



Dunkirk Estate

Policy Guideline for the Installation of Standby Electric Generators

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Dunkirk Estate

POLICY FOR THE INSTALLATION OF STANDBY ELECTRIC GENERATORS

Purpose:

The Dunkirk Estate requires a policy document to ensure that the installation of Portable Electric Standby Generators is conducted in a safe and responsible manner which is safe to both the occupants of the affected property as well as occupants and property of the surrounding neighbourhood.

Introduction:

Due to the ongoing load shedding by South Africa's electrical utility, Eskom, it has become necessary for the residents of private dwellings to embark on the implementation of providing an alternate source of electrical power for their homes during these power outage periods which have become more intense over the past two years.

Background:

The use of petrol and diesel powered standby generators is now seen to be a necessity rather than a luxury and in order to accommodate this kind of equipment it will be in the interest of the Estate to establish a set of rules and prerequisites in order to ensure that this equipment is beneficial rather than a nuisance, especially to the neighbouring home owners.

This policy has been compiled through a number of extracts from various sources and based on literature from experts in the safe use and operation of generation equipment. Standby generators are often seen by the general public as a simple "plug and play" device but if not installed by a qualified official it could be lethal to the home owner as well as the neighbouring properties.

The areas of most notable concern are the following:

- 1.) Electrical Safety
- 2.) Fuel Storage
- 3.) Environmental Control
 - Noise Pollution
 - Air Pollution

In order to ensure that the Dunkirk Estate is compliant with the current legislation, regulations and standards it is deemed necessary to include a guideline that has been compiled by a work group of electrical engineers and experts who are fully knowledgeable in the safe installation and operation of

standby power plant. This guideline is for the benefit of all home owners residing on the Estate. The comment below is from the South African Bureau of Standards and refers to the attached Guideline.

Conclusion:

Based on the information provided by one of South Africa's leading work groups on the use of power generators the following principles should be considered:

1. The placement and position of the equipment is critical and is probably the most important factor when considering the acquisition of a generator. The unit must be placed to ensure that the sound factor is aligned to the dBA ratings for the maximum in the various living areas that are stipulated in the Annex A Table. Furthermore, one is to ensure that your neighbour's living spaces are also accommodated for.
2. The placement of the unit must also provide for the discharging of the gases into the atmosphere and not to be allowed to remain in an enclosed area such as a courtyard that will cause the build-up of the carbon monoxide and flow into the house through open doors and windows. The minimum safe distance from a living unit is considered to be 4,5 meters which is based on numerous tests and as recommended by manufacturers for domestic use.
3. The unit must be rated as a ultra/super silent generator to ensure that the sound pollution is kept to a minimum.
4. Storage of fuel must be placed and locked in an area where the risk of potential fire is eliminated as well as safe from access by children.
5. The size and capacity of the generator should be based on the estimated load for the property
6. The range of units for the freehold housing would be in the 16 to 25kW capacity.
7. The maximum noise level at a distance shall not be greater than 55dBA. This would mean that all installed units irrespective of load output **may not be louder than 55 dBA from a distance of 7 meters.**
8. The Home owner is required to submit an application for permission to install a standby generator together with the machine supplier specification and the owner is to provide proof that the installer is a fully competent and certified person who will provide a certificate of compliance on completion of the work. Should the standby plant fail to meet the requirement of 55dBA at 7 meters then the unit shall be removed from site.
9. In cases where a standby plant has already been installed the home owner is to have a sound insulation casing manufactured and fitted to the plant and ensure that the above-mentioned maximum noise rating is met.
10. Discuss your proposed acquisition of a standby generator together with all your immediate neighbours and ensure that they are willing to accommodate your intention of installing the standby plant. Their approvals/acceptance should be included in your application to the Home Owners Association.

SABS - Guidelines: "Using a portable power generator safely"

It has become popular practice to use standby power generators in the case of power failures, even in household applications. Although such generators can be used safely to operate one or more pieces of electrical equipment on separate circuits, there are a number of important precautions necessary when such a generator is connected to a fixed electrical installation. Andre du Plessis, chairman of the working group for the wiring code (SANS 10142-1) at the SABS, comments as follows:

Portable generators can pose serious health hazards if used improperly as they produce carbon monoxide (CO) and cause other risks. Portable generators are useful tools during power interruptions but their CO risks are more potent than many people realise. A typical 5,5 kW 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). Petrol-engine generators are not designed for indoor use.

Please note: Your home's wiring is likely not matched for standby 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 manual transfer switch, which is used to connect and disconnect power and is also able to cut off the electrical power being produced by the generator, once the mains supply is restored. This changeover switch shall be of a three-position type, break before make, and have an appropriate rating for the size of the generating set. Such work may only be done by a qualified electrician and the work must be certified safe by a person registered by the Department of Labour in terms of the Occupational Health and Safety Act as an accredited person. Important issues concerns earthing and switchover facilities between the electrical power supply from the supply authority and the standby power generator. The size and complexity of the installation will determine the cost of such an installation. Where a single generator is used to supply only one or two appliances during a power failure and it is plugged in directly at the generator via extension cords, the costs will be relatively low. In this case there is no installation costs involved and a basic generator can be purchased as a ready to use unit for between R2000 and R8000. A standby generator installation suitable to run a normal house will depend on the size of the house and the number of appliances that will be connected simultaneously. The installation costs will also vary depending on the complexity and will be more costly, at between R25 000 to well over R100 000. A reputable supplier of such equipment should be consulted in this regard. Where standby power generation is installed, precautions should be taken that the generator cannot operate in parallel with the main supply unless the installation is approved by the supply authority. It must not be possible for the generated power to be fed back into the public network, since it can have lethal consequences in other installations. Recently, when a power source fed back into the public network, technicians working on the power supply were electrocuted during the power failure. 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 utility workers and neighbours served by the same utility transformer.

Other practical hints to note

When buying a generator, the purchaser should ask for proof that it complies with the ISO SANS 8528 series of standards. This series is fully aligned with the international ISO 8528 series of standards. The last of this series has recently been published as the SANS 8528 series 1.

Have the generator run at full speed before placing load on it; this prevents damage as the generator starts and reaches full speed

Ensure that all appliances/equipment connected to the generator have over-current protection or preferably the supply from the generator should be equipped with over-current protection.

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

Where more than one generator is installed, the installation must be designed by a professional person to ensure proper synchronisation between the generators and isolation and protection of each generator. A standby generator is normally installed to provide power only where there is a mains-power failure or when the supplier switches off the power to do maintenance work. If there is not a proper changeover switch installed to ensure that the main supply is completely disconnected before the generator is switched in, the generator will feed power back into the supply system causing a hazardous condition to anyone connected to the system. The generator will not be able to carry any such load and will fail.

More information on the installation of standby generators can be seen under the heading “Guidelines for the safe use of portable generators on public utilities’ networks” on the website of the Association of Municipal Electricity Undertakings (AMEU), www.ameu.co.za and published on page 62 of the October 2007 issue of Vector. Contact Andre du Plessis, SABS, Tel 012 346-2653, duplesad@icon.co.za

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This specification was prepared on behalf of the NRS Association. It was prepared by a working group which, at the time of publication, comprised the following members:

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In the definition of “accredited person” and in 4.3.5, reference is made to “legislation” and, in 4.2,

Reference made to “legal requirements”.

In South Africa, this means the Occupational Health and Safety (OHS) Act, 1993 (Act No. 85 of 1993) (as amended from time to time) and the Electrical Machinery Regulations promulgated in terms of the Act.

Relevant municipal bylaws, as applicable, and Eskom electricity supply agreements and conditions with individual end-users, as applicable, have been used in the preparation of this specification.

Annexes A and C form an integral part of this specification. Annex B is for information only.

Acknowledgement

The guidelines given in this specification were initially produced by and on behalf of the Association of Municipal Electricity Undertakings Southern Africa (AMEU), and are now reproduced and published as NRS 098 by the NRS Association.

Introduction: NRS 098:2008

Standby/portable generators are widely used to provide electricity in the case of mains power failures. This specification deals specifically with those installations where standby/portable generators are interfaced with the same circuitry used to locally distribute mains-supplied electrical power. This, in turn, presents the risk of inadvertent paralleling of sources of supply.

Certain sections of this specification are also applicable to stand-alone generators. Users who purchased standby/portable generators to provide electricity in the event of power outages are obliged to use safety precautions. Standby/portable generators can be hazardous if used improperly.

The principal hazards involved are:

- a) Carbon monoxide (CO) poisoning from the engine exhaust, and
- b) Electrocutation when the generator is inadvertently connected to the home electrical wiring system.

The specification is specifically aimed at “non-qualified” persons who may purchase standby/ portable generators because they perceive grid reliability to be reducing, and inadvertently create hazardous conditions when the generators are used.

This specification should be read in conjunction with SANS 10142-1.

Keywords

Back-up, standby/portable generators, carbon-monoxide poisoning, back feed, CoC.

Disclaimer of liability

Standby/portable generators can pose serious health hazards if used improperly as they produce carbon monoxide (CO) and pose other risks. Standby/portable generators are a useful tool during power interruptions. However, the risks associated with carbon monoxide are more lethal than many people realise. A typical 5,5 kW 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). Petrol-engine generators are not designed for indoor use.

Note that it is likely that residential wiring will not be designed for generator use. Connecting a standby/portable generator to the home's electrical power system or wiring could 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 which can also cut off the electrical output produced by the generator once the main supply is restored.

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

The guidelines given in this specification are not intended to infringe on or replace the manufacturer's guidelines for safety and usage.

This specification contains only suggested guidelines for the safe use of standby/portable generators on utilities' networks. The specification is not intended to be exhaustive of any subject dealt with. The information in these guidelines, including all research, opinions, or other content is therefore not intended to be and does not constitute the results of consultation or other professional advice or services.

Consultation with your own professional is advised before any decision regarding generators is made or before any action which may affect the user is taken. Every endeavour has been made by the members of the workgroup to ensure the accuracy and reliability of the information provided in this specification. However, the NRS Association and the members of the workgroup cannot warrant or guarantee that this information is both complete and accurate and therefore make no representation, implicit or implied, regarding the correctness or fitness of the specification for any purpose. All users of this specification are therefore cautioned to use the information entirely at their own risk.

The NRS Association and the members of the workgroup do not accept any liability for (or in respect of) any direct, indirect or consequential loss or damage of any kind or nature which may arise from the reliance on or provision of this information (or its failure), whether or not as a result of incorrect, inaccurate, defective or misleading data or information. The NRS Association and the members of the workgroup, therefore, will not be liable for any loss or damage, actions, proceedings, claims, demands,

liability, damages, costs, charges and expenses arising as a result of the use of these guidelines or the information contained in them.

It is the NRS Association's wish that all supply authorities will adopt the guidelines in this specification as far as their particular conditions will permit. Any differences between the guidelines of this specification and the purchaser's requirements should, as far as possible, be indicated clearly in schedules and, where appropriate, be submitted for consideration in future revisions of this specification.

1 Scope

The purpose of this specification is to specify guidelines and technical requirements for the interfacing of low-voltage generators with the local supply network, and to ensure that they do not compromise the network integrity or safety of the utility or the user. The specification describes some of the dangers presented by interfacing a standby/portable generator with mains-supplied premises.

This specification deals specifically with those installations at which a standby/portable generator is interfaced with the same circuitry used to distribute mains-supplied electrical power locally.

Generators that are operated separately from the local supply (e.g. standby generators that supply lighting or heating circuits direct) are excluded from the requirements of this specification, although some of the safety precautions might still be applicable.

This specification applies specifically to installations where the generator is prohibited from paralleling with the mains supply. Where it is required for a generator to parallel with the mains supply, for whatever reason, this shall be agreed upon beforehand by the relevant parties, and the agreement might be subject to additional technical requirements.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

SANS 10103 The measurement and rating of environmental noise with respect to annoyance and to speech communication.

SANS 10142-1 The wiring of premises – Part 1: Low-voltage installations.

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

Accredited person

A person who is registered as such in terms of legislation (see Foreword).

Certificate of Compliance (COC)

A certificate 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 10142-1.

Circuit-breaker

A mechanical switching device capable of making, carrying and breaking currents under normal conditions and of making, carrying for a specified time, and automatically breaking currents under specified abnormal circuit conditions such as those of overcurrent.

Consumer

A person who is supplied (or is to be supplied) with electricity by a supplier, or a person who supplies his own electricity.

Current

The flow of an electric charge through a conductor.

Distribution board

An enclosure which contains electrical equipment for the distribution or control of electrical power from one or more incoming circuits to one or more outgoing circuits.

Electricity distribution utility

An electricity service provider or electricity supply authority (electricity service provider) in the area of the installation.

Fault current

A current resulting from an insulation failure or from bridging of insulation or live components.

Local authority

A municipality.

Point of common coupling

A point on the utility's network, electrically nearest a particular consumer's installation, where more than one consumer is or may be connected or metered.

Point of supply

A point of metered electrical connection between the utility and the consumer.

Standby/portable generator

A source of electrical power, typically diesel or petrol driven, used as a back-up or an alternative to a grid supply.

Protective earth and neutral conductor

A conductor which forms part of a supply, combining the functions of both protective earthing conductor and neutral conductor.

Note that the conductor is also connected to other earth electrodes and exposed conductive parts of the low-voltage supply.

Protective earthing conductor (PE)

A conductor provided for purposes of safety (protection against electric shock) and which connects the supply earth to the consumer's earth terminal.

3.2 Abbreviations

- AMF Automatic mains failure.
- DB Distribution board.
- IEC International Electrotechnical Commission.
- ISO International Organisation for Standardisation.
- LV Low-voltage.
- MV Medium voltage.
- N Neutral.

4 Installation requirements

4.1 Legal requirements

4.1.1 An application for the use of a standby/portable generator (new or existing) in the case where it will be required to interface with the same circuitry used to locally distribute mains supplied electrical power, shall be submitted to the relevant electricity distribution utility.

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

- a) Contact details of the owner of the premises;
 - b) Site address;
 - c) The make and model of the standby/portable generator;
 - d) The capacity of the standby/portable generator; and
 - e) The control circuit diagram of the standby/portable generator including all interlocks with the main grid.
- 4.1.2 Work shall only commence upon written approval from the relevant electricity utility.

4.2 Safety requirements

The attention of the owner or tenant of a standby/portable generator is drawn to the following legal requirements (see Foreword):

“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) Not remove any safety equipment which relates to the machinery in question unless a person has been authorised thereto.
- e) Provide devices to start and stop machinery, and these devices shall:
 - i. Be in a position where they can be readily and conveniently reached by the person who operates such machinery; and
 - ii. Be so constructed and arranged to prevent the accidental starting of such machinery.
- f) 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 and recommendations

- 4.3.1 Additional safety requirements and recommendations are given in 4.3.2 to 4.3.24.
- 4.3.2 The installation shall take place within the boundaries of the approved application.
- 4.3.3 The owner or tenant shall comply with the relevant noise and pollution legislation detailed in Annex A.
- 4.3.4 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.
- 4.3.5 The owner or tenant shall comply with the relevant legislation (see Foreword) for the storage of fuel.
- 4.3.6 Never use a generator in enclosed or partially enclosed spaces. Generators can produce high levels of carbon monoxide (CO) very quickly. When using a standby/portable generator, remember that one cannot smell or see CO. Even if a person can't smell exhaust fumes, he or she may still be exposed to CO. Adequate ventilation shall be provided.
- 4.3.7 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.
- 4.3.8 Keep flammable materials away from the generator.
- 4.3.9 Always fuel the generator in a well-ventilated area. Fuel vapours are highly flammable and might ignite after the engine has been started. Be sure that any spilled fuel is cleaned up before restarting.
- 4.3.10 Always check for fuel leaks.
- 4.3.11 Before refuelling the generator, turn it off and let it cool down. Fuel spilled on hot engine parts could ignite.
- 4.3.12 Do not leave the generator unattended.
- 4.3.13 The total rated capacity of the generator shall not be exceeded.
- 4.3.14 Keep cables out of the way to avoid the danger of tripping over them.

- 4.3.15 Ensure that the generator's terminal voltage rating matches that of the load equipment (typically 230 V \pm 10%).
- 4.3.16 Ensure that emergency isolation of the generator is possible.
- 4.3.17 In the case of temporary generators being connected, ensure that there is complete isolation of the consumer's apparatus from the electricity distribution utility's equipment.
- 4.3.18 Have the generator run at full speed before placing load on it. This prevents damage as the generator starts and reaches full speed.
- 4.3.19 For permanently installed generators, ensure that permanent electrical interlocking exists between the consumer and the utility.
- 4.3.20 Ensure that all appliances or equipment connected to the generator have overcurrent protection or, preferably, the supply from the generator shall be equipped with overcurrent protection.
- 4.3.21 Turn off all loads before turning off the generator. (See Annex B for appliance ratings).
- 4.3.22 Check that the cables are free of cuts or tears and that the plug has all three prongs, especially a grounding pin.
- 4.3.23 Do not attempt to power the house wiring by plugging the generator into a wall outlet. This is known as "back feeding" and is an extremely dangerous practice. It presents an electrocution risk to utility workers and neighbours served by the same utility transformer.
- 4.3.24 Surge protection should be used as it is common for generators to damage more sensitive electronic equipment.

4.4 Connection requirements

- 4.4.1 Connection requirements are given in 4.4.2 to 4.4.9.
- 4.4.2 It is the responsibility of the applicant to arrange with the electricity distribution utility for the disconnection or reconnection of the mains supply to the premises when it becomes necessary to install the generator. Please note that the latest electricity distribution tariffs will apply for this service.
- 4.4.3 A Certificate of Compliance shall be completed for the installation and submitted to the relevant electricity utility before reconnection of supply to the premises.
- 4.4.4 A permanent red label (PVC or aluminium) with white lettering (of height of at least 10 mm) 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 label shall read, "Danger: generator connected". Where only parts of the installation are supplied by alternative means, only these circuits shall be labelled.
- 4.4.5 Where any form of alternate supply (generator, 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 off.
- 4.4.6 Appropriately rated protective devices shall be supplied for short-circuit and earth fault conditions to protect the distribution board, generator and user. The protective devices shall prohibit feedback onto the utility system once the main incoming supply has been switched off. The generator shall be provided with a separate, appropriately rated overcurrent protection circuit breaker, over and above any devices installed on the generator itself. Earth leakage protection shall be provided in accordance with the applicable requirements in SANS 10142-1.

4.4.7 Unless specifically agreed upon between the electricity distribution utility and the owner or tenant, the generator shall not run in parallel with the main supply at any time.

4.4.8 The consumer shall be held responsible for all damages incurred by the utility or by himself if the devices are found to be rated incorrectly or the utility supply and generator supply are paralleled (or both).

4.4.9 Neutral earthing of the generator shall be done in accordance with the requirements in SANS 10142-1.

4.5 Single residential houses or individual commercial units

4.5.1 In addition to the abovementioned requirements, the installation of a generator at single residential premises shall comply with the requirements given in 4.5.2 to 4.5.5.

4.5.2 A control panel shall be installed after the meter point and as close to the main distribution board as possible in the case of both conventional and prepayment meters. 4.5.3 The control panel shall include at least:

- a) a main circuit-breaker, and
- b) a manual or automatic changeover switch (see Annex C).

4.5.4 Where the generator is intended to provide a supply to an installation as a switched alternative to the main supply, the changeover switch shall disconnect the main supply before the generator is switched on. The changeover switch 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 and have an appropriate rating for the size of generator as detailed in Annex B.

4.5.5 No other means of connection are allowed.

4.6 Commercial, office or multi-unit blocks

4.6.1 In addition to the abovementioned requirements, the installation of a generator at commercial or multi-unit premises shall comply with the requirements given in 4.6.2 to 4.6.5.

4.6.2 An automatic or manual changeover panel shall be installed.

4.6.3 The control panel (automatic or manual) (see Annex C) shall have at least:

- a) a main circuit-breaker,
- b) a visible indicating light switched on when the generator is supplying power,
- c) a manual changeover switch. This changeover switch shall be of a break-before-make type and have an appropriate rating for the size of generator as detailed in Annex B,
- d) an emergency stop button which is easily accessible, is provided for the generator and which shall prevent the generator from accidental starting,
- e) a remote emergency stop button (utility controlled). The remote emergency stop button shall be installed next to the main incoming utility supply circuit breaker and shall have a label that identifies it. Alternatively, a circuit breaker with auxiliary contacts connected to the emergency stop or starter button may be installed to prevent the generator from starting if the main incoming supply is switched off due to safety reasons (i.e. in case of fire, etc.),
- f) in the case of an automatic changeover panel, a fool proof interlocking system that prevents the main supply from being connected to generator supply. This interlocking system shall

incorporate a mechanical as well as an electrical interlock on the changeover contactors or relays.

4.6.4 Where an individual unit within an office or multi-unit block has a generator, requirements for single residential houses shall be applied.

4.6.5 Where two adjacent commercial plots are supplied from a shared generator, each plot or connection (or both) shall have its own control or changeover panel as above.

Annex A – Maximum acceptable sound levels.

Location	Effects	Maximum L_{eq} (dBA)		Time (hours)	Time of day
Bedroom	sleep disturbance, annoyance	30		8	night
Living area	annoyance, speech interference	50		16	day
Outdoor living area	moderate annoyance	50		16	day
Outdoor living area	serious annoyance	55		16	day
Outdoor living area	sleep disturbance, with open windows	45		8	night
School classroom	speech interference, communication disturbance	35		8	day
Hospitals patient rooms	sleep disturbance, communication interference	30 - 35		8	day and night

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 SANS 10103, and given in Table A.1, are applicable. See SANS 10103 for more detail.

The main advantages with dBA - the A weighting in noise measurements - are

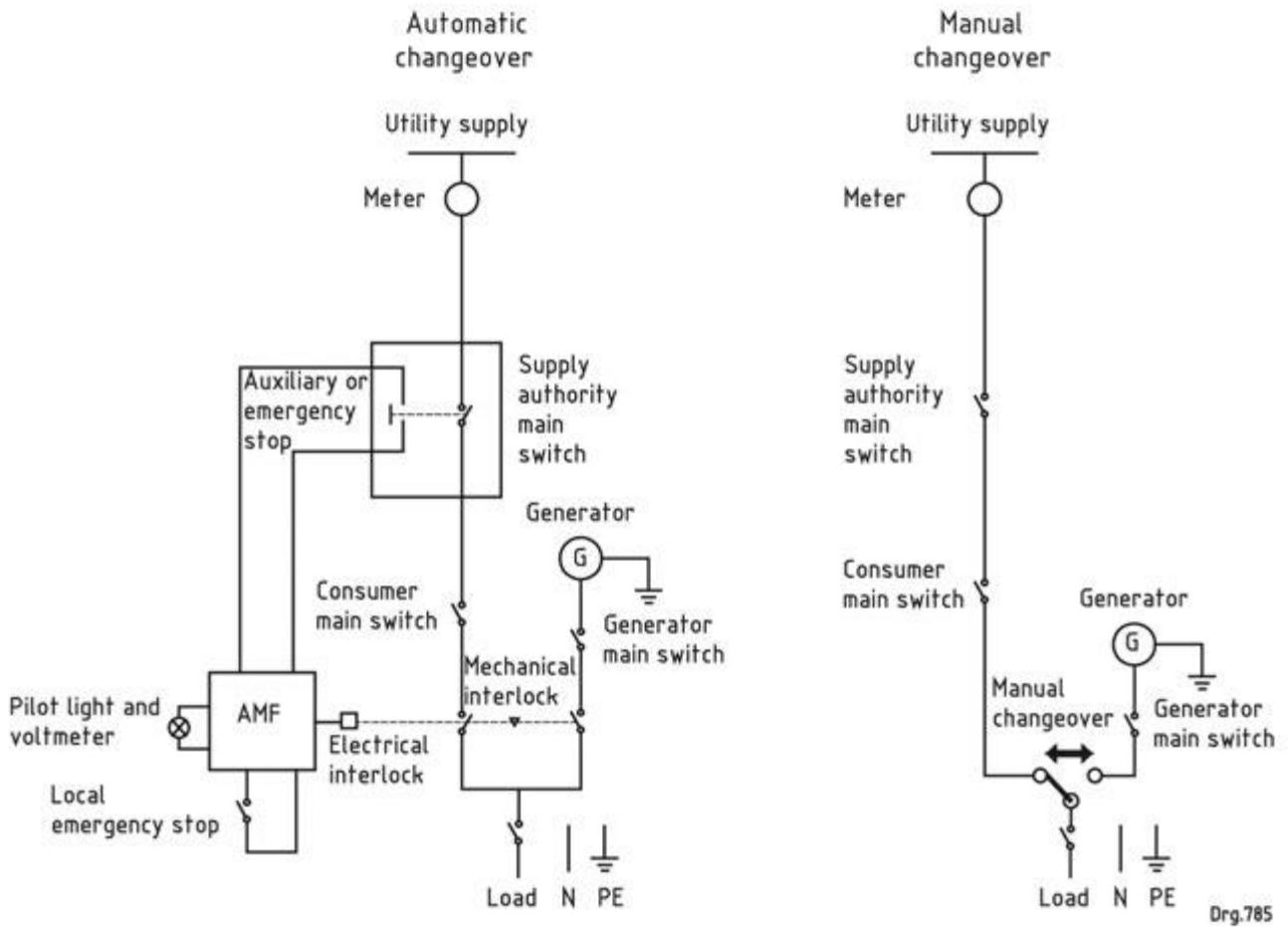
- adapted to the the human ear response to sound
- possible to measure with low cost instruments

Maximum acceptable Equivalent Sound Level - L_{eq} - at some common locations are indicated in the table above:

Annex B – Typical appliance ratings (may vary from table below)

Electrical Appliance	Rating (kW)
Lamps	
100 W	.010
75 W	.075
60 W	.060
40 W	.040
Stove	
Small Hot Plate	1.50
Large Hot Plate	2.00
Oven	2.00
Dish Washer	1.00
Electric Blanket	0.05
Electric Frying Pan	1.50
Fan	0.07
Floor Polisher	1.00
Geyser	3.00
Hair Dryer	0.50
Hi Fi	0.20
Iron	0.60
Kettle	2.00
Microwave	0.80
Computer	0.05
Power Drill	0.25
Deep Freeze	0.20
Refrigerator	0.10
Sewing Machine	0.07
Slow Cooker	0.15
Space Heating	1.00
2 – Bar Heater	2.00
Pool Pump	1.00
TV	0.30
Tumble Drier	3.00
Washing Machine	1.00

Annex C – Wiring Diagram



Annex D – Generator Safety Precautions

The following safety guideline summarises the dangers posed by portable generators as electrocution, carbon monoxide poisoning and noise and vibration hazards, and recommends adherence to the following safety tips:

- Never attach a generator directly to the electrical system of a building unless an electrician has installed it with a transfer switch, as this can energise wiring systems for great distances, creating an electrocution risk for utility workers in the area.
- Always plug electrical appliances directly into the generator using the manufacturer’s supplied cords or extension cords that are grounded.
- Ensure that the generator is grounded properly and that the grounding connections are tight.
- Never use a generator indoors or in enclosed spaces such as garages, closed courtyards and laundry areas.
- Note that open windows and doors may not prevent CO from building up when a generator is located in an enclosed space. Place generator at least 4.5m away from any open door or window.
- Generator fuel can ignite when spilled on hot engine parts.
- The storage of fuel shall not exceed that of the capacity of the standard tank size as per the manufacturer specification.
- Generator engines vibrate and create noise. Excessive noise and vibration could cause fatigue, which may affect job performance.
- Use a sound meter to evaluate the sound effect from the position of the generator to the areas mentioned in the table above.