers General Policy on Multi- Metered areas that have a stand-by capacity is to have those individual meters removed, and the installation changed to a bulked metered situation, whereby the owner or landlord, installs his own private meters, and charges tenants direct for the combination of PNG Power Limited or stand-by generated consumption.

All designs for these types of installation shall be submitted to the Manager Regulatory Services Group for approval before work commences.

3.7.1 Privately metered installations

Where a multi-unit building is Bulk-metered by PNG Power with individual consumers being sub-metered by the owner, Section 51 (1), (2) of the Electricity Industry Act provide that the owner may not re-sell Electricity at the rate higher than that which PNG Power would charge the same consumer. As power generated from a stand-by unit would normally represent only a very small percentage of the total power used in the building, PNG Power would not normally allow variations to this principle. However, in exceptional circumstances, PNG Power may consider variations particularly where the stand-by generator was required to operate more frequently, (See ETC 3.8).

3.7.2 Where no charge is made for stand-by capacity

A Stand-by Generating Capacity, installed in premises to maintain essential building services, like lifts, water or sewerage pumps, communication

arrangements etc. or preferential supply to tenants that is intended **to become part of the basic services of the building**, the cost of which is inclusive in leasing or rental agreements between the owner and the tenants and where no direct charge, either by private metering or other means is made in relation to power supplied by a stand-by generator **only during failure of PNG Power supply** then they shall not be regarded as an "Undertaker" as defined by the Act and shall not require an "Order" from the Regulator.

The installation of stand-by generating capacity under the proceeding conditions shall not absolve a person, firm or company from submitting their proposal to PNG Power for approval prior to implementation or commissioning of the generating capacity.

Where the stand-by generating capacity is installed by the owner or tenant exclusively for his own use during failure of PNG Power supply, then he is not regarded as an "Undertaker" as defined by the Act but proceeding clauses referring to inspection still applies.

3.8 MAXIMUM TARIFF OR CHARGES APPLICABLE

Where an "Order" has been issued by the Regulator, to a person, firm or company to act as an "Undertaker" than the maximum tariff or charges applicable will be the subject of discussion with the Regulator. The agreed tariff will take into account all costs to the undertaker, including a fair return on capital.

Where stand – by generating capacity is installed by the owner(s) of a group of flats, town-houses, multi-story or multiple metered installations etc. and the owner(s) intend to levy charges for the use by tenants of the facility, in the event of a breakdown of PNG Power supply then the owner is regarded as an "Undertaker" as defined in the Act, and must apply to the Regulator for an Order.

According to Section 51 (1) of the Electricity Industry Act, **It is an offence to sell electricity without the consent of the Regulator.**

3.9 STAND-BY CHARGE

PNG Power may impose a stand-by charge where a person, firm or company installs a private generator, and indicates to PNG Power the intention to use his/her set part of the time when PNG Power supply is available and use PNG Power supply part of the time, PNG Power may impose in addition to electricity consumed, a stand-by charge **not exceeding 50%** of the value of electricity that would have been supplied by PNG Power if the stand-by plant had not been operated.

Where this circular/instruction differs with AS/NZS 3010 "Electrical installations — Generating Sets" then AS/NZS 3010 shall prevail, including any amendments.

Engineering Standard: HQH-GCG 015
First Issued: 19.09.1969 Reviewed & Reissued: 31.12.1987, 05.05.2016

TRADE CIRCULAR 4**WHERE NOTICE OF INTENTION FOR MAINTENANCE WORK
IS REQUIRED****4.1 GENERAL****4.1.1 Application**

The provision of Electrical Trade Circular 4 forms standard requirement in relation to "Notice of Intention to Carryout Electricity Work".

4.2 NOTICES OF INTENTION TO CARRYOUT ELECTRICITY WORK**4.2.1 Where Required**

The 'Notice of Intention to Carryout Electricity Work' is required to be submitted to an authorized Electrical Inspector by Licensed Electrical Contractors and or Licensed Electricians as the case maybe, prior to carrying out any new, additions or alteration electrical works. These electrical works includes;

(a) Maintenance

- (i) Relocate G.P.O., light fitting, light switch, ceiling fan, fan regulator, hot water switch and stove switch.
- (ii) Ceiling fans and regulators to be connected to existing wiring.
- (iii) Dux type shower heaters to be connected
- (iv) Replacing existing stove unit of greater wattage.
- (v) Replacement of existing lighting fitting with a different type fitting
- (vi) Replacing existing light switch with different type.
- (vii) Replacing general purpose outlet with different type fitting.
- (viii) Replacing aerial service between main house and domestic servants' quarters.
- (ix) Replacing fixed hot water system.

(b) Domestic installation

- (i) To disconnect for repairs by other tradesmen, i.e. carpenters etc..
- (ii) All disconnections for repair or rewire of residences and
- (iii) For replacement of switchboards.

- (iv) Relocate G.P.O., light fitting, light switch, ceiling fan, fan regulator, hot water switch and stove switch.
- (c) Non - domestic installation (Factories, Offices, or Commercial Premises)
 - (i) Replacement of motors, starting equipment or isolators, particularly where an increase in size of motor, or a change in starting equipment occurs and applies to all permanently wired equipment such as large freezer type installations, Air Conditioning plants, Lifts or Cranes, machines etc.
 - (ii) Any maintenance to a switchboard, meter panel, or Distribution Pillar, that requires installation of equipment of different type to that existing.

Note:

All disconnection and reconnects of PNG Power supply may only be carried out by a PNG Power Officer delegated to carry out this type of work where no inspector has been appointed to the area.

4.2.2 Where Not Required

The 'Notice of Intention to Carryout Electricity Work' is not required when replacing the following:

- (a) Direct replacement of same type of light fitting, light switch, ceiling fan, fan regulator and G.P.O.s.
- (b) In the maintenance and replacement of electrical parts of stove, sink heaters, hot water systems, Dux showers heater elements, oil fuel stoves, oil burners and solar systems.
- (c) Motor rewinds (disconnects and reconnects) where same motor is reinstalled.

4.2.3 Completion Notices

The 'Notice of Completion of Electrical Wiring Work' shall be submitted after electrical works are completed for Electrical Installation Inspectors to carryout inspection.

Engineering Standard: HQH-GCW 007
First Issued: 13.03.1970 Reviewed & Reissued: 31.12.1987, 10.05.2016

TRADE CIRCULAR 5**USES OF ALUMINUM CABLES**

5.1 GENERAL**5.1.1 Application**

The provision of Electrical Trade Circular 5 outlines the standard requirement with regard to the connection to and joints in aluminum conductors using components specifically designed and the techniques specified by the manufacturer.

5.2 ALUMINUM CONDUCTORS**5.2.1 Current Rating Capacity**

The current carrying capacity of aluminum conductors shall be in accordance with Appendix B of PNGS 1022 (AS/NZS 3000) or as stated on AS/NZS 3008 Part 1 for the defined installation conditions.

5.2.2 Sizes**5.2.2.1 Minimum Size**

The minimum size of aluminum conductors shall be as laid down in AS/NZS 3000:2007 Wiring Rules No. 3.12.2.2 (a).

5.2.2.2 Maximum Size

No restriction shall be placed on the maximum size of a solid aluminum conductor.

5.2.3 Jointing

Aluminum cables may be welded or soldered. However, in general, special techniques and materials are required to ensure that satisfactory joints are made. A brief description of some of the methods which may be used is given in the following:

5.2.4 Rub Soldering

A simple method of soldering is that known as "rub soldering" or "abrasion soldering" in which solders such as 'Fayal Metal' are employed. These solders have sharp metal crystals capable of scratching through and removing thin coatings of aluminum oxide when the solder is near melting point.

5.2.4.1 Tinning

The surface to be "tinned" must first be cleaned and rubbed with fine emery paper to remove the oxide film. It is next heated until just hot enough to melt the rub-solder and then rubbed vigorously with the solder stick until brightly tinned.

5.2.4.2 Tinning Stranded Conductors

Tinning a stranded aluminum conductor by the rub solder method would be tedious and time-consuming, and "reaction fluxes" are used instead. When heated, these fluxes remove the oxide film from the aluminum strands by a chemical reaction and then deposit layer of heavy metals on the surface before the oxide film can re-form.

Once the strands are tinned, the spaces between strands can be filled with ordinary electrical solder or, preferably, with a special filling solder of high "flow ability" consisting of tin (85%) and zinc (15%).

Note that this method is very difficult to apply when using conductors of 20mm² or larger, and other methods are preferred unless highly skilled tradesmen are available.

5.2.5 Fluxes

Inorganic fluxes such as "All states 509" or "Ambraze 370" are preferable to organic fluxes, and should be used in accordance with the manufacturer's recommendations.

Fluxes residues should be removed from the completed joint or termination, as these will assist in promoting corrosion particularly in damp situations.

5.2.6 Bolted or Clamped Connections

Bolted or clamped connections must be designed to take into account aluminum oxide film, difference in co-efficient of linear expansion of aluminum and other metals and the relative softness of aluminum.

5.2.7 Removal of Oxide

Oxide film shall be removed from any aluminum contact surface, before making joints of this nature.

It is advisable to coat the contact surfaces with a compound specifically prepared to remove thin oxide films by chemical and mechanical action and to permanently exclude moisture from the immediate vicinity of the joint faces. After application of the jointing compound the contact surface is scratch-brushed through the compound to assist in the removal of oxide.

A.L.M. "Penetrox A" and Alconac "Versa seal" are suitable compounds for this purpose.

Some aluminum lugs and fittings have tinned or plated contact faces which eliminate the need for further surface preparation. The use of moisture excluding grease or compound is nevertheless advisable and preparation of aluminum conductor to be clamped is still required.

5.2.8 Bolting or Clamping

Prepared surfaces must be firmly bolted or clamped together in such a manner as to ensure that they will not loosen in service due to the expansion and contraction of the aluminum.

For this purpose aluminum alloy bolts and nuts are available which expand and contract at the same rate as the conductor and lug. This method is effective; however only where both conductors clamped by the aluminum bolts are of aluminum. In addition, caution must be exercised in the tightening of aluminum alloy bolts due to their reduced tensile strength.

5.2.9 Spring Cup Washers

An alternate method is the incorporation of a spring cup washer ("Belleville" washer) which will keep the joint tight even if the aluminum "squashes" due to heating and cooling in service. Such devices should be used whenever an aluminum conductor, lug, etc. is bolted or clamped by bolts of steel, brass, bronze or any metal other than aluminum or its alloy.

5.2.10 Tunnel – Type Terminals

Aluminum conductors shall not be clamped directly by screws in tunnel type terminals, other than special types designed to evenly distribute stress and to remove oxide film from the conductors.

Indirect clamping by means of suitable ferrules and plates etc. shall be acceptable.

5.2.11 Crimping, Indenting and Compression

These methods are widely used for jointing or terminating copper and aluminum cables, but are fully effective only when both the lugs and ferrule and the cable or conductor to which it is to be connected are of the same metal.

Due to the difference in elasticity and expansion of copper and aluminum, the crimping, indenting or compression of **copper sleeves or lugs** to aluminum conductors, or aluminum sleeves or lugs to copper conductors shall not be acceptable. This does not preclude the use of specially manufactured **aluminum to copper compression stork lugs etc.**

Where aluminum lugs or sleeves are compressed or indented to aluminum conductors, solid or stranded, the cable should be first coated with Penetrox A", "Versa seal" or similar compound and scratch-brushed through the coating.

This process shall also be carried out on the inner surface of the lug or sleeve, unless the manufacturer indicates that suitable precautions have been included in the manufacture of the lug, etc. to prevent the formation of oxide on contact surfaces.

Lugs and sleeves for attachment by compression or indenting must be of heavier construction than those normally used for soldered connection, to ensure that they do not loosen when subjected to the stresses imposed by movement of the cable during installation and in service.

It is important that all lugs and sleeves be fixed by using the die, compression device and methods recommended by the manufacturer of the lug or sleeve.

5.2.12 Underground Installations – Earthing

Aluminum cables, cables with bare aluminum sheaths or aluminum tapes **shall not** be used for direct burial in the ground, or for installation in damp situations.

Cables with a serving impervious to moisture which complies with the requirement of A.S.3147 may be buried direct in the ground and installed in damp locations.

Aluminum in general **shall not be used for earthing conductors** including earth bonding conductors other than in an approved form such as a continuous aluminum bus bar or the sheathing of an MIMS cable or in such other special cases or situations as may be approved.

5.2.13 Aerial Conductors

Aluminum aerial conductors shall comply with the requirements of A.S. 3147 as appropriate.

5.2.14 Solid Aluminum Conductor Cables (SAC)

5.2.14.1 Termination

Aluminum concentric conductors shall be terminated in accordance with the requirements of AS/NZS 300:2007 Wiring Rule No. 3.7.2.1.2 and Neutral Screened Cables, AS/NZS 300:2007 Wiring Rule No. 3.7.2.9.2

5.2.14.2 Neutral

An aluminum concentric conductor may be used as a neutral conductor but **shall not** be used as an earthing conductor.

5.2.14.3 Restriction

In underground or wet situations the aluminum concentric conductor **shall not be used** as a neutral or earthing conductor.

5.2.14.4 Solid Aluminum Conductor Cables (SAC) as Double Insulation

SAC cables shall be regarded as double insulated where the appropriate requirements AS/NZS 3155 Neutral Screened Cables in regard to requirements for double insulation are satisfied.

- (a) Mineral Insulated Aluminum Conductor Sheathed Cables;
- (b) Minimum Size of Live Cables:

The nominal cross-sectional area of any conductor shall be less than 10mm².

5.3 MINERAL INSULATED ALUMINUM CONDUCTOR SHEATHED CABLES

5.3.1 Installation

Aluminum MIMS cables shall be installed in accordance with the appropriate requirements of AS/NZS 300:2007 Wiring Rule No. 3.9.7.3. In addition a corrosion inhibiting agent must be applied to all terminations.

5.3.2 Underground Installations

Aluminum MIMS cable shall not be installed in underground or in wet situations without an overall serving of PVC.

5.3.3 Earthing

The aluminum sheath of a MIMS cable may be used as an earthing conductor in accordance with the requirements of Rule 3.16 provided that the connection of earthing conductors to the sheathing is effected by means of a suitable terminal of tinned brass or aluminum alloy incorporated in a gland.

5.3.4 Current Ratings

The Current Carrying Capacity of Aluminum conductors shall be as determined by AS/NZS 3008 Part 1 or in accordance with PNGS 1022 (AS/NZS 300:2007 Wiring Rule No. 3.4.1).

Engineering Standard: HQH-GCW 005

First Issued: 31.12.1980 Reviewed & Reissued: 31.12.1987, 12.05.2016

TRADE CIRCULAR 6

USE OF METRIC AND IMPERIAL SIZE CABLES AND EQUIPMENT

6.1 GENERAL

6.1.1 Application

The Metric measurement was introduced in Papua New Guinea on the 31st December 1976. A grace period of five years was completed on the 1st January 1982 and from than all materials used in Electrical Installations were to be measured in Metric.

Pre-1982 Electrical Installations may contain materials of imperial measurements so special care must be taken when encountered during repair works.

6.2 INSTALLATION OF IMPERIAL CABLES

Installation of imperial cables is not permitted and any special application must be referred to Manager Regulatory Services.

6.3 EXEMPTION

No Imperial Cable Connections or Conduits are permitted for use with Metric Sized Lugs, Terminals, or Fittings unless specially manufactured or designed for that purpose.

Engineering Standard: HQH-GCW 005
First Issued: 31.12.1980 Reviewed & Reissued: 31.12.1987, 07.06.2016

TRADE CIRCULAR 7**IDENTIFICATION OF FLATS, UNITS, HOUSES AND, ETC, IN
MULTIPLE METERED INSTALLATIONS****7.1 GENERAL****7.1.1 Application**

The provision of Electrical Trade Circular 7 outlines the labeling requirement to clearly identify flats, units, houses in multiple installations.

7.2 RESPONSIBILITY ON LABELLING

It is the Electrical Contractors responsibility to clearly identify the above referred installations in relation to the correct meter for that installation, both at the **Meter Panel** and on the **Main Entrance** door to that particular installation.

In carrying out this task, it must be remembered that **labels similar to dynamo tapes are not considered suitable where applied to zelemite type panels** as the tape has a drying out effect over time and labels lift off.

PNG Power has no objection to the above method, where the labels are placed actually on the plastic surface of the meter, provided that sufficient space is left for PNG Power to affix its own identifying installation number, and the meter dial is not obstructed.

7.2.1 Entrances Marking

Where the marking of main entrances to multiple dwelling installations is to be carried out, then a permanent raised number, that **cannot be painted out** must be fixed. This number must be the same as that assigned by the Owner, Landlord or Letting Agent, and must correspond to the flat or unit number labeled on the meter.

7.2.2 Service Meter Fuses

Service Meter Fuses on meter panels must also be labeled with the corresponding unit or flat number, assigned to the actual meter and main entrance door of that flat or unit. As this may present some problem with the banking of service fuses on meter panels, it is not permissible to label the actual fuse base or fuse carrier. This function should be carried out by either permanent enamel sign-writing on the panel or engraved labels, properly fixed below the fuse bank on the panel.

7.3 IDENTIFICATION SYSTEM

As this type of accommodation is subject to a large turnover in tenants, it is extremely important that the identification system is as permanent and as accurate as possible to enable smooth transaction from one tenant to another.

The initial establishment of the system and its corresponding documentation on PNG Power records for the installation is absolutely necessary for future utilization both by PNG Power and the customer.

7.3.1 Identify Section/Allotment/Street & Suburb

In addition to the above, all Section and Allotments, Street Names and Suburb should be carefully checked **before** submitting appropriate notices to PNG Power, as the address of the installation in relation to the future assigned PNG Power installation numbers is of the utmost importance not only for inspection purpose but also to identify the location of the installation for billing and associated disconnection and reconnection activities.

7.4 CONNECTION REQUIREMENT

Blocks of multiple tenancies **will not** be connected unless adequate marking and identification has been carried out to PNG Powers satisfaction.

7.5 PRECAUTION FOR WORK ON ZELEMITE PANEL

When working on zelemite panel precaution shall be taken not to inhale the fume when drilling or cutting of zelemite panel as its material composition contains hazardous chemical called asbestos which is harmful to the lung.

Engineering Standard: HQH-SCG 002
First Issued: 31.12.78 Reviewed & Reissued: 31.12.1987, 07.06.2016

TRADE CIRCULAR 8

PROCEDURES FOR WORKING ON POLES AND OVERHEAD LINES

8.1 GENERAL**8.1.1 Application**

The provision of Trade Circular No.8 outlines standards and method of procedure to be adopted by workers within the electrical industry in order to ensure safety of workers, the control and to implement the operation of the standards" stated in PART III DIVISION 1 & 2 Section 21 (1)(k) of the Electricity Industry Act.

8.2 SAFETY PROCEDURES WHEN WORKING ON POLE

Procedures to be followed when working on overhead lines as failure to observe these could lead to the cancellation or suspension of licenses, under the provision of the Electricity Industry Act.

(a) **Restriction on Ascending Pole**

No person shall ascend a pole unless he is wearing a Linesman's body belt. Before commencing actual work on the pole, his belt must be securely fastened.

(b) **Ascending Energized Power Pole**

No person other than an authorized employee of PNG Power shall ascend a pole which is the property of PNG Power.

(c) **Person Ascending Pole with Energized Conductor**

A person ascending a pole which is carrying energized conductors must be a qualified and competent tradesperson, in carrying out the task to be performed.

(d) **Safety Observer at or Near Foot of the Pole**

A Safety observer at or near the foot of the pole must be a certified person in Pole Top Rescue and also competent to warn off dangerous movements.

(e) **Rescue Kit**

A Rescue Kit consisting of body belt, lifeline rope (22 meters), a sharp knife and rubber gloves must be placed in a convenient position near the base of the ladder. The ladder **must not** be removed from the pole while a person is on the pole.

(f) **Restrictions On High Voltage Approach**

A person must not approach closer than 1.2 meters on the case of 11kV or 22 kV high voltages, or two meters in the case of 66 kV high voltage conductors unless he has been issued with a written "Access Permit" and the conductors have been de-energized.

(g) **Pole Top Rescue Training**

PNG Power Training College conducts training sessions in Pole Top Rescue at its Hohola facility, and also on request in other Centre.

An employee of any Electrical Contractor may attend these sessions with charges to receive instruction and practice in Pole Top Rescue.

Engineering Standard: HQH-GCA 001.
First Issued: 04.05.1969 Reviewed & Reissued: 31.12.1987, 07.06.2016

TRADE CIRCULAR 9**CONNECTION OF WELDING APPARATUS**

9.1 GENERAL**9.1.1 Application**

The Provision of Trade Circular No.9 outlines restrictions on the use of certain appliances under Electricity Industry (Service & Installation) Regulation 2006 Part IV.

9.2 CONNECTION OF WELDING APPARATUS

9.2.1 Electricity Industry (Service and Installation) Regulation 2006, Part IV Section 12, outline restrictions on the use of certain appliances.

9.2.2 PNG Power may prohibit or permit, subject to such terms and conditions as it considers necessary connection to its supply such Electrical appliances as:-

- a. A single phase welding apparatus of which the rated input current at 240 Volts exceeds 15 Amperes or the rated kVA at 415 Volts exceeds 7.5 amps and which is not a Three (3) Phase motor driven type.
- b. Apparatus which in the opinion of PNG Power causes or is likely to cause radio interference.
- c. Apparatus which in the opinion of PNG Power has a fluctuating load.
- d. Any other apparatus, which in the opinion of PNG Power is likely to cause the interference with PNG Power supply to other consumers or is likely to interfere with the satisfactory operation of PNG Power Plant.

9.3 APPROVAL OF PORTABLE ELECTRIC WELDING MACHINES TRANSFORMER TYPES

9.3.1 All welding machines of the above type, up to a short circuit input current of **15 kVA** must be submitted for approval to PNG Powers Appliance Approvals Officer, **Prior to Sale** and must comply with AS 3195-2002.

9.3.2 Welding machines above **7.5 kVA** must be power factor corrected to not less than eighty percent.

9.4 OTHER TYPES OF WELDING APPARATUS INCLUDING TRANSFORMER TYPES ABOVE 15 KVA

9.4.1 Spot and Projection welding equipment shall comply with AS 2799-1992.

9.4.2 Other types of welding equipment shall comply with AS1966-1985 Parts 1 and 2.

9.4.3 Equipment included in the above categories (with the exception of AC/DC motor driven machines) which have ratings above **7.5 kVA must be power factor_corrected** to not less than less than 80 percent, **prior to the sale** but does not have to be submitted for approval provided it complies with the above provision.

9.5 PNG POWER APPROVAL PRIOR TO CONNECTION

9.5.1 All welding apparatus (with the exception of motor driven AC/DC types) are subject to approval for connection and relevant Centre Inspector must be notified through use of Form 'Notice of Intention to Commence Electrical Wiring Work'.

9.5.2 Assuming sufficient power supply is available and subject to interference provisions, the Centre Inspector will decide in each case, if the apparatus will be connected.

9.5.3 Depending on the rated input current of the welding apparatus approval for connection to a single, two or three phase outlet or sub-circuit will be advised.

9.5.4 Under no circumstances should Electrical Contractors install welding apparatus that is not approved for sale as outlined in this Instruction/Circular.

9.5.5 Any person, who connects welding apparatus before permission is given or after connection has been prohibited, is guilty of an offence. (Electricity Industry (Service and Installation) Regulation 2006, Part IV Section 12 Subsection 2.

NOTE:

The Instruction/Circular should be used in conjunction with Electrical Trade Circular No: 32.

Engineering Standard: HQH-GCW 012
First Issued: 27.10.1968 Reviewed & Reissued: 31.12.1987, 07.06.2016

TRADE CIRCULAR 10

COLOUR CODINGS IN PAPUA NEW GUINEA

10.1 GENERAL

10.1.1 Application

The cable identification is of paramount important when carrying out electrical installation and therefore the provision of Electrical Trade Circular No.10 provides the standard requirement for colour coding of cables which was introduced in Papua New Guinea on the 1st December, 1969.

All cables shall be clearly identified to indicate their intended function in compliance with the requirements of Wiring Rule 3.8 & Table 3.4

10.2 INSTALLATION CABLES/CONDUCTORS

10.2.1 Earthing

The insulation or covering of earthing conductors shall be colored **green and yellow**. In any 15 mm length, one of the colours shall cover not less than 30 percent and not more than 70 percent of the surface of the conductor, with the other colour covering the remainder of the surface.

NOTE: Wiring Rule 3.8.2 and 3.8.3.1.

10.2.2 Live conductors

- a. **Red**, or any colour **other than** black, green, yellow, or green and yellow combination, for active or switch wire.
- b. In single phase installations, it is normal practice to use **white colored** conductors for switched lighting actives.

NOTE: RULE. 3.8.3.2, Table 3.4

10.2.3 Colour Identification for Neutral Conductor

Neutral conductor is identified by **Black colour**.

10.3 SLEEVING

For the active conductors larger than 6mm², the distinguishing colour required may be provided by a permanent sleeve, a minimum of 40mm in length. The sleeve must be a tight fit over the conductor insulation. Where the ~~sheathing~~ has been removed, exposing more than 40mm of conductor insulation, the sleeve shall cover all the exposed conductor insulation. Where insulated sleeving is utilized, it must comply with AS/NZS 3000 2007 Rule 3.8.2. The **taping of cables** to identify colour coding is **not permissible** in lieu of sleeving, due to the unwinding

effect that can be caused by heat, and the gradual drying out of the tape adhesive.

NOTE: Insulated conductors green or green/yellow is reserved for earthing purpose and sleeving to use it as alternative for active is not permitted.

10.4 CONTROL CABLES

The number system is accepted for multi-core cables used for control circuits.

10.5 FLEXIBLE CORDS

In addition to meeting AS/NZ 3191 and with the exception of the Provisions for use as Installation Cables, (where used as fixed wiring), flexible cords shall comply with the colour system laid down in Wiring Rule 3.8.3.2 (b) Table 3.4.

10.6 INSULATED AERIAL CONDUCTORS

Where insulated aerial conductors are used, that have no identifying colours incorporated in their design, such as Figure 8 or web type cables, but have one conductor serrated, striped, or line molded, then this conductor must be utilized as the neutral conductor. Where two pairs of this type of cables are used as a three-phase service, then all active conductors must be identified by the appropriate colour sleeving, and the line molded cable of one pair used as a neutral conductor.

10.7 EXCEPTIONS AND SPECIAL APPLICATIONS

For the purpose of European cable identification colour, care should be exercised by Electrical Contractors and Electrical Inspectors to ensure colour identification is as per AS/NZS Wiring Rule 3.3.8.8 Figures 3.1 & 3.2

10.7.1 Flexible Cords

The identification cable insulation will be:

- (a) For active is red or brown colour,
- (b) For neutral is black or a blue colour and
- (c) For earth is identified by a green or green/yellow colour.

10.7.2 Multi-Phase Cables

The identification cable insulation will be:

- (a) For active Phase/Line 1 is red or brown colour,
- (b) For active Phase/Line 2 is white or black colour,
- (c) For active Phase/Line 3 is blue or grey colour,
- (d) For neutral is black or a blue colour and
- (e) For earth is identified by a green/yellow colour.

Engineering Standard: HQH-GCW 013
First Issued: 05.07.1978 Reviewed & Reissued: 31.12.1987, 07.06.2016

TRADE CIRCULAR 11 PROTECTIONS OF CABLES & CONDUCTORS

11.1 GENERAL

11.1.1 Application

The Provision of Electrical Trade Circular No.11 outlines the cable installation in positions where they may reasonably be expected to mechanical damage and shall be adequately protected in accordance to AS/NZS 3000:2007 Rule No. 3.3.2.6 and 3.9.4

11.2 LIVING QUARTERS WITHOUT LINED CEILING

In living quarters which have no lined ceiling such and **under buildings** where the **space beneath** exceeds 1.0 meter, cables of the T.P.S. or unarmoured type which are liable to be damaged mechanically, shall be protected in accordance with the Wiring Rules 3.3.2.6 and 3.9.4.

11.2.1 Cables Run On The Surface

Cables run on the surface in places where they are liable to be damaged mechanically shall be adequately protected. AS/NZS 3000:2007 Rule No. 3.3.2.6

11.2.2 Against Mechanical Damage

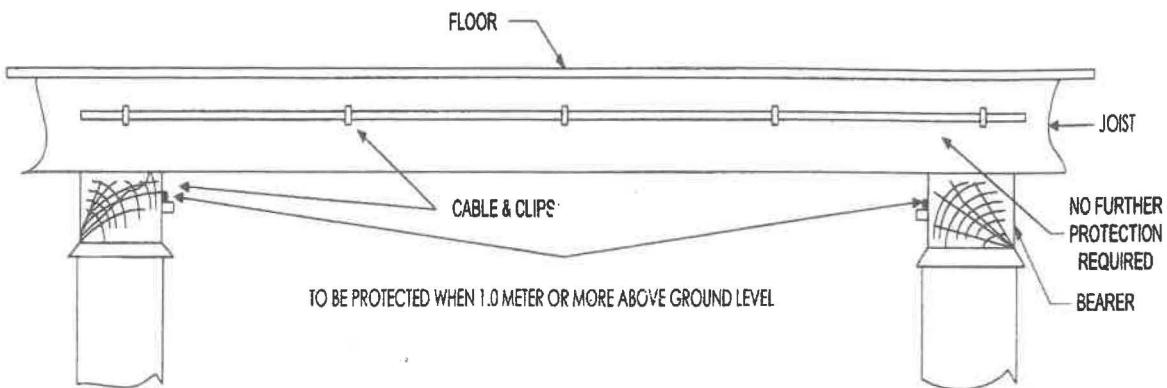
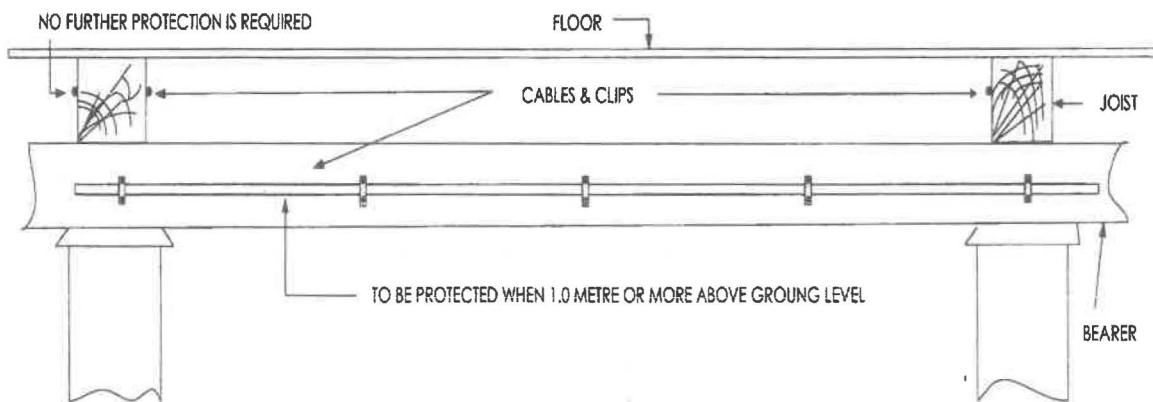
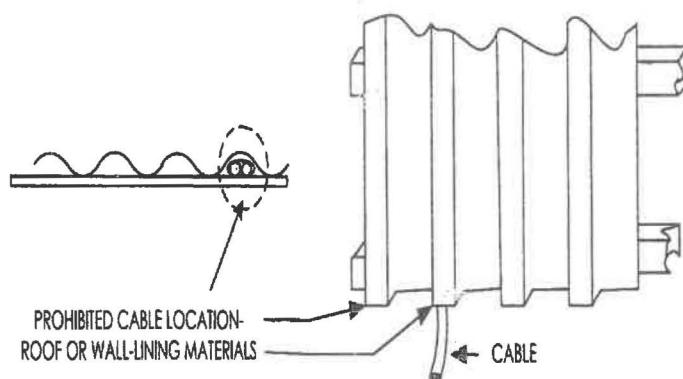
Where sheathed cables other than armoured cables are installed in positions where they are likely to be subjected to mechanical damage, they shall be adequately protected with compliance to AS/NZS 3000:2007 Wiring Rule No. 3.9.4.

NOTE:

Attention is also drawn to AS/NZS 3000:2007 Rule 3.9.4.2 for protection of cables in concrete or plaster.

11.2.3 Space Formed between Roofing and Wall-lining Material

Wiring system shall not be installed through any space formed between roofing or wall-lining material and its immediate supporting AS/NZS 3000:2007 Wiring Rule No. 3.9.4.3 Refer to Figure 11.1, 11.2, 11.3, 11.4 of ETC 11 for detail installation requirement.

**Figure 11.1****Figure 11.2****Figure 11.3**

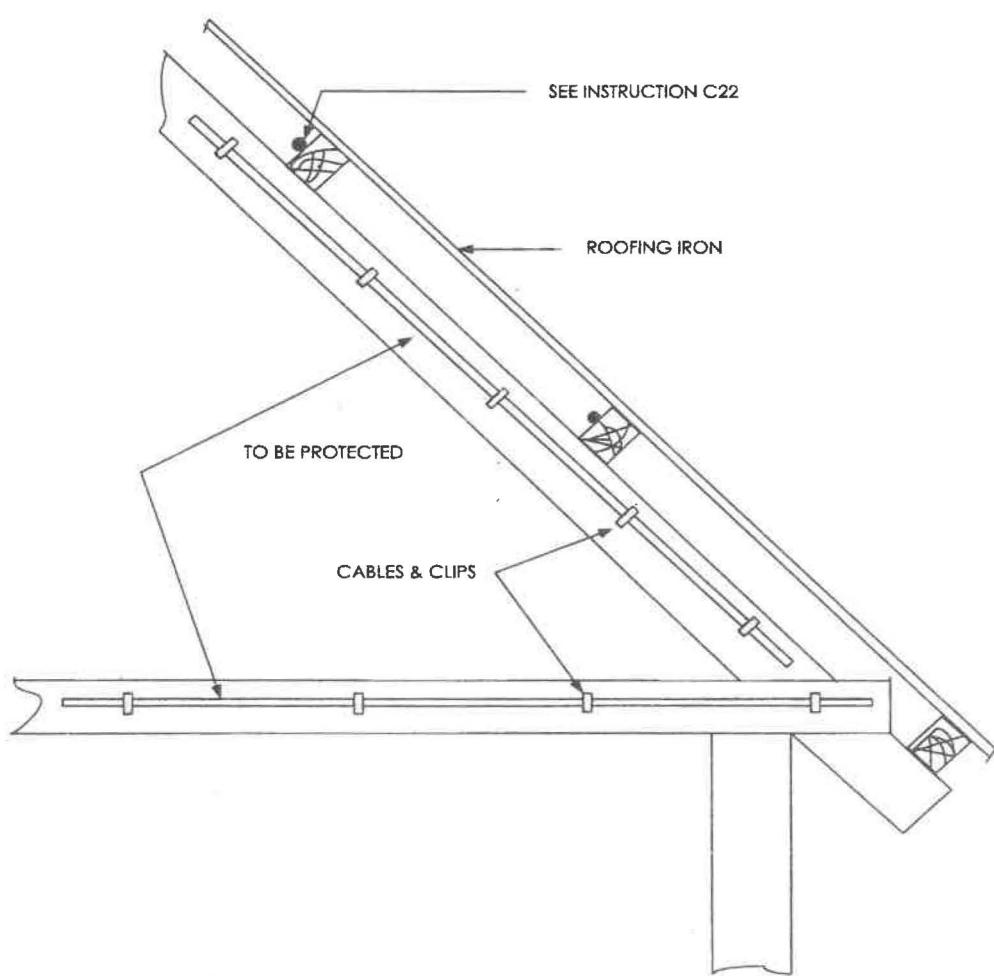


Figure 11.4

Figure 11.1, 11.2, 11.3, and 11.4; Show the diagram of protection of cables, conductors and the prohibited locations

Engineering Standard: HQH-GCG 013
First Issued: 31.12.1980 Reviewed & Reissued: 31.12.1987, 09.06.2016

TRADE CIRCULAR 12 SERVICE FEE FOR NEW AND ADDITIONAL INSTALLATIONS

12.1 GENERAL

12.1.1 Application

The provision of Electrical Trade Circular No. 12 outlines the Service Fees charged to customers for New and Additional Installations. The charges was introduced on January 1, 1981 as a nominal cost to make possible connection of electricity from PNG Power to consumer, and is not the itemized cost therefore, is non-refundable and all materials supplied remain the property of PNG Power.

12.2 SERVICE FEE

The applying of servicing fee is in addition to and quite separate from the current connection/reconnection fee (Tax inclusion) during business hours or after hours respectively.

Refer to PNG Power for confirmation of schedule of fees which are currently applicable.

12.3 CUSTOMERS REQUIRING A NEW SERVICE AND METERING QUOTATION

12.3.1 Customers, intending and existing, who require the service and metering quotation must through their electrical contractor contact the Manager or Installation Inspector in their respective Centre, who will prepare an estimate using Form CB.105.

On payment of the fee, the service will be erected and metering equipment supplied.

12.4 STANDARD COST ESTIMATE

12.4.1 The standard cost estimate allows for an aerial run of twenty (20) meters from consumer's property line in, **only**. Any additional distance required to service the installation is charged for as Sundry Debtor Basis (prime cost plus 55%).

NOTE: The twenty (20) meters stated here must not to be confused with the fifty (50) meter maximum run allowed for aerial service cable from existing distribution line to customer property.

Customers, intending or existing, requiring aerial service run exceeding fifty (50) meter will be serviced through and at the customers cost of extending low voltage distribution line.

12.5 SERVICE POLES FOR CLEARANCE WITHIN 20 METERS

12.5.1 Service poles needed to provide clearance within the distance specified in Clause 12.4.1 will not be charged to the customer, as they are covered in distribution costs. However any raisers on buildings for this purpose will be installed by the consumer at the customers' expense.

12.6 ALTERATIONS, UPRATING OR CHANGES IN SERVICES OR METERING ARRANGEMENTS TO EXISTING INSTALLATIONS.

12.6.1 No charge is made for either new meters or changing single phase meters. However:-

12.6.2 The service fee applies where a single phase aerial supply is up rated to a three phase supply.

12.6.3 Under no circumstances are refunds to be made or requested.

12.6.4 All requests for large increases in up rating of supply (i.e. increase in transformer capacity) must be referred to the Manager Engineering Design as a capital contribution may be required from the consumer.

12.7 METER CHANGE SAME TYPE

Where a meter is replaced for fault reasons, that are the same phase and current rating, as the meter changed, then no charge is made to the consumer. The same applies, where obsolete metering (i.e. clock type registers) are replaced, with digital register types of KWH meters, as part of normal PNG Power maintenance.

12.8 WILLFUL DAMAGE TO METERING EQUIPMENT

Where it can be proven that a customer has willfully damaged metering equipment, then the cost plus 10% of **replacement equipment** must be borne by the customer.

12.9 PAYMENT OF THE PRESCRIBED SERVICING FEE.

The servicing fee will be paid by the owner of the installation or his agent, who may be the Electrical Contractor carrying out the installation. To avoid lengthy delays in servicing and metering installation, payment of this fee should be made following the granting of approval by the Electrical Inspector against the Notice of Intention to Commence Electrical Installation submitted by the Electrical Contractor.

12.10 THE SERVICE FEE FOR SINGLE PHASE OR THREE PHASE

This fee shall change as determined in the tariff and connection charges schedule however as at 01.01.2014 which is current;

- (a) Single Phase service – K226.60 (VAT inclusive)
- (b) Three Phase Service – K569.80(VAT inclusive)

Engineering Standard: HQH-GCG 016

First Issued: 31.08.1981 Reviewed & Reissued: 31.12.1987, 08.06.2016

TRADE CIRCULAR 13 P.N.G WIRING RULES APPLICABLE AUSTRALIAN STANDARD

13.1 GENERAL

13.1.1 Application

The Electrical Trade Circular No. 13 provides provisions for Electricians or Electrical Contractors carrying out electrical works to work within the parameters of Wiring Rules and Regulations.

The Wiring Rules in Papua New Guinea are gazette as P.N.G., Standard 1022. This standard is a formal adoption of Australian Standard 3000-1986 Wiring Rules.

13.2 DATE EFFECTIVE

AS3000-1986 became effective in Papua New Guinea on 1st January 1987 and was in force with AS3000:1981 until 1st January 1988, when AS3000:1981 was withdrawn.

AS3000: 1986 was in force with AS3000:1991 until 1st January 1993 when AS3000:1986 was withdrawn.

AS3000:1991 was in force with AS3000:1996 until 1st January 1998 when AS3000:1991 was withdrawn

AS3000:1996 was in force with AS3000:2000 until 1st January 2001 when AS3000:1996 was withdrawn

AS3000:2000 was in force with AS3000:2007 until 1st January 2007 when AS3000:2000 was withdrawn

13.3 REFERENCES

All references to the P.N.G. Wiring Rules or AS/NZS Wiring Rules in Electrical Instruction or Trade Circulars, issued by Regulatory Services of PNG Power, refer to AS/NZS 3000 2007 as amended from time to time.

13.4 STANDARDS ADOPTED

Copies of all relevant standards as adopted by Papua New Guinea are available, from the National Institute of Standards and Industrial Technology (NISIT) P.O. Box 3042 BOROKO, National Capital District. Phone 3231852 BH.

13.5 OTHER STANDARDS

Other standards called up or referred to in the Wiring Rules shall be regarded as being formally adopted for use in Papua New Guinea under the requirement of the Electricity Industry Act, and the National Standard Act.

Engineering Standard: HQH-GCA 005
First Issued: 28.08.1981 Reviewed & Reissued: 30.06.1987, 14.06.2016

TRADE CIRCULAR 14 BANNING OF ELECTRIC HOT WATER SYSTEMS AND
CONDITIONS FOR THE INSTALLATION OF BOOSTER
ELEMENTS FOR SOLAR UNITS

14.1 GENERAL

14.1.1 Application

The Electrical Trade Circular No.14 instructs complete banning and installation of new electric hot water systems in Domestic, Industrial and Commercial Installation throughout the country is still current.

The other forms of energy are to be utilized for water heating and the National Executive Council has approved that where possible, solar hot water systems are to be installed in preference to other systems.

14.2 BOOSTER ELEMENTS FOR SOLAR UNITS

Booster elements are permitted for solar units provided they are installed within the requirements of this Instruction/Circular.

The above does not prevent PNG Power from banning installation of electric boosters in situations where power supply may become critical, contractors should check with their local PNG Power office if in doubt.

14.2.1 Solar Hot Water System includes 300 Liters Storage Capacity

Solar hot water systems up to and including 300 liters storage capacity are restricted to booster elements of **ratings up to 2.4KW** provided a one cycle (shot) temperature operated switch of a type approved by PNG Power is installed in a position convenient to the Consumer, to control booster element operation.

On completion of heating cycle, the switch must **disconnect** the supply to the booster element and **another** heating cycle must only commence when the switch is **manually reset**.

14.2.2 Solar Hot Water Units System Larger than 300 Liters

For solar hot water units of a capacity larger than 300 liters requiring bigger booster elements approval of PNG Power must be sought before installation of such elements. In particular combined solar / electric systems for multi floor buildings are permitted subject to approval of the design by the Manager Regulatory Services, and prior to any installation occurring. This is usually done during the planning stage of the project.

PNG Power requires an isolating switch **adjacent to the booster element connection** on the solar unit, located on the roof, or storage area to isolate supply to the element terminals, for maintenance purposes.

14.3 STORAGE, SINK AND SHOWER HEATERS

Installation of the above electric systems is **still completely banned. No new systems are to be installed**. Replacement of unserviceable parts in these systems is permitted, however it is strongly recommended that where possible a central solar hot water system be installed in lieu of the above electric system.

14.4 EXCLUSIONS FROM THE BAN

The ban does not include one cycle one use type appliances' like electric kettles, washing machines, tea urns, SPA pools or the like, which have built-in heating elements that take a supply of ambient temperature water and heat cycle one use operation.

14.5 SPA TYPE APPLIANCES PERMITTED

In the case of SPA pool type appliances', used in Papua New Guinea, where ambient water temperature average 25 degrees Celsius, the maximum size heating element permitted shall be 3KW.

14.6 IMPLEMENTATION OF THE BAN

The ban is applicable to electric hot water storage cylinders or shower heater units installed prior to implementation of the ban (August 1981). It is fairly accurate to assume that units no longer exist either replaced or removed.

This exemption does not permit the replacement of gas or oil fired storage units with electric types.

14.7 EFFECTIVE DATE FOR IMPLEMENTATION

This circular is effective as of the date of issue of this 4TH Edition of the Electrical Trade Circular. Previous circulars plus appendix and amendments if any, are now superseded.

Engineering Standard: HQH-GCW 017

First Issued: 19.09.1986 Reviewed & Reissued: 31.12.1987, 14.06.2016

TRADE CIRCULAR 15

EARTHING OF PRE-FABRICATED METAL-CLAD AND METAL STRUCTURE BUILDINGS

15.1 GENERAL

15.1.1 Application

The Trade Circular No.15 highlights why Pre-Fabricated Metal-Clad and Metal Structure Buildings should be earthed and why it is important that earth continuity is maintained to "exposed" metal parts of these buildings. This should include all sections of metal cladding plus window and door frames.

15.2 BONDING EARTH LINK

A bond from the earth link to the building frame adjacent to the Switchboard or meter box is acceptable, provided earth continuity is effective throughout the building and is not reduced by insulating material poor contact of joining metal parts or for any other reason.

15.3 EQUIPMENT MOUNTED ON METAL CLAD WALLS

Where electrical accessories or equipment are mounted on metal clad walls, then to maintain earth continuity it may be necessary to connect an earth conductor to each individual wall, architrave or window frame.

15.4 METAL STRUCTURE BUILDING

The structural metalwork forming the frame of a dwelling shall be earthed.

The parts of structural metalwork, including conductive building materials, shall be earthed where

- (a) The risk of contact with live parts of electrical equipment or insulated, unsheathed cables exist; or
- (b) Double insulation of cables in contact with structural metalwork is not permanently and effectively maintained.

The breaking of a conductor at the termination shall not result in contact between unearthing conductive building materials.

15.5 PROTECTIVE EARTHING

The protective Earthing should be provided in compliance to AS/NZ 300:2007 Rule No. 5.5.3.3

15.6 PREFERRED CONNECTION

This connection should preferably be made using a metal thread, nut and cutting washer.

15.7 ELECTRICAL CONTRACTOR TO CARRY OUT OWN TEST

Contractors are required to carry out their own continuity test prior to inspection, as a negative test by the Inspector will result in a defect being issued by the Inspector.

15.8 CONVERTED STEEL SHIPPING CONTAINERS

This instruction includes steel shipping containers which have been converted into portable buildings.

Engineering Standard: HQH-GCW 016
First Issued: 10.09.1981 Reviewed & Reissued: 31.12.1987, 16.06.2016

TRADE CIRCULAR 16**USE OF NON-METALLIC CONDUIT IN UNDERGROUND AND OTHER WIRING SITUATIONS****16.1 GENERAL****16.1.1 Application**

The Trade Circular No.16 outlines PNG Power policy with regard to non-metallic conduit, its application, use type and special treating. (Example, Rigid PVC non-metallic conduit)

16.2 REQUIREMENT FOR APPROVAL

All rigid non-metallic conduits must be submitted for approval to PNG Power's Approvals Section, before sale or use in Papua New Guinea.

Samples of both heavy and light duty non-metallic conduit must be accompanied with a Test Certificate from an accredited Testing Laboratory, certifying that it complies with the relevant Test Specification as laid down in AS/NZS 2053.1:2001. On Approval, a certificate of suitability will be issued by PNG Power, and the item placed on PNG Power list of approved electrical appliances and materials.

16.3 MARKING

All rigid non-metallic conduit, must be clearly and indelibly marked with the manufacture name, Trademark or other identifiable symbol, the nominal size, and its mechanical classification,

Example:

Light Duty (or LD), Heavy Duty (or HD) and the word "ELECTRICAL". The marking must appear at least once on each manufactured length of conduit.

16.3.1 Colour**(a) Light Duty Conduit.**

Conduits that are exposed to the sunlight shall be light in color and not darker than color No. 10 of AS1433. Where the need for additional mechanical protection is obvious, heavy duty conduit must be used, and where the color differs from AS1433, must be painted with a light-colored water-based acrylic paint.

(b) Heavy Duty Conduit

As this type of conduit is intended for a category 'A' system of enclosure, underground, the colour shall be **light orange** (Colour No. 557 of ASK 185)

which is the colour specified in AS1345 for the identification of **Electrical Conduits**. Again Attention is drawn to the need for **painting** of light orange conduit where exposed to direct sunlight.

16.4 FITTINGS

All fittings such as Elbows, bends, tees, junction boxes etc., must comply with AS/NZS2053 and all the proceeding conditions applicable to non-metallic conduit including marking and colour. **Light Duty** fittings or conduit shall not be used on an underground **Category 'A'** application. Table 3.5 of the wiring Rules, outlines permissible systems for underground wiring; and use of light duty conduit and fittings underground requires **Category 'B'** Mechanical Protection.

16.5 USE OF PVC WATER PIPE DRAINAGE PIPE, OR ASSOCIATED FITTINGS

Use of the above types of PVC pipe or fitting as Electrical conduit is not permitted, as it does not comply with the requirements of marking, coloring, or specific tests, laid down for non-metallic conduits.

Its use as an open-ended duct, through a concrete slab is permissible however, provided it contains either sheathed cables or complete conduit runs.

Under no circumstances are single insulated cables to be installed in the above types of PVC pipe, either underground / above ground or in concrete slabs.

Other References

Attention is drawn also to Trade Circular No. 17.

Engineering Standard: HQH-GCW 010
Reviewed & Reissued: 30.09.1988, 16.06.2016

TRADE CIRCULAR 17 LOW VOLTAGES UNDERGROUND SERVICES INSTALLATION CONDITIONS

17.1 GENERAL

17.1.1 Application

The Trade Circular No. 17 provides conditions that primarily apply to single underground services from an overhead system as and when such method of installation is considered and do not relate to underground services from an underground supply.

17.2 ELECTRICITY INDUSTRY (SERVICES AND INSTALLATION) REGULATION

The Electricity Industry (Services and Installation) Regulation 2006 states the following:-

SECTION 18 "The route of the consumer's line and the point of connection in the electrical installation shall be as determined by the electricity undertaker to whose supply of electricity the electrical installation is to be connected".

SECTION 21 "Where under these Regulations, a consumer erects or causes to be erected a consumers' line, the line shall conform to the following specifications:-

- (a) The consumer's line shall not be of a smaller cross-sectional area than the service line of the relevant electricity undertaker to which it is connected.
- (b) The drop in voltage along a conductor shall not, when the conductor is carrying the maximum required current, exceed 3 volts.
- (e) The line must comply with Wiring Rule No. 3.11.

17.3 SERVICE ROUTE OTHER THAN EXISTING PNG POWER SERVICE ROUTE

Where PNG Power has electricity available from an overhead system and the consumer wants it underground, the consumer shall bear the total cost of all the service necessary to provide the underground services from that overhead supply as assessed by PNG Power.

17.4 MAINTENANCE COST OF CUSTOMER SERVICE

Where a consumer is required by ETC 17.2 or ETC 17.3 to bear the cost of service type, the consumer is responsible to pay in addition to the cost all maintenance

costs as assessed by PNG Power, in respect of the lines or poles for which he is required to bear the cost.

17.5 RESPONSIBILITY FOR INSTALLATION

All work including future maintenance, involved in the installation of an underground service, other than jointing and /or connection to the reticulation, shall be carried out by the Licensed Electrical Contractor engaged by the customer. However, where PNG Power considers it desirable, having regard to the circumstances of the cases concerned, it may elect to carry out such work itself, using its own materials.

Where the work is carried out by a Licensed Electrical Contractor, he shall comply with the following requirements:-

- (a) Contractor shall give at least seven days notices before commencing the work, which shall be carried out by licensed competent personnel.
- (b) Contractor shall not commence any trenching until the route of the service has been approved by PNG Power.
- (c) Contractor shall carry out all necessary negotiations with the various public bodies prior to opening the road or footpath and shall take out the necessary road opening permits.

The public bodies such as:

- (i) Department of Works
 - (ii) Department of Police
 - (iii) Telikom
 - (iv) PNG Power Ltd
 - (v) Local Level Government
 - (vi) Local Town/City Authority
 - (vii) Water PNG/Eda Ranu
- (d) Contractor shall supply all cable and other materials required.
 - (e) After the cable is laid, he shall arrange for an inspection to be made by the Installation Inspector and **shall not commence backfilling** until authorized to do so after such an inspection has been made.
 - (f) He shall erect on the reticulation pole nominated by PNG Power, the first 2.4 meters of the service cable above ground which will be bolted or clamped to metal brackets which PNG Power may weld to the pole.
 - (g) He shall include plastic conduit protection (where applicable) and galvanized iron (G.I.) pipe protection and shall arranged with the area Manager of PNG Power for the balance of the cable to be left in the

manner required for connection to the reticulation. However, PNG Power may elect to carry out such work itself at the consumer's expense.

- (h) PNG Power shall erect on the reticulation pole, the section of service cable above the 2.4 meter level and any associated junction or terminal boxes. (As required by ETC 17.3, the consumer shall be responsible for the cost of this work). Refer to **Figure 17.1** for Engineering Condition.

17.6 ENGINEERING CONDITION

17.6.1 Route

The route of all underground services shall be to the satisfaction of PNG Power. Where possible, the underground cable route shall be in accordance with the Standard Engineering Service alignment of 1100mm. An example of underground services is shown below:-

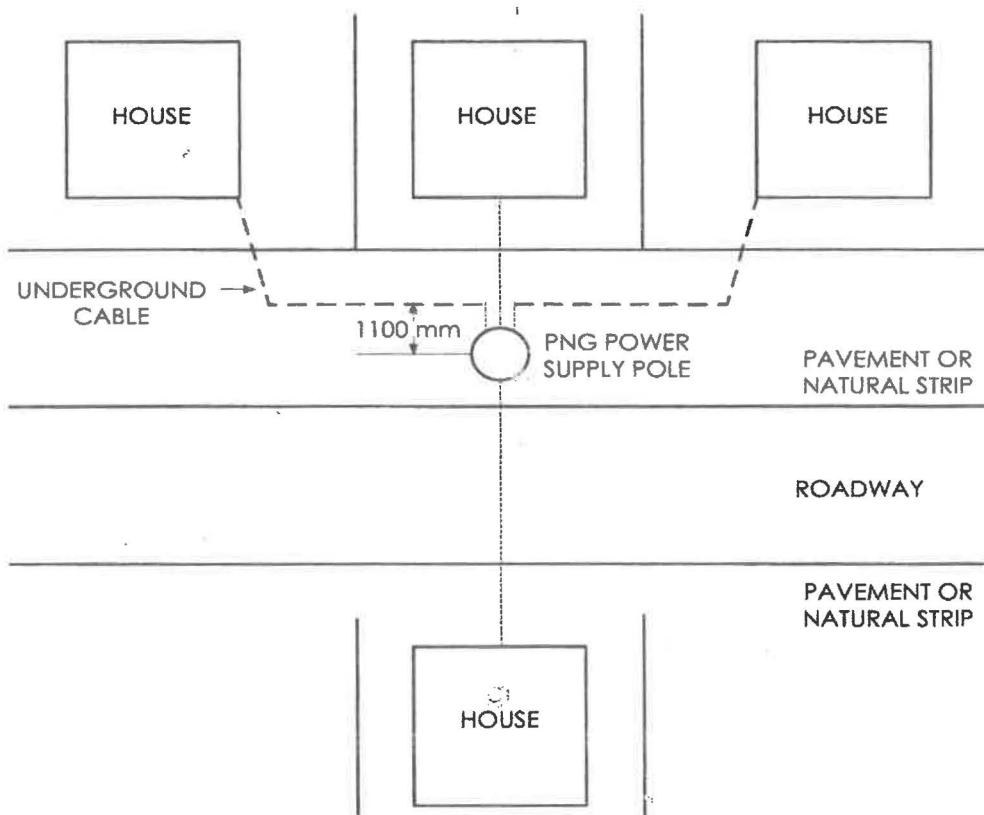


Figure 17.1

Figure 17.1 Show the engineering condition of underground service

- 17.6.1.1 In planning the route, due weight should be given to – possible future relocation of pole, ease of locating and repairing possible faults, requirements of consumer, capital costs, etc.

17.6.2 Service Boundary

Except for the section between the reticulation and the property boundary, all service cable shall normally be kept within the property owned or occupied by the consumer. However, if the circumstances of a particular case render it desirable for the service to cross other property, PNG Power may agree to such crossing provided the consumer obtains and lodges with PNG Power the written consent of the owner of the property concerned.

17.7 CABLE.

The minimum conductor size shall be 6mm² copper or equivalent conductivity aluminum. Any one of the following types of cable may be used:

- (a) Paper insulated, lead, lead-alloy or aluminum sheathed, armoured or unarmoured, served, of 0.6/3kV in accordance with AS/NZS 2893-2002 and AS/NZS 5000.1.1999.
- (b) P.V.C, insulated cable in accordance with AS/NZS 5000.1.1999 of the following types:
 - (i) 0.6/1kV single or multi-core, lead alloy sheathed and serviced (armoured or unarmoured) – Table 17 and 18 AS/NZS 3008.1. 2009
 - (ii) Two-core P.V.C. insulated and sheathed Tables 8 and 9 AS/NZS 3008.1.1 2009
 - (iii) Three-Core and Four – Core P.V.C. insulated and sheathed Table 10 and 11 AS/NZS 3008.1.2009
 - (iv) 0.1/kV P.V.C, insulated, bedded, tape or wire armoured, P.V.C served Tables 10 and 11 AS/NZS 3008.1. 2009
- (c) 0.6/1kV P.V.C double – insulated neutral screened cable:-
 - (i) Up to 16mm² in accordance with AS/NZS 4961:2003.
 - (ii) Above 7/1.70 conductors size – generally in accordance with AS/NZS 5000.1.1999 and AS4161-2003 and approved by PNG Power.
- (d) Mineral insulated metal sheathed cable AS/NZS 60702.1.2005 served with P.V.C or enclosed in bitumen filled toughing.
- (e) Solid Aluminum Conductors
 - (i) Solid Aluminum Conductors, P.V.C insulated aluminum or copper neutral screened, P.V.C sheathed cable.
 - (ii) Solid Aluminum Conductors, P.V.C insulated aluminum or steel armoured, P.V.C sheathed cable.
 - (i) and (ii) above, to AS/NZS 5000.1.1999 and as approved by PNG Power.

Aluminum neutral screen and armoring must be coated with approved corrosion inhibitor.

- (f) Any other cable as may be approved by PNG Power.

Note: 1. If aluminum conductor cables are used, special termination may be required:-

- a) Where the cable is to be connected by PNG Power to the overhead pole line, it shall be terminated in an approved weatherproof joint with copper tails for connection to fuses, where suitable type line material is made available, such as bi-metallic crimp lugs, shall connect directly into the fuse.
- b) For details of the consumer's end termination it will be necessary for the Licensed Electrical Contractor to contact the appropriate officer of PNG Power in the Centre concerned.

17.7.1 Aerial Bundled Cable

The Aerial Bundled Cable, abbreviated ABC, shall not be installed underground for any service purposes whatsoever in Papua New Guinea.

17.8 TERMINAL BOXES, JOINTS AND SUNDRY MATERIALS.

- 17.8.1** All such material shall be to the satisfaction of PNG Power.

17.9 LAYING AND PROTECTION OF CABLE.

- 17.9.1** All cables shall be laid at the following minimum depths:-

- (i) Metal sheathed cable – 450mm
- (ii) Non-metal sheathed cable – 600mm

The depths shall be measured from the top of the cable to the surface of the ground.

17.9.2 Cable Crossing Public Roads

Except as provided in ETC 17.9.6 (where cables cross under public road ways) all cables shall be laid side by side and bedded on not less than 50mm of sand or fine top soil free of stone.; and shall be covered by not less than 50mm and not more than 75mm of such material. In addition, they shall be protected by reinforced concrete cover slabs in accordance with Rule 3.11.4 of the AS/NZS Wiring Rules and shall be laid on top of the sand or fine soil with the ends butted firmly together and the edges overlapping the cables on each side for a distance of not less than 40mm.

17.9.3 Cables Position and Protection on Pole End

At the pole end, all cables shall be placed on the footpath side of the pole or in such position as directed by the appropriate officer of PNG Power and shall be so located that they are not liable to mechanical injury from vehicular traffic.

P.V.C type cables shall be enclosed in a plastic conduit from the uppermost point to a point in the ground 800mm horizontally from the pole.

17.9.4 Mechanical Protection Required Where Applicable

All cables (including plastic conduit where applicable) shall be enclosed in a galvanized iron water pipe from 2400mm above the ground to 290mm below. Such pipe shall be of internal diameter at least 13mm greater than the outside diameter of the complete cable which it is enclosing and shall be securely fixed by means of 25mm x 7mm or larger metal saddles which shall be bolted or saddled to the metal brackets on the pole.

17.9.5 Cable Protection at the House End

At the house end, cables shall be protected either in a manner similar to that specified for the pole and as above or by virtue of their position, e.g., in a cavity wall, or as directed by PNG Power.

17.9.6 Cables Cross Under Public Road Ways Required Protection

Where it is necessary for cables to cross under public roadways, the normal practice shall be to enclose them in glazed earth ware piping, which shall be bedded, covered and protected by cover slabs in a similar fashion to that provided for direct buried cables.

In special circumstances where departure from this normal practice is necessary (e.g., where it is required to bore beneath the road), other suitable piping and associated methods of bedding and protection may be used, as approved by PNG Power.

17.10 FUSING

Service fuses shall be installed by PNG Power at commencement of an underground service.

17.11 OVERHEAD SERVICE TO PROPERTY POLE TO UNDERGROUND MAINS.

Where an overhead service is available and the consumer requires an underground service to the point of attachment or point of entry, the following shall apply:

- (a) A servicing fee shall be applicable as laid down in Electrical Trade Circular No.12 Engineering Standard HQH-GCB 013.
- (b) The consumer shall bear the cost of erection and maintenance of the property pole and all other costs incurred to provide the underground

service from the overhead supply on the property pole to the point of entry to the building.

- (c) The Electrical Contractor shall leave sufficient cable on the underground service to allow connection to the overhead aerial supply where cables are large and require special jointing techniques the contractor may be required to carry out the joint, but the contractor is required to supply any special materials that may be needed. An example of an installation shown in Figure 17.2 below:-

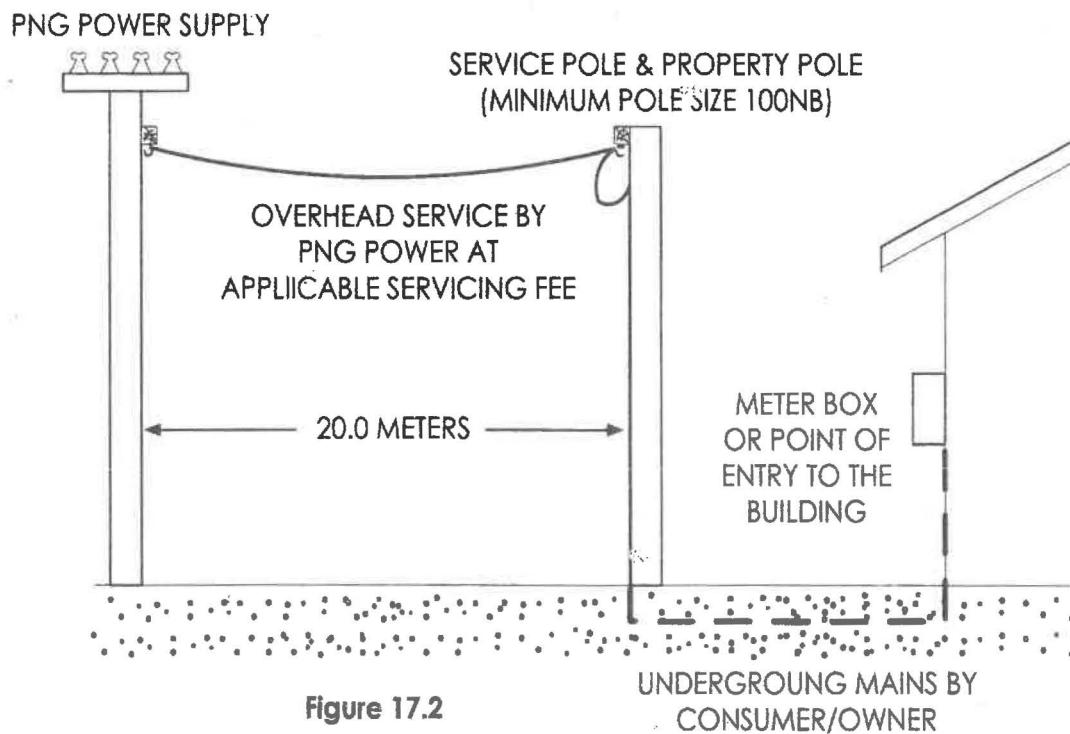


Figure 17.2

Figure 17.2 Show public bodies and re-opening roads or pathways

Engineering Standard: HQH-GCW 009
Reviewed & Reissued: 31.12.1987, 16.06.2016

TRADE CIRCULAR 18**WIRING IN ROOFS - POSSIBLE "LIVE" ROOFS**

18.1 GENERAL**18.1.1 Application**

Trade Circular No.18 provides test procedure required to prove metal roof is electrically safe.

18.2 LIVE ROOF POSSIBILITIES

Roof constructions do create situations where nails, drilling and screwing which is a common form of fixing these days could penetrate cables run in the ceiling space, and create the situation of a "Live" roof, when the installation is energized and so the roofs must be test proven to be electrically safe.

18.3 INSTALLATION TEST

A **test must be carried out**, after the installation has been energized, even if all sub circuits, consumer mains and sub-mains appear clear after a merger test, at the switchboard.

18.4 TEST PROCEDURE

The following is test procedure:

- (a) Treat all roofs as being energized at 240 volts until proved otherwise.
- (b) Warn all workers, that the installation is to be energized.
- (c) Energized the installation with all circuits switched on.
- (d) Using a trailing lead connected to the main earth electrode, and one side of a multi range voltmeter, (which has a 10 volt scale and a mains voltage scale), and the other side of the voltmeter connected to an insulated test stick with metal contact spike, measure the potential between the roof and the main earth electrode.

NOTE:

1. If the measured potential is in excess of two volts, the installation should be checked thoroughly.

It is important to note that 'out of balance' situations do cause small potential to be present, and such must be reported.

2. The Electrical Installation Inspector must conduct this test however this does not excuse the electrical contractor from conducting this test prior to the inspector to be satisfied that the roof will not be

energized by either low voltage buzzer continuity tests or other means.

3. Before metallic ladders or scuffles are allowed to be rested on iron roofs of buildings already connected to power supply for the purpose of work it is a must to conduct 'Live Roof Test' to affirm that the roof is safe for work access.

Engineering Standard: HQH-GCA 006
First Issued: 30.09.1988 Reviewed & Reissued: 16.06.2016

TRADE CIRCULAR 19 SWITCHGEAR ASSEMBLIES

19.1 GENERAL**19.1.1 Application**

The Trade Circular No.19 is on standard dealing with switchgear assemblies with reference to Section 2 of the AS/NZS Wiring Rules 3000, AS 2650 High voltage switchgear and control gear and AS3439 "Low-voltage switchgear and control gear assemblies", covers it explicitly.

19.2 MANUFACTURING SWITCHBOARD CONTROL ASSEMBLIES

Manufacturing switchboard control assemblies (SCA) installed in Papua New Guinea must comply with both the Wiring Rules and any applicable standard called up in Appendix 'A', 'C' or 'G'

19.3 ELECTRICAL CONTRACTOR OR ELECTRICAL CONSULTANTS RESPONSIBILITY

It shall be the Electrical Contractor or Electrical Consultants responsibility to ensure that any SCA manufactured either in Papua New Guinea or off-shore, comply with the following performance verification tests as a means of demonstrating the safe operation of the SCA.

- (a) Segregation.
- (b) Temperature rise.
- (c) Dielectric properties
- (d) Short-circuit capacity
- (e) Clearance and creepage distance.
- (f) Mechanical operation.
- (g) Degree of protection.
- (h) Earthing Circuit
- (i) Fault Level

19.4 SWITCHBOARD AND CONTROL ASSEMBLIES (SCA) PERMANENT LABELING

The manufacturer must affix a permanent label (that cannot be removed or painted out) to the SCA to declare that it complies with the requirements of the Wiring Rules and all standards called up.

Incorporated on the label must also be the segregation category of the SCA – either Form 1, 2, or 3.

NOTE:

1. SCA's that are not marked or labeled accordingly will be rejected.
2. Importers of large complex SCA's into Papua New Guinea must therefore be extremely confident that the SCA meets the customer's requirements for safe continued operation. The rejection of an SCA at final inspection could cause extreme financial and technical hardship for a customer, and compliance with the Wiring Rules at design stage is vital.

Engineering standard: HQH-GCW 006
Reviewed & Reissued: 30.09.1988, 16.06.2016

TRADE CIRCULAR 20 INTERNAL METER RETICULATION, POLES SIZE AND RAISERS
FOR AERIAL CONDUCTORS

20.1 GENERAL

20.1.1 Application

The Trade Circular No.20 outlines the requirements of APPENDIX D, of AS/NZS 3000/2007 Wiring Rules with regard to pole sizes and extensions to structures (Raisers) which are considered excessive for low voltage metered and unmetered overhead reticulation in Papua New Guinea.

This circular sets out the minimum requirements to this regard.

20.2 POLE REQUIREMENT

20.2.1 Minimum size

With the exception of raiser, the minimum size steel pole is 100NB (100 Nominal Bore), heavy gauge 4.5 mm pipe, and where a stronger pole is to be used; PNG Power should be contacted for approval, if in doubt.

20.2.2 Maximum height above ground

The maximum permissible height out of the ground will be 7.5 meters. PNG Power practice utilizes three, 6 meter lengths of 100NB water pipe to make two 9 meter poles.

20.2.3 Minimum depth in the ground

Minimum depth in the ground shall be 1.7 meter.

20.2.4 Maximum angle of deviation with an un-stayed pole

The Maximum deviation allowed with an un-stayed pole will be 2 degrees.

20.2.5 Maximum angle of deviation with a stayed pole

The Maximum deviation allowed with stayed poles will be 20 degrees.

20.2.6 Minimum size of un-stayed termination poles

A 100 NB pole is not acceptable at a point of termination if it is un-stayed. In this case the minimum pole size would be 150 NB.

20.2.7 Minimum specification for stays and stay anchors

Concrete stay-anchors must be manufactured to the minimum specification were stay rod and bow must be 16mm diameter, and 2.4 meters in length. Stay

wire must be galvanized, a minimum of 7/2/75, and manufactured from high tensile steel.

20.2.8 Minimum clearance

The clearances given below are for covered and bare active conductors, at a voltage not exceeding 650 volts whilst clearances for Neutral and Insulated active conductors are contained in Table 3.8 of the AS/NZS Wiring Rules.

20.2.8.1 Over Roads

The minimum clearance negotiable by vehicles is 5.5 meters, and over locations not negotiable by vehicles is 4.6 meters.

20.2.8.2 Above Floors or Structures

- (a) The minimum vertically clearance above any part of any floor of an unroofed structure which is normally accessible to pedestrian traffic only, is 3.7 meters.
- (b) The minimum vertically clearance above any part of any roof or similar structure, not normally accessible, but on which a person may stand is 2.7 meters.

20.2.8.3 Any Direction

- (a) Not Normally Accessible

In any direction from blank walls or other structures not normally accessible to persons is 0.6 meters.

- (b) Normally Accessible

In any direction from any part of a structure normally accessible to persons, including window openings, balconies and similar places of resort, is 1.5 meters.

20.3 CONDUCTOR SPAN.

The Span will be taken as the average of the spans on either side of the pole in question.

20.3.1 Maximum

Given in Table 20.1 is maximum permissible spans & current rating for bare, hard-drawn copper and aluminum conductors as applied to 100NB Poles.

Conductors of greater size than those given in this table may not be used with poles of 100 NB pipe.

No span is to exceed 60.3 meters.

Table 20.1 Show maximum spans & current ratings for bare copper and aluminum conductors as applied to 100NB poles.

Conductor		Current Rating @ 1.6KM/HR, W/v	Maximum Span Available
Size	Nominal Area mm ²		
6/1/3.75	65mm ² Aluminum	255 Amps	31.9 Meters
6/1/3.0	45mm ² Aluminum	210 Amps	39.2 Meters
7/2.75	40mm ² Copper	225 Amps	31.9 Meter
7/2.00	25mm ² Copper	170 Amps	54.7 Meters
7/1.75	15mm ² Copper	125 Amps	60.8 Meters

20.3.1 Maximum spans for other types of aerial conductors.

Maximum Spans for other insulated types of aerial conductors are contained in AS/NZS: 3000: 2007 Table 3.9 of the Wiring Rules.

20.3.2 Spacing between aerial conductors.

Spacing between conductors at supports measured in any directions is contained in AS/NZS: 3000: 2007 Table 3.10 of the Wiring Rules.

20.4 RAISER OR EXTENSIONS TO STRUCTURES.

The minimum height of the point of attachment of a covered aerial service to a building **shall be 3 meters**. Where this height cannot be attained due to the structure of the building etc., then a Raiser must be fitted. The height of this Raiser may also be dependent on clearances as in TC 20.2.8. However, Table 20.2 of ETC 20 may be taken as a guide to the size of the required raiser or extension.

Table 20.2 Guide to the size of the required raiser or extension

Length of Raiser	Number and Size of Conductors				
Free Length of Raiser	2 x 7/1.04 or 2 x 7/1.35	3 x 7/1.04 or 3 x 7/1.35	4 x 7/1.04 or 4 x 7/1.35	4 x 7/1.70 or 4 x 19/1.35	4 x 19/1.78 or 4 x 19/2.14
Not Exceeding	Size of Pipe (NB = Nominal Bore)				

1.2m	50NB	50NB	50NB	50NB	50NB
1.8m	80NB	80NB	80NB	80NB	80NB
2.7m	100NB	100NB	100NB	100NB	100NB
4.5m	100NB	100NB	100NB	100NB	100NB
6.3m	150NB	150NB	150NB	150NB	150NB

NOTE:

The Installation Inspector or the Regulatory Services Engineer must be advised as to any variation to the above table.

20.4.1 Minimum size fascia board

Raisers fitted to the fascia board must have a hardwood support (Minimum size is 100mm x 50 mm) supplied by the Contractor and placed behind the fascia board, and firmly secured to the rafters.

20.4.2 Raisers fitted to brick or concrete walls

Raisers fitted to brick or concrete walls must be securely bolted in two places to prevent movement during tensioning of Aerial Conductors.

20.4.3 Where brace or stay-wire required

Certain cases may arise where a brace or stay wire may be required, in which case the Installation Inspector will use their own discretion as to type etc.

20.4.4 Material

Normally galvanized water pipe would be acceptable. Wiring Rule 3.12.5.3 states:

Hardware - any hardware or fitting used in association with the Aerial Line shall be of non-corrosive material or other material suitably protected against corrosion, (See also Wiring Rule 3.12.5.1)

20.4.5 Earthing of raisers

A metal raiser or rafter bracket or similar conducting material which supports aerial conductors need not be earthed if it is mounted on timber and has at least 25mm clearance from metal roofing, flashing, guttering or other metallic parts of the building. If it is within 25mm of a metallic portion of a building it must be effectively earthed.

If the bracket is in contact with a roof or guttering, the bracket must be earthed. Alternatively, if the bracket is not earthed it should be separated from the

guttering or roof by at least 25mm. If a raiser has a guy fixed back onto a metal roof, then the raiser must be earthed.

20.5 DISTRIBUTION EARTHING SYSTEM

20.5.1 Metallic Distribution and Metered reticulation Poles

All metallic distribution system and metered reticulation poles carrying low voltage conductors (other than service pole carrying insulated conductors) shall be effectively bonded to the reticulation system low voltage neutral. The connection will be made using 7/2.75 H.D.B.C.C from the neutral conductor to the pole at the point 150mm below the lower cross arm carrying low voltage conductors. The connection will be made by using two split bolt clamps at the line end for H.D.B.C.C. neutral conductors, and one parallel groove clamp at the line end for A.C.S.R neutral conductors.

20.5.2 LV Reticulation Earthing Requirement

An electrode shall be installed at the last pole in each run of the reticulation system and at such poles that the electrode are not more than 360 meters line route length apart, provided also that there shall be an electrode at the end of every forth span. Each electrode shall be connected via 7/2.5 H.D.B.C.C conductor to the pole approximately 250mm above ground level, with a wire rope clamp at the pole end, and an approved connector at the electrode. This conductor shall be taken through the concrete pole foundation on new steel poles.

20.5.3 Earth Resistance at Substation

The earth resistance of the complete M.E.N system with substation or power station earthing system disconnected shall **not exceed 10 ohms** when measured at any location.

Further information is available from PNG Power Centre's and is contained in Distribution Electrical Instructions D3 and D16, available from the Manager Engineering Design, National Office.

Engineering standard: HQH-GCG 009
Revised & Reissued: 31.12.1987, 28.06.2016

TRADE CIRCULAR 21 LIMITED ELECTRICIANS LICENCE

21.1 GENERAL

21.1.1 Application

The provision of Electrical Trade Circular No.21 forms the considered special circumstances and conditions with regard to Limited Electricians License and therefore, this circular hereby supersedes Third Edition Electrical Trade Circulars 21, 26 & 32.

The requirements of limited license now take a revised meaning as a redress and control measure over concerned indiscriminate use as well as the imposition of validity with respect to specialization, validation of work permits and overseas licenses issued under AS/NZS wiring code.

21.2 WITHDRAWAL OF EXISTING LIMITED LICENSES

The existing Limited Electricians Licenses 'A' & 'B' issued to Communication and Electronic Technicians, Refrigeration Mechanics and Old Type Limited Electricians License are hereby withdrawn and holders must surrender such licenses to Manager Regulatory Services before December 31, 2017.

NOTE: Effective as of January 1, 2018 these limited licenses will no longer be valid.

21.3 LIMITED ELECTRICIANS LICENSE

Limited Electricians License when considered will be in accordance to the Electricity Industry (Licensing of Electrical Contractors and Electricians) Regulation 2006, for the performance of certain work that is stated in that license.

21.3.1 Application

Electrical trade person(s) requiring Limited Electricians' License must apply 1 month prior to any work engagement in the country and shall show proof of relevant documents such as:

- (a) Type of electrical qualification held,
- (b) Type of project or work been engaged in,
- (c) Duration of the project or work,
- (d) Validity of Electricians License (overseas license issued under AS/NZS Standard code),
- (e) Validity of Work Permit (where applicable), and
- (f) Any other necessary requirements of other relevant legislations.

Applications meeting the eligibility requirements stated in ETC 21.3.1 but limited to will be considered for process.

21.3.2 Non Compliance

PNG Power will take legal proceedings against those who do not comply with the requirements of the Licensing By-Laws.

Engineering Standard: HQH-GCM 004
First issued: 30.09.1988 Reviewed & Reissued: 17.07.2014 21.06.2016

TRADE CIRCULAR 22 INSTALLATIONS OF METERS, METER PANELS, FUSES & OTHER
METERING EQUIPMENT

22.1 GENERAL

22.1.1 Application

The provisions of Electrical Trade Circular 22 form the minimum standard in relation to selection and installation of metering systems that must be archived to satisfy this standard, either domestic, small and medium commercial premises or large industrial and commercial premises.

22.1.2 Selection and installation

The Electrical Installation Inspector shall determine the location of all metering equipment and will install the meter; this must be in a position readily accessible for reading, inspecting and testing purposes.

22.2 TYPES OF PREMISES

22.2.1 Domestic

(a) In the case of **domestic premises** fitted with:

- (i) Credit type kWh meter, the meter shall be so located as to allow access without entering the premises.

The meter shall be located in a meter-box on the external wall of the building at ground level in close proximity to where the service is terminated on the premises, preferably not exposed to direct sunlight.

For high post houses with post height of 2 meters or more the meter will be installed in a meter box suitably affixed to the post of the house or suitable structure under the house.

The main cable running from the service termination to the meter shall be protected in rigid PVC conduit and affixed to the exterior wall.

- (ii) Prepayment meter, the meter shall be located in a meter-box on the external wall of the building in close proximity to where the service is terminated on the premises and shall be installed by the Electrical Installation Inspector, preferably not exposed to direct sunlight.

The passive unit only with built in key pad shall be installed by the Electrical Contractor at a suitable location for tenant's convenience inside the building.

Appropriate cable size for the passive unit with the key pad will be

determined by the Electrical Installation Inspector depending on the distance.

22.2.2 Commercial

- (a) In the case of **small and medium commercial premises** fitted with credit type kWh meter, or prepayment meter:
 - (i) The meter shall be so located as to allow access without entering the premises.
 - (ii) The meter shall be located in a weather-proof meter-box on the external wall of the building in close proximity to where the service is terminated on the premises, preferably not exposed to direct sunlight.
 - (iii) The main cable running from the service termination to the meter shall be protected in rigid PVC conduit and affixed to the exterior wall.
- (b) In the case of **large industrial and commercial premises** fitted with:
 - (i) Normal credit type meter, the meter shall be so located as to allow access without entering the premises except where special provisions have been made and the premise is open during normal hours of business where the meter may be located within those premises.

NOTE: Where such a position has been selected, the consumer shall ensure that the conditions with regard to the accessibility of the meter which existed at the time of its installation are at all times maintained.

Where a switchboard on which is mounted PNG Power meter and other equipment is located outside an electrical installation the switchboard shall be enclosed in an approved weather proof box. When the switchboard is located inside and is likely to be damaged or affected by water then suitable type enclosure shall be erected for the adequate protection of the meter.

22.3 MINIMUM SIZE WEATHERPROOF METER BOX

22.3.1 Single phase meter

The minimum size weatherproof box or enclosure shall be 300mm x 300mm x 250 mm for any single phase meter and increase accordingly depending on numbers required, and shall not be locked unless in the opinion of PNG Power it is essential for the protection of the meter and other equipment, in which case PNG Power will supply and fit the lock.

22.3.2 Three phase meter

The meter box for any 3 phase installation shall be at least 300mm x 450mm x 450mm. The box shall be fitted with a hinged panel that shall have sufficient space in front to open the panel to 90 degrees.

22.3.3 Meter panel

The panel shall be of suitable insulating material such as zelemite or other approved materials. The panel depth shall be sufficient to close any protection door with adequate clearance for all meter equipment. Sufficient depth shall be maintained behind the panel to close and fix the panel without crushing any cables installed behind the panel. Wooden panels are not permitted.

22.3.4 Meter box

- (a) Meter boxes as stated in ETC 22.3.1 & ETC 22.3.2 above shall be of weatherproof construction and shall comprise of a fully enclosed metal box with hinged metal door. The meter box should be mounted such that the meter dial is at a height of 1.5 m to 1.65m or in a multiple meter location in such a position that the top of any meter is not more than 2.1m and that the bottom not less than 1.2m from the floor or ground level.

Where meter boxes of a different material type to that specified in ETC 22.3.1, ETC 22.3.2 & ETC 22.3.4(a), (b) are to be utilized, they must be submitted to the PNG Power Approvals Officer Section for approval of suitability for PNG Power metering equipment. If the material used in manufacture is of P.V.C or similar content, then appropriate test certificates must be obtained in all cases prior to installation of meter boxes.

In locations with adverse environmental conditions such as volcanic dust, special arrangements may be considered.

- (b) Meter boxes shall be constructed of galvanized iron having a minimum thickness of 0.80mm and shall be suitably braced with approved strengthening ribs or rolled edges.

The door of the box shall be hinged from the top and the other three sides shall have 13mm returns around the box.

A stay fastened to the door or box shall be provided to hold the door in the open position when necessary. This stay must be readily accessible. Internal and external hinges should be firmly attached by riveting. Spot welding is insufficient.

Hinges are to be fitted with suitable hard brass pins.

22.3.5 Meter box earthing

When installing these boxes, they shall be effectively connected to earth, unless double insulation is maintained, and efficient means shall be taken to render it impossible that the box shall become energized whether by reasons of defect, leakage or otherwise.

22.3.6 Meter box for several consumers

Where several consumers occupy one building or are supplied from one service,

the metering equipment will be fixed in a group or in groups in a box of sufficient size as approved by the Electrical Installation Inspector and properly labeled. However, Bulk Metering would normally be considered for such installations.

22.4 SERVICE CONNECTIONS

22.4.1 Minimum requirement

- (a) Only one service connection will be provided to each electrical installation.
- (b) The main cable running from the service termination to the meter shall be protected in rigid PVC conduit and affixed to the exterior wall.
- (c) The meter shall be located in a weather-proof meter-box on the external wall of the building in close proximity to where the service is terminated on the premises.

22.4.2 Bulk Metering of multiple installations of residential, commercial and institutional

With multiple installations of residential, commercial as well as institutional owned by a single landlord, inclusive those which are state owned will be bulk metered by PNG Power; and landlord may individually meter his/her client(s) with check meter. All meters or check meters in this case for any one building consisting of flats or home units are to be located at the one point in a position approved by PNG Power and correctly labeled. A requirement in ETC 22.4.1(a) applies.

(Refer Clause 27 of the Service and Installation Regulation). Where an underground main is installed refer to ETC 17 for installation and inspection.

22.4.3 Communal facility

If block of flats contain communal laundry facilities and /or security lighting, then these facilities may be separately check metered upon request of the Landlord.

22.4.4 Overhead service

If overhead services are requested and a service can be provided to each building from PNG Power overhead reticulation, then such services shall be provided on payment of the appropriate service fee as applicable to the type of service.

22.4.5 Large installations

In the event of a large installation containing a number of buildings served by formed roads each case should be referred to PNG Power.

22.4.6 Underground service

Where underground services are required (with exception of Aerial Bundled Cable (See Note 2 of TC 17.7(f))), then these will be paid for by the consumer (Reference Electrical Trade Circular 17 Engineering Standard HQH GCW010).

22.4.7 Single phase supply

Single phase supply will be installed for residences and small industrial/commercial consumers with no two or three phase equipment.

22.4.8 Two phase supply

Two phase supply will be installed for duplex buildings when necessary (excluding low cost housing).

22.4.9 Three phase supply

Three phase supply will be installed for blocks of three or more flats and large industrial/ domestic consumers.

22.4.10 Service protections

The present service fuse sizes supplied are 45 amps, 63 amps, 100 amps, 200 amps, 300 amps, etc. per phase. PNG Power will normally supply up to 100 amps for each installation but any higher requirements must be negotiated. The service fuses shall, except as otherwise directed, be supplied by PNG Power. They will be of the pole mounting type, and installed in position by PNG Power personnel.

22.5 CURRENT TRANSFORMER (C.T.) METERING – 100 AMPS AND OVER

Any installation with maximum demand exceeding the meter rating or 100 Amps shall be Current Transformer Metered.

22.5.1 Wiring of current transformer metering

The installation of Current Transformer (C.T.) Metering is specified in the following:

- (a) All the cables will be 2.5mm², stranded and of the correct colour coding.
- (b) The secondary return of each C.T shall be grey.
- (c) The voltage circuits or potential conductors shall be double insulated throughout their route.
- (d) C.T secondary wiring shall be as short as possible but should not exceed 10 meters.
- (e) C.T's tests blocks and meters will be supplied by PNG Power on receipt of the applicable service fees.
- (f) The meter shall be mounted at least 1.2 meters from the C.T's conductors or bus bars carrying current in excess of 100 amps, unless the meter is in the position which is fully shielded from all electrical fields. However, if without adequate shielding, refer Table 22.1 of this Electrical Trade Circular for the minimum spacing requirement.
- (g) Figure 22.8 shows Layout diagram for Current Transformer Metering cubicle and Figure 22.9 shows layout for three phase meter Current Transformer wiring diagram:

Conductor Current in Amperes	Spacing in Meters
100	0.15
150	0.3
250	0.6
300	0.9
1000	1.2
3000	1.8
Over 3000	2.4

Table 22.1 Show minimum spacing requirement for current transformer metering

All metering equipment shall be wired and installed by the Electrical Contractor to the Inspectors satisfaction. The metering equipment shall be tested and commissioned by the Electrical Installation Inspector. The test block shall be wired as per drawing (MD 3024) and mounted immediately adjacent to and in the same plane as the meter. Connecting wiring shall be enclosed by the test block cover. Surface wiring is not permitted.

22.6 WIRING OF METER PANELS

All wiring of meter panels, combined switchboard/meter panels must comply with AS/NZ Wiring Rule 2.9.6 and other applicable rules.

22.6.1 Service accessories and their conditions

Service lines, fuses, meters and the like supplied by PNG Power, remain the property of PNG power, after payment of the relevant service fee.

Where service lines, fuses, meters and the like have been supplied by the customer, the items become the property of PNG power, after the cost of these items had been properly accounted for.

Meter boxes, panels, links, etc., which remains the property of the consumer are all subject to the provisions of the Wiring Rules, and their condition is the consumers responsibility.

22.7 COMMON METERING ARRANGEMENT

22.7.1 The drawings that follow illustrate PNG Power's requirements with regard to metering of installations which consist of two or more metered sub-installations.

22.7.1.1 Two single-phase sub-installations

The Electrical Contractor should liaise with PNG Power Electrical Installation Inspector to determine whether a single or two phase service is to be provided.

- (a) Refer Figure 22.1 for **Single Phase Service** (total calculated maximum demand not exceeding 60 amps).

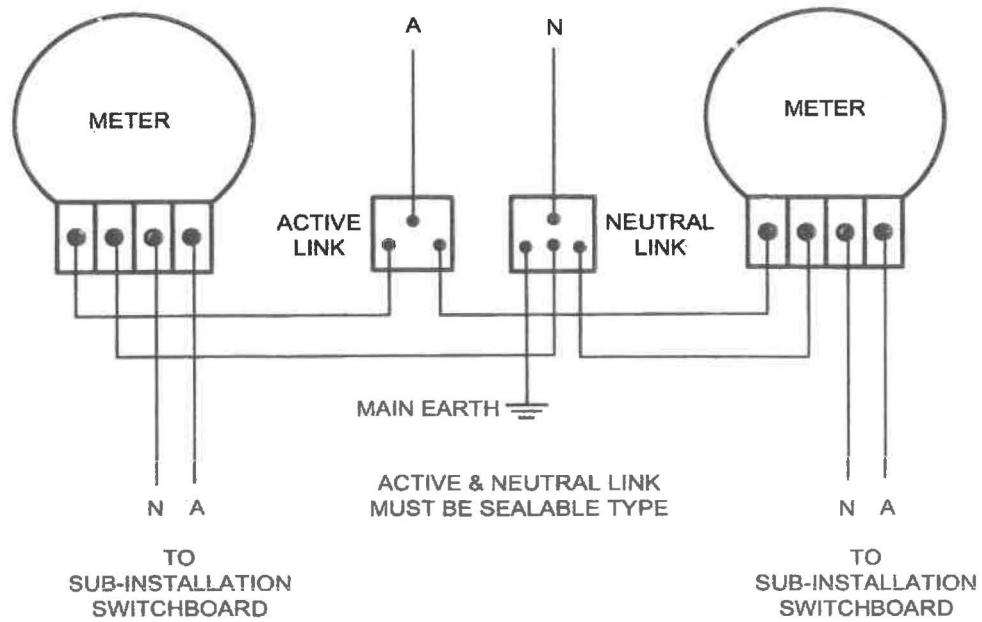


Figure 22.1 Show detail installation requirement for single phase service

(b) Refer Figure 22.2 for Two phase sub-installation requirement

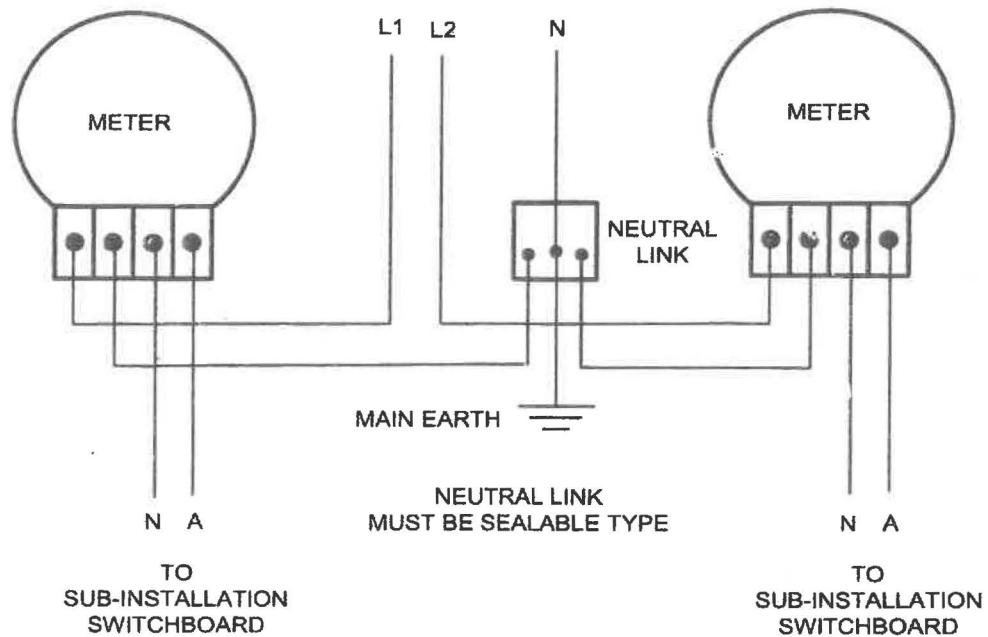
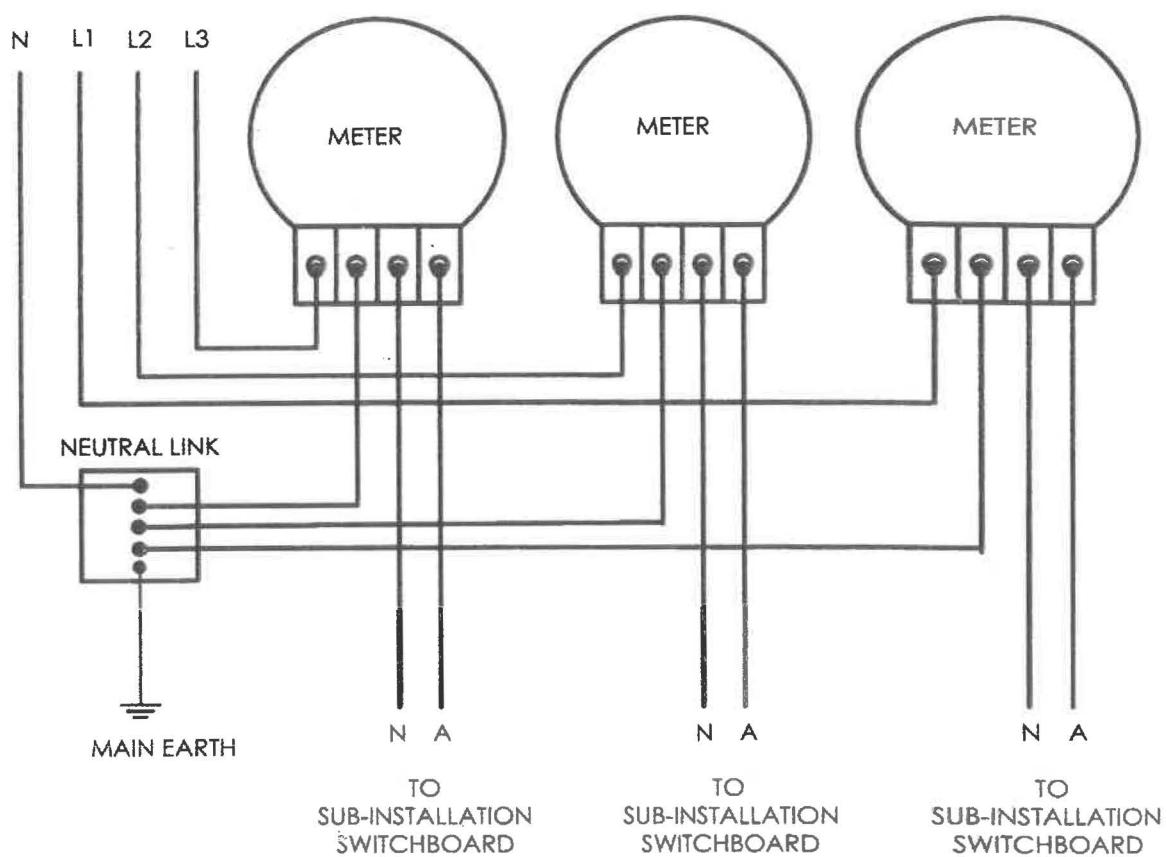


Figure 22.2 Shows detail diagram of two single phase sub-installation requirements

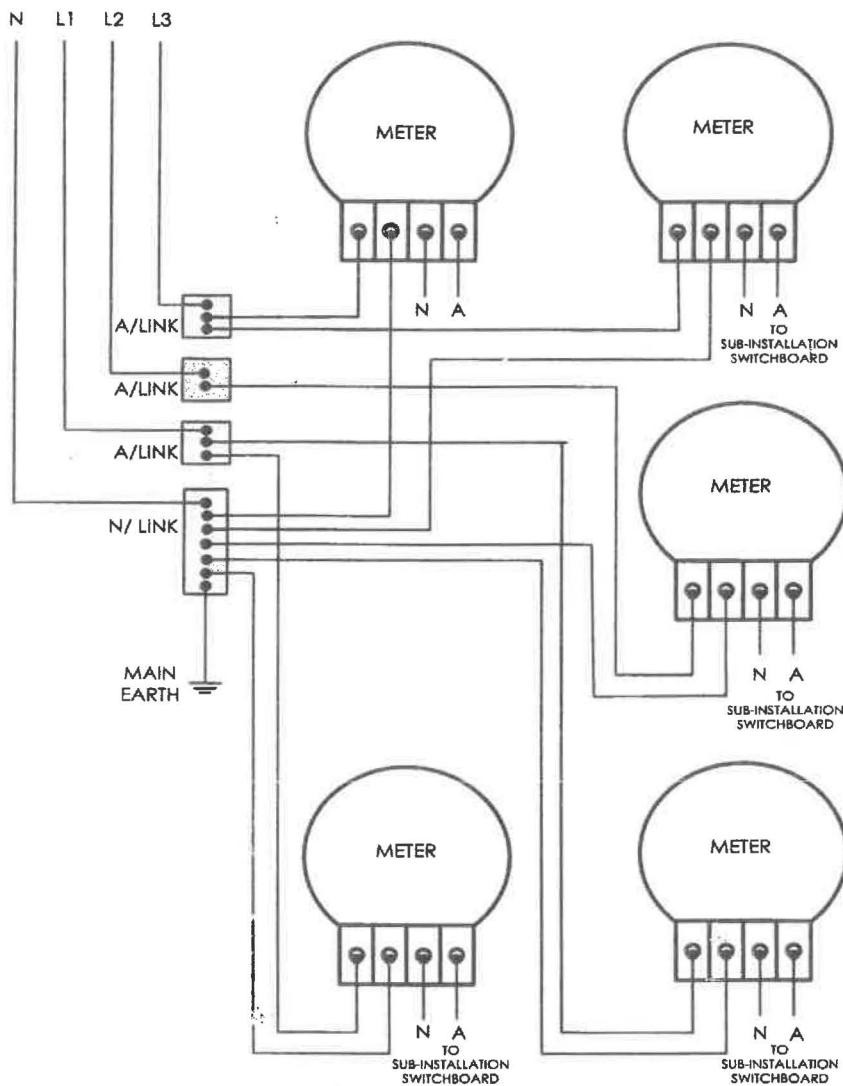
22.7.1.2 Refer Figure 22.3 for three single phase sub-installations requirement.



NOTE: Provided there is no reduction in cable size between consumers mains and metered sub-installation mains, no meter service fuse is required at the Meter panel

Figure 22.3 Shows the detail diagram of installation requirements of 3 single phase sub-installations

22.7.1.3 Refer Figure 22.4 for five single phase sub-installations.



NOTE: If reduction in cable size between consumers' mains and metered sub-installation mains occurs it will be necessary to fit a meter service fuse to each meter.

Figure 22.4 Shows the detail installation requirements for five single phase sub-installation

22.7.1.4 Refer Figure 22.5 for one three phase and two single phase sub-installations.

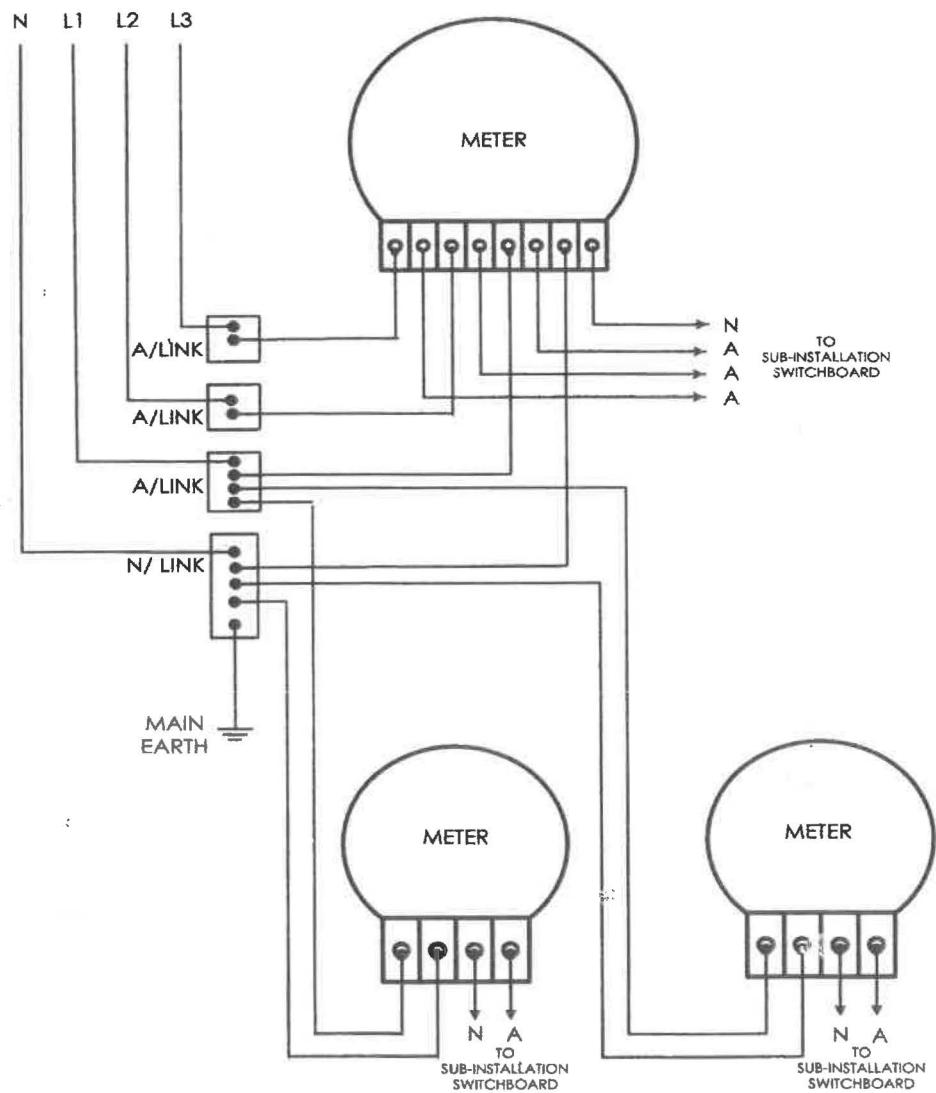
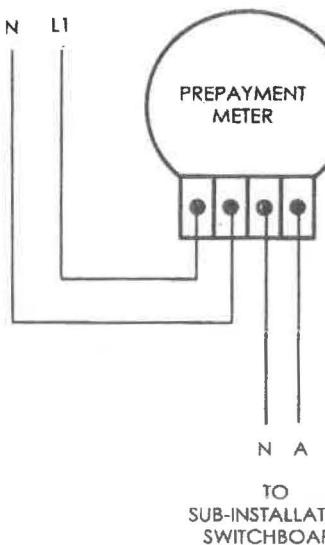


Figure 22.5 Shows the detail diagram of one three phases and two single phase sub-installation

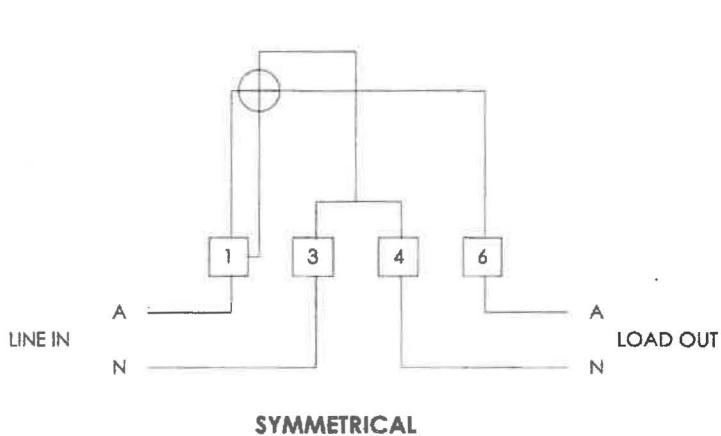
NOTE: The calculated maximum demand will govern each and every installation and sub-installation and the size of aerials, fuses, consumers mains and HRC fuses controlling such installations must be altered accordingly. The above installations have been chosen as a guide as to procedure whereas each individual installation should be calculated on its own merits.

The Electrical Installation Inspector should be contacted where any doubt exists in order that an agreeable solution may be found to the satisfaction of all concerned.

PNG Power will supply all metering units (credit type kWh or easipay meter), current transformers, test blocks and sealable HRC fuses. The contractor must supply the sealable links and the links shall comply with the AS/NZS Wiring Rule No. 2.9.4 and 3.7



Drawing (diagram 1a)



Drawing (diagram 1b)

Figure 22.6 Show diagram 1a and 1b wiring requirement of prepaid meter

22.7.1.5 Installation of prepayment meters

The prepayment (easipay) meter and accessories shall be installed as such:

- (a) Located in a weatherproof meter-box on the external wall of the building in close proximity to where the service is terminated on the premises and shall be installed by the Electrical Installation Inspector, preferably not exposed to direct sunlight.
- (b) The passive unit with built in keypad only shall be installed by the Electrical Contractor at a suitable location for tenant's convenience inside the building.
- (c) The service mains shall enter and exit the passive unit from the rear side or bottom, or a combination (as shown in **Figure 22.6** diagram 1b). Also refer Trade Circular One on Mains Cable to Meter box.
- (d) **Figure 22.6** shows the wiring requirement for prepaid meter

- (e) Refer **Figure 22.7** for detail diagram installation requirement for Consumer's mains.

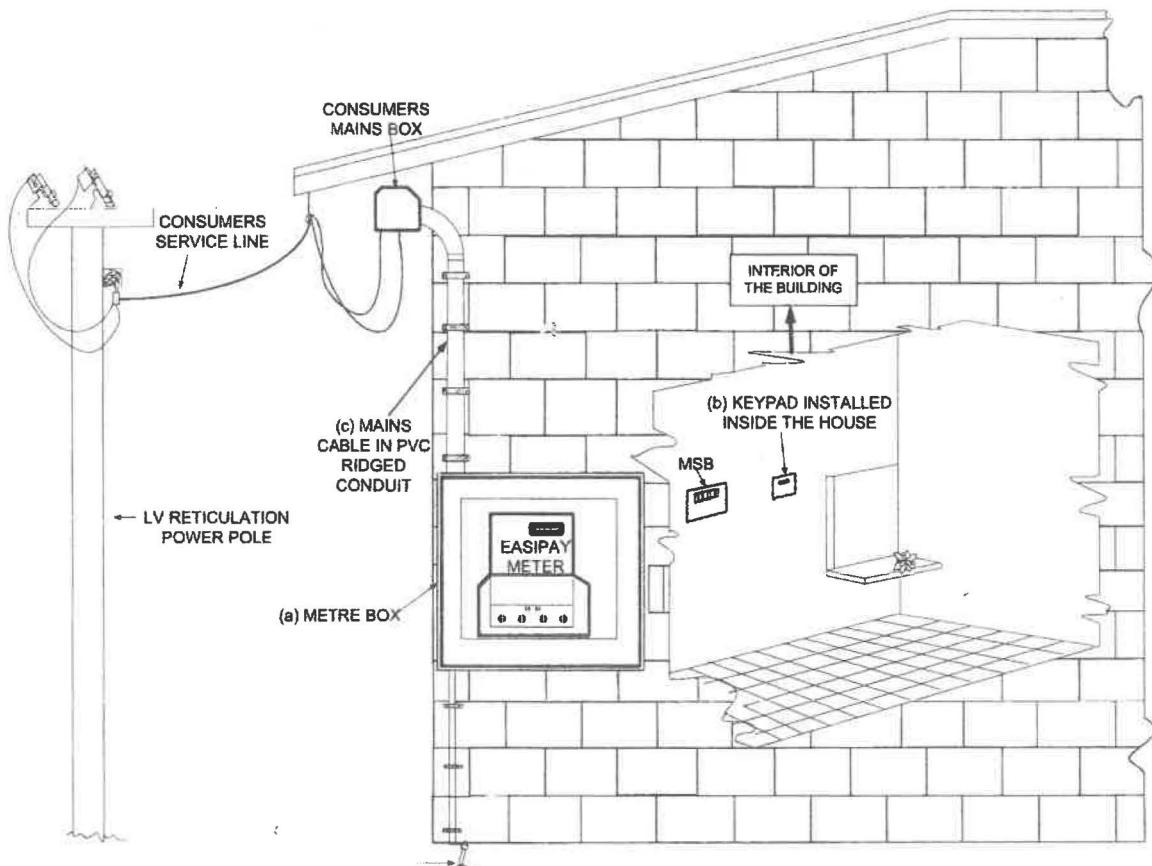


Figure 22.7 Show the diagram of consumers mains install in PVC ridged conduit exposed and visible from consumers mains box to meter box

22.7.2 Active and neutral links

All active and neutral links must be sealed by PNG Power.

Where a break of gauge in conductor size exists between consumers mains and sub- installation mains, at the meter panel, then sealable fuses must be fitted, (Supplied by PNG Power), after the active link and prior to the kWh meter.

22.7.3 Multiple Earthed Neutral (M.E.N)

In all multi metered installations, such as a block of flats, the point of M.E.N (Multiple Earth Neutral) will be at the meter panel neutral link, and the main earth conductor from the installation earth electrode, shall terminate at this point. Sub-installation earth conductors, shall tee off the main earth conductor at the meter panel, but cannot be looped from this neutral link.

See also Trade Circular No.7 Engineering Standard HQH-GCM 005, for identification and labeling of meters.

TYPICAL LAYOUT FOR CURRENT TRANSFORMER METERING CUBICLE

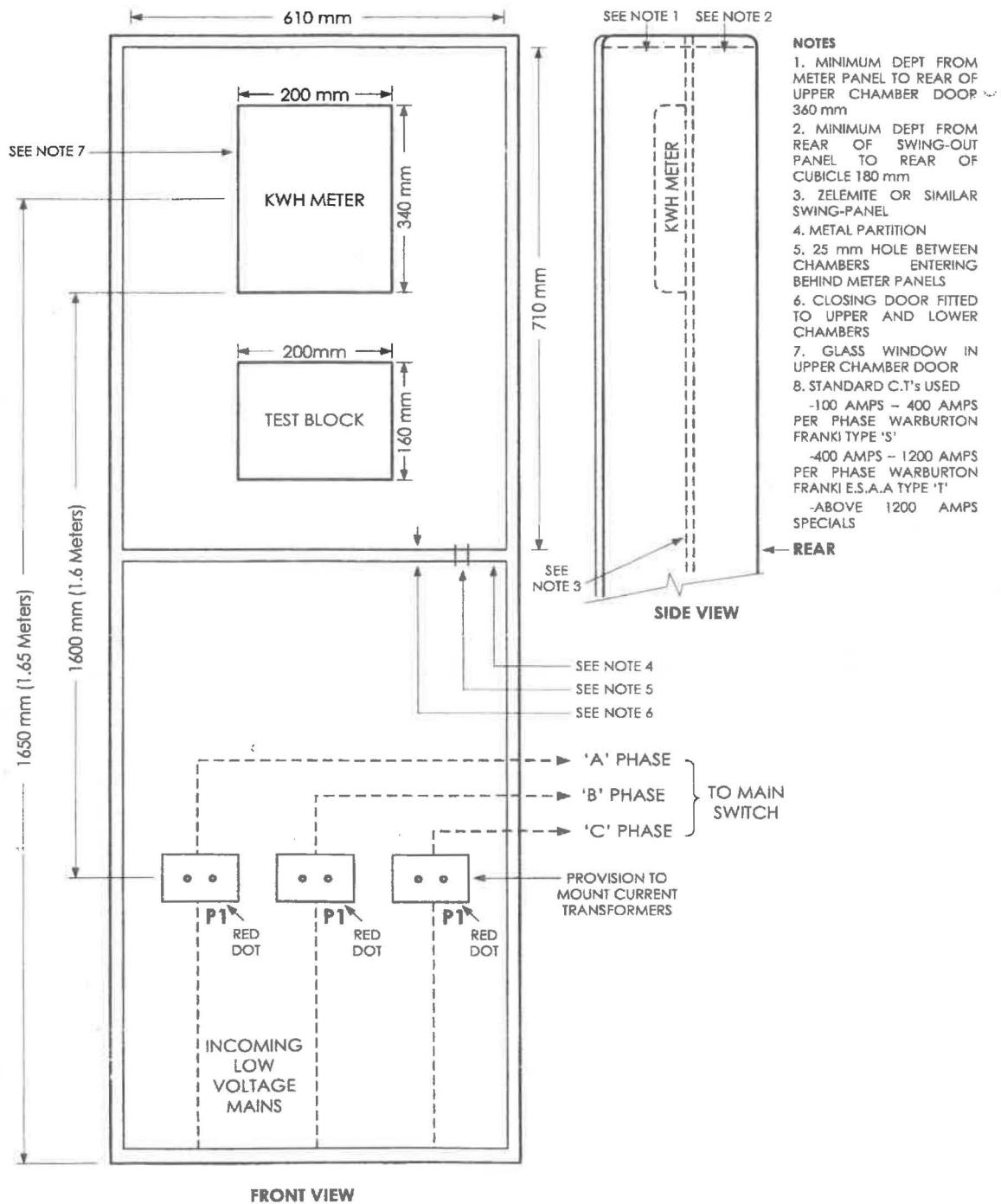
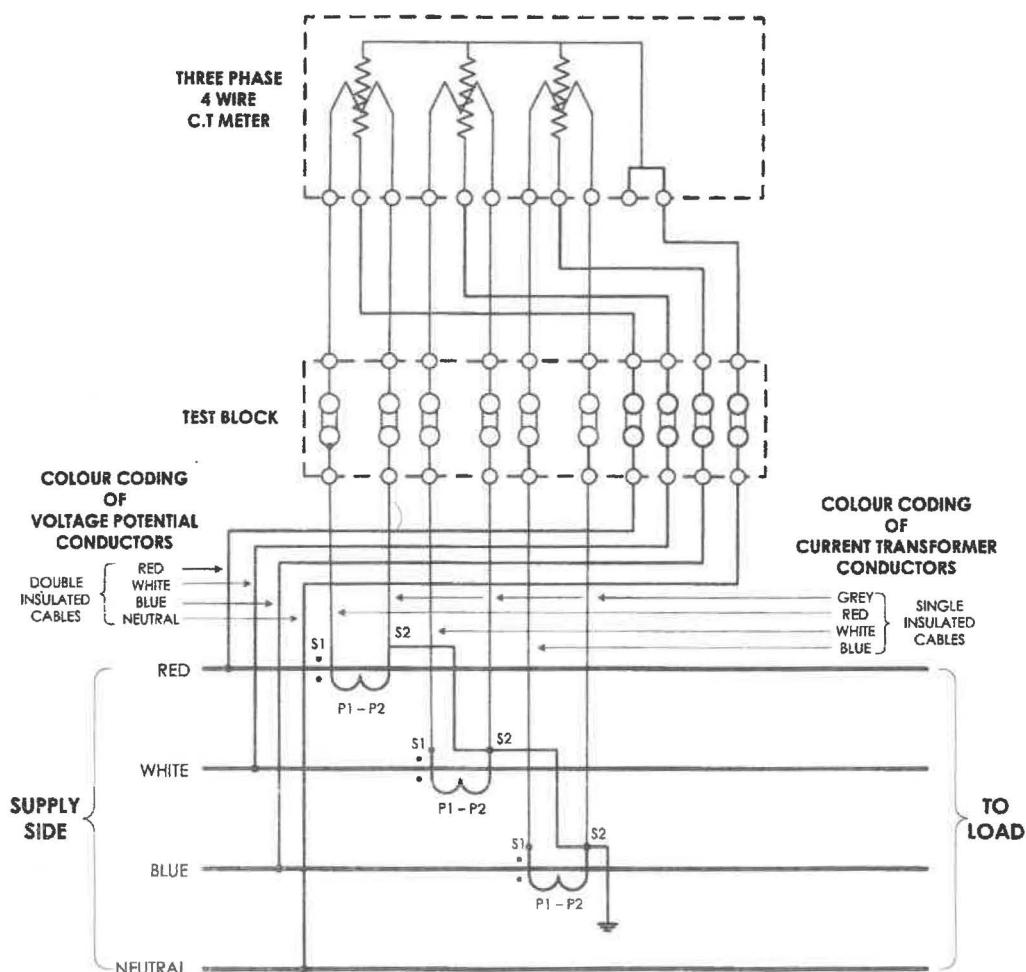


Figure 22.8 Show the layout diagram for current transformer metering cubicle

THREE PHASE KWH METER FOR CURRENT TRANSFORMERS WITH WIRING DIAGRAM



NOTES

WIRING

1. FOR C.T. 2.5 mm² PVC INSULATED STRANDED CABLE
2. FOR VOLTAGE POTENTIALS 2.5 mm² PVC DOUBLE INSULATED STRANDED CABLE
3. TO COMPLY WITH AS/NZS COLOUR CODING

TESTING

4. THE CHECKING OF CORRECT METER ROTATION OF EACH PHASE IS CARRIED OUT BY OPENING ALL POTENTIAL SLIDES, AND CLOSING ONLY ONE SLIDE AT A TIME, ENSURING THAT NO TWO SLIDES ARE CLOSED AT THE SAME TIME. THIS IS ONLY RELIABLE IF POTENTIAL CIRCUITS ARE CORRECT IN RELATION TO ACTUAL C.T. CONNECTION

METER

5. ONLY EXTENDED RANGE KWH METERS SHOULD BE USED WITH EXTENDED RANGE CURRENT TRANSFORMER (C.T.).

FURTHER INSTRUCTIONS

6. REFER TO MANAGER REGULATORY SERVICES

Figure 22.9 Shows the layout for three phase meter current transformer wiring diagram

EXTENDED RANGE CURRENT TRANSFORMER TYPES ST

200/5 ARE SUITABLE FOR LOADS BETWEEN 100 – 400 AMPS
800/5 ARE SUITABLE FOR LOADS BETWEEN 400 – 1200 AMPS

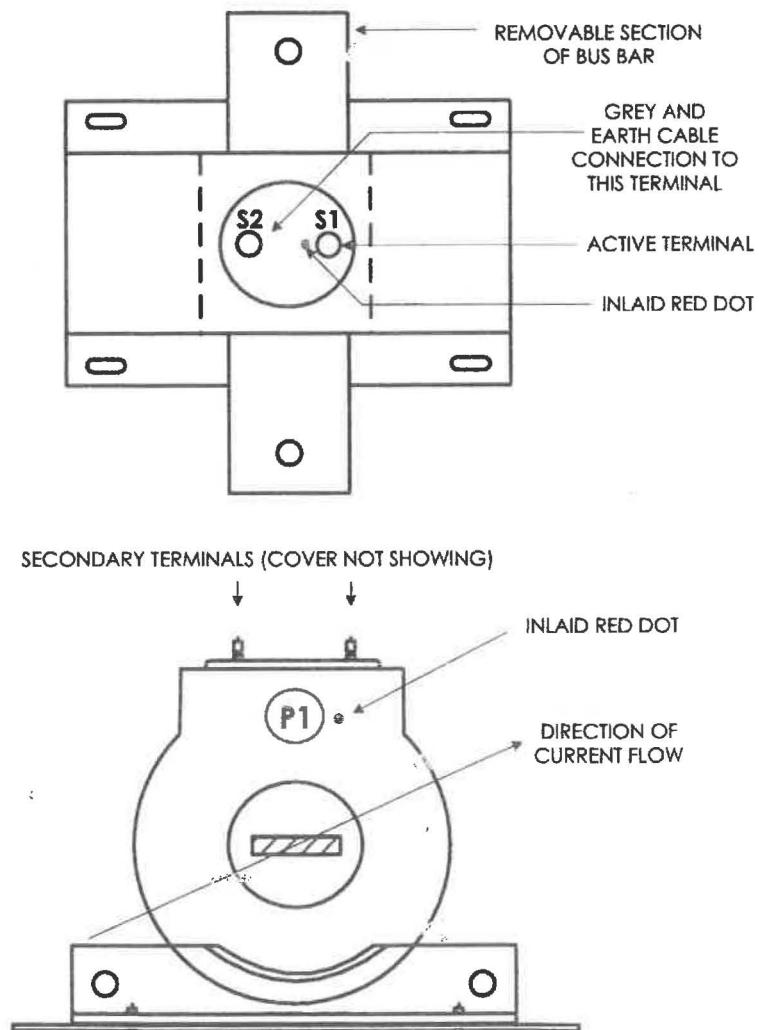


Figure 22.10 Shows the Extended Range Current Transformer, Type ST

MULTI-RANGE CURRENT TRANSFORMER

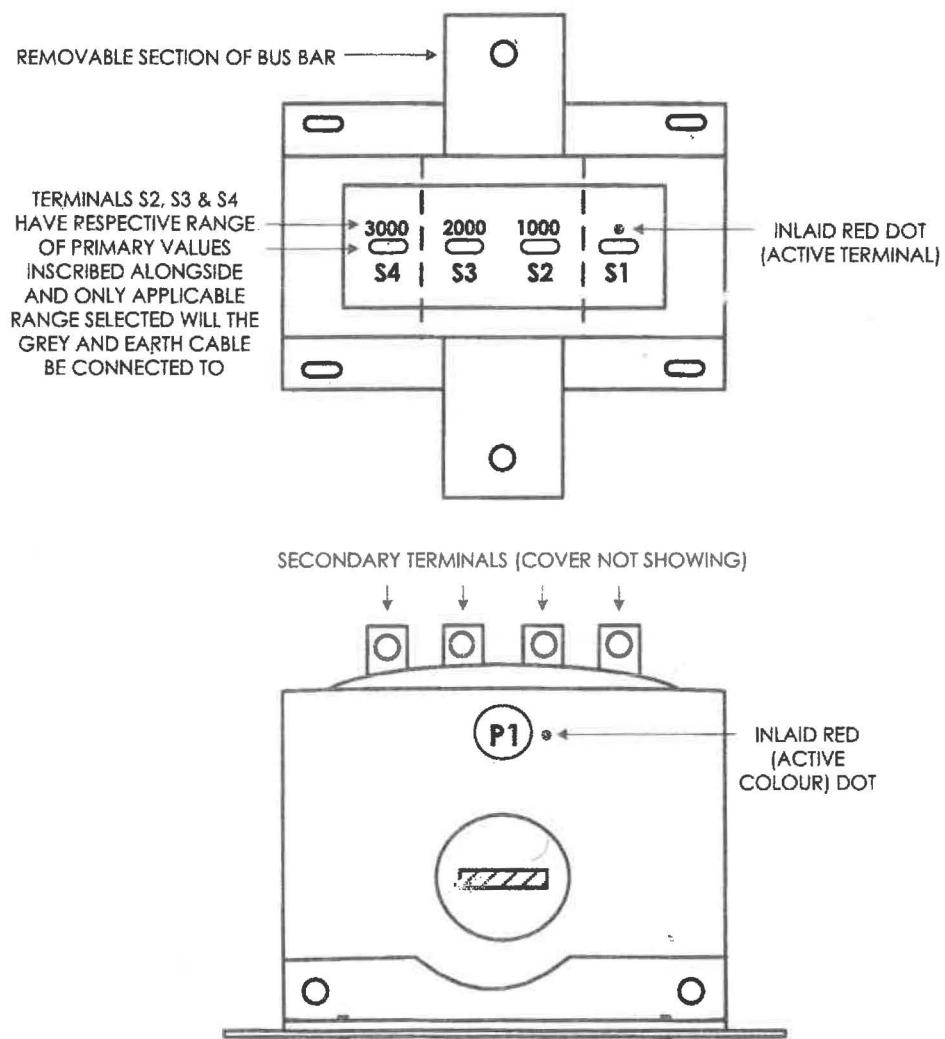


Figure 22.11 Shows the Multi Range Current Transformer, Type ST

Engineering Standard: HQH-GCG 003
Reviewed & Reissued: 30.06.1988, 23.06.2016

TRADE CIRCULAR 23 RESPONSIBILITIES OF PNG POWER CONCERNING PRIVATE GENERATING SETS POWER SUPPLIES AND INSPECTION

23.1 GENERAL

23.1.1 Application

The provision of Electrical Trade Circular No. 23 outlines the electrical installations such as Missions, Plantations, Sawmills, other place of business, private residences accommodation houses and the like, that take a power supply from privately owned and operated generating facilities.

NOTE: This Instruction/Circular is not to be confused with ENG. STANDARD HQH. GCG005 as Trade Circular No. 3 refers to Installation of Stand-by Generating Equipment.

23.2 PNG POWERS RESPONSIBILITY OF TESTING OF APPARATUS, APPLIANCES, MATERIAL OR EQUIPMENT.

23.2.1 For the purpose of technical and safety requirements of Electricity Industry Act and Regulation PNG Power performs the responsibilities under Sections 21.

Section 21 (h) of the Electricity Industry Act states that other functions of PNG Power is to control the testing and approval of appliances, apparatus, motors, fittings and things used in connexion with the use or consumption of electricity.

Section 21 (i) to determine standards for, and to inspect and control the application of the standards to, wiring, fittings, apparatus, appliances and things used in connexion with the supply of electricity to, or the use of electricity in, consumers' premises connected to the public supply of electricity

Section 21 (j) of the Electricity Industry Act gives PNG Power the right to determine standards for, and to inspect and control the application of the standards to, electrical machinery, lines and apparatus used in the generation, distribution and use of electricity by persons other than electricity undertakers.

Section 21 (k) of the Electricity Industry Act give powers to determine standards and methods of procedure to be adopted by workers within the electrical industry in order to ensure the safety of such workers, and to control and implement the operation of the standards.

23.3 DELEGATED FUNCTIONS

23.3.1 Inspectors

The functions of PNG Power as per ETC 23.2 are generally delegated to an inspector or a person authorized in writing by PNG Power who has right of access (at all reasonable hours) to premises to carry out any or all of the functions.

In many instances PNG Power does not exercise the inspection right where private generating exists, due to remoteness of the installation, or for other economic reasons.

This does not however, excuse persons newly installing a privately owned generating and distribution system from complying with **minimum** safety standards laid down by PNG Power.

Where an inspection is deemed as uneconomical by PNG Power, and a customer still requires an Installation Inspection, then all cost including travel and accommodation if necessary, shall be paid by the customer, on a sundry Debtor basis of Prime Cost plus 55%. However PNG Power will endeavor to inspect where possible, by combining other inspection business in the same locality.

If the inspections later become economical, PNG Power reserves the right to issue defects on any installation inspected after being energized by the Contractor.

23.4 NOTIFICATION OF NEAREST PNG POWER CENTRE

The P.N.G. Standard 1022 otherwise known as AS3000 Wiring Rules and other standards called up in the current edition does not **exempt** persons installing generator sets from **notifying** the nearest PNG Power Office, by means of a 'Notice of Intention to Commence Electrical Wiring' on Form **REG NI 09**, and a 'Notice of Completion of Electrical Wiring Work' on Form **REG NC 10**.

Where PNG Power finds that Electrical Contractors are installing privately owned generators, distribution and wiring works, and are not submitting the appropriate notice, then suspension of license will occur, and legal proceedings commenced to **cancel** their Electrical Contractors License.

23.5 SIGNATORY ON FORM REG'NI 09

Form REG NI 09 must be signed by the Licensed Electrical Contractor's Nominee who must be licensed as 'General Electrician'. This also allows him to energize the Installation following test set out in Electrical Trade Circular No.25.

Under no circumstances should any electrical wiring works be performed by an unlicensed electrical tradesman or apprentice. Both must be **supervised** by a licensed person.

23.6 OLDER INSTALLATIONS

Where PNG Power carries out a **safety inspection** on an existing, older type of privately-owned generating, distribution or wiring system, it can order that the installation be made safe.

These may be effected in the Form of a Notice of Faulty Electrical Installation, and defects may be issued and it is the responsibility of the customer to ensure compliance.

23.7 HIGH STANDARD OF SELF-REGULATION EXPECTED

PNG Power expects a high standard of self-regulation from Electricians and Contractors where it is uneconomical for it to inspect such work. Those who do not maintain this standard will be vigorously prosecuted under the provisions of the Electricity Industry Act.

Engineering standard: HQH-GCW 003
Reviewed & Reissued: 30.06.1988, 28.06.2016

TRADE CIRCULAR 24 EARTH ELECTRODES

24.1 GENERAL

24.1.1 Application

The Trade Circular No.24 gives an outline on earthing system used in Papua New Guinea.

24.2 EARTHING SYSTEM USED IN PAPUA NEW GUINEA

The earthing system used in P.N.G is the multiple earthed neutral (M.E.N) system of earthing. The earth conductor is connected to the Neutral and the general mass of the earth. AS/NZS Wiring Rule 1.4.66

24.2.1 Connection to earth electrodes

The connection of the main earthing conductor to the earth electrode shall comply with AS/NZS Wiring Rule 5.5.1.2 (a), (b), (c), (d) and AS1882

24.2.2 Driven electrodes

Earth electrodes in P.N.G., shall be of standard material type, driven electrodes and at specified locations that comply with AS/NZS Wiring Rule 5.3.6.2, 5.3.6.3, and 5.3.6.4

24.3 EQUIPOTENTIAL BONDING EXCLUDING SPRINKLER OR HOT WATER

The metallic piping of any water supply system (excluding sprinkler or hot water) install within a building containing the electrical installation that is metallically continuous, from inside the building to the point of contact with the ground shall be bonded to the main earthing conductor with compliance to AS/NZS Wiring Rule 5.6.2.1.

24.3.1 Earth bonding conductor size

A copper earthing conductor used for bonding the metallic piping of water supply system to the main earthing conductor shall not be smaller than 4mm^2 for copper conductors or 16m^2 for aluminum conductors and installed in accordance with AS/NZS Wiring Rule 5.6.3.2.

24.4 EARTHING SYSTEM OTHER THAN BY SINGLE ELECTRODE

Earthing systems installed other than by a single electrode shall be approved by PNG Power, and in the case of large installations, the system installed shall terminate at a bonding point with a single electrode.

The system shall be capable of being disconnected from the main earth conductor for testing purposes and if installed away from an exterior wall of the building, shall be housed in a suitable accessible pit, not subject to mechanical damage and suitably labeled.

24.4.1 High rise, factories or large building

High rise buildings, factories or large buildings with metal structures or concrete column structure shall be provided with equipotential bonding at designated location to increase effective earthing system.

NOTE: As the Wiring Rules do no lay down a specific resistance between an electrode and the general mass of earth under the M.E.N. system, acceptance of the earth system installed shall be dependent upon the effective operation of protection devices installed, under earth fault conditions.

Engineering Standard: HQH-GCW 004
Reviewed & Reissued: 30.06.1988, 30.06.2016

TRADE CIRCULAR 25 INSTALLATION INSPECTIONS INCLUDING WHERE NO PNG
POWER INSPECTOR IS AVAILABLE

25.1 GENERAL

25.1.1 Application

The Trade Circular No. 25 outlines procedures as detailed, and deals with the inspection of electrical works in remote centers where no qualified PNG Power Inspector is readily available.

NOTE: This instruction circular in no way alters the present system as applicable to Centers where PNG Power Inspector is available.

25.2 INSPECTION RESPONSIBILITY

With prior approval from PNG Power Inspector the procedure enables certified Electrical Inspector not employed by PNG Power, Licensed Electricians and Licensed Electrical Contractors to carry out electrical work, test and energize installations in remote centers of the country where location and associated costs inconvenience the immediate availability of the electrical inspector and further inconveniences the customer and the contractor.

25.3 REQUIREMENTS WITH REGARD TO INSTALLATION

25.3.1 Submit Notice of Intention to Commence Electrical Installation

The "NOTICE OF INTENTION TO COMMENCE AN ELECTRICAL WIRING WORK" Form 'REG NI 09' will be completed for all proposed new work, additions, alteration to each installation as is currently done for work being carried out in PNG Power Centers. This will be submitted to PNG Power's nearest Centre Inspector or Manager.

25.3.2 Submit Notice of Completion of Electrical Wiring Work

The "NOTICE OF COMPLETION OF ELECTRICAL WIRING WORK" Form 'REG NC 10' is to be forwarded to the same Inspector or Manager who received the original "NOTICE OF INTENTION TO COMMENCE AN ELECTRICAL WIRING WORK".

NOTE: Forms 'REG NI 09' & 'REG NC 10' is the Standard Form for use throughout the country and the only requirement 'a must' is for test results to be attached to Form 'REG NC 10'.

This system will ensure the safety of all such installations while still allowing for a full inspection to be carried out at a later date.

25.3.3 Erection of overhead services from government or PNG Power reticulation system

The erection of overhead services from the Government or PNG Power reticulation system to the installation will always be carried out by PNG Power, unless otherwise approved by the Manager Engineering Design.

25.3.4 Point of entry decided by PNG Power Inspector

When new installations are to be wired and the service has not been erected, the contractor or electrician must obtain from PNG Power Inspector in the first instance or technical representative the required details of the "point of entry" so that the mains connection box will be correctly positioned.

25.4 INSPECTION

25.4.1 Requirement prior to energizing

Before energizing any installation, the electrician carrying out the work should carry out the important tests specified in ETC 28 & 29.

NOTE:

The inspection shall be carried out after the service has been strung and connected to the supply, the primary fuse being left out.

25.5 TEST PROCEDURE

25.5.1 The test procedure given is a guide to ensure the installation is electrically safe.

- (a) Check that the service line clearances are in accordance with AS/NZS 3000:2007 Wiring Rules No. 3.12.3
- (b) Test at the meter board that none of the conductors are energized.
- (c) Inspect the main earthing conductor and connections at electrode and water pipe in accordance with AS/NZS 3000:2007 Wiring Rule No. 5.5.1.2

The main earthing conductor must be insulated. Refer to AS/NZS 3000:2007 Wiring Rules No. 5.6.2.2 for method of connections to water pipe etc.

- (d) Remove the main earthing and neutral connection to the neutral bar.

25.5.2 Visual Inspection

Visual Inspection is carried out to ensure that Installation complies with PNGS 1022 and AS/NZS 3000 Standard.

Visually check through the entire premises to observe that:-

- (a) The installation is complete and all accessories are correctly fitted and in good condition,

- (b) There are no irregular or illegal connections, and no accessories are mounted in prohibited zones,
- (c) Any overhead conductors are installed in accordance with Wiring Rule AS/NZS3000:2007 Rule 3.12.
- (d) That the meter board and switchboard wiring is correct,
- (e) That fuse links, rating fuses and circuit breakers, and any other switchgear on each board, are correct,
- (f) The metering equipment will be suitably located and protected against weather.

25.5.3 Earth continuity testing

The Earthing continuity test is carried out to ensure that earthing continuity is maintained within the installation, this includes equipotential bonding that form part of the installation.

This test requires the use of an ohm meter capable of accurately reading in the range 0 – 200Ω. All readings must comply with the provisions of AS/NZS Wiring Rules 8.3.5.

25.5.3.1 Testing Procedures

- (a) Remove MEN from Neutral Links
- (b) Disconnect any earthing conductor completely from any hot water system
- (c) Using Ohms Meter, check the operation of the ohm – meter on the low resistance scale (i.e. open circuit and short circuit readings).
- (c) Connect a trailing lead to the earth electrode.
- (d) Using the ohm-meter and the trailing lead measure the resistance to:-
 - I. The main earth conductor, at the switchboard
 - II. The ends of any metallic conduit systems, including any metal conduit enclosing the consumer's mains, or sub circuits,
 - III. To all power point earth terminals,
 - IV. To all earth metal fittings,
 - V. To all permanently connected earth appliances or equipment;
 - VI. To all earthed portable appliances when connected in position,
 - VII. To all other parts of the installation required to be earthed

NOTE: These readings must be not greater than 0.5 Ω (AS/NZS Wiring Rule 8.3.5.2)
- (e) If readings are satisfactory reconnect the earthing conductor to the hot water system.

25.5.4 Insulation testing

Insulation Test is carried out to ensure that the insulation resistance between all live conductor and earth or as the case maybe, all live parts and earth is adequate and integrity of the installation is maintained. AS/NZS 3000:2007 Rule No. 8.3.6

25.5.4.1 Testing procedures

This test will require use of high resistance scale of the megger.

- (a) Disconnect MEN from Neutral Bar
- (b) All light switches to 'Off' position
- (c) Take note of the 2 way and intermediate switches
- (d) Switch-off all GPO circuits
- (e) Disconnect any element connected
- (f) Test the insulation between the mains conductors and main earthing conductor.
- (g) At the switchboard test the insulation between all conductors and earth. Disconnect any circuit conductors having low readings.

NOTE 1: The insulation resistance between conductors and earth, either of the complete installation or of any part thereof, measured with all fuse elements in place and all switches on, **shall not be less than 1 meg-ohm**. This value shall be obtained with appliances, lamps and other consuming devices disconnected.

NOTE 2: The megger or other instrument must apply a voltage or not less than twice the working voltage of the installation provided that were the working voltage does not exceed 250 volts between conductors and earth, the test voltage need not exceed 500 volts, and in other cases need not exceed 1000 volts.

NOTE 3: It has been found that the insulation resistance with heating appliances, such as an electrical range, may be less than 1 meg-ohm. Provided this resistance is greater than 100 ohms the appliance may be connected to supply and re-tested after it has operated for between 30 minutes and 1 hour, allowing 10 minutes for it to cool down. This is covered more fully in ETC 25.5.5.2

25.5.5 Energizing the Installation

Energizing the Installation is carried out when tests proven that installation is safe and meets all Safety Requirements and satisfactory in compliance to AS/NZS 3000:2007.

25.5.5.1 Energizing Procedures

- (a) Connect mains conductors at meter board to kilowatt-hour meter, if fitted, or to load limiter.
- (b) Ensure that main switch is off, and that the main earth and neutral are disconnected from the neutral bar.
- (c) Advice all persons present that the main switchboard is being energized.
- (d) Insert service pole fuse cartridge.
- (e) Ensure at main switchboard, by means of test lamps, that polarity is correct.
Do not energize circuit fuses or circuit breakers as yet.
- (f) Reconnect the main earth and main neutral to the neutral bar.
- (g) Ensure that the water supply is "on" before energizing any water heater.
- (h) If an instantaneous water heater such as a "Dux" or "Thermex" is installed, turn the water supply "on" at that appliance to eliminate any possibility of damaging the heating element if its switch is in the "on" position.
- (i) Individual circuits can now be energized, by inserting fuses or operating circuit breakers.

25.5.5.2 Electrical Range or Other Heating Appliance (resistance of 100 Ω & 1MΩ)

If the electric range or other heating appliances give insulation resistance of between 100 ohms and 1 meg-ohm, switch all elements onto the "high" position and leave to dry out.

25.5.6 Circuit checks

Circuit checks is carried out to ensure correct rated protection devices are used to protect the individual circuit or number of circuits. This includes heating, cooling appliances and motors.

25.5.6.1 Circuit Check Procedures

- (a) Switch on individual switches and check out circuits, i.e. water heater switch should control water heater.
- (b) Check number of power outlets on each fuse or circuit breaker.
- (c) Check that all fixed appliances such as shower heater, air conditioners, etc. have appropriate circuit segregation.

25.5.7 Socket Outlet Check/Tests

25.5.7.1 Test all plug sockets using Test lamps or Voltmeter as follows:-

- (a) TEST LAMP - Operate switch to "off" position and insert prongs of **test lamps or Voltmeter** into active and neutral. Switch "on" and lamps should glow, switch "off" and lamps should cease to glow.

VOLTMETER - The meter should read 240 Volts when switch "on", Switch "off" then meter should read 0 volt.

- (b) TEST LAMP - Remove prong from neutral and place in earth point. Switch "on" and lamps should glow, switch "off" then lamps should cease to glow.

VOLTMETER - The meter should read 240 Volts when switch "on", switch "off" meter should read 0 volt.

- (c) TEST LAMP - Remove prong from active and place in neutral. Switch "on" or "off". Lamps should give no glow proving that polarity is correct.

VOLTMETER - the meter should read "0" (zero).

25.5.8 Lighting circuits:

Check the operation of all lights, paying special attention to two-way or multiple switching.

NOTE:

With the exception of the light being tested all other lighting switches must be in the "off" position.

25.5.9 Metering where fitted:

- (a) Whilst the electrical range or other appliance is operating, check that the kilowatt-hour meter is rotating in the correct direction.

On completion of the tests, check that units consumed have been registered.

- (b) In the case of a poly-phase meter similar checks should be carried out by loading one phase at a time.

- (c) Check the phase rotation of any poly-phase meter.

- (d) Ensure that the **meter panel and metering equipment** is correctly installed.

25.5.10 Refer ETC 25.5.4.1(b) NOTE 3 and ETC 25.5.5.2

If an electric range or other heating appliance had given a low insulation resistance the appliance should now be switched "off" allowed to cool, and another reading taken.

If the resistance is still less than 1 meg-ohm the appliance is to be disconnected as faulty.

25.5.11 Miscellaneous

- (a) The power maybe left connected if no major faults are present and the consumer has signed for power supply. The consumer must present the receipt for that installation to show that he/she has signed up. Alternatively, the supply may be connected following direction from the local senior

representative of the Department of Finance. (Generally the District Manager).

- (b) If **no** application has been received for power supply the installation is to be **disconnected** by removing the load tail active at the meter.
- (c) When supply is left connected and the consumer is not present the switch should be left in the "off" position and an appropriate notice left at the installation.
- (d) Date of connection or disconnection must be recorded.
- (e) Ensure that no appliances have been left in the "on" position.
- (f) Note that all installations connected to PNG Power supply must be metered, whilst installations in Government Centers will have either meters or load limiters, depending on the area tariff applicable.
- (g) If these tests do not give satisfactory results, the installation **cannot** be considered safe.

Engineering Standard: HQH-GCG 012
Reviewed & Reissued: 30.06.1988, 30.06.2016

TRADE CIRCULAR 26**ELECTRICAL INSPECTIONS, NOTICES OF INTENTION,
NOTICES OF COMPLETION AND FAULT NOTICES****26.1 GENERAL****26.1.1 Application**

The Trade Circular No.26 outlines the requirement for prior approval from the Electrical Inspector with regard to electrical installation works. This is to prevent Electrical Contractors from:

(a) Submitting Notices of Completion to PNG Power Office for the Inspection of electrical work which has already been connected to the supply.

(b) Supply Connected without Notices of Intention or Notices of Completion

26.2 ELECTRICITY INDUSTRY REGULATIONS

Contractors are advised that connection of power supply to any installation which has not been inspected is in contravention of the Electricity Industry Regulations

26.2.1 Electricity industry (service & installation) regulations

The Electricity Industry (Service and Installation) Regulations states as follows under Part II, General, Section 5

INSPECTION BEFORE CONNECTION

- (1) An electrical installation or additions or alteration shall not be connected to an electricity undertakers supply of electricity unless:-
 - (a) a notice of completion in Form 3 has been forwarded to the electricity undertaker by the Electrical Contractor doing the work and;
 - (b) an Inspector appointed by the electricity undertaker has inspected the installation or additions or alterations and certified that these Regulation has been complied with;
- (2) Where an inspection, an electrical installation or addition or alterations do not comply with these Regulation -
 - (a) A Notice in Form 4 of Schedule 1 shall be issued by the relevant electricity undertaker to the Electrical Contractor; and
 - (b) Notwithstanding the issue of a notice, the relevant electricity undertaker may connect the installation or additions or alterations to the electricity undertaker's supply, subject to such conditions, (if any) as

the electricity undertaker imposes, in accordance with these Regulation or the Wiring Rules

- (3) A person who connects an electrical installation to the electricity undertaker's supply of electricity in contravention of this Regulation is guilty of an offence.

NOTE: The Forms 3 & 4 referred to in ETC 26.3.1(a) and ETC 26.3.2(a) have been revised and is now Form REG NI 09 & REG NC 10 respectively.

26.3 PNG POWER WORKING HOURS

26.3.1 Regular working hours

Electrical Contractors are reminded that PNG Power's "Regular Working Hours" as laid down in the "Conditions of Supply" By-Laws are as follows:-

- (a) Eight o'clock in the forenoon and noon, and
- (b) Four thirty o'clock in the afternoon, Mondays to Fridays but does not include those hours on public holidays.

26.3.2 Non regular working hours

Saturday overtime and any other additional hours work are not classed as "Regular Working Hours" as such are liable to be charged to Electrical Contractors requiring inspections etc. during these times. Rates are available on request.

26.4 INSPECTION APPOINTMENT

It is now a requirement that all future "NOTICE OF COMPLETION OF ELECTRICAL WIRING WORK" will require a period of forty eight (48) hours from receipt of such Notice before an inspection is carried out. However, the Installation Inspector or other authorized PNG Power Officer carrying out electrical inspections may decide at his/her discretion, depending on the volume of work outstanding, as to when an inspection is carried out.

26.4.1 Power interruption related to inspections

Notwithstanding the above it is realized that in some circumstances, due to the nature of work being carried out, the power could be disconnected in the morning and then require inspection and connection later in the day. The electrician or electrical contractor would then be required to liaise with PNG Power prior to such work being carried out but under no circumstances should Friday be chosen for inspection.

26.4.2 Urgent inspection

Urgent Inspections will be considered on their merits individually and left entirely to the discretion of the Inspector as to what constitutes urgency and whether a charge should be raised for work outside "Regular Working Hours".

26.5 FAULT NOTICE

Where a Fault Notice is issued as per Section 5 (2) (a), (b) and power connected as per Section 5 (3) of the (Service & Installation) Regulation 2006 by the Electrical Contractor or his employee, then in addition to prosecution he may be required to show cause in writing to the Manager Regulatory Services why his license should not be cancelled.

26.5.1 Delay in Compliance Where Disconnected

Other situations arise where a Fault Notice is issued and the electrical installation disconnected until such time as faults are rectified, and the electrical contractor does not speedily rectify these faults.

PNG Power views with great concern the fact that in some situations the customer moves into the installation where minor faults are present and in others cannot move in until the faults are rectified.

PNG Power has decided that each and every Fault Notice must be rectified within thirty (30) days; otherwise a subsequent re-inspection will be carried out after such a period.

In accordance with Section 6 (b) (i) & (ii) of the (Service & Installation) Regulation 2006 such an inspection will incur a re - inspection fee of K20.00 and subsequent re-inspection fee of K40.00 respectively.

26.6 COMPLIANCE

All contractors are requested to comply with the requirements laid down in this circular in order to improve relations between all persons concerned, and avoid lengthy delays for PNG Power customers.

Engineering Standard: HQH-GCA 003
Reviewed & Reissued: 30.09.1988, 12.07.2016

TRADE CIRCULAR 27 APPLIANCES AND APPLIANCE APPROVALS

27.1 GENERAL

27.1.1 Application

The Trade Circular No. 27 provides instructions and standard requirements when using electrical goods such as appliances, plugs, audios and accessories.

With the increasing counterfeit electrical goods despite numerous warnings, it is disconcerting to see electrical appliances being offered for sale which do not conform to the recognized standards, particularly those which do not have the correct type of plug fitted. Other unsatisfactory features which are relatively prevalent are the absence of earth in cases where this is essential, and inadequate installation in component transformers separating the 240V supply from the battery terminals and other exposed parts of portable AC/DC radios, cassette players, etc.

27.2 PLUGS TOPS

The standard electrical plug tops used in Papua New Guinea is the same in Australia, New Zealand and some other Pacific Island Nations. It has two flat pins forming an inverted V-shape plus a vertical earthing pin. These flat blades measure 6.35 by 1.6 mm with the Active and Neutral pins 17.35mm long set 30° to the vertical and the vertical Earth pin being 20mm in length.

The pins are arranged at 120° angles around a common midpoint, with the Active and Neutral centered 7.92mm from the midpoint, and the Earth pin centered 10.31mm away.

27.3 PLUG OUTLET

The plug outlet has provision for two inclined 240V live pins and an earth pin arranged in accordance with the Australian Standard 3112: 2002 Approval and Test Specification for plugs and plug sockets. PLUGS WHICH DO NOT CONFORM TO THESE REQUIREMENTS ARE PROHIBITED (EXCEPT AS ALLOWED FOR BELOW).

NOTE: The purchaser of appliances with an incorrect type of plug inconveniences as well as risks exposure to an unnecessary hazard.

27.3.1 Unsafe practices

The **unsafe practices** such as unskilled fitting or replacement of plugs, the modification of pins or the use of unsatisfactory adaptor arrangements results in the case of the two pin flat pin types the practice of bending the pins has resulted in the exposure of live (240V) parts to personal contact. When jug type

appliance plug is used to convert a European round pin plug, discontinuity of earthing results.

It is most important that the correct plug be fitted to the appliance before it is sold. It is desirable that this be done by the manufacturer. Where this is not convenient the work must be done by a License Electrician employed by the importer/wholesaler and NOT by the retailer. **It should never be left to the purchaser.**

27.3.2 Plug Specifications

The specifications require that plugs be fitted in a satisfactory manner. Approved plugs have two cord anchorage facilities designed to prevent damage to the lightly insulated cores of a sheathed flexible cord or contact with the wires should they become detached flexible from the terminals.

The various anchorage devices provided such as the tortuous (looped) path, threaded plastic ferrules, clamps etc. should always be used. It should be appreciated that the sheathed outside cover of cord must be held as well as the conductors. This does not apply to figure. 8 flexible cord where there is a single layer of thicker insulation and only one form of anchorage is necessary.

27.3.3 Plugs That Does Not Require Earthing Pin

Plugs which are integrally molded to cords are acceptable with an approved type. These may have only 2 inclined pins if the appliance does not require earthing (see below) and is not rated in excess of 7.5 amps. i.e., portable radios, hand held hair dryers etc.

MODULAR AUDIO EQUIPMENT SUPPLIED WITH 2 PIN, PARALLEL PIN CONNECTING PLUGS.

Importers and manufacturers agents wishing to sell this type of equipment may do so provided that the following conditions are observed:-

- (a) Each importer or agent must apply in writing to the Approvals Officer PNG POWER for written approval to sell the goods as described.

The application will include a list of all their wholesale and retail distributors in P.N.G and the trade name, type and model numbers of all the appliances requiring approval.

The name plate details including warning signs **must be** clearly written in English.

- (b) The appliances must be displayed for sale (priced accordingly) and sold only in module form, **NOT** as separate items.

- (c) Each appliance must have a label or tag securely attached to the flexible cord, adjacent to the plug, and marked with the following essential safety warning, or a similar notice is to be placed into the appliance container.

FOR YOUR SAFETY

THIS APPLIANCE IS SUPPLIED WITH A 2 PIN CONNECTING PLUG FOR USE ONLY IN MODULAR AUDIO SYSTEMS.

IF CONNECTION TO A NORMAL 240 VOLT OUTLET SOCKET IS REQUIRED, "CUT OFF" THE 2 PIN PLUG AND ATTACH THE 3 PIN PLUG WHICH WAS SUPPLIED WITH THE APPLIANCE, BY THE DISTRIBUTOR.

DANGER

DO NOT USE THIS 2 PIN PLUG IN A 3 PIN SOCKET

This danger notice is to be printed in bold red print. This label or tag is to be provided by the importer or agent and **NOT** by the retailer.

- (d) A new, approved type rewirable 3 pin flat pin plug, accompanied by suitable wiring instructions is to be supplied by the importer or agent, NOT the retailer, with each component modular system.
- (e) Failure to comply with the above conditions would mean revoking of the written permission, by PNG Power, for sale of the appliances, and legal action taken.

27.3.3 Earthing

The principal of earthing as a means to prevent the exposed metal of an appliance inadvertently becoming live at 240V should an internal fault occur is well accepted. This safety principal is just as applicable to electronic equipment such as amplifiers, record players, etc., as it is to the toaster or iron, etc., **WHERE METAL CAN BE TOUCHED AND IS SEPARATED BY ONE LAYER OF INSULATION I.E., THE INSULATION ON A CONDUCTOR, THAT METAL MUST BE EARTHED.**

The earthing must be in good electrical contact with the earth pin of an approved 3 pin plug. (Technically the resistance measured should not exceed 0.1 Ohms) Means should be provided to ensure that painted surfaces are in good electrical contact i.e., by the use of star washers.

Other points to note on earthing are:-

- (a) All earthing conductors must be correctly colour coded. i.e. green/ yellow.
- (b) The earth terminal must be clearly marked.

- (c) The termination of the supply earthing conductor should be independent of any internal earthing conductor.
- (d) The earthing conductor should not have less current carrying capacity than the live conductors.

NOTE: As with the change of plug, any work involving the changing of cord should be done by a License Electrician.

27.4 COMPONENT TRANSFORMERS

(EXTRA LOW VOLTAGE – i.e., Secondary of 32V OR LESS)

Experience overseas has shown that some AC/DC radios have component transformers which have inadequate insulation whereby the 240V wiring is not properly separated from exposed parts, such as the battery and other terminals. It is necessary that an insulation barriers equivalent to double insulation is maintained between these parts.

NOTE: The climatic conditions in Papua New Guinea warrants that similar radios, recorders, etc., sold in this country **must** be tested.

The method for checking compliance involved the examination of insulation between windings of the transformer and to check its electrical quality by the transformer and to check its electrical quality by the application of a high voltage (3,500V) for one minute. Because of this requirement it is important that radios, etc., submitted for approval (see below) is accompanied by a spare identical component transformer.

An appliance incorporating an Extra Low Voltage transformer that is subjected to a high voltage test between the primary coil and either core or secondary coil is considered to have been "stressed" beyond the level of normal electrical insulation. Hence the transformer must be replaced by a new unit before the appliance is sold. The responsibility for replacement lies with the importer of the appliance.

Details of "double insulation" are given in Australia Standard 3100.

27.5 FEE FOR APPLIANCE APPROVAL

When an application for approval of an electrical appliance is submitted to the Regulatory Services Group (Appliances Approvals Laboratory) several factors are involved with regard to fees:-

- a) If the appliance is the subject of an Australian Approval Certificate (a copy of which is attached to the application form) then a sample of the appliance is not required to be submitted and the application fee of K100.00 is applied. (GST not inclusive).

- b) If the appliance has not been approved by a Regulatory Authority in Australia, a sample appliance is required for testing. In this case the application fee of K100.00 is applied plus K 30.00 per man hour for testing.
- c) If the appliance is a modification of a previously PNG approved appliance the application fee is reduced to K50.00. A sample appliance may be required for inspection.

Ancillary costs e.g., freighter, travel expenses etc. will be charged where applicable.

NOTE: All payments to be payable to PNG Power Cashier office.

27.6 CERTIFICATE OF APPROVAL

A Certificate of Approval will be issued in respect to each electrical appliance which is submitted and found to comply with the recognized standard.

In general the basis of approval of all electrical appliances is compliance with the Standards Association of Australia Approval and Test Specification 3100- 2009 Definitions and General Requirements to Electrical Materials and Equipment. In the case of electronic equipment the additional standard AS3159 is applicable.

The sale of an electrical appliance which is not the subject of a certificate of Approval or its equivalent constitutes a breach of the Electricity Industry (Approval of Electrical Appliances) Regulations 2006

27.7 SAFETY OF USERS AND THE PUBLIC

The primary object of the above mentioned By-Laws is to ensure that the user or public is protected as far as possible against the risks attached to the use of articles of an unsatisfactory electrical standard. It is also a means of affording some protection to the manufacturer, importer and distributor of electrical goods against the unbalanced completion resulting from the marketing of articles of substandard quality.

27.8 SAMPLE OF APPLIANCES, EQUIPMENT, AUDIOS, ACCESSORIES AND CABLES SUBMITTED WITH APPLICATION OF APPROVAL FOR TESTING

Application for approval may be made by completion of Form 1 and forward together with one sample of the appliance to PNG Power Appliances Approvals Office, 4 mile, marked to the attention of Manager Regulatory Services.

As previously mentioned, when certain electronic equipment incorporating component transformers are submitted, these should be accompanied by an additional transformer.

On completion of tests, the submitters will be advised to collect articles from the same address within a three (3) months period.

Further information regarding approvals may be obtained from Team Leader Appliances Approvals on Telephone 325 7307.

27.9 STANDARDS AVAILABLE AT NISIT & PUBLICATIONS OF APPLIANCES APPROVAL

Copies of Standards are available from the NATIONAL INSTITUTE of STANDARDS and INDUSTRIAL TECHNOLOGY, P.O. Box 3042, BOROKO. PHONE: 3231852.

For details of the purchase of PNG Power publications namely "Appliances Approved in Papua New Guinea" and the Electricity Industry Act and Regulation, reference should be made to Trade Circular No. 34 Engineering Standard HQH-GCG018.

27.10 PRESCRIBED ELECTRICAL APPLIANCES

Attached is a list of prescribed Appliances, gazette in 1982. Importers should check this list to establish if an item for importation requires approval.

PNG Power will accept no responsibility for shipments of articles that have been rejected for approval. Importers should therefore obtain approval prior to shipping large quantities of appliances.

PUBLIC NOTICE



PRESCRIBED ELECTRICAL APPLIANCES

CURRENT SINCE 1ST APRIL 1982

PNG Power wishes to advise all importers, wholesalers, retailers, manufacturers and leasing agents of electrical appliances that commencing on the April, 1982 all electrical appliances and materials included in the following list will be known as "**PRESCRIBED ELECTRICAL APPLIANCES AND MATERIALS**" and will be required to be the subject of a **Certificate of Approval**. The approval of these articles is mandatory under the Electricity Industry (APPROVAL OF ELECTRICAL APPLIANCES) Regulation 2006 and failure to comply with will incur heavy penalties.

The articles must be submitted for testing in accordance with the relevant Australian Standard Specifications, or such other standard adopted for use in Papua New Guinea under the National Standard Act to:

The Manager Regulatory Services Group

PNG Power Ltd
P.O. Box 1105, BOROKO
National Capital District
Papua New Guinea

Attention: Team Leader Approvals

LIST OF PRESCRIBED APPLIANCES FOR PAPUA NEW GUINEA

1. Appliance plugs
2. Cord Extension Sockets
3. Cord Lines Switches
4. Decorative Lighting Outlets
5. Domestic Electrical sewing machines
6. Domestic Electrical Washing Machines
7. Electric Bread Toasters
8. Electric Blanket and Bed Warmers
9. Electric Clocks and Clock Radios
10. Electric Clothes Dryers-Cabinet
11. Electric Clothes Dryers-Rotary
12. Electric Fans
13. Electric Floor Polishers
14. Electric Grillers
15. Electric Hair Clippers
16. Electric Hand Dryers
17. Electric Hand Lamps
18. Electric Kettles & Saucepans
19. Electric Jugs
20. Electric Irons
21. Electric Lawnmowers, Hedge Trimmers
22. Electric Microwave Ovens
23. Electric Razors
24. Electric Room Heaters
25. Electric Soldering Irons
26. Electrical Installation Accessories
27. Electrical Installation Cables
28. Electrically Operated Projectors
29. Earth Leakage Circuit Breakers
30. Electronic Sound & Vision Equipment
31. Extra Low Voltage Transformers
32. Fluorescent Lamp Ballasts, Condensers, Lamp holders
33. Heater – Aquarium

34. Household Electric Dishwashing Machines
35. Household Electric Food Preparation Appliances
36. Household Electric Hair Dryers & Accessories
37. Household Electric Ranges
38. Household Electric Refrigerators
39. Low Voltage Fuse Base & Carriers (HRC & Wire Elements)
40. Metallic & Non Metallic Conduits & Fittings
41. Meter Boxes
42. Miniature over Current Circuits Breakers
43. Normal Bayonet Lamp holders
44. Normal Bayonet Lamp holder Adaptors
45. Office Associated Equipment (i.e. Calculators, Cash Registers, Erasers, Intercoms, Typewriters, etc.)
46. Photographic Equipment
47. Plugs & Plug Sockets
48. Plug Sockets Adaptors
49. Portable Electric ARC welding Machines (Transformer Type to 15 KVA MAX)
50. Portable Electric Drills
51. Portable Electric Hedge Cutters
52. Portable Electric Grinders, Sanders, Polishers
53. Portable Electric Planners, Routers
54. Portable Electric Saws
55. Portable Electric Switching 7 Control Devices
56. Portable Electric Vacuum Cleaners
57. Portable Immersion Heaters
58. Portable Lamp Standards & Brackets
59. Room Air Conditioners
60. Security Alarm Equipment
61. Supply Flexible Cords
62. Switchboard Panels
63. Wall Switches
64. Water Heaters – All Types

COMPONENTS INCORPORATED IN ABOVE PRESCRIBED ITEMS:-

- a) Thermostats
- b) Switches
- c) Transformers
- d) Motor Control Devices
- e) Quick Connect Tabs
- f) Energy Controllers
- g) Lamp holders
- h) R.I.S Devices
- i) Thermal Protective Devices

27.11 APPLIANCES, MATERIALS, MACHINERY AND EQUIPMENT NOT NEEDED FOR APPROVAL

Appliances, materials, machinery and equipment which are not included in the above list will not be required to be submitted for approval however, PNG Power has the right to "call in" a non-prescribed article if in the opinion of a PNG Power Installation Inspector the article appears to be electrically un-safe.

These non-prescribed articles can be submitted voluntarily for testing and the submitter will be issued a Certificate of Suitability or in some cases a Letter of Acceptance for connection to PNG Power supply.

This ruling does not preclude a non - prescribed article from meeting the requirement of having approved accessories incorporated in the appliances e.g., plugs, switches, sockets, etc.

27.12 PNG POWER APPROVED STICKER

The public should be aware of the prescribed articles and check when purchasing an appliance that it bears a 'PNG POWER APPROVED' sticker and further affirm the issued 'Certificate of Approval'. If the article is not approved or appears to be unsafe, notify the Regulatory Services Appliance Approvals Laboratory or the nearest PNG Power Center Manager.

Engineering Standard: HQH-3CW 00B
Reviewed & Reissued: 0.06.1988, 12.07.2016

TRADE CIRCULAR 28 CEILING FAN REGULATORS

28.1 GENERAL

28.1.1 Application

The Trade Circular No.28 outlines installation requirement for ceiling fan regulators.

28.2 RESISTANCE TYPE FAN REGULATOR

28.2.1 Resistance type fan regulators fixed to flammable structures (such as plywood walls) are to be mounted with fire resisting materials between the structure and the regulator.

28.3 CHOKE TYPE FAN REGULATORS OR ELECTRONIC TYPE REGULATOR

28.3.1 The above does not apply to choke type fan regulators, or electronic type regulators.

28.4 EARTHING

28.4.1 The earthing of fan regulators must be in accordance with AS/NZS 3000:2007 Wiring Rule No. 5.4.1.1 and earthing will apply as such;

- (a) Fan regulators with exposed metal parts must be earthed.
- (b) Fan regulators which are all-insulated but dependent upon a metal base plate for mounting on metal; walls or steel reinforcement must be earthed unless the regulator is fitted with a fully insulated barrier between this plate and any live parts.
- (c) Due to the possibility of a change in regulator type at a later date, from an unearthing type to a type that requires earthing; **all regulators must have an earth conductor provided**. If unused it must be terminated at the rear or inside the fan regulator, in a connector or similar, for future use.

Engineering Standard: HQH-3CW007
Reviewed & Reissued: 30.06.1988, 12.07.2016

TRADE CIRCULAR 29**HOUSEHOLD WATER PUMPS & STORAGE WATER HEATERS
INCLUDING SPECIAL METERING REQUIREMENTS****29.1 GENERAL****29.1.1 Application**

The Trade Circular No. 29 provides provisions and recommendation on the type of Household pumps required to be connected when rain water tank or gravity fed system fail to supply sufficient pressure.

29.2 APPROVED HOUSEHOLD WATER PUMPS

Household water pumps shall be of a type that has been submitted and approved through Appliance Approvals Laboratory of PNG Power.

Any cover on the pump that must be removed to gain access to expose live parts shall be of a type requiring the use of tools for its removal.

29.3 CLIP-ON COVERS NOT TO BE CONNECTED UNLESS APPROVED BY INSPECTOR

Household water pumps with Clip-on covers will not be connected, unless an arrangement, satisfactory to the installation inspector, is carried out, either by the Electrical Contractor or the Plumbing Contractor, to comply with ETC 29.2 paragraph 2.

This is to avoid unauthorized person removing covers for maintenance or adjustments, and failing to replace the same, thus in many cases exposing live parts and single insulation.

29.4 DANGERS

All Electrical Trades person(s) should be fully aware of the danger involved, if they do not replace covers in a permanent manner after maintenance or connection and are accountable for accidents caused through any negligence.

29.5 CONSUMERS INDIVIDUAL PUMPS.**29.5.1 Central Pump connected to Community Services Meter**

Unless a group of flats are supplied with water from a central water pump that is metered separately, on a community services meter, paid for by the owner or landlord, then each individual flat shall be provided with its own individual water pump, controlled from its own respective switchboard and meter. The same policy applies to storage water heaters or booster elements for solar hot water units.

29.5.2 Central Water Pump NOT to be connected to Individual Meter

Under no circumstance is one Central Water Pump, or on Central Storage Water Heater System for a group of flats, to be connected to the **meter of one flat only**, even if that is the Owner's or Landlord's personal flat.

29.5.3 Transient Occupancy

If the type of property is subject to transient occupancy, the Water Pump and Storage Water Heater/Booster for other flats must not be affected, should a Tenant have power disconnected for any reason.

NOTE: This Instruction/Circular is to be used in conjunction with Electrical Trade No.14 Engineering Standard HQH-GCA 005.

Engineering Standard: HQH-GCW 011
First Issued: 30.06.1988 Reviewed & Reissued: 4.07.2016

TRADE CIRCULAR 30**LIGHTING EQUIPMENT- MINOR POWER STATIONS**

30.1 GENERAL**30.1.1 Application**

The provision of Trade Circular No 30 outlines restriction to the connection of incandescent lamps and other appliances or accessories to isolated government power supply for the duration of 24 hours unless granted by Department of Finance or FNG Power Inspector.

PNG Power on behalf of the Department of Finance will only allow single 20 watt 305mm and 40W at 610mm fluorescent light fittings and equivalent, in accordance with Finance Circular no: 144 (attached) to be installed in minor centers.

The main purpose of this ruling is to curtail the use of incandescent lamps of a higher rating than 40/60 watts in Bayonet Cap Holders.

Electrical Contractors wishing to install fittings other than the above must obtain approval in writing from the PNG Power before such fittings may be installed. (See Attachment Finance Circular No. 144)

NOTE: The Finance Circular No. 144 was issued in 1978 and therefore references have change in which 'Electricity Commission' or 'Commission' now means 'PNG Power', 'Electricity Commission's Consumers Engineer' now means 'Manager Regulatory Services Group'.

PAPUA NEW GUINEA

**Department of Finance
Post Office
WARDS STRIP, WAIGANI**

NDP 26-0-0

10th February, 1978**FINANCE CIRCULAR No. 144**

**General Distribution,
Revised 10th February, 1978**

USE OF ELECTRICAL APPLIANCES EQUIPMENT -**GOVERNMENT POWER SUPPLY AREAS**

This instruction cancels Finance Circular Number 291 of 19th September, 1973.

1. Subject to the availability of electricity, the following general load limits will apply in all areas supplied from a government owned power station, including power stations operated by individual Government Departments as from the date of this circular.

Capacity of Power Station

2 x 10 kVA Installed Capacity
2 x 25 kVA Installed Capacity
2 x 40 kVA Installed Capacity
2 x 62.5 kVA Installed Capacity
200 kVA Installed Capacity
200 - 400kVA Installed Capacity
Above 400kVA installed Capacity

Maximum Load Permitted at any one time per installation

Up to 600 watts
Up to 700 watts
Up to 1000 watts
Up to 2000 watts
Up to 2500 watts
Up to 3600 Watts
As Below

2 Notwithstanding these limits, the following appliances are restricted .

a) Heating Appliance

Radiators and other air-heating appliances are expressly forbidden in all centers with exception that a maximum of 2 x 60 watt cupboard heaters per installation may be installed in Category "C" centers

b) Cooking Appliances

- I. Wired – in stoves are forbidden in all centers other than Commission centers. Existing stoves connected to the circuit will be replaced as they become due for replacement with fuel burning stoves (Gas stoves)
- II. Plug – in stoves (Vulcan or similar) are no longer to be installed in centers with 2 x 62.5kVA sets or smaller are to be phased out by replacement with fuel burning stoves when they become due for Board of Survey.

- III. Toasters, vertical grillers and similar appliances designed for short term use are permitted only where the total load as set out in paragraph (1) is not exceeded.
- IV. Frying Pans, rice cookers and other appliances likely to remain connected for long periods are forbidden in centers of 2 x 40kVA or smaller, and will only be permitted in larger centers provided that:
 - 1. They are connected to a metered installation
 - 2. The permitted loads as set out in paragraph (2) are exceeded
 - 3. They are in case, less than 2.5kw

c) Water-Heating Appliances

- I. Jugs are permitted only where the total load of the installation as set out in paragraph (1)
- II. Storage heaters are no longer to be installed in any center. Solar heaters are now required. Existing units in centers with 62.5kVA sets or smaller than are to be replaced with fuel burning units as they come due for replacement or solar heaters.
- III. Instantaneous heaters are only permitted where the total load of the installation as set in paragraph (1) is not exceeded.

d) Air-conditioning Appliances

These are all forbidden except in Commission centers

e) Cooling Equipment

Refrigerators, deep freezers and cool rooms may be used provided that the total allowable load per installation as set in paragraph (1) is not exceeded and provided the motor size is permissible.

f) Motor -driven Equipment

The following rules shall apply to motors

- I. No motor with a name plate rating per phase in excess of five per centum of the minimum rating of the power station shall be connected. The minimum rating of the generating(s) set normally run at the lightest load period, e.g. a 3 x 100kVA power station would have a rating of 100kVA, and a 2 x 62.5kVA station would have a minimum rating of 62.5kVA and so on.

Maximum Motor Size

Size of Power Station	Single Phase	Three Phase
2 x 10 kVA	400 watts (0.50HP)	-
2 x 25 kVA	400 watts (0.50HP)	1000watts (1.5HP)
2 x 40 kVA	600 watts (0.75HP)	1600watts (2 HP)
2 or 3 x 62.5 kVA	800 watts (1.00HP)	2500watts (3 HP)

2 or 3 x 100kVA 1200 watts (1.70HP) 4000watts (5HP)

Note that where a 3 sets station normally runs two sets in synchronism (i.e. not applying split loads)

- II. No motor with a name plate rating (per phase) in excess of two per centum of the minimum rating of the power station (generator) shall be started using the Direct on Line (DOL) method.
- III. The starting current of any motor shall not exceed fifteen (15) per centum of the minimum rating of the power station/generator.
- IV. The maximum permissible motor size is in addition limited by time allowable installation loads as set in paragraph (1)

g) Lights

The only type of light allowable on other than Commission centers is the fluorescent fitting either 36watts or 18watts. Incandescent fittings are not allowed in any except category "C" centers.

h) Welders

The smallest type of electric arc welder available, namely, one rated at 15 amperes 240 volts, will cause noticeable light flicker when connected to even a 100kVA set. This type of welder may only be connected in centers with at least 3 x 100kVA sets and then only follow approval by the Commission in each case.

Larger welders will only be allowed following investigation and approval in each case by the Electricity Commission's Consumers Engineer. Approval will be given where interference in the supply of other consumers is met so great as to cause annoyance.

Note that three phase motor generator type welders are not nearly as bad as transformer types. Generally, a three phase motor driven welder is treated the same as in paragraph 2 (f) (i).

i) General

Under the Electricity Supply (Government Power Stations) Act 1970, and relevant By-Laws, consumers connected to Government Power Systems are not permitted to cause interference to others consumers.

Interference can be:-

- (i) Fluctuations in voltage caused switching on and off of large appliances or starting of motors. Note that many cooking appliances are turned off and on continually by the thermostat.
- (ii) Rapid fluctuating in voltage cause by welders
- (iii) Low voltage cause by excessive current draw
- (iv) Overload of the power station caused by excessive current draw

- (v) Radio interference caused by noisy appliances such as unsuppressed power tools.

Should any consumer cause interference to other consumers, the Department of Finance reserves the right to refuse to supply electricity to that consumer until the offending apparatus is removed permanently from the supply?

3 General Principles

The power station run by the Government run at enormous loss – estimated to be in excess of K6 million in 1976/77. (including institutional stations run by individual Departments).

In fact, electricity generated by small diesel engines in remote locations is a very expensive commodity – costly, in some locations, as much as K1.00 per kWh to generate (including maintenance). That means that a single large hotplate on an electric stove would cost the Government K2.40 per hour to run.

A gas or fuel stove would not cost anything like this to operate.

It is therefore Government policy to limit the use of electricity in small Government centers to those uses that have no cheap or satisfactory alternative. In general, lights, small entertainment appliances (such as radios), refrigeration equipment, small pumps, and fans are devices which maximize the use of existing power supplies.

In some cases, the Department, in consultation with electricity entity may approve variations to the above rules, as follows:

(a) Government Installations

Many Institutions, such as hospitals or Corrective Institutions have power requirements that exceed the allowable load. Equipment such as X-Ray machines, sterilizers and high levels of security lighting are some examples.

These loads will generally be connected provided that there is sufficient capacity at the station. It should, however be realized that many of these appliances will cause interference to the supply that would normally be considered unacceptable. In some cases, it will necessary to limit the use of such appliances to certain times during the day to minimize interference.

Officers specifying equipment to be installed in minor centers are to take note of the following:

- (i) Electric stoves are not to be installed in any institution other than those in PNG Power centers. In one case in 1976, an electric stove was installed at a high school at a remote station when the maximum load drawn by the stove exceeded the entire power output of the power station.

Again from this students trained to use this type of stove would not have access to one in normal life so that the training is partly wasted.

- (ii) Motor driven equipment should have the smallest possible motor consistency with the function. It is better that compressor and pump models operate longer hours while drawing smaller amounts of power at any one time.

- (iii) Air conditioning equipment will only be permitted in minor stations where it is essential for the function. In many cases, the need for air conditioning can be eliminated with thought -e.g. the use of tropical, proof electronic equipment or the use of adequate ventilation.
- (iv) In any case, all requests for installation of equipment in excess of that allowable must be considered individually by the PNG Power Limited. Under no circumstances is an officer to specify large current drawing appliance without consulting Manager Regulatory Services Group.

(b) Private Consumers

Many requests are received for the connection of trade stores, hotels and the like to government supplies. Typical equipment includes pie warmers, freezer rooms, cool rooms and other heavy loads. Requests for the connection of such consumers must be submitted through the Provincial Administrator to the coordinator of works.

Approval will be given if:

- i. The proposed connection is endorsed by the Provincial Administrator as being necessary for the benefit of the town.
- ii. No appliances are installed (such as stoves) that could readily utilize alternative fuel.
- iii. Metering is installed and a monthly account based on the reading is forwarded to the consumer.
- iv. There is sufficient capacity in the Power House.

Under no circumstances are such consumers to be connected without this procedure being followed. Failure to observe this procedure will lead to the consumer involved. Private residences connected to small centers must comply with the rules as set out in Clause 32.4.1.

Again it is stressed that these consumer frequently interfere with the supply to other consumers in the center.

No such consumer is permitted to connect additional equipment to his/her installation without receiving approval from the Coordinator of Works.

(c) Metering and Load Limiting

All consumers are to be fitted with either a load limiter, and/or a meter which is reading monthly, as follows:

(i) 8 and 12 Hours Per Day Centers

All consumers are to be fitted with Load Limiter. A load limiter is fitted to allow more than the allowable load set out in paragraph (1), and then the consumer must be metered and billed at Zone 7 Tariff

(ii) 18 hours Per Day Centers

All consumers must be metered and in addition load limiters are to be installed.

(iii) Category "B" Centers

All consumers must be metered. In addition load limiters may be installed where insufficient power is available to supply existing consumers.

(d) Category "C" Centers

These are centers that will when they grow to a certain size become economic and will be taken over by Electricity Commission. The rules relating to these centers are the same as those that apply to minor centers.

However, the size of appliance is still governed by the size of the power station so that the rules of paragraph 2 still apply.

(e) By - Laws

Note that the Service and Installation and Conditions of Supply By - laws imposed further restrictions on the use of certain types of equipment.

The Electricity Commission's Consumers Engineer can provide details of allowable equipment on request.

Please ensure that this revised instruction is brought to the notice of all officers concerned with the supply of electricity.

SECRETARY FOR FINANCE

Engineering Standard: HQH-GCW 015
Reviewed & Reissued: 30.09.1988, 14.07.2016

TRADE CIRCULAR 31 PROTECTION OF MAIN EARTHING CONDUCTOR

31.1 GENERAL**31.1.1 Application**

The Trade Circular No. 31 provides requirements for ensuring provision of adequate protection for the connection of the Main Earthing conductor to the Earth Stake without interference.

31.2 INEFFECTIVE PROTECTION OF MAIN EARTHING CONDUCTOR

The usual method of protecting Main Earthing conductors to the Earth Stake by the use of PVC Conduit has in the majority of cases proven ineffective.

In particular, Institutional (School etc.) and low cost housing areas seem to be the most subject damage.

31.3 WHERE DAMAGE OCCURS

Damage occurs mainly when the Building is of the elevated type necessitating an unsupported length of conduit to the Earth Stake. Refer Figure 32.1 for detail on unprotected wiring arrangement.

This makes it extremely accessible to damage by children and/ or vandals.

31.4 ADEQUATE MECHANICAL PROTECTION REQUIRED

The circumstances where chances of damage seem likely, galvanized steel conduit must be used to provide adequate Mechanical Protection, for the unsupported section.

31.5 LOCATION

The location for Earth Stake should be assessed and selected according to the nature and type of installation.

31.6 DISCRETION OF THE INSPECTOR

As this ruling is to be implemented at the discretion of the Inspector, the contractors should comply with it, if any doubt exists, this may save unnecessary fault notices and returns to the job to repair any defect issued.

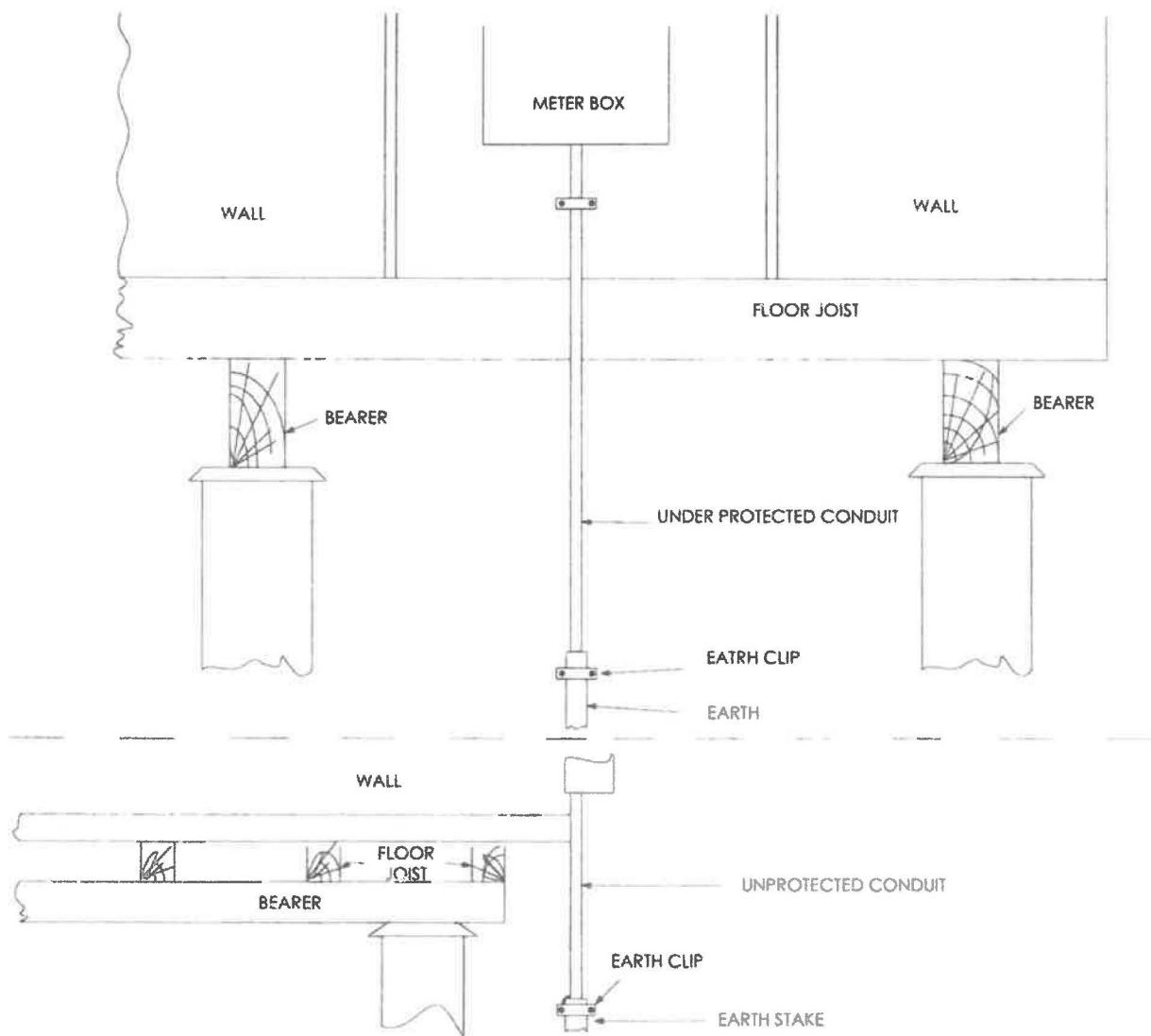


FIGURE 32.1 SHOWS THE UNPROTECTED MAIN EARTH WIRE IN CONDUIT

Engineering Standard: HQH-GCA 004
Reviewed & Reissued: 30.09.1988, 28.07.2016

TRADE CIRCULAR 32 CONNECTIONS OF MOTOR AND LARGE APPLIANCES

32.1 GENERAL

32.1.1 Application

The Trade Circular No. 32 under Electricity Industry (Services and Installation) Regulation provides some guidelines for the connection of large appliances.

32.2 CONSENT ON CONNECTION OF LARGE APPLIANCE

32.2.1 PNG Power under Section 12 (1) "may prohibit or restrict, subject to such terms and conditions as it considers necessary, the connection to its supply of the following electrical appliances:-

- (a) A single phase welding apparatus, of which the rated input current at 240 volts exceeds 15 amperes or the rated kVA at 415 volts exceeds 7.5 and which is not a 3-phase motor-driven type;
- (b) A cooking range having a rating exceeding 50 amperes;
- (c) A thermostatically - controlled commercial oven having a rating exceeding 35 amperes;
- (d) A 3-phase instantaneous water heater;
- (e) An instantaneous water heater where maximum loading exceeds 15 amperes at 240 volts;
- (f) A water-boiler having a rate exceeding 4kW single-phase 240 volts;
- (g) A single-phase air conditioning unit without a separate sub-circuit originating on the main distribution board;
- (h) A 240 volt single-phase motor of greater than one horsepower (750W) employing the split-phase method of starting;
- (i) A 240 volts single-phase motor of greater than two horsepower (1450W) employing capacitor start or repulsion start;
- (j) A 3-phase motor of greater than (2200W) with a method of starting which does not conform with the requirements of PNG Power;
- (k) Apparatus which , in the opinion of PNG Power causes or likely to cause radio interference;
- (l) Apparatus which, in the opinion of PNG Power, has a fluctuating load; and

- (m) Any other apparatus which, in the opinion of PNG Power, is likely to cause interference with PNG Powers power supply to other consumers or is likely to interfere with the satisfactory operation PNG Powers plant".

32.2.2 Welders

PNG Power may under Section 13 disconnect welding apparatus that it considers is causing interference.

32.2.3 Starting current

Unless otherwise directed by PNG Power in accordance to Section 32, the starting current of an alternating current motor when measured with a damped ammeter or with locked rotor shall, not exceed the current specified in Schedule Four in relation to the type of motor.

SCHEDULE FOUR.

Starting Current of A.C Motors;

1. Single phase 240 volts motor - 20 amperes
2. Three-phase motor where –
 - a) Rating of motor does not exceed 2HP (1450W)-16amps.
 - b) Rating of motor exceeds 2 HP- [HP rating of the motor multiplied by 8(amperes) (or kW rating x 11)] but does not exceed 6 HP (4.4kW)the HP
3. For motors rated at over 6HP – [HP rating of the motor Multiplied by 2.5 plus 33(amperes)(or kW x 3.4 +33)]

32.3 DISCRETIONARY POWERS

32.3.1 Note that in the above regulation, PNG Power has discretionary powers as to whether a certain size or type of equipment is allowable, as well as discretionary powers as to the system of starting of motors.

32.4 DECISION TO CONNECT APPARATUS OR NOT

32.4.1 There is only one criterion for deciding whether equipment can be connected or not. That is the criterion of Section 12 (m) of the Service & Installation By-Law **will the apparatus cause Interference to PNG Powers supply to other consumers or is it likely to interfere with the satisfactory operation of PNG Power's plant?**

32.5 DEFINITION OF INTERFERENCE.

32.5.1 Interference may be broken up into two broad areas:-

- (a) Interference to the operation of other electrical equipment - e.g. electronic computing devices, some processing machinery, etc this equipment is affected by "Step" voltages, which can cause mal-

operation of electronic circuits, or cause sudden changes in torque on motor drives. In addition, all equipment is affected one way or the other by a voltage level that is too low.

- (b) "Annoying" flicker in lighting systems. This area cannot be calculated scientifically, as annoyance will vary with:-
- (i) Magnitude and duration of voltage dip
 - (ii) "shape" of voltage dip
 - (iii) Type of lighting installation (e.g. mixture of artificial/natural, incandescent or fluorescent, etc.).
 - (iv) Nature of task performed by user of light (e.g. draftsmen, office workers, etc.).

32.5.2 Graphic representation of voltage changes

32.5.2.1 Incandescent lamp

The **Figure 33.1** graph gives a guide to the perception and toleration of incandescent lamp flicker due to voltage fluctuations.

32.5.2.2 Fluorescent lamp

For fluorescent fittings this is conservative, as fluorescent lights are less sensitive to voltage changes than incandescent types.

32.5.2.3 Motors

For motors starting less frequently than once per hour, a general limitation of 8% should be applied.

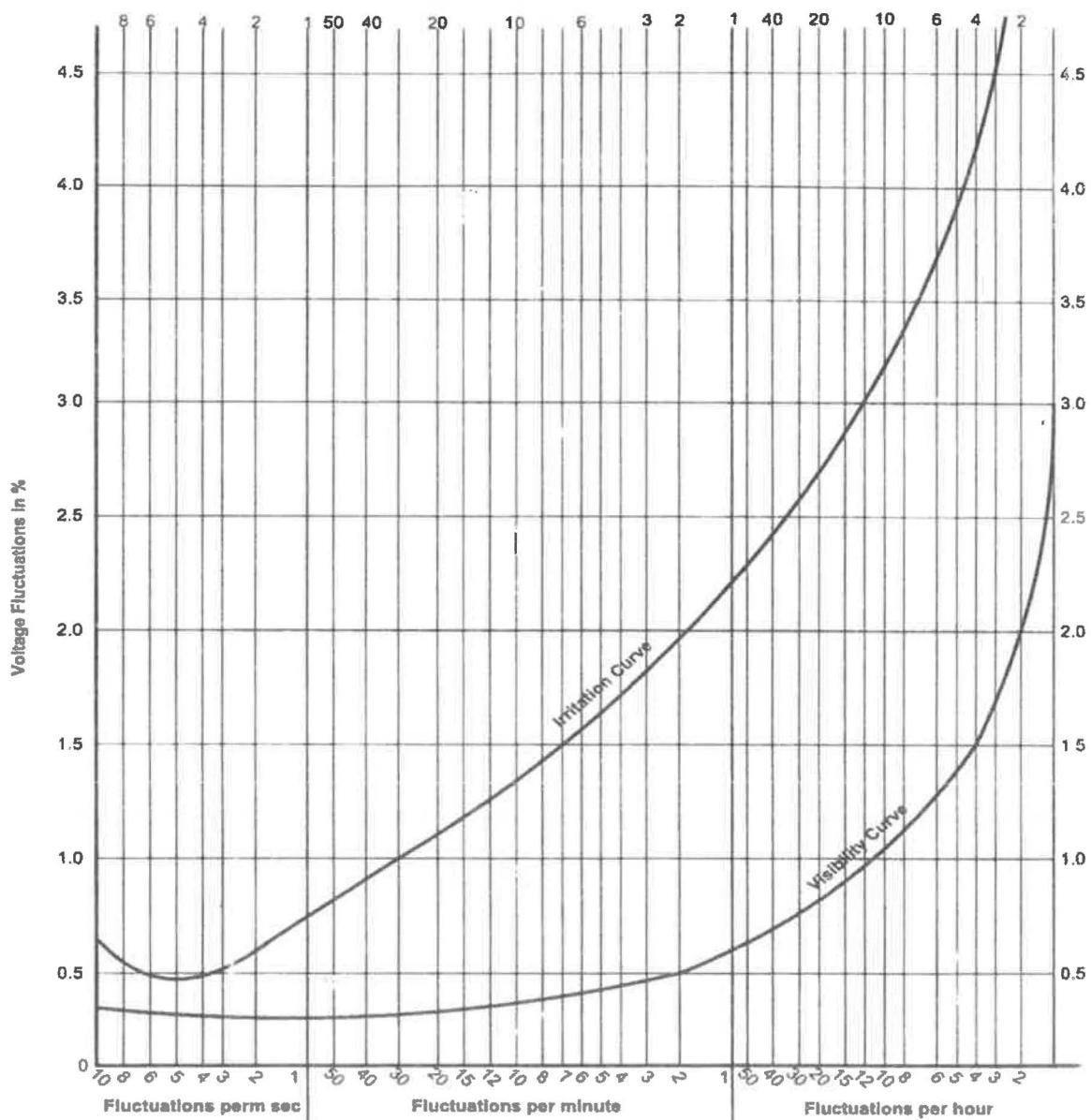


Figure 33.1 Gives a guide to the perception and toleration of incandescent lamp flicker due to voltage fluctuations

32.5.3 Some general conclusion may be drawn from the above graph-

- (a) Appliances causing rapid fluctuations such as welders will cause irritation at voltage variation of 0.5%, although the incidence of full short circuit current would be less frequent, and an annoying value could be assumed to be about 1.0%. Hence the rated current drawn by the welder should not cause voltage fluctuations exceeding 0.5% in supply to other customers, while the short circuit current should not produce a voltage fluctuation exceeding 1%.

Of course, in some industrial area where little lighting is used during the day, much higher levels could be acceptable, particularly where the consumer using the welder is the only one affected. In such areas, the above figures could be doubled for daytime use to 1.0 % and 2.0 % respectively.

- (b) Apparatus cycling in the 1-10 minute range produces irritation at voltage fluctuations in the 2.0-3.5 % range. As a general rule for refrigeration equipment, including air-conditioning plants and compressor installations, a limit of 2.5 % in the voltage fluctuation affecting other consumers can be applied. Again, for industrial areas with little lighting, this figure could be increased to 4.0 % for daytime use.
- (c) For motors starting only occasionally-twice per hour or less, a voltage fluctuation of 5 % affecting other customers is acceptable, while starts of less than one per hour permit fluctuations of 8 %.

Note that while lamp flicker considerations allow fluctuations of up to 8 %., the requirement of much electronic equipment, including computers and process control equipment found in modern factories, are more stringent.,

An upper limit of 5% is therefore be used.

PNG Power also is obliged to keep customers' voltage within the range nominal ± 5%. This in itself will make it virtually impossible to allow voltage fluctuations of more than 5%.

The Table 33.1 provides a general guide to allowable voltage fluctuations affection other consumers for particular appliances. Individual cases may be considered in the light of the above graph in special circumstances.

Table 33.1 Provides the general guide to allowable voltage fluctuations affection other consumers for particular appliances

Appliance	Normal Residential Commercial Areas	Industrial Areas with little artificial lighting (daytime use only).
Welder	0.5% rated current 1.0% S/C current	1.0% rated current 2.0% S/C current
Air Conditioner Compressor Refrigeration	2.5% (on starting current)	4.0%
Motor-2 starts/ hour or less	5% (on starting current)	5%

32.6 VOLTAGE DROPS IN POWER STATION, DISTRIBUTION LINES AND SUBSTATIONS.

32.6.1 Effects by fluctuating loads

Voltage drops caused by a fluctuating load occur at every point between the power station and the consumer.

Except in small centers with Thermal Generation and most Government centers, the power station is not likely to be a problem.

Normally, the voltage drop in the various parts of the system will be calculated by Engineering and Design Division for appliance larger than those as covered by the By-Laws. Government centers are covered by Finance Circular 144, (See Electrical Trade Circular 30, and Engineering Standard HQH-GCW 011) in small stations it is necessary, in addition to the considerations, to ensure the motor starting current does not cause overloading of the power station Generation System.

32.7 CUSTOMERS SUPPLIED FROM DEDICATED OR THEIR OWN SUBSTATION.

These customers are more isolated from other customers than is normally the case. It is therefore possible to make a blanket rule that any motor may draw up to 65% of the nominal substation rating on starting. In practice, this means that a motor having a current rating 10% of the transformer rating can be started D.O.L., while a motor of 20% of the transformer rating can be started Star/ Delta. For motors with infrequent starts, these figures can be increased to 15% and 30% respectively, but these cases must be referred to the Manager Engineering and Design, as substation fuses could blow while the motor is starting.

32.8 LARGE CUSTOMERS.

Generally, a motor with a nameplate current rating of up to 10% of the current rating of the connected motor load (that can be run simultaneously) of a single installation may be started D.O.L, provided that it does not start more than 8 times per hour.

32.9 MULTIPLE INSTALLATIONS.

In cases where a number of separately metered consumers are situated within a block of land or building, the voltage fluctuations at one consumer's meter caused by other consumer's load shall not exceed the above values. As a general rule, the contractor may assume that the full estimated load * of the whole installation will cause a 5% voltage drop in the external power system. For example, a block of flats with a maximum demand of 200 amperes has a 5 kW lift motor situated on the top floor. If the voltage drop in the rising main is 0.6% while the motor draws 18 amperes maximum, what is the total voltage drop.

*This is the best estimate of the actual full load, not the AS/NZS calculated figure.

Voltages drop in external power system = $18+200 \times 5\% = 0.45\%$

Total Voltage drop = 0.6 + 0.45% = 1.05%

According to the toleration graph, this level of fluctuation is permissible up to about 17 times per minute; hence this installation is acceptable.

32.10 NOTIFICATION TO PNG POWER.

Contractors must individually list all appliances have a load exceeding that listed in paragraph 1 on the Intention Notice.

For motors falling within that guidelines set up in ETC No.32.6, 32.7 and 32.8, the Senior PNG Power Inspector in each center may allow connection of motor size in relation to the whole installation is correct.

However, **In all cases** of appliances having a load exceeding that listed in ETC 32.2.1, the Manager Engineering and Design shall be notified by the Installation Inspector, to ensure that the distribution system can cope with the increased load. This shall be done by forwarding a copy of alternatively, forwarding a memo (even a hand written one) giving details of the proposed appliances.

Where particular cases are referred to the Manager Engineering and Design for decision, the Manager Engineering and Design shall forward a letter to the consumer, copy the Installation Inspector, approving or disallowing the motor or appliance concerned.

32.11 GOVERNMENT CENTERS

The Government Power Stations Act and By-Laws broadly have similar provisions to Electricity Industry Act and Regulations.

However, with small Government centers there is the additional problem that the supply source is a small generator; generators normally have high impedance – up to 17 %, so that; combined with voltage drops in the distribution system, the regulation of the systems very poor in comparison to a large system.

Finance Circular 144 gives broad guidelines covering the connection of appliances in Government Centers; all requests or connection of appliances in excess of the stated sizes must be directed to the Manager Engineering and Design. (See Trade Circular No.30 Engineering Standard HQH-GCW 011).

Engineering Standard: HQH-GCG 018
First Issued: 30.04.1991 Reviewed & Reissued: 25.07.2016

TRADE CIRCULAR 33 MINIMUM SUPPLY KITS

33.1 GENERAL

33.1.1 Application

In an effort to expand and accelerate rural electrification, PNG Power has introduced a Minimum Supply Kit (MSK) for the wiring of rural houses. The Trade Circular No.33 provides provisions and restriction for safety use of the Minimum Supply Kit.

33.2 MINIMUM SUPPLY KIT HIRE PURCHASES

PNG Power supplies and installs this kit and the customer purchases it on hire purchase.

33.3 MAXIMUM DEMAND

The kits are intended to supply individual appliances rated up to 10 amps and a total installation maximum demand of up to 16 amps. The connection of higher power appliances is not permitted. Electrical Contractors must not adapt or extend these Minimum Supply Kits.

33.4 KIT TO BE PROTECTED BY RCD CIRCUIT BREAKER

Minimum Supply Kit shall be supplied with Type II 15A RCD Circuit Breaker to protect 2 x 10A Double GPOs.

33.5 THE RECOMMENDED CABLES

The flexible cords shall be used to supply lights, equipment or other appliances ensuring not to overload the carrying of the conductor.

The flexible cords used to supply lights, appliances or equipment shall be used within the vicinity of the premises only.

33.6 PROHIBITED AREA OF USE

The used of extension cords or TPS cables installed in expose condition to supply other premises or locations on permanent basics are prohibited.

NOTE: The inclusion of Residual Current Device (RCD) shall minimize electrical shocks or electrocution and increase safety.

Engineering Standard: HQH-G
First Issued: 28.07.2016

TRADE CIRCULAR 34**RESIDUAL CURRENT DEVICES FOR LIGHTING AND GPO CIRCUITS****34.1 GENERAL****34.1.1 Application**

The Trade Circular No. 34 Introduces the Inclusion of Residual Current Devices (RCDs) in electrical installation to provide additional protection in Papua New Guinea.

As of the Fourth Edition of the Electrical Trade Circular, the Installation of Residual Current Device (RCD) is mandatory installation requirement for domestic, commercial and Industrial installations.

The Installation of Residual Current Device (RCD) used as protective device should minimize cause of electrocution-shock from electricity passing through the body to the earth. It should provide some protection against electrical fires.

34.2 SELECTION AND ARRANGEMENT**34.2.1 For the purpose of selection and arrangement of installation**

- (a) RCDs with a maximum sensitivity of 30 mA can be either 10mA or 30mA
- (b) A minimum of 2 RCDs is required per domestic installation.
- (c) All socket outlet and lighting circuits shall be distributed over circuit RCDs.

These arrangements are intended to minimize the impact of the operation of a single RCD.

34.3 RATED CURRENT OF THE RCD

The rated current of the RCDs shall be selected according to the maximum sustained load it will carry.

The rated current of the RCD shall be at least the same as the fuse or circuit breaker, through if feeding many circuits.

Note: The combination fan, light and heater units, exhaust fans and ceiling sweeps fans are all regarded as lighting points.

34.4 EQUIPMENT NEEDING RCD PROTECTION:

- (a) Hand Held Electrical Plant
- (b) Electrical Plant which is moving during operation

- (c) Plant is moved between operation where damage to plant or the supply cord could occur
- (d) Where electrical safety could be affected by the operating environment

34.5 TYPE OF RCD

RCDs shall be fixed setting in compliance with AS/NZS 3190, AS/NZS 61008.1 or AS/NZ61009.1 and intended for fixed installation.

The type of RCD shall be selected and in compliance to AS/NZ 3000:2007 Rule No: 2.6.2.2

Note: Where an RCD is integral to a socket-outlet (socket-RCD or SRCD), the RCD shall interrupt all live conductors.

34.6 NUMBER OF POLES

RCDs may comprise;

- (a) Two poles use single pole phase AC supplies (Two current parts)
- (b) Three poles for use on Three phase AC supplies (Three current paths) or
- (c) Four poles for use on three phase and neutral supplier.

34.7 OTHER ELECTRICAL INSTALLATION

34.7.1 Protection

Additional protection by RCDs with a maximum rated residual current 30 mA shall be provided for according to AS/NZS 3000:2007 Rule No: 2.6.3.2.1;

- (a) Final sub circuits supplying sockets where the rated current of any individual socket-outlet does not exceed 20 A; and
Final sub - circuits supplying lighting where any portion of the circuit has a rated current not exceeding 20 A; and
- (b) Final sub circuits supplying directly connected hand-held electrical equipment. E.g. hair dryers or tools.
- (c) For home dialysis installation Socket-outlets shall be installed and protected in accordance with Clause 2.6.3.3.

NOTE:

The final sub circuits referred to in item (b) include, without limitation, those supplying the following equipment:

External lighting installations, such as bollard-type luminaries;

- (i) Illuminated signs.
- (ii) Group lighting and

(iii) Ground-mounted lighting for the illumination of public features

34.7.2 Areas access by children

Additional protection by RCDs with a maximum rated residual current of 10 mA shall be provided for final sub-circuits supplying socket-outlets in areas normally accessible by children in:

- (1) Kindergartens; and
- (2) Day care centres for pre-school children; and
- (3) Primary schools.

34.8 ALTERATIONS ADDITIONS AND REPAIRS

Socket-outlets that are added to an existing circuit shall be protected by an RCD.

34.8.1 RCD Not Required

RCDs are not required for circuits supplying fixed appliances, such as hot water system and stoves.

34.9 REQUIREMENT NEED NOT APPLY

- (1) Where other methods of protection are applied, e.g. a separated supply in accordance with AS/NZS 3000:2007 Clause 7.4
- (2) Special situations refer to Section 6 and 7 of AS/NZS 3000:2007 that requires RCD protection which shall be provided in accordance with the requirements of the relevant Clause.
- (3) Where socket-outlets or lighting points those are not RCD-protected
- (4) replaced, including the replacement of a single socket-outlet with a multiple socket-outlet assembly
- (5) Extensions to final sub-circuits supplying lighting points only provided that the existing final sub-circuit is not RCD-protected.

34.10 TESTING OF RCDs

The RCDs test is carried out to determine how fast it can discriminate any earth leakage in shorter period of time than the normal circuit breaker because of the arrangement of the neutral connection.

Test shall be made on the load side of the RCD between the line conductor of the protected circuit and the associated circuit.

34.10.1 Testing Procedures:

- (1) Any load or appliances should be disconnected prior to testing
- (2) Ensure that RCD Tester is in working condition.
- (3) There is no visual damage to Instrument or Test leads.

- (4) Test leads for continuity with continuity meter.
- (5) Select RCD trip time tester suitable for 10mA or 30mA.
- (6) RCD Lighting Circuit:
 - (a) Select Earth Leakage Test Value of 10mA;
 - (b) Connect active, Neutral and Earth test leads to their designated testing point;
 - (c) Simulate the fault condition by pressing the button.
 - (d) The RCD protective device should trip within less than 40ms when it reaches 10mA.
 - (e) Test all lighting RCD protective devices for each circuit.
- (7) RCD GPO Circuit:
 - (a) Select Leakage value of 30mA.
 - (b) At the GPO circuit, using 3 pin plug RCD Tester. Plug the male plug in the GPO;
 - (c) Simulate the fault condition by pressing the button;
 - (d) The RCD protective device should trip with less than 200ms
 - (e) Test all GPOs RCD protective devices for each circuits

NOTE:

1. Led light should indicate the polarity of the test.
2. When an RCD with a rated residual operating current exceeding 30mA is used to provide additional protection. The operating time is **40 milliseconds**.
3. Manual pushbutton (Trip) test can be performed by the Electrical Installation Inspector to determine the RCDs tripping function and approximate tripping time.

Engineering Standard: HQH - GCW 014

First Issued: 20.04.2017

TRADE CIRCULAR 35 SOLAR STANDBY FACILITY

35.1 GENERAL

35.1.1 Application

The Electrical Trade Circular No 35 provides standard requirements with regards to Solar Standby Facility (SSBF) circuit system, operation and the related system components.

35.2 SOLAR STANDBY FACILITY REQUIREMENTS

35.2.1 System

The following requirement shall be considered when choosing SSBF:

- (a) It will only operate via automatic transfer switch (ATS) when the main power supply fails and switches off automatically when the main power supply (PPL) comes back.
- (b) The system shall only be applicable for residential and commercial building with three phase power (single phase on permissive basis)
- (c) The maximum input voltage and current can be determined from the arrays short circuit current and open circuit voltage at their lowest ambient temperature.
- (d) The power output from SSBF inverter is an AC three Phase system. i.e. 240V single phase and 415V phase to phase.
- (e) The system shall consist of PV source (modules, panels or arrays) and support structures, battery charge controller, battery bank and enclosure, inverter, and an automatic switch transfer (ATS), protective device and associated balance-of-system (BOS) components including wiring, conduit, disconnects, overcurrent devices, surge suppression and grounding equipment

35.3 COMPONENTS OF THE SYSTEM

The components of the SSBF are as follows;

35.3.1 Photovoltaic Source

The photovoltaic sources consist of module, panel or an array that converts sunlight to dc power. (Refer AS5033/2014)

35.3.2 Array

The photovoltaic (PV) array for the SSBF shall be designed in accordance with AS 4509.2, AS/NZS 5033, and the following:

35.3.3 Module

The PV modules used shall be in accordance with AS/NZS 5033, DPNGS/IEC 61215, (DPNGS/IEC 61646 and the following:

- (a) Crystalline cell type modules or thin-film type
- (b) Nominal output voltage of 12V d.c
- (c) Efficiency energy conversion ratio greater than 12%.
- (d) Capable of operating at the installation location considering ambient temperatures and extreme weather conditions (for example hail).
- (e) Warranted power output of not less than 90% of nominal for at least 10 years

35.4 INSTALLATION GUIDELINES

35.4.1 General

The installation of array shall be in accordance with AS/NZS 5033, AS4509 and the following:

- (a) The array shall be positioned, oriented and installed to maximise the output power while avoiding shading, temperate and wind effects.
- (b) All PV array shall be facing north (tilt between 2 and 11 degrees) since the optimum angle depends on the site latitude.
- (c) The array mounting hardware supplies shall be compatible with the site considerations and environment conditions
- (d) All arrays shall be properly sized and rated for the application, location and voltage drop.

35.4.2 Cabling

The wiring and cable for the module and array shall be in accordance with AS/NZS 5033 and the following

- (a) PV array cables shall be double insulated and be flexible (multi strand) to allow for movement.
- (b) PV cabling must be identified with a permanent, indelible marking in English or coloured "SOLAR" labels attached. When the PV cable is enclosed in conduit or other wiring enclosure a coloured "SOLAR" label must be attached at each end of the wiring enclosure and at each change of direction

- (c) The solar array to inverter solar and DC cables within buildings shall be in heavy duty conduit.
- (d) If exposed to the environment, cabling shall be UV resistant or protected from UV by installation in UV resistant conduit.
- (e) Cable connectors must be d.c rated

35.4.3 Earthing

The Earthing for PV module and array shall be in accordance with AS/NZS 5033

- (a) Modules should be connected to each other and the mounting structure with grounding conductors to ensure a continuous grounding connection.
- (b) Cable lugs, earthing termination and bonding cables are to be fixed by stainless steel bolts, washers and penetrating washers to aluminium frames
- (c) Earthing or bonding connections MUST BE arranged so that the removal of a single module earth connection will not affect the continuity of the earthing or bonding connections to any other module .
- (d) Equipment grounding (Earthing) shall connect all non-current carrying metal receptacles, electrical boxes, appliance frames, chassis and PV panel mounting structures in one long run. The grounding wire should not be switched, fused or interrupted.

35.4.4 Overprotection

- (a) The overcurrent protection devices shall be provided in the combiner box in accordance with AS/NZS 4509.1
- (b) Protection against over currents must be provided when the carrying capacity of the cable is less than 1.25 times the calculated fault current in any point.

35.4.5 Disconnection devices

The disconnection devices for the SSBF shall be in accordance with AS/NZS and the following

- (a) An isolating/disconnection device shall be installed adjacent to a PV array.)
- (b) Disconnection devices will not be polarity sensitive and must operate in all active conductors.
- (c) If Circuit breakers are used, they are not to be polarity sensitive. They must also be rated to interrupt the full load when operated and have a voltage rating greater than open circuit voltage (Voc).

Note. Bonding refers to the standard (AS5033-2014) and the earthing layout

35.5 BATTERIES

All installations of batteries and associated equipment shall be in accordance with the requirements of AS4086.2 except as varied herein.

35.5.1 Location of Batteries

All Batteries shall be located in an area that shall be designed to prevent access by unauthorised person.

Batteries shall be installed in one of the following

- (a) A dedicated equipment room or battery enclosure; or
- (b) A fenced off section in a larger room does not have restricted access,

Example: part of a larger shed

Note: A sealed (valve regulated) battery is installed in the battery enclosure

35.5.2 Equipment Room or Battery Enclosure

Ventilation of the battery installation shall comply with the requirements of AS4086.2 except as varied herein.

A minimum horizontal separation of 500mm shall be provided between the battery and all other equipment from 100 mm below battery terminals except where there is a solid separation barrier. If a battery is enclosed in a battery box with no other equipment installed in the box there is no need for the 500 mm clearance from the walls to the battery box.

No equipment shall be placed above the batteries or battery enclosure except for non-metallic battery maintenance equipment.

35.5.3 Battery Protection Equipment

Battery protection equipment (e.g. fuses & circuit breakers) should be mounted outside the battery enclosure but as close as possible to the battery enclosure to minimise cable length.

Where overcurrent protection equipment is mounted in the battery enclosure, the equipment shall be mounted a minimum of 100mm below the battery terminals or a minimum of 500mm horizontal from the batteries.

Note: Capital protection in the battery enclosure should be located to minimise the risk of being splashed when topping up battery electrolyte.

35.5.4 Battery Installation

The following requirements/practices shall be observed when installing batteries.

- (a) Safety signs shall be provided and fixed in position

- (b) The general safety sign "DANGER: RISK OF BATTERY EXPLOSION" shall be visible on approach to the battery enclosure
- (c) Battery enclosure or battery stand shall protect batteries from damage due to seismic activity and shall comply with AS4219
- (d) Exposed terminals, inter-cell straps and battery cabling connections shall be insulated and mechanically protected.
- (e) Protective safety equipment including eye protection and acid protective gloves shall be provided where flood cells are used.

35.6 CHARGE REGULATOR

Regulators, and associated temperature sensors where provided, shall be installed according to the manufacturer's instructions.

The regulator should be securely fixed and if fitted with a heat sink, be positioned to achieve adequate cooling airflow over heat sink(s)

35.7 BATTERY CHARGERS

All battery chargers shall be connected to the battery bank by fixed wiring via the main battery fuse or circuit breaker. If the main battery fuse or circuit breaker will not provide overcurrent protection for the battery charger output wiring, the battery charger output cabling shall be protected from overcurrent by separate HRC fuse or D.C rated circuit breaker adjacent to the main battery fuse or circuit breaker.

The battery charger shall be fitted with a fuse or circuit breaker to prove an isolating point and battery charger overcurrent protection.

35.8 INVERTER

35.8.1 Size

The size of inverter shall be determined in relation to the installed load capacity in that it must be rated in excess of 25% of the peak installed load.

35.8.2 Inverter Fixing

The inverter should be securely fixed and positioned to achieve adequate cooling airflow over the inverter heat sink(s) as indicated in the IEC 62109.1 of the manufacturer's instructions in this regard.

All cabling between an inverter and a battery bank shall be kept as short as possible. The inverter d.c input connection shall be fitted with overcurrent protection at the connection to the d.c supply (e.g. the main battery fuse)

35.8.3 Inverter Installation

The electrical contractors are to pay attention to inverter installation arrangement as given in ETC 35.8.3.1 & 35.8.3.2

35.8.3.1 Inverters with Separation

For inverters which provide separation/isolation (on both a.c & d.c output and inverter controls) between the d.c input and Low Voltage a.c output, the following shall apply:

- (a) The a.c output may be connected to M.E.N configured main installation switch board or operated as a separated (isolated) supply.
- (b) The d.c input may be left floating or be earthed on one side.

35.8.3.2 Inverters without Separation

Where the d.c supply to the inverter is E.L.V inverters that do not have isolation/separation between the d.c input and the a.c output shall not be used.

35.9 SUPPLY TRANSFER ARRANGEMENT

The transfer of power supply will be restricted to automatic switching arrangement as stated below.

35.9.1 Automatic Transfer Switch (ATS)

The ATS is an electrical switch that switches a load between two sources that automatically switch on when it sense the main supply fails. The primary function of the transfer switch is to redistribute power from the main supply to a backup (SSBF) source of power. It shall install such that the output of the inverter is connected to the ATS so that the solar power can provide temporary power when the main supply fails.

35.9.2 Automatic Transfer Equipment

The automatic change-over equipment or Automatic Transfer Switch (ATS) shall include a series of electrical interlocks, controlled by sensing devices incorporated within the equipment, that will ensure that under no circumstances will the supply equipment be capable of feeding back through the control or contactor arrangement and energizing the metering equipment of the installation.

35.9.3 Manual Transfer

With the inclusion of (a) & (b) in the note below refer to ETC 3.2.4.2 for requirements in manual transfer arrangement.

The label shall have the wording "**MAINS/SSBF TRANSFER SWITCH**"

NOTE:

- (a) Solar Standby Facility should be in operation only when the Normal Supply fails
- (b) Solar Standby Facility shall not be switched on when the Normal Supply is available.

35.9.3.1 Stand-by Charge

Refer to Electrical Trade Circular No 3 Clause 3.9

NOTE:

If a person, firm or company fails to notify PNG Power, the penalty charges shall be applied with back bill of loss of Kilowatt Hours under the Electricity Regulatory Contract pursuant to the provisions of the ICCC Act and Electricity Industry Act 2002.

35.9.4 Changeover Switching Arrangement

The changeover device for a solar supply shall be selected to maintain the function of, and prevent damage to, the electrical installation being supplied.

The changeover device shall open all active conductors of the normal supply when the solar supply is connected. Where the operation of a switch automatically brings into service a solar supply, the purpose of the switch shall be marked accordingly.

Typical switching arrangements shall comply with Trade Circular 3

35.10 EARTHING

An earth conductor, of sufficient size to carry an earth fault current, in relation to the output of the invertor, must be run from the invertor frame to the main earth bar at the main switchboard, and labeled "Invertor Earth". The earthing conductor shall be sized, to the rated current output of the generator, as per AS/NZS 3000/2007 Wiring Rule No. 5.3.3.1.2 and Table 5.1

35.11 NEUTRAL CONDUCTOR

A Neutral Conductor of sufficient size in relation to the output of the Invertor is to be run to the main Neutral Bar on the main switchboard and connected adjacent to the M.E.N point on the bar, and labeled, "Invertor Neutral". The neutral conductor size shall be related to the size of the active conductors as per AS/NZS 3000/2007 Wiring Rule No.3.5.2.

35.12 AREA TO BE SUPPLIED

The requirement of this section satisfies the power supply arrangement in which only one source of power supply is made available at any one time to a building, irrespective of number of lease tenants, and that the change-over originate from a main distribution board.

Engineering Standard: HQH - GCW 014
First Issued: 20.04.2017

TRADE CIRCULAR 36 SOCKET OUTLETS

36.1 GENERAL

36.1.1 Application

The Electrical Trade Circular No 35 provides standard requirements for safety use of Socket Outlets where applicable. Socket-outlets shall be suitable for the intended application and location of installation.

36.2 STANDARD SOCKETS OUTLETS

A standard socket-outlet in Papua New Guinea provides a nominal voltage of 230 volts RMS at a maximum of 10 amps and always includes an earth connection.

36.3 WIRING OF ELECTRICAL INSTALLATION

The wiring of the electrical installation shall terminate at a suitable socket-outlet, the wiring to the electrical equipment being continued by means of a plug and flexible cord or cable.

36.4 ACCESSIBILITY

Each socket-outlet shall be installed so that any plug intended to be used with the socket-outlet can be conveniently inserted and withdrawn and not cause damage to any flexible cord or cable connected to the plug. Socket-outlets shall not be installed where the withdrawal of a plug from the socket-outlet is restricted by a permanent fixture or fitting within the installation.

36.5 SWITCHING REQUIREMENTS

Each socket-outlet shall be individually controlled by a separate switch that operates in all active conductors in compliance to AS/NZS 3000:2007 Wiring Rules No. 4.4.4.1 and either AS/NZS 3133 or AS 60947.3

36.6 CURRENT RATING

Each switch shall have a current rating, at its operating voltage, not less than the current rating of the socket-outlet it controls.

36.7 PROTECTION OF SOCKET-OUTLETS

Socket-outlets shall be installed so that they will not be subjected to undue mechanical stress or damage in normal service. For additional protection refer AS/NZS 3000: 2007 Rule No. 4.4.2.2 for further instruction.

36.8 EQUIPMENT WIRING

Equipment wiring shall—

- (a) be as short as practicable; and

NOTE: A maximum flexible cord or cable length of 2.5 m is recommended.

- (b) have a current-carrying capacity not less than the maximum load of the connected appliance or luminaire; and

NOTE: The minimum cross-sectional area of 0.75 mm² for flexible cords is recommended, other than those specified for portable or hand-held appliances and luminaires

- (c) be protected against short-circuit, in accordance with Clause 2.5.4; and

- (d) where earthing is required, be provided with a protective earthing conductor of suitable cross-sectional area that will ensure operation of the circuit protective device, in the event of a fault to earth, without damage to the protective earthing conductor.

36.9 SINGLE SWITCH CONTROLLING TWO SOCKET-OUTLETS

Single switch may be used for the control of two socket-outlets located immediately adjacent to each other and current rating of the switch shall be equal to the total current rating of the sockets it controls. The type of socket outlet used shall comply with AS/NZS 3000:2007 Rule No. 4.4.4.2

36.10 AUTO SWITCHED SOCKET-OUTLET BY PLUG INSERTION

Automatically switched socket-outlets may be used to supply power to refrigerators, some computers and other accessories that normally should not be switched off. The absence of a switch prevents the accidental switching off of such devices.

A socket-outlet that is switched by the insertion and withdrawal of the plug shall meet these requirements:-

- (a) A socket-outlet rated not more than 10 Amps, installed for the connection of a fixed or stationary appliance or a luminaire and not readily accessible for other purposes need not be controlled by a switch. Such a socket-outlet and plug, installed in a ceiling space.
- (b) Stationary appliances (such as fans) and most luminaires would normally be controlled by a remote switch, which would switch the supply via the socket-outlet concerned. Exceptions could be devices such as illuminated "Exit" signs, which require connection to the power supply at all times.

36.11 MEANS OF OPERATION

Each switch or means of operating a switch, for a socket-outlet shall be –

- (a) As close as practicable to the socket-outlet; and
- (b) Marked to indicate the socket-outlet(s) or the connected electrical equipment that it controls.

A socket-outlet that is switched by the insertion and withdrawal of the plug shall be deemed to meet the requirements.

36.11.1 Exception

Marking is not required where the socket-outlet controlled is obvious because of the location of the switch.

36.12 DOUBLE POLE SWITCHES ARE REQUIRED IN CARAVANS AND MOBILE HOMES

All switches that are installed in transportable structures and intended to be connected to the site supply shall operate in all live active and conductors. Refer AS/NZS3001:2008 (Electrical Installations – Transportable structures and vehicles) - 3.6.2

Switches that directly control socket-outlets shall comply with the above requirements.

36.13 FIXED OR STATIONARY APPLIANCE OR A LUMINAIRE AND THAT IS NOT READILY ACCESSIBLE

A socket-outlet rated not more than 10 A, installed for the connection of a fixed or stationary appliance or a luminaire and that is not readily accessible for other purposes, need not be controlled by a switch, such as socket-outlet and plug installed in a ceiling space.

Stationary appliances, such as fans and most luminaires would normally be controlled by a remote switch, which would switch the supply via the socket-outlet. Exceptions could be devices such as illuminated "Exit" signs, which require connection to the power supply at all times.

36.14 POLARIZATION AND PHASE SEQUENCE

Where socket-outlets of the same type form part of an electrical installation, the order of connection of the socket-outlets shall be 'earth', 'active' and 'neutral' in a clockwise direction.

All socket-outlets that accommodate three-pin/flat-pin plugs shall be connected so that, when viewed from the front of the socket-outlet, the order of connection commencing from the slot on the radial line shall be earth, active and neutral in a clockwise direction.

36.15 MARKING

Marking is not required where the socket-outlet controlled is obvious because of the location of the switch. Refer AS/NZS 3000:2007 Wiring Rule No. 4.4.4.3

36.16 OTHER VARIANTS

Other variants include plug/sockets with a rating of 10 A utilizing a round earth pin shall only be used for special use circuits.

36.17 DIFFERENT SYSTEMS

Where an ELV electrical installation and an electrical installation of greater than ELV are in the same premises, all socket-outlets supplied at ELV shall—

- (a) have their voltage conspicuously marked; and
- (b) be of a form that will prevent insertion of an ELV plug into a socket outlet connected to a circuit of greater than extra-low voltage.

NOTE: AS/NZS 3112 contains a specific plug and socket-outlet arrangement recommended for ELV applications. Refer AS/NZS 3000: 2007 0: 2007 Rule 4.4.1.2

Plugs and socket-outlets for SELV and PELV systems shall not be provided with an earthing contact or pin and shall comply with Clause 7.5.10.

36.18 EARTHING CONTACTS

Every socket-outlet shall be provided with an earthing contact

36.19 PENDANT-TYPE SOCKET-OUTLET

A switch incorporated in a pendant socket-outlet attached to a flexible cord shall interrupt all live (active and neutral) conductors.

Exception: Pendant-type multiphase outlets with switching only in the active conductors may be used where—

- (a) the outlet is not dependent on the supply cable for support; and
- (b) additional mechanical protection is provided where necessary; and
- (c) the supply cable or cord is selected to take into account any likelihood of vibration and movement expected during operation.

36.20 PLUGS

The plug used in Papua New Guinea, has two flat pins forming an inverted V-shape plus a vertical earthing pin. Refer TC 27.2 & 27.3 for detail specification.

As from 3 April 2005 the "live" (Line and Neutral) pins of every 10 amp and 15 amp flat pin plug sold were required to comply with the requirements of AS/NZS 3112: 2000, which states that the live pins must be insulated.

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