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Guidelines for the safe use of Permanent/Portable Generators on PIETERMARITZBURG ELECTRICITY NETWORKS.

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INTRODUCTION

Permanent/Portable generators are widely used to provide electricity in case of a mains power failure. This document deals specifically with those installations at which a stand-by generator is interfaced with the same circuitry as is issued to locally distribute mains-supplied electrical power. This in turn presents a risk of inadvertent paralleling of sources of supply. Certain sections of this document are applicable also to stand-alone generator sets. Consumers who have purchased permanent/portable generators to provide electricity in the event of power outages must use safety precautions. Permanent/Portable generators can be hazardous if used improperly. The principle hazards are: (1) **carbon monoxide (CO) poisoning** from the toxic engine exhaust and (2) **electrocution** from connecting the generator to the home electrical wiring system. The document is specifically aimed at "Non-qualified" persons who may purchase portable generators due to the perception that the grid reliability is reducing and inadvertently creating hazardous conditions when using them.

1. SCOPE

The purpose of this document is to specify the technical requirements to be met with the interfacing of low voltage generating sets with the local supply networks and to ensure that they do not compromise the network integrity or safety of the Council's network or user. The document describes some of the dangers presented by interfacing a stand-by generator with mains-supplied premises.

This document deals specifically with those installations at which a stand-by generator is interfaced with the same circuitry as is used to locally distribute mains-supplied electrical power. Generator sets that are operated separately from the local supply (e.g. portable generator sets supplying lighting or heating circuits directly) are excluded from the requirements of this document, although some of the safety precautions may still be applicable.

The document applies specifically to installations where the generator set is prohibited from paralleling with the mains supply. Where it is required for a generator set to parallel with the mains supply, for whatever reason, this shall be agreed to beforehand by the affected parties, and may be subject to additional technical requirements.

This document shall be read in conjunction with SANS 10142-1, specifically Section 7.12.Alternative Supplies

2. NORMATIVE REFERENCES

The following documents contain provisions which, through reference in this text, constitute provisions of this guideline. All documents are subject to revision and, since any reference to a document is deemed to be reference to the latest edition of that document, parties to the use of this document are encouraged to take steps to ensure the use o f the most recent editions of the documents listed below

SANS 10142-1 The wiring of premises Part 1 Low Voltage Installations

Occupational Health and Safety Act, 1993 (Act 85 of 1993)

Relevant Municipal Electricity Supply and other Bylaws, as applicable.

3. DEFINITIONS AND ABBREVIATIONS

3.1 General

3.1.1 **Circuit Breaker**: Mechanical switching device that is capable of making, carrying and breaking currents under normal conditions and of making, carrying for a specified time, and automatically breaking currents underspecified abnormal circuit conditions such as those of overcurrent.

3.1.2 **Certificate of Compliance:** Certificate that is issued by an accredited person in respect of an electrical installation or part of an electrical installation that ensures that the installation complies with SANS 10142

3.1.3 **Consumer**: Person who is supplied (or to be supplied) with electricity by a supplier, or a person who supplies his own electricity.

3.1.4 **Electricity distribution utility:** The electricity supply authority, being either Eskom or the Municipal electricity service provider in the area of the installation.

3.1.5 **Current:** Flow of electric charge through a conductor.

3.1.6 **Accredited person:** person who is registered in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).

3.1.7 **Distribution Board:** enclosure that contains electrical equipment for the distribution or control of electrical power from one or more incoming circuits to one or more outgoing circuits.

3.1.8 **Fault Current:** current that results from an insulation failure or from being bridging of insulation or live components.

3.1.9 **Local Authority:** -Municipality

3.1.10 **Point of common coupling: -** The point on the Utility's network, electrically nearest to a particular consumer's installation, at which more than one consumer is or may be connected or metered

3.1.11 **Point of Supply: -** the point of metered electrical connection between Pietermaritzburg Electricity& Consumer

3.1.12 **Permanen**t/**Portable / Standby Generators:** a source of electrical power, typically a diesel or petrol driven generator, that is used as back-up or an alternative to a grid supply.

3.1.13 **Protective Earthing Conductor: -** conductor provided for purposes of safety (protection against electric shock) and that connects the supply earth to the consumer earth terminal

3.1.14 **Protective Earth and Neutral Conductor: - conductor** that forms part of a supply combining the functions of both, protective earthing conductor and neutral conductor. The conductor is also connected to other earth electrodes and exposed conductive parts of the low voltage supply

3.2 Abbreviations

SANS	South African National Standards
IEC	International Electrotechnical Commission
ISO	International Organization for Standards
COC	Certificate of Compliance
MV	Medium Voltage
N	Neutral
PE	Protective Earthing Conductor
AMP	Automatic changeover panel
DB	Distribution Board
PMB ELECT.	Pietermaritzburg Electricity

4. INSTALLATION REQUIREMENTS

4.1 Legal Requirements

An application for the use of Permanent/Portable installed Generating Sets (new or existing) in cases where it will be required to interface with the same circuitry as is used to locally distribute mains-supplied electrical power, shall be submitted to PMB Elect.

The application shall include, but may not be limited to, the following:

1) Contact details of the owner
2) Site Address
3) Make & Model of the Generating unit
4) Capacity of the Generating unit
5) Control circuit diagram of the generating unit including all interlocks with the main grid.

Only upon written approval from PMB Elect., before the work commence.

4.2 Safety Requirements

The attention of the owner/tenant of a permanent/stand-by /portable generator is drawn to the following requirements of the Occupational Health and Safety Act, 1993 (Act 85 of 1993):

"Any user of machinery shall:

a) Ensure that all machinery used by him is suitable for the purpose for which it is used, and that it is installed, operated and maintained in such a manner as to prevent the exposure of persons to hazardous or potentially hazardous conditions or circumstances.

b) In particular cause every exposed and dangerous part of the machinery, which is within the normal reach of a person to be effectively safeguarded by means of insulation, fencing, screening or guarding, except where an inspector has granted written permission for the omission of such safeguarding.

c) Ensure that all safety equipment is kept in a good working condition and is properly used; and ensure that the quality of material used in; and the construction of the machinery or safety equipment is suitable for the purpose for which it was intended.

d) Unless a person has been authorized thereto, no person shall remove any safety equipment, which relates to the machinery in question.

e) Shall provide devices to start and stop machinery, and these devices shall

i. Be in a position where they can readily and conveniently be reached by the person who operates such machinery; and

ii. Be so constructed and arranged as to prevent the accidental starting of such machinery.

f) Shall provide positive means for rendering the controls of machinery driven by an electric motor inoperative while repairs or adjustments are being made, and such means shall not only be the mere tripping of a switch."

4.3 Additional Safety Requirements & Recommendations

a) The installation shall take place within the boundaries of the approved application.

b) The owner/tenant shall comply with the relevant noise and pollution legislation. See Annexure C for noise levels.

c) Where new buildings are erected or alterations to existing buildings are made, building plans are to be submitted to the relevant Local Authority for approval

d) The owner/tenant shall comply with the relevant legislation for the storage of fuel

e) **NEVER** use a generator in enclosed or partially-enclosed spaces. Generators can produce high levels of CO (Carbon Monoxide) very quickly. When using a portable generator, remember that one cannot smell or see CO. Even if a person can't smell exhaust fumes, he/she may still be exposed to CO. Adequate ventilation shall be provided.

f) Only operate the generator outdoors in a well-ventilated, dry area, away from air intakes to the home, and protected from direct exposure to rain, preferably under a canopy, open shed, or carport. Do not enclose the generator in any structure.

g) Keep flammable materials away from the generator.

h) Always fuel the generator in a well ventilated area. Fuel vapours are flammable and may ignite after the engine is started be sure that any spilled fuel is cleaned up before restarting.

i) Always check for fuel leaks.

j) Before refuelling the generator, turn it off and let it cool down, fuel spilled on hot engine parts may ignite.

k) Occasionally monitoring of Generator while in use.

l) The total rated capacity of the generator should never be exceeded.

m) Keep cords/cables out of the way so as to avoid the danger of tripping over them

n) Ensure that the generator's terminal voltage rating matches that of the load equipment (typically 230V±10%)

o) Ensure that emergency isolation of the generator is possible

p) In the case of temporary generators being connected, ensure that there is complete isolation of the consumer's apparatus to PMB Electricity network

q) Have the generator run at full speed before placing load on it, this prevents damage as the generator starts and reaches full speed and switch off load before shutting down.

r) For permanently installed generators ensure that permanent approved electrical interlocking exists between the consumer and Electricity networks.

s) Ensure that all appliances/equipment connected to the generator have overcurrent protection.

t) All loads should be turned off before the Generator is turned off

u) Check that any cords are free of cuts or tears and that the plug has all three prongs, especially a earth pin.

v) **Never try to power the house wiring by plugging the generator into a wall outlet, a practice known as "back feeding."** This is an extremely dangerous practice that presents an electrocution risk to Electricity workers and neighbours served by the same transformer.

w) Consider using surge protection, it is common for generators to damage more sensitive electronic equipment.

4.4 Connection requirements

a) Where necessary for the installation of the generator set, it is the responsibility of the applicant to arrange with the Pietermaritzburg Electricity for the disconnection/reconnection of mains supply to the premises. Please note that the latest Pietermaritzburg Electricity tariffs will apply for this service.

b) A COC must be completed for the installation and submitted to Pietermaritzburg Electricity prior to reconnection of supply to the premises.

c) A permanent red label (PVC or aluminium) with white lettering (at least 10mm high) shall be affixed to the main distribution board inside the premises as well as to all other distribution boards fed from the main board and the main incoming utility supply circuit breaker. The level shall read "DANGER GENERATOR CONNECTED". Where only parts of the installation are supplied by alternative means, only these circuits shall be labelled.

d) Where any form of alternate supply (generating set, UPS, etc.) is connected and automatically supplies power to circuits on the distribution board, a visible indicator (light) shall be provided on each distribution board where such circuits are live after the main supply on that board has been switched of.

e) Appropriately rated protective devices shall be supplied for short- circuit and earth fault conditions to protect the distribution board, generating set and user. The protective devices shall prohibit feedback onto the utility system once the main incoming supply has been switched off. The generating set including the connecting cable shall be provided with separate appropriately-rated over current protection circuit breaker, over and above any devices installed on the generating set itself. Earth leakage protection shall be provided in accordance with SANS 10142-1 Section 6.8.

f) **Unless specifically agreed to between Pietermaritzburg Electricity and owner/tenant, the generating set shall not run in parallel with the main supply at any time.**

g) The consumer shall be held responsible for any and all damages incurred PMB Elect. if the devices are found to be incorrectly rated and/or the utility supply and generator supply are paralleled.

h) Neutral earthing of the generator set shall be done in accordance with SANS 10142-1 Section 7.12.3

4.4.1 **Single residential houses/individual commercial units**

a) The installation of generating sets at single residential premises shall conform to the above requirements as well as the following requirements.

b) A control panel shall be installed after the meter point for both conventional and prepayment meters, as close to the main distribution board as possible.

c) The control panel shall include at least,

1) A main circuit breaker. (To include breaking the neutral).

2) A manual or automatic changeover switch. **Where the generating set is intended to provide a supply to an installation as a switched alternative to the main supply, the changeover switching device shall disconnect the main supply before the generating set is switched in. the changeover switching device shall be interlocked in such a way that the main supply and the alternative supply cannot be connected to the same installation at the same time.** This changeover switch shall be of a break-before-make type (see annexure A) and have an appropriate rating for the size of the generating set.

3) No other means of connection is allowed.

4.4.2 **Commercial/Official or Multi-unit Blocks**

a) The installation of generating sets at commercial premises or multi unit premises shall conform to the above requirements as well as the following requirements. An automatic or manual changeover panel shall be installed.

b) The control panel shall have at least,

1) A main circuit breaker.

2) A visible indicating light that is on when the generation set is supplying power.

3) A manual or automatic changeover switch. This changeover switch shall be of break-before-make (see connection diagram) and have an appropriate rating for the size of the generating set.

4) An emergency stop button that is easily accessible shall be provided for the generating set, this emergency stop button shall prevent the generating set from starting.

5) (A) There shall be a remote emergency stop button (PMB Elect. controlled). The remote emergency stop button will be installed next to the main incoming Electricity supply circuit breaker with a label identifying it. Alternatively a circuit can be installed with auxiliary contacts connected to the emergency stop/starter preventing the generator from starting if the main incoming supply is switched off due to safety reasons (i.e. in case of fire, etc.)

5) (B) The remote emergency stop button shall have the means to be locked in the off position with a personal lock.

6) In the case of an automatic changeover panel:

A foolproof interlocking system shall prevent the main supply from being connected to generating set supply. This interlocking system shall incorporate a mechanical as well as an electrical interlock on the change over contactors/relays.

d) Where an individual unit within an office/multi-unit block has a generating set, requirements for single residential houses shall be applied.

e) Where two adjacent commercial plots are supplied from a shared generating set, each plot/connection shall have its own control/changeover panel as above.

5. DISCLAIMER OF LIABILITY

Portable generators can pose serious health hazards if used improperly as they **produce carbon monoxide (CO) and other risks.**

Portable generators are a useful tool during power interruptions, however their carbon monoxide risks are more potent than many people realize. A typical 5.5-kilowatt home generator can produce the same amount of CO as six idling cars, according to a study by the US Centre for Disease Control and Prevention (CDC). Gasoline-engine generators are not designed for indoor use.

Please note: Your home's wiring is likely not matched for your Generator use. Connecting your portable generator to your home's electrical power system or wiring can be lethal. It is recommended that a qualified electrical engineer or contractor install a transfer switch, which is used to load and unload power and is also able to cut-off the electrical output being produced by the generator, once the main-supply is restored.

Every generator manual includes the manufacturer's guidelines for safety and usage, including warnings urging users to operate their generators in a dry, well-ventilated area to avoid both electrocution and CO poisoning. It is therefore highly recommended that any running of a generator is conducted with a healthy dose of common sense and in strict compliance with the manufacture's requirements for safe use. Please pay heed to their advice, use recommended oils and lubrication, attend to the regular maintenance schedules and keep the standard operating procedures adhered to, at all times.

The guidelines expressed in this document are not intended to fringe nor replace the manufacture's guidelines for safety and usage. This document is only a suggested guideline for the safe use of portable generators on Electricity networks.

These guidelines are only intended to provide general information regarding the safe use of permanent/portable generators on Electricity networks, it is not intended to be exhaustive of any subject dealt with. The information in these guidelines, including, without limitation, all research, opinions or other content is therefore not intended, nor does it constitute consulting or other professional advice or services. Before any decision is made or any action taken which might affect the user, consultation with your own professional is advised.

All users of this resource are therefore cautioned to use the information entirely at their own risk.

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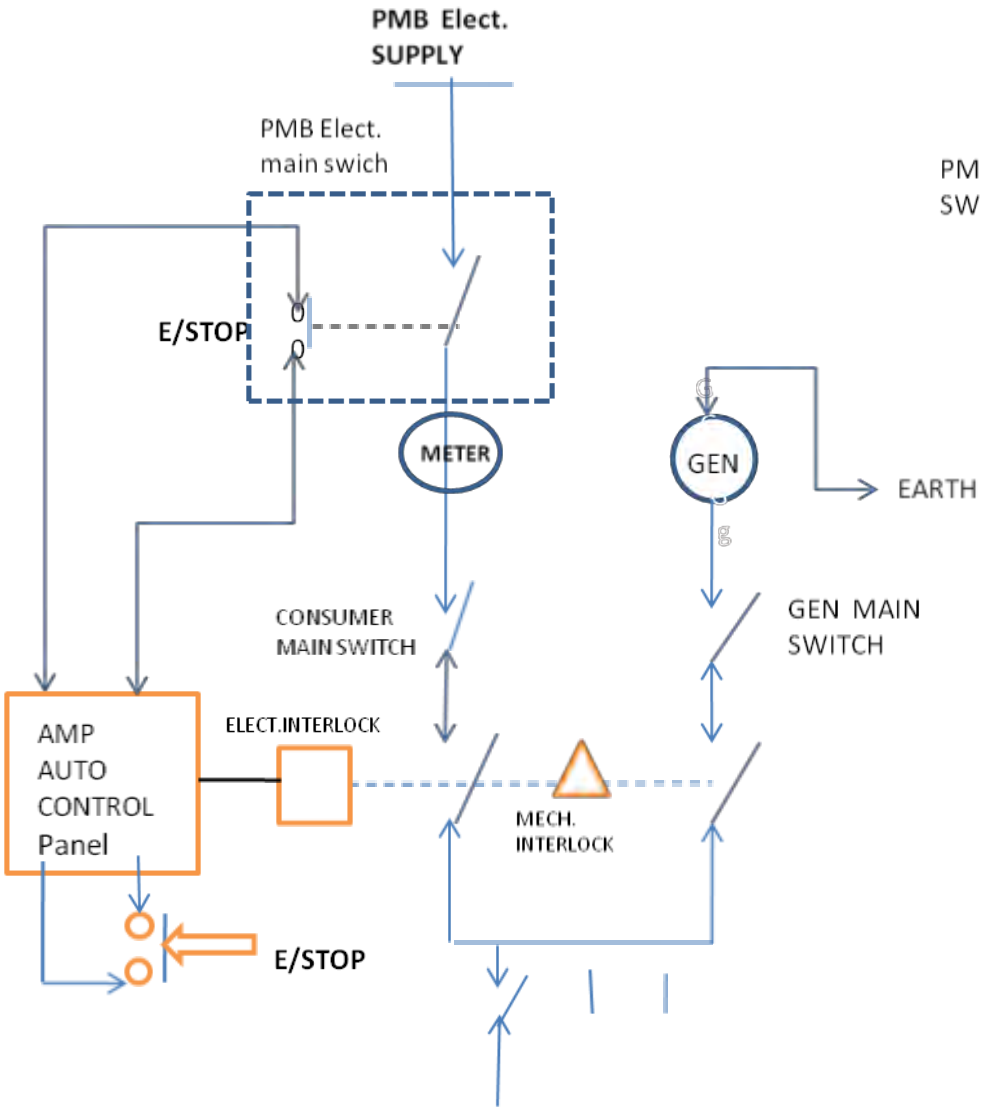
'This installation guideline meets with AMEU requirement'

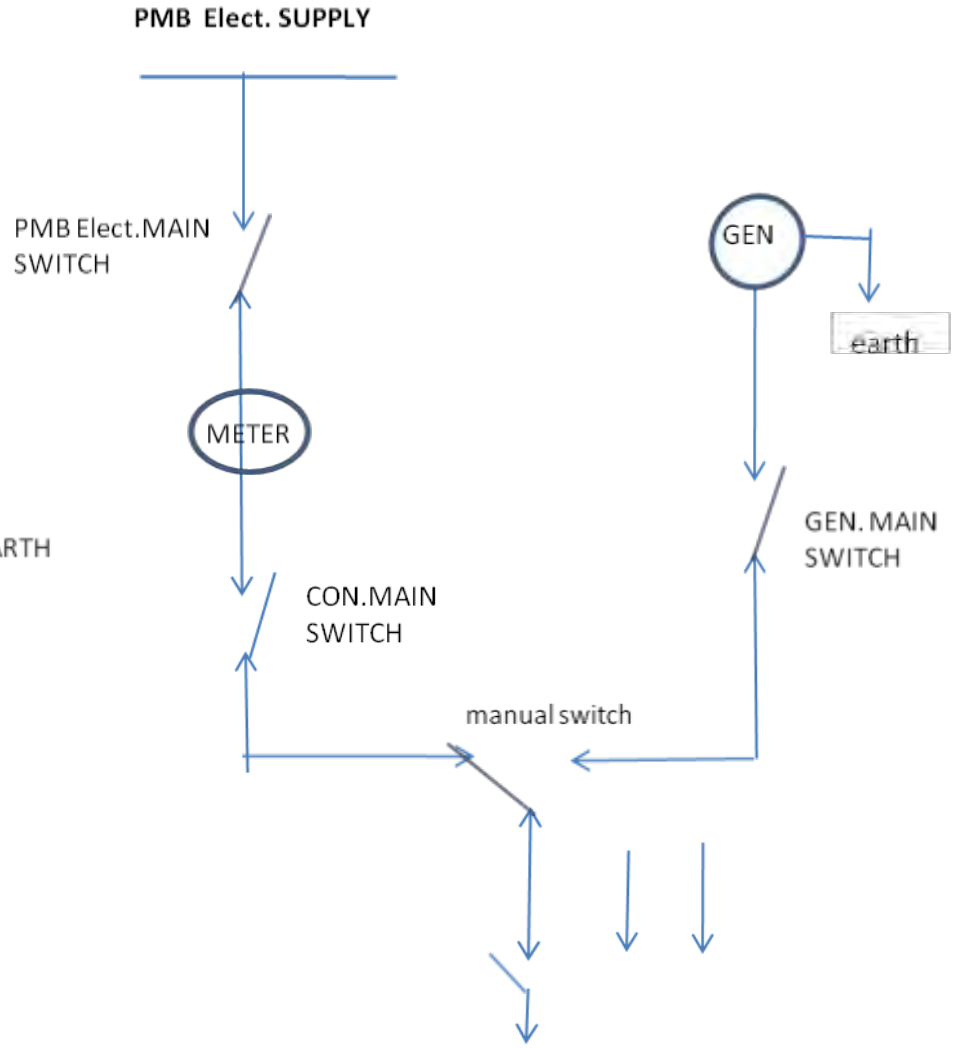
ANNEXURE
"A"

GUIDLINES FOR THE SAFE USE OF PORTABLE / PERMANENT GENERATORS ON PIETERMARITZBURG ELECTRICITY NETWORK

AUTOMATIC CHANGE OVER



MANUAL CHANGE OVER



Annexure B – Noise Levels

A "disturbing noise" means a noise level that causes the ambient noise level to rise above the designated zone level, or if no zone level has been designated the typical rating level for ambient noise in districts, indicated in table 2 of SANS 0103 of 2004 which appears hereunder. See SANS 0103 for more detail.

Table 2 – Acceptability rating levels for noise in districts

1	2	3	4	5	6	7
Type of district	Equivalent continuous rating level (LREG.T) for noise dBA					
	Outdoors			Indoors, with open windows		
	Day-Night $L_{R,dn}$a	Day-Time $L_{Reg,d}$b	Night-time $L_{R,dn}$a	Day-night $L_{R,dn}$a	Day-time $L_{Reg,d}$b	Night-time $L_{Reg,n}$b
RESIDENTIAL DISTRICTS a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
NON RESIDENTIAL DISTRICTS d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

NOTE 1 If the measurement or calculation time is considerably shorter than the reference time intervals, significant deviations from the values given in the table may result.

NOTE 2 If the spectrum of the sound contains significant low frequency components, or when an unbalanced spectrum towards the low frequencies is suspected, special precautions should be taken and specialist advice should be obtained. In this case the indoor sound levels may significantly differ from the values given in columns 5 to 7. See also annex B

Note 3 Residential buildings, e.g. dormitories, hotel accommodation, residences etc.should be allowed in non-residential districts on condition that the calculated or anticipated indoor $L_{Reg.T}$ values given in column 3 of the table 1 are not exceeded.

a) The values given in column 2 and 5 are equivalents continuous rating levels and include corrections for tonal character, impulsiveness of the noise and the time of day.
b) The values given in column 3,4,6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise.

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